Equal Opportunity/Affirmative Action
George Mason University is an Equal Opportunity/Affirmative Action institution. See General Policies section in this catalog for a full statement of the university's Equal Opportunity/Affirmative Action policies.

The Catalog
This catalog describes the graduate programs and degrees offered by George Mason University. All information, including statements of tuition and fees and admission and graduation requirements, is subject to change without notice.

For more information about any of the programs listed or for application forms, please write or call the Office of Admissions, Finley Building, Room 117, George Mason University, Fairfax, VA 22030-4444, (703) 993-2400.

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# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Calendar</td>
<td>1</td>
</tr>
<tr>
<td>Profile of George Mason University</td>
<td>5</td>
</tr>
<tr>
<td>Graduate Study</td>
<td>11</td>
</tr>
<tr>
<td>Graduate Programs</td>
<td>12</td>
</tr>
<tr>
<td>Educational Centers</td>
<td>15</td>
</tr>
<tr>
<td>Graduate Policies and Procedures</td>
<td>21</td>
</tr>
<tr>
<td>Admission</td>
<td>22</td>
</tr>
<tr>
<td>Registration</td>
<td>25</td>
</tr>
<tr>
<td>Graduate Policies</td>
<td>27</td>
</tr>
<tr>
<td>Degree Requirements</td>
<td>30</td>
</tr>
<tr>
<td>Honor System and Code</td>
<td>33</td>
</tr>
<tr>
<td>Tuition, Expenses, and Financial Aid</td>
<td>37</td>
</tr>
<tr>
<td>Student Life</td>
<td>45</td>
</tr>
<tr>
<td>College of Arts and Sciences</td>
<td>53</td>
</tr>
<tr>
<td>Biology</td>
<td>54</td>
</tr>
<tr>
<td>Chemistry</td>
<td>60</td>
</tr>
<tr>
<td>Cultural Studies</td>
<td>63</td>
</tr>
<tr>
<td>Economics</td>
<td>66</td>
</tr>
<tr>
<td>English</td>
<td>70</td>
</tr>
<tr>
<td>Environmental Science and Public Policy</td>
<td>78</td>
</tr>
<tr>
<td>Foreign Languages and Literatures</td>
<td>81</td>
</tr>
<tr>
<td>Geographic and Cartographic Sciences</td>
<td>85</td>
</tr>
<tr>
<td>History</td>
<td>87</td>
</tr>
<tr>
<td>Mathematics</td>
<td>92</td>
</tr>
<tr>
<td>Music</td>
<td>95</td>
</tr>
<tr>
<td>Physics and Astronomy</td>
<td>99</td>
</tr>
<tr>
<td>Program on Social and Organizational Learning</td>
<td>102</td>
</tr>
<tr>
<td>Psychology</td>
<td>105</td>
</tr>
<tr>
<td>Public Administration</td>
<td>115</td>
</tr>
<tr>
<td>Sociology</td>
<td>121</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>124</td>
</tr>
<tr>
<td>Visual Information Technologies</td>
<td>126</td>
</tr>
<tr>
<td>School of Business Administration</td>
<td>131</td>
</tr>
<tr>
<td>Accounting and Taxation</td>
<td>132</td>
</tr>
<tr>
<td>Business Administration</td>
<td>135</td>
</tr>
<tr>
<td>Graduate School of Education</td>
<td>145</td>
</tr>
<tr>
<td>Community College Education</td>
<td>146</td>
</tr>
<tr>
<td>Education</td>
<td>149</td>
</tr>
<tr>
<td>School of Information Technology and Engineering</td>
<td>167</td>
</tr>
<tr>
<td>Computer Science</td>
<td>168</td>
</tr>
<tr>
<td>Electrical and Computer Engineering</td>
<td>172</td>
</tr>
<tr>
<td>Information and Software Systems Engineering</td>
<td>178</td>
</tr>
<tr>
<td>Information Technology</td>
<td>185</td>
</tr>
<tr>
<td>Statistics</td>
<td>197</td>
</tr>
<tr>
<td>Systems Engineering</td>
<td>201</td>
</tr>
<tr>
<td>College of Nursing and Health Science</td>
<td>211</td>
</tr>
<tr>
<td>Exercise Science and Health</td>
<td>212</td>
</tr>
<tr>
<td>Nursing</td>
<td>213</td>
</tr>
<tr>
<td>Centers and Institutes</td>
<td>223</td>
</tr>
<tr>
<td>Computational Sciences and Informatics</td>
<td>224</td>
</tr>
<tr>
<td>Conflict Analysis and Resolution</td>
<td>234</td>
</tr>
<tr>
<td>Dance</td>
<td>238</td>
</tr>
<tr>
<td>Interdisciplinary Studies</td>
<td>240</td>
</tr>
<tr>
<td>International Transactions</td>
<td>243</td>
</tr>
<tr>
<td>Public Policy</td>
<td>247</td>
</tr>
<tr>
<td>Programs and Additional Graduate Courses</td>
<td>253</td>
</tr>
<tr>
<td>General Policies</td>
<td>259</td>
</tr>
<tr>
<td>Campus Map</td>
<td>268</td>
</tr>
<tr>
<td>Telephone Directory</td>
<td>270</td>
</tr>
<tr>
<td>Index</td>
<td>273</td>
</tr>
</tbody>
</table>

http://catalog.gmu.edu
Academic Calendar
Academic Calendar, 1994-96

Fall Semester 1994
August 29
First day of classes.

September 5
Labor Day; university closed.

September 12
Last day for schedule adjustment and registration.

October 1
Last day to drop without dean's permission.

October 10-11
Columbus Day recess (Monday classes and laboratories meet on Wednesday this week only).

November 24-27
Thanksgiving recess; university closed.

December 10
Last day of classes.

December 12-12
Reading days.

December 13-21
Examinations (for times, see Schedule of Classes).

February 24
Last day to drop without dean's permission.

March 12-19
Spring recess.

May 6
Last day of classes.

May 8-9
Reading days.

May 9-17
Examinations (for times and snow day make-up, see Schedule of Classes).

May 20
Commencement.

May 29
Memorial Day observed; university closed.

May 30
Summer Term begins.

Spring Semester 1995
January 23
First day of classes.

February 6
Last day for schedule adjustment and registration.

Summer Term 1995
Summer Term consists of three sessions of five or eight weeks from May 30 to August 9. More than 650 day or evening classes are scheduled, making it possible to earn up to 12 credits. For details, consult the Summer Schedule of Classes available in early March.

Fall Semester 1995
August 28
First day of classes.
September 4
Labor Day; university closed.

September 11
Last day for schedule adjustment and registration.

September 30
Last day to drop without dean's permission.

October 9-10
Columbus Day recess (Monday classes and laboratories meet on Wednesday this week only).

November 23-26
Thanksgiving recess; university closed.

December 9
Last day of classes.

December 11-12
Reading Days

December 12-20
Examinations (for times, see Schedule of Classes).

Spring Semester 1996

January 22
First day of classes.

February 5
Last day for schedule adjustment and registration.

February 23
Last day to drop without dean's permission.

March 11-18
Spring recess.

May 4
Last day of classes.

May 6-7
Reading days.

May 7-15
Examinations (for times and snow day make-up, see Schedule of Classes).

May 18
Commencement.

May 30
Memorial Day observed; university closed.

May 28
Summer Term begins.

Refer to the Schedule of Classes for specific term-related information such as filing dates for commencement, last day to pay tuition, pre-registration dates, etc.

Summer Term 1996

Summer Term consists of three sessions of five or eight weeks from May 28 to August 7. More than 650 day or evening classes are scheduled, making it possible to earn up to 12 credits. For details, consult the Summer Schedule of Classes, available in early March.
Profile of George Mason University
Profile of George Mason University

George Mason University is a dynamic, forward-looking institution that provides a diverse and interactive curriculum to educate students for life in a rapidly changing, highly technical world. More than 21,000 students study in more than 100 degree programs at the undergraduate, master’s, doctoral, and professional levels. By emphasizing high technology, public policy, and the fine and performing arts, the university has formed links with the community by meeting its needs while taking advantage of the best it has to offer in people and resources. Its innovative programs and visionary outlook have attracted a faculty of world-renowned scholars and teachers.

Both George Mason and surrounding Fairfax County have experienced phenomenal development over the past several years. From its beginning in 1957 as a two-year branch of the University of Virginia, George Mason has grown into a comprehensive institution offering degrees through the doctoral level. From a rural suburb of Washington, D.C., Fairfax County has developed into a center of high technology enterprise, promising to rival the West Coast’s Silicon Valley and the Boston area’s Route 128 corridor.

The university’s growing stature and reputation are exemplified by the presence of Virginia’s first Nobel laureate, economist James Buchanan. The George Mason professor won the 1986 Nobel Prize in economics for his public choice theory of political decision making. Buchanan is executive director of the university’s Center for Study of Public Choice, which applies scientific economic methods to the “public choice behavior” of voters, party leaders, and other politicians, lobbyists, and bureaucrats. This center and more than 60 other GMU centers and institutes enhance university scholarship and contribute, both directly and indirectly, to the intellectual growth of the George Mason student.

Location
Located in Northern Virginia, George Mason is convenient to all the resources of the nation’s capital and the greater Washington, D.C., metropolitan area. Situated on 583 wooded acres near the City of Fairfax, the university’s Fairfax Campus combines the quiet of a suburban setting with accessibility to Washington’s libraries, galleries, and museums; Virginia’s historic sites; and Fairfax County’s high-technology firms. Metrorail, the Washington area’s subway system, enables GMU riders to reach the U.S. Capitol in 35 minutes. It also provides a quick ride to GMU’s 5.2-acre Arlington Campus, which houses the law school, a professional center, and a conference center. Its campus in Prince William County, called the Prince William Institute, offers academic, community and business support programs.

Programs
The university’s main academic divisions are the College of Arts and Sciences, Institute of the Arts, Graduate School of Education, School of Business Administration, School of Information Technology and Engineering, College of Nursing and Health Science, and School of Law. GMU offers more than 100 degree programs, including 55 undergraduate, 40 master’s, 11 doctoral, and a juris doctor degree.

Many innovative and distinctive programs are available. For example, the university’s Plan for Alternative General Education (PAGE), an interdisciplinary program, received the 1986 G. Theodore Mitau Award for Innovation and Change in Higher Education from the American Association of State Colleges and Universities. The George Mason English Department, with several noted writers on its faculty, is establishing a national reputation. Its seminars and workshops attract many internationally known authors as workshop leaders and seminar speakers.

Students
The majority of the university’s approximately 21,000 students are from Virginia, with the other 49 states and 79 foreign countries well represented in the student body. While full-time undergraduates, 18 to 24 years in age, make up the largest student group, part-time graduate and un-
dergraduate students, 25 and up, are growing in numbers. George Mason welcomes qualified students with a wide range of interests and backgrounds.

Faculty

The university's 707 full-time instructional faculty members are experts in a broad range of fields, who have published widely, contributed to major research findings, and consulted with government and business. The faculty includes a Nobel laureate, winners of awards from the Guggenheim Foundation and the National Endowments for the Arts and the Humanities, and winners of Fulbright Awards and Mellon Fellowships.

Of particular interest to undergraduates are the Robinson Professors, outstanding scholars in the liberal arts and sciences who have come to George Mason from prestigious positions elsewhere. They are concerned with broad and fundamental intellectual issues, and are dedicated to undergraduate teaching. The Schedule of Classes printed every semester gives details about courses being taught by Robinson Professors.

Campus Facilities

George Mason has matched its rapid development with a carefully planned building program. Its academic facilities include modern classroom buildings and state-of-the-art scientific laboratories and computer centers supporting student class work and faculty research.

A leader in the use of information technology, Mason's several state-of-the-art mainframe computers, including IBM 4381 and Digital VAX 6420 and 8530 systems, provide large-scale, contemporary software environments. Several hundred microcomputers (primarily IBM PC compatibles) are available for student use in general-purpose, open-access computer laboratories in many of the academic classroom buildings, the library, residence halls, and other key locations, providing access to a variety of microcomputer-based software and to the mainframes.

Additional computing facilities, used for special applications such as artificial intelligence, computer graphics, elementary and secondary teacher education, library searching, and English composition, are also available in their specific academic departments and research centers. Students have ready access to computing throughout the campus by means of MASONet, a campus-wide data communications network. All academic buildings are linked to the central Computer Center through MASONet, and a student with the capability at home can dial-in to the network.

Automation also aids students using the university's library facilities. The five-story Fenwick Library is a leader in the field of applying computer technology to library functions and services. XLibris, the on-line library information system, is available for patron use in the library and from other campus locations, and includes the university's on-line catalog, the Washington Research Library Consortium catalog, and numerous periodical indexes. Also available is CD-ROM and dial-up access to more than 300 data bases of interest to researchers in all fields.

Combined university library facilities, including Fenwick Library on the Fairfax Campus, on the Arlington Campus, at Prince William Institute, and the School of Law Library in Arlington, house collections of approximately 900,000 volumes, with annual additions of 20,000 books. Periodical subscriptions total 8,300. In addition, the library is a member of the Washington Research Library Consortium.

A second Science and Technology Building has been newly constructed on the Fairfax Campus, and the Center for the Arts, opened in 1990, is into its fifth successful season of providing world-class entertainers and is rapidly becoming a cultural focal point in Northern Virginia. The Harris Theater, TheaterSpace, and the Black Box Theater in the new Performing Arts Building, the 2,000-seat Concert Hall, and the Dance Performance Studio provide ample space for performing arts presentations on campus.

Presently under construction are the University Center and Enterprise Hall. The University Center combines a library facility with the meeting and activity space normally associated with a student union. The building, scheduled for occupancy in fall 1995, provides students a total learning experience through interaction with books, technology, their peers, and faculty. Enterprise Hall is a classroom building that will feature a lecture hall and additional office space for academic departments.

The Patriot Center, a 10,000-seat sports and entertainment arena, provides a spacious home for George Mason's major campus and varsity athletic activities, and benefits the larger Northern Virginia community. The center is designed for basketball, indoor soccer, concerts, and other sports and entertainment events, as well as large convocations such as commencement.

The multipurpose Sports and Recreation Complex features 64,000 square feet of space indoors, including a 200-meter track; basketball, tennis, handball/raquetball, and volleyball courts; a baseball and softball diamond and batting cage; a weight room; saunas; and golf and archery nets.

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Outdoor features include a 400-meter track, a baseball diamond, and soccer and other playing fields.

The university's residence halls house approximately 3,000 students. A variety of dining facilities, meeting rooms, a computer store, a bank, the campus bookstore, and other student services are available in George Mason's two student unions.

Arlington Campus Professional Center and Conference Center

The Arlington Campus Professional Center and Conference Center are on the third floor of the Arlington Campus building, 3401 North Fairfax Drive, near the Virginia Square-GMU Metro Station (Orange Line).

Both graduate and undergraduate courses are offered at the Professional Center, including several liberal arts undergraduate courses. Most credit courses are taught in convenient one-per-week sessions, with beginning times of 4:30, 6, and 7:20 p.m. Non-credit courses are scheduled from 8 a.m. to 4 p.m. Approximately 600 non-credit courses are taught in the Professional Center. More than 16,000 credit and noncredit students are served.

The 200-seat Conference Center hosts an additional 10,000 persons annually, who participate in university and community programs and business and professional conferences. The Metro Gallery holds 12 professional art shows annually and is the site of many community cultural events.

The GMU Information Center on the Kirkwood Drive side of the building provides university publications and information on programs and activities at both campuses, including catalogs and applications. The Information Center is open from 9 a.m. to 9 p.m. weekdays. The telephone number is (703) 993-8140.

Prince William Institute

The Prince William Institute (PWI) is George Mason's academic presence in the Prince William County area. The institute serves Prince William, Fauquier, and western Fairfax counties; Manassas and Manassas Park cities; and adjoining areas to the west and south. The institute offers creative programs of instruction, research, and public service developed through a public/private partnership in a new higher education service district in the Prince William County area.

Academic programs in place as of spring 1994 include a school-based master's in education program, a master of public administration program, an accelerated program for a B.S.N., and a B.S. in administration of justice program.

PWI presently occupies 10,000 square feet of space in Sudley North Business Center, 7946 Donegan Drive, Manassas. The telephone number is (703) 330-5967.

Consortium of Universities of the Washington Metropolitan Area

George Mason University is a cooperating member of the Consortium of Universities of the Washington Metropolitan Area. Full participating Consortium members include The American University, The Catholic University of America, Gallaudet University, George Mason University, The George Washington University, Georgetown University, Howard University, Marymount University, Mount Vernon College, Trinity College, University of the District of Columbia, and the University of Maryland-College Park.

Eligible students have the opportunity to benefit from the combined offerings of member institutions and to enroll for courses at any of the participating institutions. Students register and pay tuition at their home institution for all Consortium courses.

Professional Programs and Activities

School of Law

The School of Law is at the Arlington Campus, 15 minutes from downtown Washington via the Metrorail's orange line. The school offers programs leading to the first professional degree in law, the juris doctor. Full-time faculty members teach most courses in both the day and evening divisions. The school is fully accredited by the American Bar Association and is a member of the Association of American Law Schools.

The curriculum provides the basic knowledge and skills necessary for practice in any state. Many courses are problem oriented or involve extensive writing. The faculty includes perhaps the largest concentration of law and economics scholars in the United States.

The School of Law offers an innovative series of specialty tracks—in patent law, corporate and securities law, litigation law, international business law, and regulatory law—that allow students to supplement their general legal education with in-depth study of a specialized area of practice.

For more information, see the School of Law catalog or write or call George Mason University School of Law, Admissions Office, 3401 N. Fairfax Drive, Arlington, VA 22201-4498; (703) 993-8010.

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George Mason University Press
The George Mason University Press provides a scholarly publishing dimension to the university's overall mission of creating and disseminating knowledge through teaching, research, and publications. The GMU Press publishes monographs, books, research reports, conference proceedings, symposia, and reference works developed by local faculty and by authors throughout the world of scholarly endeavor. Among its publications, the press issues an annual series of lectures presented on The Legacy of George Mason. GMU Press books are advertised, exhibited, promoted, and sold worldwide by the exclusive agent of the press, University Publishing Associates.

Visiting the Campuses
Visitors are always welcome at the university, and prospective students are especially encouraged to visit the campuses, preferably while the university is in session. Administrative offices are open Monday through Friday, but because hours vary, appointments are suggested.

Parking on campus surface lots is by permit or decal only, Monday through Friday from 7 a.m. to 8 p.m. Visitors are strongly encouraged to park in the Parking Deck located on Mason Drive. A limited number of metered parking spaces are also available throughout the campus. Decals are not required on weekends. Parking places are provided for disabled persons. Parking permits and assistance in parking are available at both campuses through the Parking Services office and Finley Circle information booth.

Accreditation
George Mason University is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools to award bachelor's, master's, and doctoral degrees, and is a member of the Council of Graduate Schools in the United States.

Mission
The mission statement of the Board of Visitors reads as follows:
George Mason University will be an institution of international academic reputation providing superior education enabling students to develop critical, analytical, and imaginative thinking and to make well-founded ethical decisions. It will respond to the call for interdisciplinary research and teaching not simply by adding programs but by rethinking the traditional structure of the academy.

The university will prepare students to address the complex issues facing them in society and to discover meaning in their own lives. It will encourage diversity in its student body and will meet the needs of students by providing them with undergraduate, graduate, and professional courses of study that are interdisciplinary and innovative.

The university will energetically seek ways to interact with and serve the needs of the student body.

The university will nurture and support a faculty that is diverse, innovative, and excellent in teaching, active in pure and applied research, and responsive to the needs of students and the community. The faculty will embody the university's interactive approach to change both in the academy and in the world.

The university will be a resource of the commonwealth of Virginia serving private and public sectors and will be an intellectual and cultural nexus between Northern Virginia, the nation, and the world.

Graduate Study
Graduate Study

Graduate Study
Graduate study was initiated at George Mason in 1970 with the goal of providing opportunities for students to participate in intensive and individualized programs of study under the direction of a strong faculty. To promote this goal, the university encourages research, inquiry, and scholarship at the highest levels from both students and faculty. George Mason offers 40 master's programs, 11 doctoral programs, and 10 certificate programs. Nearly all graduate courses are offered in the late afternoon and early evening. In fall 1993 there were 5,455 master's and doctoral students at George Mason, and 1,814 postbaccalaureate students were taking courses through extended studies enrollment.

Organization
The Graduate Council is the governing body for all graduate academic policies and procedures. The Graduate Council approves all new graduate programs; authorizes all graduate course work, policies, and degrees conferred by the university; and sets standards for admission to and graduation from the graduate programs.

Administration
Deborah Boehm-Davis, Associate Provost for Research and Graduate Studies

Purpose of Graduate Study
Graduate education is not simply an extension of undergraduate education. Graduate education means advanced, intensive, and purposeful study. Accordingly, the graduate experience requires rigorous inquiry and complete involvement in scholarly activities.

Graduate course work directly reflects and builds on the knowledge and intellectual maturity a student acquires during the undergraduate years. The graduate experience should be of such duration that there is time for reflection, absorption, and the emergence of intellectual independence and scholarly self-confidence.

George Mason's teaching resources and educational environments promote advanced learning, meet graduate-level educational objectives, and allow students to cultivate close, working relationships with experienced scholar-teachers. Regular evaluation of student performance ensures both students and their graduate teachers of the worth of their intellectual accomplishments.

Graduate study at the university involves a commitment to understanding and activity unlike that ordinarily called for in undergraduate degree programs. Accordingly, both full- and part-time graduate students are expected to meet requirements and standards of study that exceed those expected in undergraduate courses. Graduate students are asked to join faculty members in seeking excellence in advanced study.

Graduate Programs

Admission requirements for graduate study applicable to all degrees are given in the first sections of the catalog. Specific graduate degree programs and their requirements are discussed in detail in sections divided up by school, college, or center/institute, where they are then listed in alphabetical order.

A number of departments without graduate degree programs offer graduate-level courses for elective credit and for personal or professional enrichment.

Graduate and Professional Degrees, and Department or School Offering Degree
Accounting M.S. (School of Business Administration)
Applied and Engineering Physics M.S. (Physics and Astronomy)
Biology M.S. (Biology)
Business Administration M.B.A., E.M.B.A.  
(School of Business Administration)
Chemistry M.S. (Chemistry)
Community College Education D.A. (The National Center for Community College Education)
Computational Sciences and Informatics Ph.D. (Institute of CSI)
Computer Science M.S. (Computer Science)
Conflict Analysis and Resolution M.S., Ph.D. (Institute for Conflict Analysis and Resolution)
Counseling and Development M.Ed. (Graduate School of Education)
Creative Writing M.F.A. (English)
Cultural Studies Ph.D. (College of Arts and Sciences)
Curriculum and Instruction M.Ed. (Graduate School of Education)
Dance M.F.A.
Economics M.A., Ph.D. (Economics)
Education Ph.D. (Graduate School of Education)
Education Leadership M.Ed. (Graduate School of Education)
Electrical Engineering M.S. (Electrical Engineering)
English M.A. (English)
Environmental Science and Public Policy Ph.D. (Biology)
Exercise Science M.S. (College of Nursing and Health Science)
Foreign Languages M.A. (Foreign Languages and Literatures)
Geographic and Cartographic Sciences M.S. (Geography and Earth Systems Sciences)
History M.A. (History)
Information Systems M.S. (Information and Software Systems Engineering)
Information Technology Ph.D. (School of Information Technology and Engineering)
Interdisciplinary Studies M.A.I.S. (Office of the Provost)
International Transactions M.A.I.T. (International Institute)
Law J.D. (School of Law)
Mathematics M.S. (Mathematical Sciences)
Music M.A. (Music)
Nursing M.S.N., M.B.A., Ph.D. (College of Nursing and Health Science)
Operations Research and Management Science M.S. (Operations Research and Engineering)
Psychology M.A., Ph.D. (Psychology)
Public Administration M.P.A. (Public and International Affairs)
Public Policy Ph.D. (The Institute of Public Policy)
Sociology M.A. (Sociology and Anthropology)
Software Systems Engineering M.S. (Information and Software Systems Engineering)
Special Education M.Ed. (Graduate School of Education)
Statistical Science M.S. (Applied and Engineering Statistics)
Systems Engineering M.S. (Systems Engineering)
Taxation M.S. (School of Business Administration)
Telecommunications M.A. (College of Arts and Sciences)
Urban System Engineering M.S. (Systems Engineering)
Visual Information Technologies M.A., M.F.A. (College of Arts and Sciences)

Certification Programs
Command, Control, Communications, and Intelligence (C3I) Systems Engineering
Community College Education (diploma)
Federal Statistics
Gerontology
International Nursing
Nursing Administration
Nursing Education
Software Systems Engineering
Teaching of English as a Second Language
Translation

Course Numbering

General
1. Course titles are followed by numbers in parentheses (0:0:0), separated by colons. The numbers have the following significance:
   First number: semester credit hours
   Second number: hours of lecture/seminar per week
   Third number: hours of laboratory/studio per week
2. For independent study, reading, topics, or similar courses, individual instructors set hours.

Graduate
1. Courses numbered 500 and above are graduate courses.
2. Courses are occasionally renumbered by departments. Additional credit is not permitted for a course under a different number if all requirements have been completed and a satisfactory letter grade has been earned in the course under its original number. Students may check with the department offering the course to be certain that they are not repeating a graduate course for which they already have credit.
3. Graduate courses are divided into the following categories:
   500-599 Open only to graduate students (admitted to master’s or doctoral programs), to other bachelor’s degree holders, and to approved advanced undergraduate students. Advanced un-
dergraduate students who have secured the per-
mission of the department offering the course
may select from these courses to accumulate
the hours necessary for completion of an under-
graduate degree. With the written permission
of the dean of their college, they may take
these courses for reserve graduate credit.
600-699 Open only to graduate students (admit­
ted to master's or doctoral programs) and to
other bachelor's degree holders.
700-799 Master's level graduate courses open
only to graduate students (admitted to master's
or doctoral programs).
800-899 Doctoral level graduate courses open
only to graduate students admitted to study in
doctoral programs.
4. Courses with the following numbers are re­
served for the uses designated:
600-609 Limited applicability graduate credit
courses. Courses intended for in-service profes­
sional development and not directly leading to
a graduate degree. A limited number of hours
from these courses may be applied to a gradu­
degree.
798 Master's project research.
799 Master's thesis research.
800 Studies for the Doctor of Philosophy in Edu­
cation program.
998 Doctoral project research.
999 Doctoral dissertation research.
790, 890 Supervised practicum.
794, 894 Internship.
796, 896 Directed reading and research courses
for master's and doctoral level students.

Glossary of Course Symbols
Abbreviations of graduate courses offered by the
university:

<table>
<thead>
<tr>
<th>Department</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting</td>
<td>ACCT</td>
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Educational Centers

Center for Applications of Mathematics
Affiliated with the Mathematical Sciences Department, main goals are to build a bridge between industry and academia that will create joint research and to produce a series of experimental advanced courses in applied mathematics.

Center for Basic and Applied Science
Focuses on solving environmental-related problems such as a regional survey of radon in homes, geochemical rock analyses, and liquefaction of Virginia coal. Affiliated with the Department of Chemistry.

Center for Behavioral and Cognitive Studies
Conducts basic and applied research on leadership and management topics in areas related to the development of human resources and the enhancement of human performance. Affiliated with the Psychology Department.

Center for Bilingual/Multicultural Teacher/ESL Preparation
Trains bilingual and English as a Second Language (ESL) teachers. Trains teachers in Fairfax County schools for a Japanese-language immersion program at the kindergarten level.

Center for Business Expert Systems Research
Promotes research useful to local business communities and other national/international business organizations on information requirements analysis and expert systems with particular emphasis on systems with high return on investment.

Center for Computational Statistics
Focuses on the relationship between statistical science and computing science.

Center for Cross-Cultural Understanding
Promotes research and publications on the ways people from different cultures can understand one another despite linguistic, ethnic, and cultural boundaries.

Center for Economic Education
Helps pre-college educators (1-12) across Northern Virginia to introduce economic thinking into their curricula. Focusing on teacher training, provides conferences, seminars, and classes, and offers a variety of resources, both print and electronic. Affiliated with the Department of Economics.

Center for European Union Studies
Appointed a European Documentation Center by the Commission of European Communities, it is the only center in the United States that provides information on service, regulations, and legal questions related to the European Community. Houses a specialized library of official EC documentation, including access to EC databases in Brussels and Luxembourg.

Center of Excellence in Command, Control, Communications, and Intelligence (C3I)
Nation's first university-based comprehensive technology development program. Performs research in data fusion, command decision-making theory, communications, simulations, and C3I systems engineering. Offers programs/communication between large and small companies. Affiliated with the School of Information Technology and Engineering.

Center for Global Market Studies
A policy-oriented center devoted to examining and discussing the issues arising from the dramatic and increasing integration of international markets of all kinds, including financial, commodities, services, and manufactured goods.

Center for Government, Society, and the Arts
Houses the archives of the Depression-era Federal Theatre Project (FTP) and a collection from the American National Theatre and Academy. Organizes existing audiotapes on all Works Progress Administration arts projects. Administers the Institute on the Federal Theatre Project and New Deal Culture.

Center for Health Policy
Provides a forum for the generation and examination of health policies that meet the challenges facing the health care delivery systems of the United States and other nations.

Center for Health Promotion
Sponsors health and fitness programs for community residents including exercise for senior citizens, consultations, classes, and workshops on AIDS, substance abuse, nutrition, and stress management.

Center for Human disAbilities
Holds activities designed to improve the lives and productivity of persons with disabilities by working with all colleges and departments to develop products, services, and lifelong programs for persons with disabilities.
Center for Image Analysis
Undertakes research in the areas of computer vision and image processing. Current work includes the development of a parallel image understanding algorithm on an Intel Hypercube.

Center for Instructional Software in Astronomy and Physics
Develops high-quality instructional software for college-level courses in astronomy and physics.

Center for Interactive Educational Technology (CIET)
Promotes research and development in the use of advanced technology in education and training. Supports technology initiatives, including developing a computer-based training laboratory.

Center for Market Processes
Promotes education and research in the market economy, especially in the methodology of the Austrian School of economic thought. Publishes a scholarly newsletter, Praxis, and affiliated with the Economics Department.

Center for Outdoor Education
Provides cooperative education and nature programs as well as environmental and recreational studies, located at Hemlock Overlook Regional Park. Conducts conference-retreats and a summer camp.

Center for Parallel Computation
Provides a dedicated environment for developing, understanding, and using multiprocessor systems.

Center for Recreation Resources Policy
Sponsors research and training for national and local natural resource agencies and conducts an annual training symposium.

Center for Robotics and Control
Conducts research in robotics control, technical diagnostics, computational methods for control, system simulation methodology, and neural nets control systems. One research team, involved with an American automobile manufacturer, is developing methods for detection and diagnosis by a car's on-board computer of emissions caused by engine-component faults. In addition to applying theoretical results of this research to a practical problem, nontechnical implications are that the resulting technology helps maintain air quality, to reduce the cost of car maintenance and repair, and to improve the United States auto industry's competitiveness.

Center for Secure Information Systems
Provides a dedicated environment to encourage the development of expertise in both theoretical and applied areas of information systems security.

Center for Software Systems Engineering
Focuses on research involving the technical and managerial aspects of analysis, design, implementation, and modification of complex computer software systems. Complementary to the master's degree and Ph.D. in Information Technology.

Center for Study of International Technologies
The center aims research at a better understanding of factors, conditions, and environments that affect the development, adoption, and transfer of technology in Europe and the Pacific Rim and the implications of these findings for American business. It focuses on research, development, and commercialization of manufacturing, and information technologies.

Center for Study of Public Choice
Applies scientific methods to the "public choice behavior" of voters and other political groups. Supports programs of education/research in public choice theory and formulates relevant proposals for basic institutional or constitutional reforms based on such research. Founded on Nobel laureate James Buchanan's work in the Department of Economics.

Center for the Study of Regional Mobility
Conducts research on issues related to traffic congestion and land use. Works with a consortium of national organizations to study regional mobility issues and provide information to the public.

Center for Transportation and Land Policy
Applies information technology to practical transportation system management in both supply and demand situations related to public policy issues.

Citizens' Applied Research Institute
Works with Northern Virginia government, industry, and civic organizations to stimulate interest in regional research.

Early Childhood Special Education Technical Assistance Center #3 (ESCE TAC 3)
Provides programs and resources for preschool handicapped children, and for children and adolescents who are severely mentally and/or physically disabled, deaf, and/or blind. Is technology coordinator for Virginia's TAC network.

http://catalog.gmu.edu
Education Study Center
Provides a community service setting for clinical experience and research to graduate students in the Graduate School of Education's reading, special education, and guidance/counseling programs.

The English Language Institute (ELI)
Provides non-native speakers of English intensive noncredit English instruction as a preparation for enrollment in higher institutions. Also provides worksite instruction for community businesses.

Entrepreneurship Center
Promotes the success of small and emerging companies based or doing business in Virginia through the GMU Incubator Program providing direct company start-up assistance. Includes the Northern Virginia Small Business Development Center (NVSBDC), the Procurement Technical Assistance Program (PTAP), and Program to Research and Implement Minority Exports (PRIME II).

Incubator Program
Offers extensive assistance to a select number of high-technology companies possessing strong growth potential. Also provides support to government contractors pursuing commercial markets. Help includes active management support, development of an outside advisory board, faculty-led student teams, and operational support. Some clients' companies become tenants and operate from the incubator facility.

Indochina Institute
Serves as a clearinghouse for information and research on Indochina and its refugees, and sponsors conferences and workshops.

Institute for Advanced Study in the Integrative Sciences (IASIS)
Develops and tests a new science of generic design that manages the complexity of the invasive systems that support, constrain, and threaten our lives without creating "hazard gaps" (gaps between implementation of information systems and the user's knowledge).

Institute of the Arts
Makes the arts an intrinsic part of all students' university experience by sponsoring professional performances and workshops. A key element is artists- and companies-in-residence. Includes the Center for the Arts, the Theater of the First Amendment, and the academic divisions of Art Studio, Dance, and Theater.

Institute for Computational Sciences and Informatics (CSI)
Combines research from the College of Arts and Sciences, such as biology, chemistry, mathematics, and physics with research in the School of Information Technology and Engineering. Develops strong connections with local industry and the federal government. Offers a Ph.D. program in computational sciences and informatics.

Institute for Conflict Analysis and Resolution
Offers advanced degree programs in conflict management, including the nation's first doctoral program, to train professional intervenors for mediating disputes at all levels of society. Its outreach program puts it in contact with conflict resolution programs around the world.

Affiliated organizations are:

- Consortium on Peace Research, Education, and Development (COPRED), a networking organization.
- Northern Virginia Mediation Service (NVMS), offering mediation services to Northern Virginia residents involved in civil or minor criminal disputes.
- Starting Small, teaching conflict-resolution and problem-solving skills to children.

Institute for Educational Transformation (IET)
Promotes comprehensive transformation of educational systems that contribute to the reconstruction of public policy in education. Establishes partnerships among business and industry, school divisions, and the university, focusing on the Manassas/Prince William area. Operates academically through the Graduate School of Education and the Prince William Institute.

The Institute of Public Policy (TIPP)
Focuses on both training and multidisciplinary research, with an emphasis on the interface between the public and private sectors. Offers a Ph.D. program with specializations in public management policy, science and technology policy, and regional development policy.

Institute on the Federal Theatre Project and New Deal Culture
Focuses on the culture and politics of the 1930s and coordinates exhibits and discussions of the FTP. Houses the FTP archival collection, on deposit from the Library of Congress, including original stage and radio production scripts, posters, stage and costume designs, and photographs of theater productions. Publishes a newsletter, Federal One.
International Center for Applied Studies in Management Information Systems
Conducts research and develops curricula relating to a broad range of international issues associated with informatics planning, development, and management in other countries. Has ongoing projects in Eastern Europe, Africa, and South America.

International Institute
Develops and administers the university's international activities including lectures by foreign scholars and officials. Offers a master's program in International Transactions and manages the university's study abroad and international exchange programs.

Krasnow Institute for Advanced Study
The Krasnow Institute, initiated by a bequest from the late Shelly Krasnow, furthers the understanding of the mind and intelligence by combining the fields of cognitive psychology, neurobiology, and the computer-driven study of artificial intelligence and complex adaptive systems. These overlapping disciplines promise progressively deeper insight into thought processes, and the institute will bring together scholars, at its planned center on the Fairfax Campus and by electronic outreach throughout the world, to further cross-disciplinary research in cognitive sciences and examine how new insights can improve our understanding of teaching and learning at all levels.

Law and Economics Center (LEC)
Demonstrates the applicability of economic and scientific scholarship to legal policy and to the substance and procedures of law. Offers residential programs for federal judges, law professors, and academic economists; hosts conferences; sponsors faculty research and workshops; and publishes Supreme Court Economic Review.

Leadership Academy
Northern Virginia Regional Assessment and Development Center (NOVRAC). Assesses the administrative skills of prospective public school principals in Northern Virginia and District of Columbia school systems and develops leaders for education, industry, and nonprofit organizations.

The National Center for Community College Education
Offers a doctoral program in community college education to prepare the next generation of community college faculty and to further the education of those already teaching in community colleges.

National Policy Board for Educational Administration
Formed to establish a national certification process for school principals and superintendents, is developing performance standards and criteria for national certification. Intends to establish a national certification board to begin operating in 1994.

Northern Virginia Institute (NVI)
Promotes the economic viability of the Northern Virginia region through involvement of the corporate community in areas ranging from economic development to governmental assistance in public policy implementation. Publishes Mason magazine.

Northern Virginia Mediation Service (NVMS)
Helps mediate conflicts by using impartial, trained, third-party volunteers. Affiliated with the Institute for Conflict Analysis and Resolution. Provides training and seminars in conflict resolution.

Northern Virginia Small Business Development Center (NVSBDC)
Funded by GMU and the federal Small Business Administration, supports the local business community by providing counseling and training to persons starting their own business. Part of the Entrepreneurship Center. Has locations in Arlington County, Fairfax City, and Loudoun County.

Northern Virginia Survey Research Laboratory
Examines issues important to Northern Virginians, conducts surveys on regional growth/change and national issues, and provides expertise in research methodology for faculty and staff. Affiliated with the Department of Sociology and Anthropology.

Northern Virginia Writing Project
Represents a statewide effort to improve the writing of all students, kindergarten through university-level. Offers an intensive summer program for teachers.

Prince William Institute (PWI)
An academic presence of creative flagship programs of instruction, research, and public service through public/private partnership in a new higher-education district in Prince William County.

Procurement Technical Assistance Program (PTAP)
Provides management and business development support to companies seeking to do business with
federal, state, and local governments and helps government contractors diversify into the commercial sector. Gives assistance in identifying, pursuing, winning, and managing government contracts. Part of the Entrepreneurship Center.

**Psychological Clinic**
Provides the campus and Northern Virginia community with psychological assessment and psychotherapy services by faculty and graduate students under professional supervision.

**Shared Research Instrumentation Facility (SRIF)**
Provides a laboratory environment that supports the research and teaching of GMU faculty and students. Active in collaborative and contract research that supports the university's continuing involvement in the Northern Virginia community. Major instrumentation includes electron microscopes and gas chromatographs/mass spectrometers.

**Small Business Institute (SBI)**
Provides intensive management assistance to small businesses by teams of graduate and undergraduate business students, with faculty supervision, who consult with businesses to identify problems or opportunities, resulting in a comprehensive, written report.

**Theater of the First Amendment**
The university's professional theater company produces plays by both new and established playwrights. Enables students to witness play development through staged readings, workshops, and lectures.

**Virginia Economic Bridge Initiative**
Links business opportunities and crosses information gaps between Virginia's regions. Builds bridges over trade and communication barriers that separate Northern and Southwest Virginia. Has developed, in conjunction with Virginia Tech and other institutions, the Virginia Procurement Pipeline, a database of several hundred Virginia-based companies listing their products, services, and other data.

**Women's Studies Research and Resource Center**
Supports faculty and staff proposals and research on the topics of sex and gender. Organizes workshops, lectures, and other activities on topics relevant to student life and on issues of concern to women. Complementary to the Women's Studies Program.

**Writing Center**
Assists students, faculty, and staff of the university with writing projects and assignments on an individual or small workshop basis.
Graduate Policies and Procedures
Graduate Policies and Procedures

Admission

Admission to the university and acceptance into a particular degree program are competitive. Admission space is determined largely by the availability of resources. Demand for resources is balanced to meet the university's many educational responsibilities. The university, therefore, qualitatively evaluates students and makes selections based on performance and evidence of potential for success.

For an applicant who wishes to obtain a graduate degree, the general university admission requirements are:

1. A baccalaureate degree or equivalent from an accredited institution of higher education.
2. A 3.0 GPA (on a 4.0 scale) or better in the last 60 hours of undergraduate study. (For students with postbaccalaureate credits, a separate GPA is calculated for each institution.)
3. Undergraduate preparation for the chosen field of graduate study or appropriate experience in that field.
4. Test scores and letters of recommendation as required by each program.

Departmental admission requirements for a degree student are listed in the catalog under the relevant discipline, as well as in the Graduate Application for Admission.

A degree-seeking applicant with a baccalaureate degree who has not met all other admission requirements may be offered provisional admission if sufficient evidence is presented to suggest an applicant has the ability to pursue graduate work. A student with provisional status must have as initial objectives the removal of any deficiencies and advancement to degree status.

An applicant who is not interested in pursuing a graduate degree program but who wishes to take one or more graduate courses should request nondegree status in a graduate program. Although the primary mission of graduate study is to conduct programs of instruction leading to graduate degrees, a qualified student who has no immediate degree objectives is welcome to the extent that available university and graduate program resources allow. An applicant requesting nondegree status must submit a transcript showing that a baccalaureate degree has been earned at an accredited college or university.

Submission of Application

Requests for information about graduate admission, the application for admission, and related forms should be addressed to the Office of Admissions, Finley Building, George Mason University, 4400 University Drive, Fairfax, VA 22030-4444; (703) 993-2400 or 993-2404. An applicant seeking admission to a graduate program must submit the following:

1. An application form.
2. Two official copies of transcripts from each institution attended.
3. A $25 application fee (nonrefundable).
5. Examinations scores (GRE, GMAT, etc.) mailed directly from ETS as required by certain departments (see admission requirements of appropriate program).
6. Letters of recommendation as required by departments (see admission requirements of appropriate program).
7. For international applicants (J-1 and F-1 visas), a notarized statement of financial support.
8. A non-native, English-speaking applicant must take the Test of English as a Foreign Language (TOEFL) and attain a score of 575 or higher.

Application Deadlines*

The applicant is recommended to submit all application materials well ahead of the deadline to ensure ample processing time through the Office of Admissions. Please refer to the graduate application for any variation in deadlines or contact the academic department regarding specific application, fellowship, and assistantship deadlines.
Graduate Admission Examinations (GRE and GMAT)

Although a number of graduate programs do not require the Graduate Record Examination (GRE), almost all will use such test scores as an additional measurement of an applicant’s qualifications. The GRE may be taken in either or both of two forms: (1) the General Test, and (2) the Subject Tests. Some departments require official scores for both the General and the Subject Test.

The Graduate Management Admission Test (GMAT) is required of all applicants seeking an M.B.A., M.S. in Accounting, and, in certain cases, M.S. in Information Systems.

Academic Testing in the Office of Admissions administers all academic examinations for the university, including the GRE and the GMAT.

Information concerning examinations, test applications, and dates may be obtained from the Testing Office, Finley Building, (703) 993-2390. Applicants also may write directly to GRE, Box 955, or GMAT, Box 966, Princeton, NJ 08540. A telephone number for the Educational Testing Service is (609) 921-9000.

Foreign Language Requirements

Certain graduate programs require students who have not already completed 12 hours of undergraduate credit in a foreign language to satisfy a foreign language requirement. This may be accomplished by taking the appropriate courses or demonstrating the equivalent proficiency by passing an examination. Contact the academic program for information on demonstrating language proficiency.

International Student Admission

1. Students must meet all requirements and regulations of the university and their school or department.

2. Students must present with their application for admission official documents certifying their previous educational training and attainments. Graduate student applicants’ documents should show the award of either a bachelor’s degree or equivalent, or a graduate degree. Personal student papers, photostats, or attested copies are not accepted for evaluation.

3. Students must have completed the Test of English as a Foreign Language (TOEFL) and have attained a score of 575 or higher. A TOEFL score of at least 600 is required of teaching and research assistants. Information concerning the time and place of the TOEFL can be obtained from TOEFL, Educational Testing Service, Princeton, NJ 08549.

4. Students on J-1 or F-1 visas are required to secure an affidavit of support and a notarized financial statement proving that they have a sufficient amount of money to support themselves for the duration of their study.

5. After applicants receive a written offer of admission, the I-20 will be provided, upon request, to those requiring an F-1 student visa who have verified financial support through the document noted in 4. International students must enter the United States on a valid student or other visa. Visitor or transit visas are not valid for enrollment at the university. Students sponsored by the U.S. government or their home government are required to enter the U.S. on an Exchange Visitor’s Visa (J-1).

6. The U.S. Department of Justice, Immigration and Naturalization Service regulations governing nonimmigrant F-1 students require that international students in this category pursue a full course of study (nine credits for graduate students) while maintaining nonimmigrant student status.

7. All students holding a J-1 visa or an F-1 visa are required to carry medical insurance either on their own or through the Office of International Student Services insurance program.

8. International students must meet and conform to all current regulations of the U.S. Immigration and Naturalization Service.

Admission of Graduate Degree Holders

An applicant holding one or more graduate degrees may earn an additional graduate degree in another discipline. For admission to a second graduate degree program, the applicant should submit an application, transcripts, and other documents as required by the second degree program.

Course credits used to satisfy the degree requirements for the first graduate degree may not be used to satisfy the degree requirements for the second graduate degree at the university. In programs with overlapping or similar requirements, students will be advised in the subsequent degree program regarding appropriate course substitutions for subjects already covered.

Offer of Admission

A written offer of admission is made by the Dean of Admissions to an applicant who has been accepted. The offer specifies the effective date of admission, the category of admission offered, and the name of the faculty adviser assigned to the applicant. This offer of admission is good only for the semester for which the applicant is admitted. The offer of admission must be accepted by returning an enrollment confirmation card. An individual whose offer of admission has lapsed must
submit a new application and fee to be reconsidered for admission at a later date.

Reactivation of Deferred Applications

Applicants are notified when action on an application has been deferred pending completion of courses that are prerequisite to graduate study in a chosen field. Such an applicant is encouraged to notify the Admissions Office in writing as soon as the prerequisites have been met. The applicant is responsible for furnishing official transcripts confirming that the prerequisite courses have been satisfactorily completed even if they were completed at the university. No admission decision can be made until these grades are received.

Records Maintenance and Disposal

All graduate admission documents, including academic records sent from other institutions, become part of the official university file and can neither be returned nor duplicated for any purpose. A student should maintain copies of official credentials for other personal requirements.

Admission credentials are retained for 24 months only and subsequently destroyed for applicants who (1) do not register for courses within the time period for which the offer of admission is valid, (2) have been denied admission, (3) do not respond to requests for additional information, or (4) fail to submit complete applications with respect to the receipt of all official transcripts and test results.

Permission to Re-enroll in a Graduate Program

Permission to re-enroll in courses must be obtained by all doctoral students who have failed to enroll in at least one credit of course work for two or more consecutive semesters at George Mason University and by all master's students who have failed to enroll in at least one credit of course work for two or more consecutive semesters at George Mason University. Permission is obtained from the department. Forms are available from the Office of the Registrar, Krug Hall, (703) 993-2441.

Change in Field of Graduate Study

Admission to graduate study is contingent on a recommendation by the department in which the student proposes to concentrate. Therefore, a student is not free to change graduate programs at will. A student who wishes to change from one field of study to another must submit a new application and fee for admission. Previous acceptance into one graduate program does not guarantee acceptance into another.

Extended Studies Enrollment

The Extended Studies Program enables persons who have no immediate degree objectives, or who may need to satisfy prerequisites for graduate admission, to request enrollment in courses for which they are qualified without seeking formal admission to the university. Extended Studies applications are available through the Admissions Office. Extended studies enrollees are restricted to undergraduate and 500- and 600-level graduate courses. Prospective enrollees are required to supply unofficial evidence of their academic background along with the Extended Studies application to the Office of Admission. Transcripts or grade reports of previous college course work are required prior to enrollment. Credits earned by students as extended studies enrollees are recorded on regular university transcripts. Extended studies enrollees are expected to achieve a semester average of at least C (2.00) in all undergraduate courses and at least B (3.00) in all graduate courses. Students who do not meet these criteria during two consecutive periods of enrollment are not permitted to register again as extended studies enrollees.

Extended studies enrollees who wish to apply for graduate admission to the university may do so at any time by following the regular graduate admission procedures.

With the approval of a school or college dean, one may apply a maximum of 12 graduate credit hours earned through GMU Extended Studies toward a master's program. During initial registration as an admitted student, the student is responsible to initiate this request on a Transfer of Credit Form available in the schools and colleges. If the student also has transfer credit from another institution, the amount of applicable credit earned through Extended Studies is reduced accordingly.

Guest Matriculant

A graduate student admitted to another graduate school may be given permission to register on a temporary basis as a guest matriculant. This admission as a visiting student is for one semester. A guest matriculant must have been officially admitted as a graduate student at another recognized university and certified by his or her dean as being in good standing. Copies of transcripts or grade reports of previous college course work are required prior to enrollment. Guest matriculants apply using the Extended Studies application.

Senior Citizens Enrollment

The Extended Studies Program coordinates enrollment under the Senior Citizens Higher Education Act of 1974, as amended and as applicable to the
university. Under the terms of this act, eligible Virginia residents over 60 years of age with a taxable income of less than $10,000 are entitled to enroll in courses offered for academic credit on a space-available basis without payment of tuition and fees.

In addition, the act provides for audit of courses offered for academic credit and also for enrollment in noncredit courses on a space-available basis without payment of tuition and fees, regardless of the taxable income level. Tuition may be charged, however, for courses designed exclusively for senior citizen groups. No senior citizen may change registration status in any given semester after registering for classes.

Learning in Retirement

The Learning in Retirement Institute (LRI) at George Mason provides opportunities for older adults to explore intellectual and cultural subjects and to share their experiences and talents. LRI is membership-run. There are no exams, no credits, no grades, and no college degree required. LRI is located at 4210 Roberts Road, Fairfax. For more information, contact (703) 385-1593.

Graduate Study During Summer Term

Applicants wishing to begin graduate work in summer must complete an application for admission before submitting a Summer Term course request form. A $25 nonrefundable fee is required with the application for admission.

Students accepted for fall are considered admitted students and may take courses during the previous summer.

Students close to graduating should not rely on the Summer Term for courses required to complete their degrees.

Registration

Permission to Register as a Graduate Student

Registration for courses in a graduate program is permitted only after the student has been notified of admission. Admitted students are given preference over Extended Studies students through the pre-registration process. Dual registration (e.g., as a graduate student and as an extended studies enrollee) is not permitted. The graduate student is responsible for being properly registered and aware of all regulations and procedures required by a program of study. Regulations and degree requirements are not waived nor are exceptions granted because of ignorance of university, college/school/institute, or departmental regulations.

Academic Advising for Graduate Students

At the time of admission to graduate study, the student is assigned a faculty adviser by the department responsible for the student's program of study. Registration for newly admitted graduate students, as well as continuing students, begins with a visit to the student's academic adviser. There the student can obtain information about specific courses and degree requirements and develop an individual program of study. Progress in an approved program of study is the shared responsibility of the student and the adviser. The graduate student is responsible for compliance with the rules and procedures of their college/school/institute and all applicable departmental requirements that govern the individual program of study. Students should consult with their advisers before registration each semester.

Newly admitted graduate students must consult with their faculty adviser prior to registration.

Schedule of Classes and Telephone Registration

In developing a program of study with the adviser, the graduate student needs to consult the Schedule of Classes, distributed before each registration period by the Office of the Registrar. It provides information about the times and locations of classes, the names of course instructors, the final examination schedule, and procedures for paying tuition and fees.

Students can pick up copies of the Schedule of Classes at numerous locations on campus. Courses listed in the Schedule of Classes are withdrawn when enrollment is insufficient. The university reserves the right to change the class schedule and to adjust individual section enrollments as necessary.

The Schedule of Classes also contains information and procedures for registration using 4GMU, the automated telephone registration system. For each registration, the student, consulting with the adviser, prepares a schedule of courses appropriate to satisfying degree requirements and individual needs. This schedule is then requested by the student using 4GMU. Newly admitted graduate students meet with their faculty adviser prior to registration.
Registration Procedures and Information

After registering, each new student is issued a university photo identification card. It must be presented to obtain a library card, for admission to university events, and when using university facilities after normal operating hours. It is not transferable and is validated each semester after payment is made for classes. Validation stickers are mailed. Questions may be directed to the Photo ID office, 993-1004.

Each student is required to notify the Office of the Registrar of any change of home address, telephone number, or legal name.

Special Registration for Non-Enrolled Students

Students not enrolled in a credit-bearing course but pursuing an activity related to their GMU matriculation who wish to retain active status may register for Special Registration (SREG 200, Section 001) for a $45 fee. This special registration allows students to retain their library privileges, student ID, and the privilege to purchase a student parking decal. Students must have active status in order to apply for or receive a degree, take an examination, or prepare a thesis under the active supervision of a faculty member.

Student Information

Before or during each registration period, all students are asked to provide directory and other types of information used in preparing a student's education record and numerous statistical reports. Such information is collected and disseminated in compliance with the Family Educational Rights and Privacy Act of 1974, as amended, which provides that the university maintain the confidentiality of student education records and establish the right of students to inspect and challenge the data maintained in those records. Personally identifiable data from a student's education record may be released only to persons described in the Act, including "school officials with a legitimate educational interest."

The university may release directory information to any outside party at its discretion except when a student requests in writing that some or all directory information be withheld.

Category I of directory information includes student's dates of attendance, major(s), full- or part-time status, and awards received.

Category II of directory information includes student's address, telephone number(s), date and place of birth, participation in recognized activities and sports, weight and height (normally given only for athletics), most recent previous institution attended, and other similar information.

Students desiring to withhold directory information from the public should request such withholding in person or in writing from the Office of the Registrar at the time of registration for a semester or summer session. Since such withholding may prohibit the Office of the Registrar from providing confirmation of enrollment to prospective employers or even residence address to the student's family, students who are considering such a request should consult the Office of the Registrar.

Students may inspect their education records and obtain more information about the Privacy Act at the Office of the Registrar. They also may obtain copies of most parts of their records for a nominal fee.

Academic Load

Graduate students are urged to register each semester for only the number of hours they can successfully complete. A full-time academic load is 12 semester hours. The minimum full-time academic load is nine hours per semester during the regular academic year. To be considered a full-time student, a graduate research or teaching assistant must register for a minimum of six hours. During the summer, a normal full-time academic load is nine semester hours for the entire term. Permission of the department chair is required to exceed the normal load.

Graduate students are expected to attend all class periods of courses for which they are registered and to meet all course requirements set by graduate faculty.

Graduate Course Enrollment by Undergraduates

A student may seek to take a 500-level graduate course either for reserve graduate credit or for undergraduate credit. A maximum of six hours may be earned for reserve graduate credit. Courses numbered 600 and above are closed to undergraduates.

Approval to register for reserve graduate credit (earned credit held in reserve to apply later toward a graduate degree) is normally given only to George Mason seniors within 15 hours of completion of undergraduate study. In addition, this privilege is normally extended only to seniors who have completed a minimum of 12 semester hours at the university, have a cumulative grade point average of 3.0 or better, have successfully completed all prerequisite courses and have a major in the de-
partment offering the courses. Permission must be obtained in writing prior to registration. Forms are available at the Office of the Registrar. Students are responsible for obtaining all signatures required.

Approval for reserve graduate credit does not imply approval for admission into a graduate program at the university or that credit so earned will be accepted at another graduate school. Credit for the same course is not given toward both graduate and undergraduate degrees.

University policy permits undergraduates to enroll in graduate courses numbered 500 to 599 and apply the credit earned toward an undergraduate degree. For details of requirements and procedures see Graduate Course Enrollment by Undergraduates in the Admission section of the undergraduate catalog.

Adding and Dropping Courses
To add or drop a course during the schedule adjustment period, a graduate student must complete the transaction using 4GMU, the automated registration system.

The last day for dropping a course is five calendar weeks after and including the first day of classes. The last day for adding a course is two calendar weeks after and including the first day of classes.

Withdrawal from All Classes
Graduate students who are enrolled in one or more courses are considered in attendance until they formally withdraw by having an official withdrawal form approved by the dean of their college/school/institute.

Upon approval by the dean of their college/school/institute, graduate students may withdraw from all classes after the drop period without academic penalty, but only for nonacademic reasons that prevent completion of the courses. Graduate students who stop attending all classes after the drop period without the dean's approval to withdraw receive Fs in all courses.

Graduate students withdrawing before the final examinations in any semester or Summer Term forfeit credit for work done in that term.

The university may impose enforced withdrawal as a penalty for any fault that prevents the graduate student from fulfilling the purposes of enrollment.

Repeating a Course
A graduate student who has passed a course with a grade of B or better is not permitted to repeat the course for credit. A graduate student may repeat a course in which a grade of C or below has been earned. Permission for repeating the course must be obtained from the department offering the course. Each department establishes procedures for granting permission for repeating a course.

When a course is repeated, all hours attempted are used in determination of termination or dismissal, the transcript shows both the original and repeat grades, and only one grade per course may be presented on the degree application.

Auditing a Course
Auditing a course requires the permission of the department chair in which the course is offered. A previously audited course may be taken for credit at a later date. A graduate student may also audit a course previously taken and passed. A graduate student may not change from credit to audit status after the five week drop period. The usual tuition and fees apply to audit status.

Graduate Policies

Final Examinations Policy for Graduate Courses
Written examinations are held at the end of each semester. No changes may be made in the announced examination schedule unless approved in writing by the chair of the department offering the course.

After consulting the department chair, the individual faculty member may exercise judgment regarding the use of a formal examination at the end of the course.

Absence from examination is not excused except for sickness on the day of the examination, or for other cause approved by the appropriate dean. If an absence is unexcused, the grade on the course is entered as F. A student whose absence from an examination is excused may be given a grade of AB and take a special examination within a 10-day period on a date to be arranged between the student and the instructor in charge of the examination. If the examination is not taken within 10 days, the grade on the course is entered as F. A request to take an examination late should be made on a Student Request Form and submitted by the graduate professor to the department.
Grading System

The grading system for graduate credit is A, B (satisfactory), C, F (unsatisfactory). Theses and dissertations will be assigned an IN (in progress) until completed. When completed, a letter grade will be assigned. The mark of IN (incomplete) may be given when all course requirements have been completed except for assigned papers or reports which the student has been compelled to postpone for reasons beyond the student's control. Regulations concerning incomplete marks may be found under the section Change of Grade.

Grade points for each semester hour are assigned on a scale of 4 for A, 3 for B, 2 for C, and 0 for F. A grade point score is computed by multiplying the value of the letter grade by the number of credits for the course. As an example, a student receiving an A in a three-semester-hour course earns 12 grade points. Dividing the number of grade points earned by the number of semester hours attempted gives the GPA. (Note: The marks of S, NC, and IP have no grade points associated with them and hours with such marks are not included in GPA computations. NC and IP have no negative impact on a student's record.)

Each faculty member is responsible for preparing course examinations and determining grades.

Policies concerning the weight given to examinations in computing final grades and the kinds of examinations used may differ according to the preferences of individual instructors.

Grade reports are sent to the student and to the adviser each semester in which the student is registered, including those in which the student withdraws. The report includes all courses for that semester and the grades received.

Change of Grade

Final grades in courses for graduate credit may be changed only on the basis of the following two circumstances and procedures.

Change from Incomplete and In Progress to Letter Grade. For cause beyond reasonable control, a student may be unable to complete a course on schedule. In such cases, the instructor may assign a temporary grade of Incomplete (IN). Graduate students have only nine weeks to complete work in a course in which they received a grade of IN. If the student fails to complete all requirements in time for the instructor to assign a regular grade by the end of the ninth week of classes of the next semester (excluding Summer Term), the mark of IN is changed by the Office of the Registrar to F. The student is responsible for submitting work to the instructor with sufficient time allowed for its evaluation.

While the mark of IN remains on the transcript, it is treated as an unsatisfactory grade and may contribute to dismissal. A mark of In Progress (IP) is used for courses numbered 999, 998, 799, 798, internship courses, and some other courses until such time as all course work is completed. IP is not treated as an unsatisfactory grade, nor is it subject to the time limit prescribed for IN.

Change of Final Grade. Once a final grade in a course has been recorded by the Office of the Registrar, it can be changed only in cases of computational error or other justifiable cause approved by the appropriate dean. (Refer to Appeal of Grade.) All changes of final grades must be initiated, approved, and recorded prior to the last day of classes of the next regular semester (excluding Summer Term).

Appeal of Grade

Although generally the individual faculty member must be the best judge of student performance, there may be instances in which a graduate student believes a grade has been assigned unfairly. In such cases the student should ask the professor to reconsider the grade. If the student is not satisfied, an appeal may be made to the department chair, who initiates procedures established by the department. No appeal of a grade is considered after the end of the drop period of the next regular session (excluding Summer Term).

Academic Dismissal

A graduate student is dismissed upon accumulating 12 hours of unsatisfactory grades in graduate-level courses. These are minimum standards of academic performance; some programs have higher standards. See the program requirements section. A student may also be dismissed for failure to meet other program requirements such as doctoral competence examinations. The notation of academic dismissal is affixed to the graduate student's official record. A student who is dismissed may not take additional course work at the university.

Academic Termination

A provisional graduate student who fails to achieve at least a 3.00 GPA after completing 12 hours of course work as a provisional student is terminated from provisional status. The notation of academic termination is affixed to the graduate student's official record. Provisional students are also terminated after accumulating 12 hours of un-
satisfactory undergraduate course work grades. Graduate and undergraduate grades are not combined in the calculation of hours toward termination or dismissal. However, nondegree students are terminated after the accumulation of 12 hours of unsatisfactory grades in graduate or undergraduate courses combined.

Change from Provisional to Degree Status
For a change from provisional status to be considered, a graduate student must have completed 12 semester hours of graduate course work in provisional status with at least a 3.0 GPA, supplied all admission credentials, and removed all deficiencies as established in the student's letter of admission. Written confirmation from the college/school/institute dean or director indicating the change of status is sent to the student. Credits earned in the provisional status may be used subsequently in meeting minimum hour and program degree requirements. However, a maximum of 12 graduate credits earned in nondegree status may be applied toward a master's degree. Students admitted in these categories are therefore strongly urged to obtain faculty guidance before beginning course work. Credits cannot be applied toward a graduate degree unless they are specifically approved for that purpose.

Change from Nondegree to Degree Status
A student admitted for graduate study in nondegree status may request a change to degree-seeking status within the same program. To do so, the student must secure departmental and college/school/institute's approval on the college/school/institute's Student Request Form. All admission requirements as normally defined by the student's program for degree status must be met (e.g., official transcripts, letters of recommendation, etc.). If the student intends to use credits earned in nondegree status toward a degree, the credits must be approved on the college/school/institute's Transfer of Credit form.

Transfer of Credit for Work Taken Prior to Admission
With the recommendation of the appropriate program faculty and approval of the appropriate dean or director, a master's student may transfer up to six semester hours of graduate credit earned at other accredited institutions before the student enrolled in the George Mason graduate program. Up to 12 hours of credit may be transferred within the Cooperative Graduate Engineering program and the Master of Arts in Interdisciplinary Studies program. Undergraduate courses taken at other institutions are not transferable for credit to graduate programs within the university. All graduate work offered as transfer credit must be applicable to the degree program the student is pursuing at George Mason University.

Credit is normally considered for transfer, upon the request of the student, at the time of initial registration as a degree student. Transfer of credit requests from provisional students are not considered until such students are advanced to degree status. The collegiate dean sends students written confirmation of all credits approved for transfer.

A maximum of 3 semester hours of transfer credit from other universities may be applied toward a graduate certificate program with the approval of the certificate coordinator and the appropriate dean or director. All other general policies applicable to transfer credit to degree programs apply to transfer credit for certificate programs.

Criteria for Transferable Credit
To be accepted for transfer, previous credits must have been earned within six years prior to admission. Credits previously applied toward a degree at another institution or at GMU are not allowed as transfer credit.

In all cases of courses accepted for transfer of credit, a minimum grade of B must have been earned and the courses must be applicable toward a degree at the institution offering the course. Extension and inservice courses that are not intended by the institution offering the courses to be part of a degree program are not acceptable for transfer to the university. The student is responsible for furnishing such evidence. The dean decides whether work taken elsewhere and presented for transfer credit to a graduate program at the university is acceptable. Departmental recommendation alone is insufficient.

Courses at Other Institutions
A student enrolled in a degree program may take graduate courses at another accredited institution and apply these credits to a master's or doctoral degree with the prior approval of the department and the college/school/institute. Students may earn up to 6 hours of such transfer credit toward a master's degree or 12 hours toward a doctoral degree. Permission to take a course elsewhere must be secured in writing from the dean prior to registering at the other institution. The student is responsible for requesting transfer credit for such courses after their completion and for having an
official transcript submitted to the college/school/institute office for evaluation of possible transfer of credit.

Permission does not exempt a graduate student from satisfying the 18-hour minimum for a master's degree or the 36-hour minimum for a doctoral degree of course work taken at the university.

Experiential Learning Credit
Credit for experiential learning is considered only in the Master of Arts in Interdisciplinary Studies degree.

Student Requests and Appeals
A graduate student who wishes to request an exception to published academic regulations or to appeal decisions involving the application of academic regulations to a program of study may do so by submitting a petition to their dean. Graduate departments provide a mechanism for grade appeal. Thus all grade appeals should be submitted to the department responsible for the course.

Students who are terminated or dismissed from their programs may appeal this action. The student is responsible for presenting relevant information or documents in support of an appeal. The appeal is heard by the Student Appeals Committee. The student is notified of the time and place of the meeting and decides whether or not to attend to present written or verbal information. Such meetings are academic and not legal hearings. The committee makes a recommendation to the dean. The dean's decision is final and cannot be appealed.

Catalog in Effect for Graduation
Graduate students may choose to graduate under the catalog in effect when they were admitted or the catalog in effect when they graduate or any catalog that was in effect during the time of their enrollment. However, students who have been inactive more than one year must graduate under a catalog in effect after they have been granted permission to re-enroll.

Degree Application
Master's students who expect to complete all degree requirements in a given semester will be mailed an intent to graduate form along with the degree application from the Graduate Office. Students are expected to return the form with appropriate department signatures from their school, college, or institute by the date designated in the Academic Calendar.

Foreign Language Requirement
Several degree programs require that a student demonstrate a proficiency in one or more foreign languages as part of the degree requirements established by the program faculty. Such a requirement is listed under the degree requirements for a specific degree in the academic program section of this catalog. Certification of the successful completion of the foreign language requirement should be sent by the academic adviser to the collegiate dean.

Commencement
Effective with the Spring 1992 Commencement, the titles of master's theses will no longer be listed in the Commencement program. Master's candidates who file an Intent to Graduate Form for August but who have not yet completed all degree requirements may participate in the Commencement ceremony in anticipation of the completion of the degree. Their names will be marked with an asterisk identifying them as master's candidates pending completion of all requirements. Effective with the Spring 1995 Commencement, doctoral students may participate only if they have successfully defended and submitted a signed final copy of their dissertation.

Degree Requirements

Requirements Applicable to All Master's Degrees
Candidates must satisfy all university degree requirements and all requirements set by the master's program faculty. Specific departmental degree requirements are listed under the respective graduate programs in this catalog.

General Requirements
The following requirements apply to all master's degrees:
1. A candidate must have earned a minimum of 30 semester hours of graduate credit.
2. Only graduate-level courses may apply toward the degree.
3. A graduate student may apply up to 6 hours of C grades in graduate-level courses and must have a grade point average of at least 3.0 on the degree application. The GPA calculation does not include transfer credits.
4. A candidate must have completed at least 18 semester hours of graduate-level work at the university after having been admitted to degree status.

5. A candidate must have completed at least 24 semester hours at the university of which:
   a. A maximum of 6 semester hours may be in master's thesis research (799) or in master's project research (798);
   b. No more than 12 semester hours may have been earned through enrollment in nondegree status or through extended studies enrollment prior to acceptance in a degree program;
   c. Of these 12 credits, no more than 6 semester hours may be transfer credit for course work taken prior to admission, with credit earned in nondegree status or through extended studies enrollment reduced accordingly (exceptions are noted under individual degree programs);
   d. A maximum of 6 semester hours may be transfer credit taken after admission to the university.

Time Limit
A student must complete all requirements for the desired master's degree within six years from the date of initial registration as an admitted (degree or provisional) graduate student. A graduate student who terminates enrollment and later is granted permission to re-enroll may not count the six-year time limit as beginning on the date of re-enrollment.

Thesis and Nonthesis Options
Requirements regarding a thesis vary with the degree program. A number of master's programs offer both a thesis and nonthesis option. The same quality of work is expected of students regardless of their chosen option. For further information, consult the section on degree requirements under each degree program.

Master's Thesis
When a thesis proposal has been approved by the appropriate department, the department chair sends the collegiate dean a copy of the thesis proposal, including the approval signatures of the master's thesis committee members. The student may enroll in the thesis research course (799) at the beginning of the next semester. Students must register for 3 hours per semester until the required number of thesis hours is reached. Once the required number is reached, students must enroll for 1 credit hour per semester until graduation.

The master's thesis committee is named by the candidate's department chair, who also designates a member of the Graduate Faculty from that department as the thesis committee chair. The committee is appointed after consultation with the candidate and the adviser, and consists of at least three persons, two of whom must be members of the Graduate Faculty, and one of whom may be from outside the department. At least two committee members must be members of the Graduate Faculty.

The thesis committee chair is primarily responsible for directing and guiding the candidate's research and writing activities. The student is responsible for keeping all committee members informed of the scope, plan, and progress of both the research and the thesis.

Students selecting the thesis option should obtain from their school, college, or institute a copy of the Guide for Preparing Graduate Theses, Dissertations, and Projects. Students may register in the thesis course (799) only after a thesis proposal has been submitted and approved as prescribed in the guide. Any student not in attendance at the university who is preparing a thesis under the active supervision of a member of the faculty, or who wishes to take an examination, must maintain continuous registration for at least one hour per semester.

Thesis Submission
The original and one copy of the thesis with signed cover sheet must be deposited with the graduate dean or director on or before the date specified below:

- November 15 . . . January graduation
- March 31 . . . . . May graduation
- July 15 . . . . . August graduation

Requirements Applicable to All Doctoral Degrees
Candidates must satisfy all university degree requirements and all requirements established by the doctoral program faculty. Specific program degree requirements are listed under the respective doctoral programs in this catalog.

General Requirements
The requirements that follow apply to all doctoral degrees. A doctoral candidate must:

1. Acquire a minimum of 72 semester hours of graduate credit beyond the baccalaureate degree, with the following limitations:
(a) No more than 24 semester hours in doctoral dissertation research (999) or doctoral project research (998) combined.
(b) No more than 12 semester hours of transfer credit taken after admission to doctoral degree status.

2. Pass a written and/or oral doctoral candidacy (qualifying) examination.

3. Defend the dissertation. This final oral doctoral examination must be approved by the doctoral dissertation committee, the department chair, the graduate dean, or their school, college, institute, or program director.

The number of hours required by a doctoral degree program may be reduced by a maximum of 30 hours if a master's degree or other appropriate hours have been earned prior to admission.

Residence
All doctoral students are required to spend a minimum of two consecutive semesters, not including the Summer Term, in continuous registration. The doctoral program of study must include a minimum of 36 semester hours of graduate work taken at George Mason University after admission to degree-seeking status.

Time Limit
Doctoral students must complete all degree requirements to be advanced within six years. The date of advancement does not change if a student terminates enrollment and later is granted permission to re-enroll in the same doctoral program.

Dissertation Committee
At the time that a doctoral student is to be considered for advancement to candidacy, the dean or director of their college/school/institute appoints a dissertation committee upon recommendation by the department chair or institute director. The committee consists of a professor from the department of the student's major and at least two other members of the graduate faculty, one of whom must be from outside the student's department. Additional members may be appointed who are not members of the graduate faculty or who are from outside the university. A professor from the student's major department must chair the committee.

The dissertation committee is responsible for approving the doctoral dissertation. In addition, the graduate dean may appoint a member of the graduate faculty to attend the dissertation defense.

Doctoral Research Skill Requirements
Some doctoral degree programs require demonstration of proficiency in a research skill: a reading knowledge of the research literature in a foreign language, knowledge of a computer language, knowledge of statistical methods, or knowledge of a research tool specific to the discipline. Research skill requirements are included with the degree requirements for the specific doctoral degree. Where demonstration of research skills is required, certification that this requirement has been met must be completed for advancement to candidacy.

Program of Study
Normally before the end of the second year of graduate study, but no later than consideration for advancement to candidacy, a doctoral student must submit a program of study for approval by the dean or director of their school, college, or institute. The program of study must include major courses and supporting courses to be completed, research skills required, subject areas to be covered by the candidacy examination, and a proposed date for the candidacy examination. Program of Study forms are available from each program's doctoral coordinator.

Advancement to Candidacy
Advancement to candidacy implies that a doctoral student has demonstrated both a breadth and depth of knowledge in the field of study and is capable of exploring problems on the boundaries of knowledge.

The candidacy examination includes a written part and may include an oral part, depending on the particular doctoral program. Doctoral students should consult the degree requirements for each doctoral program to determine whether an oral portion is required, whether it is judged separately or with the written portion, the number of times a failed candidacy examination may be repeated and any time limits for repeating, and any time limits for attempting the candidacy examination.

Before doctoral students may be advanced to candidacy by the graduate dean or director of their school, college, or institute, they should have completed all course work required by the program faculty, have been certified in all doctoral research skills required, have passed the candidacy examination, and have been recommended by the doctoral supervisory committee or the program coordinator.
Doctoral Dissertation
A dissertation is required for the doctor of philosophy degree and most professional doctoral degrees. The dissertation is a written piece of original thinking that demonstrates doctoral candidates' mastery of the subject matter, methodologies, and conceptual foundations in their chosen fields of study. This is generally achieved through consideration of a problem on the boundaries of knowledge in the discipline.

The director of the dissertation committee is primarily responsible for directing the doctoral candidate's research and guiding the preparation of the written dissertation. After the dissertation committee is appointed, the student should begin discussions with the director to define a suitable problem for the dissertation. Before the student may enroll in doctoral dissertation research (999), the dissertation proposal must be approved by the dissertation committee and evidence of its approval sent to the graduate dean or director of their school, college, or institute for approval. Prior to that time, the student may enroll in proposal research (998).

Guidelines for the content and general format of the doctoral dissertation may be found in the Guide for Preparing Graduate Theses, Dissertations, and Projects, which is available from each student's school, college, or institute. The guide also includes information on the number of copies required, and submission of the dissertation for approval by the dissertation committee and the graduate dean or director. Consult your doctoral coordinator to determine which reference manuals are appropriate to your discipline.

Continuous Dissertation Registration
Registration for doctoral research proposal courses (998) and doctoral dissertation courses (999) must be completed during early registration or by the end of the Schedule Adjustment period. If this date is missed, students must register for these courses the following semester.

All registration for doctoral dissertation research (999) must be planned in advance with the dissertation director and doctoral coordinator. Students must register for a minimum of 3 hours per semester (6 hours per semester is required to be considered full time) until the required number of dissertation hours is reached. Once the required number is reached, students must enroll in a minimum of 1 credit hour per semester until graduation.

Once the required number of dissertation hours is reached, students are eligible for two additional semesters of consideration for full-time status provided their dissertation adviser and project coordinator verify their full-time dissertation work and they are registered for one credit of dissertation research each semester.

Doctoral Defense
As soon as all degree requirements have been satisfied, including the completion of the doctoral dissertation, the doctoral candidate may arrange with the dissertation committee to schedule the doctoral defense.

The oral defense should demonstrate the candidate's maturity of judgment and intellectual command of the chosen branches of the candidate's field of study.

At the close of the final defense, the dissertation committee makes final judgments for approving the dissertation. The doctoral candidate is responsible for making all required changes promptly, securing the signatures of the director and other members of the dissertation committee, and submitting the original and required copies to the graduating candidate's perspective school, college, or institute for approval by the graduate dean or director.

Dissertation Submission and Fee
The original and one copy of the dissertation must be deposited with the graduate dean. In addition, submission of the dissertation to University Microfilms International (UMI) is required; a fee of approximately $50 is paid by the student for this process. All copies of the dissertation must be submitted and fees paid before the doctoral degree is awarded.

Honor System and Code

George Mason University shares in the tradition of an honor system that has existed in Virginia since 1842. The Honor Code is an integral part of university life. On the application for admission, students sign a statement agreeing to conform to and uphold the Honor Code. Therefore, students are responsible for understanding the provisions of the code. In the spirit of the code, a student's word is a declaration of good faith acceptable as truth in all academic matters. Therefore, attempted cheating, plagiarism, lying, and stealing of academic work and related materials constitute Honor Code violations. To maintain an academic community according to these standards, students and faculty must report all alleged violations of
the Honor Code to the Honor Committee. Any student who has knowledge of, but does not report, an Honor Code violation may be accused of lying under the Honor Code.

The Honor Committee is independent of the Student Government and the university administration. It is made up of students selected by the student body and has the primary duty of espousing the values of the Honor Code. Its secondary function is to sit as a hearing committee on all alleged violations of the code.

At the beginning of each semester faculty members have the responsibility of explaining to their classes their policy regarding the Honor Code. They must also explain the extent to which aid, if any, is permitted on academic work. The complete Honor Code is printed below:

Honor Code
To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of George Mason University, and with the desire for greater academic and personal achievement, we, the members of George Mason University, have set forth the following code of honor.

I. The Honor Committee
The Honor Committee is a group of students elected from the student body whose primary and indispensable duty is to instill the concept and spirit of the Honor Code within the student body. The secondary function of this group is to sit as a hearing committee on all alleged violations of the code.

II. Extent of the Honor Code
Duties of the Honor Committee:
The Honor Code of George Mason University deals specifically with:
A. Cheating and attempted cheating,
B. Plagiarism,
C. Lying, and
D. Stealing.

A. Cheating encompasses the following:
1. The willful giving or receiving of an unauthorized, unfair, dishonest, or unscrupulous advantage in academic work over other students.
2. The above may be accomplished by any means whatsoever, including but not limited to the following: fraud; duress; deception; theft; trick; talking; signs; gestures; copying from another student; and the unauthorized use of study aids, memoranda, books, data, or other information.
3. Attempted cheating.
B. Plagiarism encompasses the following:
1. Presenting as one’s own the words, work, or opinions of someone else without proper acknowledgment.
2. Borrowing the sequence of ideas, the arrangement of material, or the pattern of thought of someone else without proper acknowledgment.
C. Lying encompasses the following:
The willful and knowledgeable telling of an untruth, as well as any form of deceit, attempted deceit, or fraud in an oral or written statement relating to academic work. This includes but is not limited to:
1. Lying to administration and faculty members.
2. Falsifying any university document by mutilation, addition, or deletion.
3. Lying to Honor Committee members and counsels during investigation and hearing. This may constitute a second charge, with the committee members who acted as judges during that specific hearing acting as accusers.
D. Stealing encompasses the following:
Taking or appropriating without the permission to do so, and with the intent to keep or to make use of wrongfully, property belonging to any member of the George Mason University community or any property located on the university campus. This includes misuse of university computer resources (see Computer Use Policy under General Policies). This section is relevant only to academic work and related materials.

III. Responsibility of the Faculty
Professors are responsible, to the best of their ability, for maintaining the integrity of the learning and testing process, both in the classroom and outside of it, and for fostering conditions of academic integrity. Faculty members may actively proctor examinations in situations that they believe warrant it.

To alleviate misunderstandings, all professors are required to delineate at the beginning of each semester what constitutes a violation of the Honor Code in their classes. This should include an explanation of:

A. The extent to which collaboration or group participation is permissible in preparing term papers, laboratory exhibits or notebooks, reports of any kind, tests, quizzes, examinations, homework, or any other work.
B. The extent to which the use of study aids, memoranda, books, data, or other information is permissible to fulfill course requirements.
C. Guidelines on what constitutes plagiarism, including requirements for citing sources.

All professors are encouraged to send the Honor Committee a written copy of their Honor Code policies, which are kept on file. These require-
ments should also be stated before each test, examination, or other graded work to clarify what is permissible.

Faculty members who witness an Honor Code violation should proceed as outlined under Procedure for Reporting a Violation.

IV. Responsibility of the Students

Students should request a delineation of policy from each professor if none is given at the beginning of each semester. Students should also request an explanation of any part of the policy they do not understand. Students are responsible for understanding their professors' policies with regard to the Honor Code. Students are also responsible for understanding the provisions of the Honor Code.

As participating members of this community, all students have the duty to report to a member of the Honor Committee, within the prescribed time outlined under Procedures for Reporting a Violation, any violations of the Honor Code. This duty is important not only because it enforces the Honor Code, but also because it gives all students the opportunity to express their respect for personal integrity and an honest academic community.

V. Procedure for Reporting a Violation

All students or faculty members witnessing or discovering a violation of the Honor Code should enlist, wherever and whenever possible, one or more corroborating witnesses to the overt act. The accuser(s) (student, faculty, or staff), within 15 working days from date of realization, notifies the Honor Committee. The Honor Committee, within five Honor Committee working days, mails a letter of accusation to the suspected party. This letter is addressed to the accused student's current mailing address listed with the Office of the Registrar.

The Honor Committee retains a copy of the accusation letter, which informs the suspected parties that they have five Honor Committee working days to contact the Honor Committee office and make an appointment to see the committee chair to be advised of their rights and options. The Honor Committee begins an investigation, which does not involve a presumption of guilt on the part of the accused. Any member of the George Mason University academic community who knows of but does not report an Honor Code violation may be accused of lying under the Honor Code.

VI. Counsel for the Accused and Accuser

Counsel for the accused and accuser may be provided by any member of the George Mason University student community, including members of the Honor Committee, but not including students of the School of Law.

VII. Appearance of Witnesses

The Honor Committee may require any member of the university community to appear as a witness before the Committee at the time of the hearing. All requests for such appearances are issued by the chair of the Honor Committee, or by the counsel appointed to that case. The appearance of the accuser is required.

VIII. Verdict

To find a student guilty of an honor violation, there must be a four-fifths majority vote (four to one) for a verdict of guilty. Clear and convincing evidence must be presented to find the student guilty.

A student may not be tried more than once for the same offense except when an appeal is granted.

IX. Penalty

If the accused is found guilty of an honor violation, the Honor Committee determines the nature of the penalty by majority vote.

The Honor Committee is not restricted to one kind of penalty but determines one commensurate with the seriousness of the offense. Typical of the range of penalties which may be given are:

A. Oral reprimand: An oral statement to the student given by the chair of the hearing. No entry is made on the student's scholastic record.

B. Written reprimand: A written censure placed in the confidential files of the Honor Committee and in the student's academic file but not made part of the student's scholastic transcript records.

C. Non-academic probation: Exclusion from holding or running for an elected or appointed office in any organization or activity associated with the university. Ineligibility to participate in any activity representing the university on either an intercollegiate or club level and ineligibility to serve as a working staff member of any student organization. This action is noted in the judicial administrator's file but is not made a part of the student's scholastic record.

D. Service hours: Library or other supervised university service hours to be completed by a specific time. Upon completion the hold on the student's records is removed.

E. Failing grade: Recommendation in writing to the instructor for a grade of F for the work involved, or for the entire course. The student's permanent record reflects the academic evaluation made by the instructor.

F. Recommendation of suspension from the university for one or more semesters: A student's
scholastic record would read: "Non-academic suspension from (date) to (date)." The recommendation is made to the Associate Provost and Dean for Undergraduate Studies or the Dean of the Graduate School.

G. Recommendation of expulsion from the university. A student's scholastic record would read: "Non-academic expulsion as of (date)." This penalty is recommended to the Associate Provost and Dean for Undergraduate Studies or the Associate Provost for Research and Graduate Studies only in extraordinary circumstances, such as for repeated offenses.

X. Appeal
A written request for an appeal, detailing new evidence, procedural irregularities, or other sufficient grounds that may have sufficient bearing on the outcome of the trial, must be presented to the chair of the Honor Committee within seven working days after the date on which the verdict was rendered.

The written request is reviewed by at least three voting members who were not involved with the original case. If a new hearing is granted, no voting member from the original hearing may vote in a second or subsequent hearings of the same case.

XI. Keeping of Records
The records of the hearing are kept in the Honor Committee's files. These records include a tape or a full transcript of the hearing and all evidence presented at the hearing. If the evidence belongs to any person other than the accused, the original is returned to the owner and a copy kept with the records of the Honor Committee.

XII. Composition of the Committee
The Honor Committee is proportionally composed of students from each school and faculty adviser(s), although the latter are nonvoting members. Undecided majors, B.I.S. students, and continuing education students are considered together as a school. The total number of members is as close to one-half of one percent of the student body as possible. Freshmen are appointed in the fall to serve until the following spring election. One or more clerks appointed by the committee from the student body serve as aides to the chair.

The chair and vice chair of the committee are elected by majority vote of the committee members. For each hearing, five members of the Honor Committee are designated as voting members.

The faculty hearing adviser, acting as a nonvoting member of the committee, sits with and advises the committee at all hearings. The faculty adviser and faculty hearing adviser are chosen by the Honor Committee.

Previous Honor Committee members may serve during the summer term.

XIII. Eligibility of Members
Any student who maintains a 2.0 grade-point average and is in good standing with the university is eligible for the Honor Committee. A committee member must maintain a 2.0 average to continue in office.

XIV. Election of the Honor Committee
The Honor Committee is elected in the spring semester. The term of office begins upon election and runs until the following spring election.

In the fall semester the chair appoints new members to fill any vacancies that have occurred and to fill the freshman seats on the committee.

XV. The Challenging and Voluntary Withdrawal of a Member of the Committee from Participation in a Particular Hearing
An accused person who challenges the right of any member of the Honor Committee to sit in judgment on him or her must present cause to the chair of the hearing.

The hearing committee then decides the validity of the challenge with the challenged member abstaining from voting. A simple majority decides the validity of any challenge. A successfully challenged committee member must not be present during the hearing.

A member of the Honor Committee who feels prejudiced as to the facts of the case, is a close friend or relative of the accused, or would not be able to render an impartial judgment must withdraw from a specific hearing.

XVI. Provision for Amendments
Upon petition of 20 percent of the student body, amendments to or revisions of the Honor Code may be proposed for ratification. Said amendments and/or revisions are voted on by the student body as a whole. A two-thirds majority of the votes cast is necessary for acceptance of any amendment or revision.

The Honor Committee may also propose amendments to be voted on by the student body as described in paragraph one of this section.

Approved amendments take effect immediately for all new cases. New provisions are not applied to cases initiated prior to the amendments.
Tuition, Expenses, and Financial Aid
Tuition, Expenses, and Financial Aid

Tuition and Fees

General Guidelines and Student Responsibilities
1. By registering for classes, students accept responsibility for charges for the entire semester.
2. Registration shall not be completed unless all outstanding balances due the university are paid in full.
3. Refer to the Payment Schedule and Tuition Liability charts in the Schedule of Classes for payment due dates and penalties.
4. Payments are due at the Cashier's Office on or before due dates, regardless of postmark if mailed.
5. Failure to receive a reminder bill confirming your charges does not waive the requirement for payment when due. Once priority registration is over, the 4GMU telephone system (option 4) will confirm student tuition/fee charges.
6. The student is responsible for maintaining a current billing address at the Registrar's Office.
7. The entire student registration is canceled if payment or payment arrangements are not made in full by the Cancellation Date (see table in the Schedule of Classes).
8. Non-returning students are responsible for submitting a written withdrawal to the offices of the Registrar, Housing and Residential Life, and Financial Aid. Penalties may apply.
9. Students enrolling in GMU off-campus courses are assessed tuition and fees at the same rates as those for on-campus courses.
10. A few GMU degree programs include academic credits that students must earn at other institutions. Students enrolling for such credits assume all financial responsibility directly with the other institution.

Tuition Charges Per Semester

<table>
<thead>
<tr>
<th></th>
<th>In-State</th>
<th>Out-of-State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time (12-17 credit hours) per semester</td>
<td>$2,022.00</td>
<td>$5,334.00</td>
</tr>
<tr>
<td>Per-credit-hour (less than 12 or more than 17)</td>
<td>168.50</td>
<td>444.50</td>
</tr>
</tbody>
</table>

Related Fees

<table>
<thead>
<tr>
<th></th>
<th>In-State</th>
<th>Out-of-State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Fee</td>
<td>$25</td>
<td>$25</td>
</tr>
<tr>
<td>New Student Fee</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>International Student Health Insurance Fee</td>
<td>N/A</td>
<td>to be determined</td>
</tr>
</tbody>
</table>

Special Registration Fee
Students not enrolled in a credit-bearing course but pursuing an activity related to their GMU matriculation who wish to retain active status may register for Special Registration (SREG 200, Section 001) for a $45 fee. This special registration allows students to retain their library privileges and Student ID, and to purchase a student parking decal. Students must have active status in order to apply for or receive a degree, take an examination, or participate in cooperative education.

International Student Health Insurance
Health insurance is required for all F-1 and J-1 visa holders. Health insurance fees are deducted from all payments received by the university before funds are applied to tuition or other charges. Failure to plan for this payment can result in a shortfall in the student's tuition payment, which could result in cancellation of classes.

Off-Campus Courses
Students enrolling in GMU off-campus courses are assessed tuition and fees at the same rates as those for on-campus courses.

Credits Earned Elsewhere
A few George Mason University degree programs include academic credits that students must earn at other institutions. Students enrolling for aca-
demic credits at other institutions assume all financial responsibility for these arrangements.

Tuition Charges/Refunds for Dropped Courses

Students are required to pay full or partial tuition for courses that they drop after the first week of class. See the Tuition Liability chart on page 2 of the Schedule of Classes. In cases where tuition liability is less than the payment on the student's account, a refund of the overpayment may be requested. A Refund Request form, available in the Office of Students Accounts, Krug Hall, Room 103, must be completed and submitted to that office. Questions should be addressed to (703) 993-2484.

Tuition Liability Scale for Dropped Courses

<table>
<thead>
<tr>
<th>Week #</th>
<th>Tuition Liability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>None***</td>
</tr>
<tr>
<td>2</td>
<td>33%</td>
</tr>
<tr>
<td>3</td>
<td>67%</td>
</tr>
<tr>
<td>4 and later</td>
<td>100%</td>
</tr>
</tbody>
</table>

** $25 Withdrawal fee if dropping all courses.

On-Campus Housing Costs 1994-95

<table>
<thead>
<tr>
<th>Room Rental Charges Per Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apartments</td>
</tr>
<tr>
<td>2-person $1,975.00</td>
</tr>
<tr>
<td>4-person $1,820.00</td>
</tr>
<tr>
<td>6-person $1,615.00</td>
</tr>
<tr>
<td>Commonwealth and Dominion</td>
</tr>
<tr>
<td>Double rooms $1,575.00</td>
</tr>
<tr>
<td>University Commons</td>
</tr>
<tr>
<td>Single rooms $1,850.00</td>
</tr>
<tr>
<td>Double rooms $1,575.00</td>
</tr>
<tr>
<td>University Park</td>
</tr>
<tr>
<td>Townhouses $1,925.00</td>
</tr>
<tr>
<td>Patriots Village</td>
</tr>
<tr>
<td>Single rooms $1,850.00</td>
</tr>
<tr>
<td>Double rooms $1,575.00</td>
</tr>
<tr>
<td>Presidents Park I and II</td>
</tr>
<tr>
<td>Single rooms $1,850.00</td>
</tr>
<tr>
<td>Double rooms $1,575.00</td>
</tr>
</tbody>
</table>

All rates are per person. Four persons are assigned to a two-bedroom townhouse.

Meal Plan Charges Per Semester

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>19 meals per week</td>
<td>$880.00</td>
</tr>
<tr>
<td>15 meals per week</td>
<td>800.00</td>
</tr>
<tr>
<td>10 meals per week</td>
<td>700.00</td>
</tr>
</tbody>
</table>

All residents, with the exception of those residing in the townhouses and apartments, are required to have a meal plan.

Payment Methods

WHERE:
Window, Cashier's Office, Krug Hall, Room 106, 9 a.m. to 4:30 p.m.
Drop Box, outside Cashier's Office, Krug Hall, Room 107
U.S. Mail, George Mason University, Cashier's Office, Fairfax, VA 22030-4444

HOW:
Cash, At window only
Check, Payable to GMU, student ID# written on front. Third-party checks not accepted. Checks must be payable in U.S. dollars.
Credit card (subject to credit approval), MasterCard or Visa. Daytime phone number must be provided. Written authorizations only.
FAX: FAX Payment Authorization (703) 993-2492.

WHEN:
See Payment Schedule in the Schedule of Classes for deadlines.

Deferred Payment Plan

A semester payment plan is available through Week 3 of classes for students who need to budget. Minimum contract amount must be equivalent to 6 credit hours at the in-state rate. A payment contract must be completed at the Office of Student Accounts and submitted to the Cashier's Office with a down payment (1/2 of contract amount plus fee). The contract fee is $25 and is nonrefundable. Failure to pay the outstanding balance by due date on contract will result in a $25 late fee, Financial Suspensions, and ineligibility to defer payments in future terms.

Monthly Installment Plan

Full-time students may budget all or part of their yearly tuition, room, and board expenses in 10 equal monthly installments. A life benefit insurance plan is included. A minimum budget is required, and an annual fee is charged. For information, call Academic Management Services, (800) 556-6684.

Payment Authorizations

Third-party authorization or government training vouchers are accepted only through Week 3 of classes and are to be submitted to the Office of Student Accounts.

Refunds

Refunds can only be processed if there is an overpayment by the student on the account. A Refund Request form must be completed and submitted to the Office of Students Accounts. Forms may be obtained at Krug Hall, Room 103.

Financial Penalties

$25 Penalty Fees (for in-state and out-of-state students)

Late Fee
Failure to make any payment on or before the due date results in a late fee of $25.

http://catalog.gmu.edu
Withdrawal Fee
A $25 withdrawal fee will be charged all students who withdraw after the Cancellation Date and before the 33% Tuition Liability period (see chart in the Schedule of Classes).

Nonpayment Cancellation Fee
Students who are cancelled from classes for non-payment or insufficient payment of tuition are assessed a $25 fee. Once imposed, this fee is not removed even if the student re-registers.

Returned Check Fee
A $25 returned check fee will be charged for each check returned by the bank unpaid. If the returned check results in an unpaid account, an additional $25 Late Fee will be charged, and the student will be placed on Financial Suspension.

Reinstatement Fee
Students placed on Financial Suspension because of outstanding obligations in excess of $100 are assessed a $25 reinstatement fee.

Financial Suspension
All academic service is withheld for students who are not in good financial standing with the university. This means that no transcripts of record are issued, no diplomas are released, and no registrations are permitted until outstanding obligations, including the reinstatement fee, have been paid in full. Outstanding obligations include, without limitation, fines owed for traffic and parking violations and to libraries of institutions and participating public libraries of the Consortium for Continuing Higher Education in Northern Virginia.

Collection of Accounts
Failure to meet financial obligations to the university may result in the delinquent account being placed with a collection agency, withholding of money from tax returns, and other collection procedures. Students are responsible for costs incurred by the university in collecting their delinquent accounts. Fines owed for traffic and parking violations and to libraries of institutions and participating public libraries of the Consortium for Continuing Higher Education in Northern Virginia similarly affect students’ status.

Housing and Dining Services

Release from the Housing and Dining Services Agreement
Refunds are given only after an approved release per the outlined guidelines, available in the Office of Housing and Residential Life, has been obtained.

Housing Refund Policy
Refunds of housing reservation deposits and room charges are made according to the following schedule:
1. The $200 reservation fee: Each year students are required to pay a reservation fee before being allowed to select a room assignment. This fee is due at an advertised time each year for the following academic year and is applied to the first semester's housing charge. Students applying for spring semester may forward their deposits beginning October 1. This is a nonrefundable fee.
2. The $100 damage deposit: The damage deposit is paid when a student applies for housing. This is a one-time deposit that is refundable upon graduation or termination from housing, less any unpaid current damage charges.
3. Housing charges are refundable with an approved housing release as follows:
   a. Released during the first week of classes — full refund less the reservation and damage deposit;
   b. Released during the second week of classes — a refund equal to 66.7 percent of the housing charges and the damage deposit is forfeited;
   c. Released during the third week of classes — a refund equal to 33.3 percent of the housing charges and the damage deposit is forfeited;
   d. Beginning the first day of the fourth week of classes, no refunds are given and the damage deposit is forfeited.
4. Refunds are rounded to the nearest whole dollar.

Dining Plan Change and Refund Policy
Residents may change dining plans and receive refunds during designated change periods according to the following schedule:
1. Changes: New residents may change food plans during the designated change period at the beginning of the semester. Current residents may change plans for the spring semester during the designated change period shortly before Thanksgiving.
2. When a plan is canceled, a per-week charge plus a $50 cancellation fee is assessed. The balance is refunded to the student.
3. All refunds are rounded to the nearest whole dollar.

**Eligibility for In-State Tuition**

To be eligible for in-state tuition charges, a person must have been domiciled in Virginia for at least one year prior to the semester for which in-state tuition is sought. A person becomes domiciled in Virginia when legally capable of establishing a domicile and when physically present in Virginia with the present intention of remaining in the state indefinitely.

Domiciliary intent is a part of the definition of domicile. The student seeking the benefit of in-state tuition rates bears the burden of demonstrating such intent existed for at least one year.

See the receptionist in Finley Building for a copy of the complete domicile legislation.

**Change of Domicile Classification**

Out-of-state students who seek reclassification of their domicile status are strongly encouraged to complete a Request for Domicile Reclassification form at least four weeks before tuition payments are due so that a decision can be made before tuition payments must be made. All applications are processed in chronological order as of date they are received.

No requests will be accepted after the first day of classes within the semester for which the reclassification is sought. Out-of-state students with request(s) pending at the time of tuition billing will be billed at the out-of-state rate. Students subsequently determined to be in-state can request reimbursements from the Office of Student Accounts.

The Request for Domicile Reclassification form is available in the Registrar's Office, Krug Hall, Room 102, (703) 993-2441. Questions should be addressed to the Registrar's Office.

**Penalties**

A student, who fraudulently or knowingly provides false information for the purpose of achieving in-state status, may be required to pay retroactively the out-of-state tuition differential of the enrolled term(s) intervening between the fraudulent application and its discovery. The student may also be subject to dismissal or other disciplinary action.

**Motor Vehicle Registration Fees**

Students who park their vehicles on university property must register them with Parking Services and pay a fee for a parking decal. Decals are available in the Registrar's Office, Krug Hall, Room 201A, (703) 993-2441. Questions should be addressed to Room 354, (703) 993-2710.

**Financial Aid**

**Office of Student Financial Aid**

The Office of Student Financial Aid provides a variety of services to help students finance their education. These services include financial counseling, referral and information resources, and financial assistance. Student financial assistance consists of grants, loan and work-study employment. Awards are based on financial need, although there are some alternative financial aid resources available for those who may not qualify for need-based financial aid. Located in the Finley Building, Room 201, the office is open Monday, Wednesday, Thursday, and Friday from 9 a.m. until 4:30 p.m., and Tuesday from 1 p.m. until 7:30 p.m. Financial aid counselors are assigned to students alphabetically, based on students' last names and are available daily on a by-appointment basis.

To apply for financial aid, each year new and currently enrolled students must complete a Free Application for Federal Student Aid (FAFSA). Priority consideration for all sources of financial aid is given to those students whose financial aid applications are on file with the student aid office by March 1. To meet this priority filing date, students should file the FAFSA as soon as possible after January 1. Financial aid for Summer Term is generally limited to those students graduating at the end of the summer or fall terms. Contact the Office of Student Financial Aid for specifics regarding summer financial aid.

All students receiving financial aid must:

1. be enrolled in a degree or approved certificate program for at least 6 credit hours in any given semester;
2. be maintaining satisfactory academic progress as defined by the student aid office, in accordance with federal guidelines; and
3. be a U.S. citizen or eligible noncitizen as defined by the U.S. Department of Education.

All aid recipients are responsible for becoming familiar and complying with applicable federal/state laws, university regulations, the GMU student aid
information resources, and the student aid satisfactory academic progress policy, available in the Office of Student Financial Aid.

The university administers federal, state, and other aid programs as outlined below:

Federal Programs

Federal Perkins Loan Program
Long-term, 5 percent interest loans from the federally sponsored Perkins Loan Program are available to qualified students who demonstrate significant financial need. Repayment begins nine months after graduation or after the student drops below half-time status. Repayment may be deferred under certain circumstances for students entering graduate school, the Peace Corps, VISTA, or military service. Students must be enrolled at least half-time to qualify for this program. Half-time is defined as six credit hours for both undergraduate and graduate students.

Federal Work-Study (FWS)
Funds are available on a first-come, first-served basis to provide part-time work opportunities to help meet college expenses. Students must generally be enrolled at least half-time and must demonstrate financial need. FWS may also be available for students during Summer Term.

Federal Family Education Loan Programs (FFELP)

Federal Stafford Student Loan (FSSL)
All undergraduate and graduate students enrolled at least half-time in an approved program are eligible to borrow money under the low-interest FSSL program. Students who demonstrate financial need are eligible to apply for "subsidized" loans and have the interest that accrues on these loans paid by the federal government while they are in school. Students who do not demonstrate financial need are eligible to borrow "unsubsidized" loans and are responsible for paying or capitalizing the interest that accrues while they are in school. Some students may qualify for Stafford loans that are partly subsidized and partly unsubsidized. The Office of Student Financial Aid will specify students' eligibility under these two programs.

Graduates may generally borrow $8,500 per academic year as part of the subsidized/unsubsidized Stafford Loan program and may be eligible to borrow an additional $10,000 under the unsubsidized Stafford program if the student's cost-of-attendance accommodates this added borrowing. There are cumulative borrowing limits under both programs.

Repayment of the loans begins six months after the student graduates or after the student drops below half-time enrollment status. These loans are made by commercial lenders, using applications available in and processed by the Office of Student Financial Aid.

Virginia Programs for State Residents

Virginia Work-Study Program (VWS)
VWS is a state-supported program providing part-time employment opportunities for students who are enrolled at least half-time, demonstrate financial need, and are Virginia residents. For further information on this work-study program, contact the Virginia Work-Study coordinator in the Office of Student Financial Aid.

State Nursing Scholarships
The Bureau of Public Health Nursing provides limited scholarships to full-time students who are Virginia residents. These scholarships are based on financial need and are available to graduate and undergraduate students. The application deadline for students previously enrolled in a nursing program is March 1; for new students entering a nursing program, the deadline is June 1. Applications are available through the College of Nursing and Health Science.

Graduate Assistance

University Fellowships
George Mason University annually awards a limited number of University Fellowships. They are funded by the commonwealth of Virginia and can be awarded in any department. The awards, based on merit, are intended to encourage and assist superior students in completing graduate studies in the shortest time possible. All recipients must enroll for a minimum of 6 hours of graduate work each semester. Prospective graduate students must have indicated their desire to be considered for an award on their completed application file in the Office of Admissions to be considered. Students already admitted to a graduate program may obtain an application from their graduate coordinator.
Outside Scholarships and Fellowships

Woodrow Wilson Foundation
The Woodrow Wilson Foundation provides funds for graduate fellowships to students planning college teaching careers in a liberal arts field. Seniors interested in applying for such grants as they become available must be nominated by one of their professors in October. Consult the departmental adviser or the Woodrow Wilson campus representative for further information.

Zonta Scholarship
The Zonta Club of Fairfax offers a scholarship to a woman admitted for graduate study leading to a profession. The field of study and the amount of the award varies. Call the Office of the Provost at (703) 993-8865 for information and an application. The application deadline is March 1 for the following academic year.

Other Fellowships and Grants
The American Association of University Women, the National Research Council, and other organizations administer graduate fellowships and grants. Contact the Office of Student Financial Aid.

Graduate Assistantships
The university offers a number of graduate teaching and research assistantships in departments with graduate programs. Assistantships are awarded on a non-need basis. A student holding an assistantship must be in degree status and must take at least six semester hours of graduate credit each semester. Stipends range from $6,000 to $20,000 for the 1994-95 academic year. Application for a graduate assistantship should be obtained from the department where the student seeks an assistantship. Students applying to the university should indicate their desire for an assistantship position on the admissions application.

Inservice Training Program for Teachers
Candidates for graduate degrees may establish eligibility to receive state funds for graduate study closely related to their field of work through one of the state's division superintendents of schools. Candidates may use the funds to enroll at the university in previously approved courses.

Emergency Loan Programs
Mary E. Ferguson Emergency Loan Program
Currently enrolled students may borrow funds for legitimate emergencies excluding tuition, fees, books, and supplies. Emergency loans must be repaid within 30 days; overdue payment results in a late charge of $5 for each 30 days past due. Failure to repay the loan within 30 days, without requesting an extension for a reasonable justification, will result in financial suspension. Students financially suspended for nonpayment of an emergency loan are ineligible for any future emergency loans. Application is made through the Office of Student Financial Aid.

Veterans Services

Veterans' Educational Benefits
Students eligible for Veterans' Educational Benefits while attending the university must contact the Office of Veterans Services. The following actions are required:

1. Veterans, active duty personnel, and reserve personnel who have never received benefits must apply on form 22-1990. The application should be turned in to the Veterans' Services Office on the Fairfax Campus with a certified copy of the student's DD-214 (where applicable).

2. Students who have received benefits from another school or who are changing either their type of program or course objectives must fill out form 22-1995—Request for Change of Program or Place of Training.

3. Veterans' dependents who receive educational benefits under Chapter 35 of Title 38 USC must establish eligibility with the Veterans' Services Office. They should fill out form 5490 or 5495. The office then sends the paperwork to the Department of Veterans Affairs (formerly Veterans Administration) with the school certification.

4. Students must request that the veterans' counselor send an enrollment certificate to the VA Regional Office (VARO) each school year (each semester if the students are under halftime, on active duty, or in continuing education). Students must apply separately for Summer Term. Students in continuing education will be certified for no more than two semesters while the GMU application is pending.

5. Students are responsible for notifying the Veterans Services office on the Fairfax Campus of any change in status. Such changes include:
   a. adding or dropping courses
   b. change in marital status
   c. addition of a dependent
   d. change of address (also notify VARO immediately)
   e. withdrawal from school (notify immediately)

Forms for making these changes are available at the Office of Veterans Services in Room 210 of Finley Building.

6. VA benefits are paid on the following basis:
Tuition, Expenses, and Financial Aid

Students on active duty and those taking fewer than six undergraduate hours are paid either tuition and fees or the rate set for the training time, whichever is less. Books and supplies are not included. Benefits are not payable for ENGL 101 or 102 when a no-credit grade is received. The Department of Veterans Affairs will not pay for an audit course.

Public Law 98-525 established a new GI Bill (Chapter 30) and also a new educational assistance program for members of the Selected Reserve (Chapter 106). Details may be obtained from the Veterans Services Office on the Fairfax Campus.

Tutorial Service for Veterans
The VA will pay $100 per month, not to exceed $1,200 per year, for needed tutorial services. For further information, see the Veterans Services Office.

Virginia War Orphans Education Program
The Virginia War Orphans Education Program provides educational assistance to children of qualified veterans. To be eligible, an applicant must meet the following requirements:

1. The applicant must be between the ages of 16 and 25.
2. The applicant's parent must have served in the armed forces of the United States and must (a) be totally disabled due to an injury or disease incurred in a time of armed conflict; or (b) have died as a result of injury or disease incurred in a time of armed conflict; or (c) be listed as a prisoner of war or missing in action.
3. The applicant's parent must have been a resident of the commonwealth of Virginia at the time of entry into active military duty, or must have been a resident of the state for at least 10 consecutive years immediately prior to the date of application.
4. The applicant must provide written verification of acceptance as a student in a state-supported post-secondary school.

Eligible individuals are entitled to a maximum of 48 months of tuition-free education at a state-supported educational institution. For more information, contact the Office of Veterans' Services.

Departmental Scholarships

Applied Music Scholarships
A limited number of applied music scholarships are available to incoming freshmen and transfer students at George Mason University. Application should be made to the Department of Music.

Student Education Association Endowment Scholarships Fund
This fund provides grants to a limited number of eligible George Mason University students of demonstrated scholastic achievement, during their student teaching semester.
Student Life
Student Life

George Mason University provides many facilities and support services to enable students to take full advantage of the university's educational and personal enrichment opportunities.

Facilities

Housing

The university has on-campus housing for approximately 3,000 students. Six residential complexes offer a variety of accommodations designed to meet the needs of a diverse population. The university provides traditional residence halls with double accommodations as well as suite-style residence halls. Student apartments and townhouses are also very popular. All facilities are carpeted and fully furnished.

For information about opportunities available in the residence halls, call the Office of Housing and Residential Life, (703) 993-2720.

Student Unions

A student union is more than a building. It serves as a unifying force in the life of the university. It is the focus of campus activity. Our two unions serve as the community center of the university. They are a part of the educational program. As such, they serve as a laboratory of citizenship, training students in social responsibility and for leadership. They provide a cultural, social, and recreational program aiming to make free-time activity a cooperative factor with study and education. In all its processes, the unions encourage self-directed activity, giving maximum opportunity for self-realization and for growth in individual social competency and group effectiveness. Our goal is the development of mature persons as well as intellects. The union programs and activities create a coherency between students' academic lives and their lives outside the classroom.

With the amazing growth of the university over the past decade, the unions themselves have undergone tremendous change to meet the expanding needs of the university community. Currently, a new university center is under construction and scheduled to open in the spring of 1995. It will break with tradition, combining a state-of-the-art library and a student union. The building brings together the two crucial elements of the university—student life and academic endeavor. The result of many hours of consultation between faculty, staff, students, and architects, the concept of the university center is unique. No other university in the country has a building designed to achieve similar goals. The university center will symbolize the university's commitment to providing a first-class education in the twenty-first century.

Student Union Building I (SUB I)

SUB I is an 80,000-square-foot building built in 1971. It is home to nearly 200 student organizations NS several administrative offices, and it serves as the center for student life. The following programs are housed in SUB I:

- Services: Apple Federal Credit Union, Copy Shoppe/Stamp Pad, George Mason Bank, Mason Jar, Patriot's Locker, Information Desk, and the SUB I Scheduling Office
- Food: H.B. Quick's, Rathskeller, Mediterranean Menu Adventure, and Quickstop
- Facilities: Gameroom, Meeting Rooms, Patriots Lounge, One Union Place, Typing and Computer Laboratory, and Quiet Study Lounge.

Student Union Building II (SUB II)

SUB II is an architecturally striking 91,000-square-foot building built in 1982. It was enlarged by an additional 18,000 square feet in 1991. SUB II serves as a conference, meeting, and event center, and houses the bookstore and residential dining services. The following programs and services are housed in SUB II:

- Services: Information Desk, University Dining Services by Marriott, SUB II Scheduling Office, the University Bookstore, and the university's computer store
Food: Marketplace, Residence Dining Hall, University Room, and the Court Cafe including Taco Bell, Pizza Hut Express, The Sub Connection, Salad Alley, and other fast-food services

Facilities: Ballroom and meeting rooms

The last decade of this century continues to be an exciting time for the student unions and the entire George Mason University community. We encourage you to take advantage of the many opportunities available within your student unions.

Sports and Recreational Facilities

The Patriot Center, a 10,000-seat arena, is home to the university's men's and women's basketball teams, as well as a center of activity for Northern Virginia. Large gatherings such as Commencement are held there, as are community activities and recreational events. Among 1994 Patriot Center events were Disney on Ice, David Copperfield, 10,000 Maniacs, Sting, and Alan Jackson.

Facilities of the Sports and Recreation Complex are available at no charge to university students. These include indoor and outdoor tracks and playing fields, basketball and volleyball courts, a weight room, sauna, and other sports facilities.

Performing Arts Facilities

Free tickets are available to George Mason University students for more than 120 events sponsored annually by the Institute of the Arts. The Center for the Arts is a complex of performance spaces that are the focal point of the university's performing arts programs. The 2,000-seat Concert Hall is host to professional music, dance, opera, and theater productions. TheaterSpace and Black Box Theater provide two of the most versatile performance spaces in the Center for the Arts complex, accommodating many seating and staging configurations. Harris Theater is a proscenium theater seating 500, used for a wide variety of campus events. The complex also includes the Performance Dance Studio, which is used for workshops and dance student works-in-progress.

Student Support Services

Career Development Center

The Career Development Center's primary purpose is to foster students' career planning and job search readiness through involvement in activities that promote career exploration, expand knowledge of the labor market, and provide greater access to employers and the world of work. The office, located in Student Union I, Room 348, is open Monday through Friday from 8:30 a.m. until 5 p.m., and on Tuesday evenings during the fall and spring semesters. For information call 993-2370. The following major program areas are available:

Career Consultation

Through individual consultation sessions and workshops, students learn to assess personal interests, skills, and values, and to research relevant career opportunities. Consultants also assist students with various aspects of their job search.

Career Workshops and Seminars

Workshops are offered on the following topics: What Careers are Best for Me?, How to Get a Job, Applying to Graduate/Professional School, Job-Hunting Strategies, Networking, and Interviewing Skills and Practice. Check the Career Development Center brochure for the workshop schedule and program descriptions. Special seminars provide information on specific career fields.

Career Library

This specialized library contains information on career fields, graduate and professional schools, government employment, researching employers, and job hunting. SIGI Plus, a computerized career information system, is available to assist students with their career explorations. Videotapes and handouts on career planning and job-hunting topics are available for students who want to work on their own.

Career Connection

Career Connection is a program through which students can contact alumni and friends of George Mason University for career information to help them plan their careers, learn about employer expectations, and job search effectively. The alumni and friends in this network have agreed to share career information in three ways:

Information Interview: Students arrange to interview Career Connection members in person or by phone.

Externship: Students arrange to spend one to five days at Career Connection members' work sites. The experience enables students to learn firsthand about career fields and employers.

Seminar Speaker: Students may ask Career Connection members to present career information to student organizations or classes.

Cooperative Education

Cooperative Education is a program that provides qualified students with professional-level, progressively responsible, paid work experience in positions related to their majors. Two calendar plans
are available: the alternating plan, in which students alternate periods of full-time work with full-time study; and the parallel plan, in which students work 15 to 24 hours per week while carrying at least 9 credit hours. Positions are open to both undergraduate and graduate students in all disciplines. Participation is recognized by the university through notation of the co-op experience on academic transcripts. Orientation sessions are scheduled weekly to provide more complete information.

**Job Center**

This “one-stop” student employment resource area provides listings for part-time and full-time professional jobs, internships, summer jobs, and other part-time jobs.

**On-Campus Interviews**

Companies and school systems visit the campus during the fall and spring semesters to interview students for full-time career positions. Seniors who will receive their degrees within a year and admitted graduated students who have completed at least 9 hours are eligible to participate. Alumni and students enrolled in certificate programs are also eligible. Participants must attend an orientation session and complete registration materials.

**Job Leads**

Graduating students and alumni can register to receive weekly bulletins of full-time job vacancies. Job notices are also filed in the Job Center and posted on a job bulletin board outside the office.

**Credential File**

Graduating students and alumni may establish credential files containing references, resumes, and course listings to support application for employment or graduate school.

**kiNexus**

An easy-to-use, cost-effective electronic resume referral system that matches candidates’ qualifications with employer hiring requirements. Students and alumni pick up a diskette from the Career Development Center, enter their resume data, return the diskette to be up-loaded, and then wait to hear from employers.

**Counseling Center Services**

**Counseling and Mental Health**

The Counseling Center provides personal counseling and group programs to assist students in their emotional and academic development. Both group and individual counseling are available to students who are experiencing personal or academic problems. Counseling can help students resolve concerns that may be adversely affecting academic progress or relationships with others.

Issues frequently discussed with a counselor include stress, relationships, alcohol and substance abuse, academic problems, gay and lesbian lifestyles, racism, sexual harassment, sexual assault and rape, death, divorce, suicide, sexual abuse, loneliness, independence, self-confidence, management of multiple roles, self-esteem, goals, study skills, anxiety, and depression. Psychiatric consultation and crisis intervention are also provided.

To schedule an appointment for individual counseling or to sign up for a group, call 993-2380 between 8:30 a.m. and 5 p.m., weekdays, and until 8 p.m. on Tuesdays. The main office is located in SUB I, Suite 364.

**Learning Services**

The Learning Services component of the Counseling Center supports the educational and intellectual development of students. Individual study skills counseling and structured workshops are provided. Workshops typically offered include exam strategies and test anxiety management, writing a research paper, speech anxiety, how to study math and deal with math anxiety, scheduling and time management, and study methods. Specific times and dates are listed in the center’s Programs and Groups brochure.

Learning Services recruits and maintains a tutor referral service. Names of tutors approved by Tutorial Services are available for most subjects offered at the university. Students are encouraged to request tutor information early in the semester. The office is located in SUB I, Room 350, 993-2999.

**Self-Development Center**

The Self-Development Center provides audio-tapes, videotapes, and computer-assisted programs that students can use on their own or with the assistance of a counselor. Students can learn about themselves, polish academic skills, and explore new ways to cope with academic and personal stresses. Programs are available on such topics as managing stress, avoiding procrastination, setting goals, increasing motivation, handling feelings, strengthening relationships, developing effective learning strategies, and many others.

**Consultation and Outreach Services**

The Counseling Center staff provides consultation services to students and to faculty and staff to assist in their work with students. Counselors provide mental health education training and consultation to faculty on how to assist students with problems that affect the learning process, and how to respond to crisis situations. Consulta-
tion on learning styles, adjustment to college, human relations issues, and other mental health topics is also available. The center provides educational programs to the university community on a variety of topics. Presentations on mental health, personal development, and academic skills topics are available. Contact the Counseling Center for requests and additional information.

Black Peer Counseling Program
The Black Peer Counseling Program, located in SUB I, Room 235, 993-2377, provides a diversity of services to enhance the academic experience of black students at the university. In addition, multicultural programs are offered through classes and campus organizations.

Multicultural Research and Resource Center
The Multicultural Research and Resource Center (MRRC), located in SUB I, Room 106C, is designed to collect and disseminate information on sources for multicultural training and research. The center responds to requests for multicultural resources available on campus and in the community. Services the center provides include: a clearinghouse of staff available to facilitate diversity and anti-oppression workshops, maintenance of a resources/video library, and coordination of diversity-related committees and information for the entire university community. Contact the MRRC office at 993-4003 for more information.

Disability Support Services
Students with disabilities, including learning disabilities, have access to a wide range of services and assistance. Because students who need special consideration in curriculum, assignments, or testing must provide documentation of their disabilities, they are advised to forward existing documentation to Disability Support Services. Please contact Disability Support Services at 993-2474 (voice/TTY) for more information.

Students with disabilities who feel they are being discriminated against on the basis of disability and who have been unable to resolve their problems through conventional channels should use the following:

Grievance Procedure for Disabled Students
A student who feels that reasonable accommodation, as provided through Section 504 of the Rehabilitation Act of 1973, has been denied may seek remedy by contacting the Disability Support Services Office, in writing, explaining the nature of the complaint and the actions previously undertaken to resolve the complaint. This document should include a detailed account of all contacts with members of the university community as they relate to the specific complaint.

A complainant will be required to provide appropriate documentation of the disability and its relationship to the specific complaint. If appropriate documentation is not available, processing of the complaint may be delayed until such time as documentation is provided.

A complainant who is not satisfied with the outcome achieved through the Disability Support Services Office, or who prefers not to work through the Disability Support Services Office, may appeal the decision or initiate the same procedure through the Affirmative Action Office.

All complaints will be processed in a timely and efficient manner. It is the student's responsibility to file complaints within a reasonable period of time (no more than 189 days) from the time of the action(s) that led to the complaint.

Student Health Center
The Student Health Center is operated through a partnership between the Office of Student Services and the College of Nursing and Health Science. The principal mission of the Student Health Center is the provision of high-quality primary health care services for the students of George Mason University. The Health Center offers a comprehensive, confidential health service for students, targeted to their particular primary health care needs including components of self care, health promotion, health maintenance, and disease prevention.

Referral services are incorporated as needed for concerns exceeding the capabilities of the clinic. Students with medical insurance policies should bring that information with them to the center. A student health and dental insurance plan is available through the center. The Health Center is managed by a director who is responsible for the overall operation of the center. The clinic staff includes a full-time physician, nurse practitioners, a registered nurse clinic coordinator, and a receptionist. The insurance program and immunization compliance program are managed by the administrative staff.

The Student Health Center is located on the Fairfax Campus in Student Union I, Room 232 (993-2830). Hours are 8:30 a.m. to 5 p.m., Monday through Friday, when the university is in session. An appointment system is in place. Emergencies will be seen as walk-ins. Immunization Clinic hours are Mondays, 9-11:30 a.m., and Wednesdays, 1-3:30 p.m.
Health Education Center
The Health Education Center provides educational programs and resources on a variety of health-related topics including sexual assault, acquaintance rape, HIV/AIDS, safer sex, life skills, contraception, nutrition, and eating disorders. The programs are designed to support the student’s personal growth and to encourage healthy lifestyle decisions. Seminars are provided for residential students, student organizations, and scheduled classes; seminars are open to all faculty, staff, and students.

Campus Networks, a group of peer educators, is supported by the Health Education Center. The peer educators present seminars across campus and provide individual assistance to students. Additionally, a collection of resources is available to assist students with class presentations, papers, and projects. The center is located on the Fairfax Campus in Student Union I, Room 255A, 993-2829.

Health Insurance and Dental Plan
All George Mason University students are eligible, on a voluntary basis, to enroll in the university-endorsed Accident and Sickness Health Insurance Plan and the university-sponsored dental plan made available through DENTICARE of Virginia.

The health insurance policy includes provisions for major medical coverage, outpatient laboratory fees, and X-ray coverage, as well as the usual provisions for hospital room and board and surgical expenses. At minimal cost, this policy covers the insured student 12 months per year, 24 hours per day, worldwide, at the university or elsewhere. For a minimal yearly fee, the dental plan provides X-rays, teeth cleaning, and office visits at no charge, and various dental procedures such as fillings, crown and bridgework, and root canal therapy at reduced costs.

Health insurance brochures, enrollment applications, and claim forms, as well as dental plan information, may be obtained at the Student Health Center or by calling 993-2827.

Office of International Programs and Services
The Office of International Programs and Services is responsible for all matters pertaining to U.S. immigration law affecting students at the university. For example, the staff at OIPS issues the immigration documents necessary for the entry of international students and scholars to the United States, and helps students maintain their immigration status once here. OIPS seeks to foster the intellectual, cultural, and personal development of international students during their time at GMU and in the United States.

Services consist of the following:
1. Reviewing and verifying documents relative to the issuance of the certificate of eligibility (Form I-20 and Form IAP-66) to international students and scholars.
2. Advising international students and scholars on immigration and visa requirements.
3. Providing orientation programs for newly admitted international students, covering such issues as cross-cultural adjustment, housing, and academic policies.
4. Organizing activities for international students to integrate them into the academic process, the campus student population, and the surrounding community.
5. Conducting intercultural events on campus, such as International Week and other educational programs.

Student Union I, Room 308, 993-2970.

Campus Ministry
The Campus Ministry is an ecumenical group available on campus to assist students, faculty, and staff. The ministry includes religious counseling, Bible study, worship services, social-action opportunities, education programs, social activities, seminars, retreat weekends, and fellowship gatherings.

The Campus Ministry offices are in Student Union I, Room 207, and are open daily for discussion and assistance of any kind. For more information, call 993-3322 or contact the individual ministries: Baptist (993-3323 or 425-4522); Campus Crusade for Christ (993-3323); Intervarsity Christian Fellowship (993-3320); Jewish (993-3321 or 301-468-3422); Muslim (993-3323); Orthodox Christian Fellowship (670-0867); Roman Catholic (993-3322 or 425-0022); and United College Ministries (993-3323 or 820-2144).

Minority Student Affairs
Minority Student Affairs is charged with the responsibility of assisting academic and nonacademic units with increasing participation and retention of minority students (African Americans, Asians, Hispanics, and Native Americans). It assists and advises other university offices in initiating, developing, and implementing programs to enhance the matriculation of minority students. The office participates in an ongoing evaluation and assessment of the impact of university policies and procedures on minority students.
Minority program initiatives are designed to stimulate multicultural (racial/ethnic) understanding, and to create an educational atmosphere where minority students will be successful. The director of Minority Student Affairs is a catalyst for university administrators' efforts in monitoring and reporting data regarding issues and the retention of minority students.

University Police
The George Mason University Police Department is a nationally accredited police department with officers sworn in in Arlington and Fairfax counties. University police officers serve on foot, bicycle, and motor patrol 24 hours a day, every day, maintaining constant contact with the university community. The police department offers the following services on a continual basis:
Crime Prevention: 993-2824
Victim/Witness Services: 993-2824
Student Escort Services: 993-4357 (HELP)
For Police Emergencies, call 993-2800.
For Police Assistance, call 993-2810/2811/2812.

Veterans' Services
The Office of Veterans' Services assists veterans, service personnel, dependents, and survivors in obtaining authorized educational benefits. The office staff also helps veterans adjust to university life. Located in the Krug Hall, Room 101, the office is open Monday through Friday from 9 a.m. to 5 p.m.

Women's Studies Research and Resource Center
The Women's Studies Research and Resource Center is located in SUB I, Room 206A, 993-2896. The center is open to the university community and the general public. It houses and distributes informational literature regarding issues of concern to women, as well as information on women's studies and other related activities in the area. In addition, lectures, workshops, and other activities relevant to campus life are organized through the center.

Writing Center
The Writing Center offers one-to-one conferencing on all stages of the writing process. Conferences are available, free of charge, to all GMU students, faculty, staff, and alumni. Writing Center tutors, who are graduate teaching assistants in the English Department, have been trained in the current methods of composition instruction. They help clients overcome writer's block, develop organizational and revision strategies, and learn useful strategies for editing their own work.
Appointments should be made in advance by calling 993-1200 or by coming to Robinson I, Room A116, to schedule a session.

Student Activities
Student participation helps shape the character and the quality of the students and the university. Thus, George Mason encourages people to express their talents and interests through participation in student government, student publications, and membership in academic, Greek, international, special interest, law, cultural, religious, and athletic organizations.
While involvement in such activities is a desirable adjunct to classroom learning, participation must be complemented by academic progress. For this reason, only students in good academic standing are eligible to hold or run for elective or appointive office in any organization or activity associated with the university, to participate in any athletic or other activity representing the university on either an intercollegiate or club level, or to serve as a working staff member of any student organization.

Graduate Student Council
The Graduate Student Council (GSC) is the advocacy organization for graduate students at George Mason. The GSC publishes a weekly newsletter via e-mail, organizes social activities, serves as the umbrella funding organization for graduate student groups, and provides travel funds to graduate students who are presenting papers at academic conferences. The GSC also maintains the Graduate House, a facility adjacent to the Fairfax Campus and available for graduate student groups to use for meetings.
The GSC is governed by an executive board and delegate body, which has 50 members who are appointed by graduate students organizations or by academic departments. The GSC also appoints graduate students to university committees to provide a graduate voice in the administration of the university.
A current list of events can be obtained by calling the GSC Info-Line at (703) 993-2903. For more information, contact GSC by e-mail at gsc@gmu.edu or leave a message on the Info-Line.
Performing Arts Activities
George Mason offers students the opportunity to participate in many arts events throughout the school year. The George Mason University Dance Company presents four annual concerts and all students are encouraged to audition at the beginning of each semester.

Theater events include four major productions, directed by faculty, guest artists, and students. Theater of the First Amendment, the university's professional theater company, produces a four-play season incorporating students both on- and offstage. Auditions for theater events are open to all George Mason students and are held in advance of each production.

Students interested in technical theater can work on a variety of production crews including scenery, lighting, sound, costumes, and publicity. Information concerning auditions, crew work, and performance dates may be obtained from the divisions of Dance and Theater.

Students interested in music may audition to perform in the following: Symphony Orchestra, Symphonic Band, Jazz Ensemble, Pep Band, and various chamber ensembles. No auditions are required for participation in the university Chorale and Symphonic Chorus. All members of the university community are invited to attend concerts and recitals given by the Department of Music.

The Volunteer Center
The Volunteer Center is here to help you help others. We can give you information on volunteering to work with children, the homeless, women's issues, health care, legal services, and many others. Through volunteering, you can broaden your experience, add to classroom learning, and develop professional skills.

Besides volunteer information, we sponsor many programs throughout the year that pertain to community service and helping others. We are also affiliated with nine different student volunteer organizations. We look forward to seeing you at the center, which is located in SUB I, Room 305, or call us at 993-4009.

Student Leadership Center
George Mason provides a variety of opportunities for students to develop their leadership skills including workshops, retreats, conferences, credit courses, a resource collection, and individual consultations. Center programs are open to all students interested in developing their leadership abilities. For more information on program dates and times, contact the Student Leadership Center, Student Union I, Room 307, (703) 993-2900.

Student Organizations
Approximately 200 on-campus student organizations complement the university's curricular programs and provide opportunities for students to exercise and develop their talents. The organizations span a wide range of interests including politics, forensics, drama, music, journalism, academics, service, recreation, business, social life, religion, and fellowship. Membership in student organizations is open to any registered George Mason University student and can open vistas to new friendships, informal contact with faculty and staff, learning opportunities, and leadership experience.

The recognized organizations at George Mason operate under an umbrella system, where groups of similar nature are clustered together to create a forum for communication and programming. Each umbrella is headed by an organization that provides governance, representation, support, and communication and allocates fee-funds to its constituent organizations. Newly recognized organizations are given information on how to establish specific criteria and expectations for membership, umbrella group recognition, and funding, the only prerequisite being prior recognition by the university through University Unions and Student Activities. There are advantages for new organizations to be affiliated with an umbrella, such as having a network of similar organizations for support, communication, help in orienting new groups, and opportunities to do joint programming.

GMU Alumni Association/Office of Alumni Affairs
The GMU Alumni Association offers several undergraduate scholarships and student awards and provides for the Beaman Emergency Loan fund. In addition, the association works in conjunction with the Career Development Center and individual academic and administrative departments to provide career development opportunities for students. For more information, call the Office of Alumni Affairs at 993-8696.
College of Arts and Sciences

http://catalog.gmu.edu
College of Arts and Sciences

Biology

Faculty

Adamkewicz, S. Laura, Ph.D., University of Virginia, 1968; Associate Professor
Andrykovitch, George E., Ph.D., University of Maryland, 1968; Associate Professor, Chair
Birchard, Geoffrey F., Ph.D., Dartmouth Medical School, 1985; Associate Professor
Botkin, Daniel B., Ph.D., Rutgers University, 1968; Professor and Director, Program on Global Change
Bradley, Ted R., Ph.D., University of North Carolina, 1968; Associate Professor
Brown, Luther, Ph.D., Ohio State University, 1978; Associate Professor
Christensen, Alan H., Ph.D., Michigan State University, 1983; Assistant Professor
Emsley, Michael G., Ph.D., University of London, 1964; Professor
Ernst, Carl H., Ph.D., University of Kentucky, 1969; Professor
Hart, Jayne T., Ph.D., University of Wisconsin, 1969; Professor
Jonas, Robert B., Ph.D., University of North Carolina, 1981; Associate Professor
Jones, R. Christian, Ph.D., University of Wisconsin, 1980; Associate Professor
Kelso, Donald P., Ph.D., University of Hawaii, 1970; Associate Professor
Lawrey, James D., Ph.D., Ohio State University, 1977; Associate Professor
Litchfield, Carol D., Ph.D., Texas A&M University, 1969; Associate Professor
Morowitz, Harold J., Ph.D., Yale University, 1951; Robinson Professor of Biology and Natural Philosophy
Oates, Karen K., Ph.D., George Washington University, 1985; Associate Professor
Rockwood, Larry L., Ph.D., University of Chicago, 1972; Associate Professor
Royt, Paulette A., Ph.D., University of Maryland, 1974; Associate Professor
Sahfer, Jay C., Ph.D., Cornell University, 1967; Professor
Sherald, Allen F., Ph.D., University of Virginia, 1973; Associate Professor
Skog, Judith E., Ph.D., Cornell University, 1972; Professor
Soyfer, Valery, Ph.D, Kurchatov Institute of Atomic Energy, 1964; Distinguished University Professor of Molecular Genetics
Stanley, Melissa S., Ph.D., University of Utah, 1965; Professor
Taub, Stephan R., Ph.D., Indiana University, 1960; Professor
Torzilli, Albert P., Ph.D., University of Georgia, 1976; Associate Professor
Walbridge, Mark R., Ph.D., University of North Carolina, 1986; Assistant Professor
Willett, James D., Ph.D., Massachusetts Institute of Technology, 1965; Professor
Wilson, John W., Ph.D., University of Chicago, 1972; Associate Professor

Biology, M.S.

The Master of Science program in Biology provides advanced training for recent college graduates, professionals in teaching, technical, and other biology-related fields, and research-oriented individuals. Students may enroll in one of five biological science specializations or the specialization in environmental science and policy.
Biological Sciences Specializations

Admission Requirements

An applicant for the M.S. program in a biological science specialization is expected to have a bachelor's degree in biology or its equivalent, with a grade point average of 3.0 or better in biology courses. The applicant must submit three letters of recommendation and scores on the Graduate Record General and Subject Biology Examinations. To be accepted as a degree student, an applicant's scores on the verbal and quantitative general test should total 1,100 or greater and should be in the 50th percentile or better on the biology subject portion with no raw subscore less than 60 (40th percentile). A substantial statement of interest in the program and of career goals, must be submitted with the standard application. Prospective students are encouraged to contact potential advisers. Information concerning faculty interests can be obtained from the departmental office. Admission is contingent upon acceptance by an adviser.

Deadlines are March 15 for admission to the fall semester and October 1 for admission to the spring semester. Please note these deadlines are for completed applications. Decision notification will be made by May 1 for fall admission and December 1 for spring.

Degree Requirements

A student must complete at least 30 semester hours, including at least two hours of seminar. During their first semester, new students should register for Introduction to Graduate Studies in Biology (Biology 690). Students are required to form a supervising committee and submit a program of study to the program coordinator for approval within the first 12 credits of course work. Course requirements may be fulfilled by completing courses from a variety of departments and institutes on campus.

Students have the option to conduct either a formal thesis for which up to 6 credits of 799 (master's thesis research) could be earned, or a project for which up to 3 credits of 798 (master's project research) could be earned. The difference between the two options is in the depth and sophistication of the project. Whereas a thesis normally involves original research, independent acquisition, and interpretation of data, a project could be employment-related research or a comprehensive report resulting from an internship.

At the conclusion of the program, students pursuing the master's project option must successfully complete a comprehensive written and oral examination. Students pursuing the master's thesis option must defend their thesis and present their results in a public seminar.

Lack of enrollment for two consecutive semesters will result in inactive status. Reactivation of program enrollment is by application to the M.S. coordinator and is contingent on availability of program resources. The basic requirements for each specialization are detailed below.

1. Organismal Biology: An organized set of course work is developed after consultation with an academic adviser. Traditional programs of study such as botany, vertebrate zoology, developmental biology, animal behavior, genetics, or physiology may be included in this specialization.

2. Ecology, Systematics, and Evolutionary Biology: The student must complete a program of study selected from a list of courses emphasizing evolutionary and systematic biology. These courses must be approved by the academic adviser and must include one course from each of three areas: evolution, ecology, and experimental methods.

3. Molecular, Microbial, and Cellular Biology: The student must complete three hours of seminar in addition to BIOL 690. In consultation with the academic adviser, the student may enroll in BIOL 691: Current Topics in Biology and/or BIOL 695: Seminar in Molecular, Microbial, and Cellular Biology. All further course work is selected after consultation with the academic adviser.

4. Interpretive Biology: This specialization is for individuals currently or recently employed in interpreting biology to the public, including teachers, park naturalists, and science writers. Three to 9 hours are chosen from BIOL 504, 601, 602, 605, or approved graduate courses in other departments. The remaining 21 to 27 hours must be graduate-level biology courses and must include two hours of seminar. All courses must be approved by the student's graduate committee.

5. Bioinformatics: In addition to 21 hours of graduate biology courses including biochemistry, 9 hours of courses are taken in the information sciences. Students requiring more grounding in mathematics take INFT 500. Other courses are chosen from the core curriculum courses in information technology. Suggested courses are CS 580, CS 521, and INFS 714. Entering students are expected to be familiar with a programming language such as Pascal, C, or Fortran. Status of computer prerequisites and choice of courses in informational sciences are decided with the graduate coordinator in computer science.
Biology, M.S.
Specialization in Environmental Science and Policy

The M.S. specialization in environmental science and policy is designed to meet the increasing need to train environmental scientists and managers who would address the problems of land and water pollution, hazardous waste management, land-use and urbanization, wetland loss, and ecosystem preservation. These professionals would also contribute to the analysis and resolution of global problems such as deforestation, world food supplies, acid deposition, population growth and public health, global warming, and depletion of the ozone layer. Environmental problems are defined in the real world, and they do not necessarily conform to traditional academic disciplines—rather they require creative combinations of the diverse interests and subjects to be resolved. Effective training can be accomplished only by rigorous, problem-focused interdisciplinary education in a setting where research is an essential element supporting the instructional mission.

The M.S. specialization in environmental science and policy can also serve as a training ground for students wishing to further their education by pursuing the Ph.D. in Environmental Science and Policy at George Mason University.

Admission Requirements

For the environmental science and policy specialization, those holding a baccalaureate degree in natural or earth sciences, engineering, resource planning, or related fields from an accredited institution with a GPA of 3.0 (out of 4.0), are invited to apply for admission. If the baccalaureate degree is in a field other than the above mentioned, the applicant should have taken several science courses beyond the introductory level. An applicant may be required to make up deficiencies before being permitted to enroll in the program.

Three letters of recommendations should be submitted including at least one from a former professor. The aptitude portion of the Graduate Record Examination is required with a minimum score of 1100 for verbal and quantitative combined. A substantial statement of interest in the program, potential area of specialization, and career goals must be submitted with the standard application. Prospective students are encouraged to contact potential faculty advisers appropriate to their interests. The departmental office can provide a list of faculty research interests. Admission is contingent upon acceptance by an adviser.

Deadlines are March 15 for admission to the fall semester and October 1 for admission to the spring semester. Please note these deadlines are for completed applications. Decision notification will be made by May 1 for fall admission and December 1 for spring.

Degree Requirements

The environmental science and policy specialty of the M.S. in biology encourages an independent and creative approach in the development of curricula. Students are required to form a supervising committee and submit a program of study to the program coordinator for approval within the first 12 credits of course work. Course requirements may be fulfilled by completing courses from a variety of departments and institutes on campus. Lack of enrollment for two consecutive semesters will result in inactive status. Reactivation of program enrollment is by application to the M.S. coordinator and is contingent on availability of program resources.

The program requires a minimum of 33 graduate credits distributed in four categories to provide both depth and breadth in knowledge related to environmental problems.

Category 1—Natural Sciences: A minimum of 9 credits is required in areas such as biology, geology, geography, chemistry, or environmental engineering.

Category 2—Social Sciences: A minimum of 6 credits is required in areas such as public policy, economics, law, sociology, ethics, business, or conflict management.

Category 3—Environmental Methods: A minimum of 6 credits in areas such as statistics, remote sensing, cartography, instrumental analysis, mathematics, modeling, or management and information systems.

Category 4—Individual Programs Focus: A minimum of 12 credits that should reflect a cohesive area of study. Graduate seminars for credit and research hours belong in this category. The Environmental Science seminar must be taken once.

Students have the option to conduct either a formal thesis for which up to 6 credits of 799 (master’s thesis research) could be earned, or a project for which up to 3 credits of 798 (master’s project research) could be earned. The difference between the two options is in the depth and sophistication of the project. Whereas a thesis normally involves original research, independent acquisition and interpretation of data, a project could be employment related research or a comprehensive report resulting from an internship. At
the conclusion of the program, students pursuing the master's project option must successfully complete a comprehensive written and oral examination. Students pursuing the master's thesis option must defend their thesis and present their results in a public seminar.

Environmental Science and Public Policy, Ph.D.

The Biology Department serves as the lead department for the interdisciplinary Ph.D. program in Environmental Science and Public Policy. This program is described in detail under Environmental Science and Public Policy.

Biology Courses (BIOL)

504 Virginia Natural History for Teachers (4:3:3). Prerequisite: Permission of instructor. The interrelations of plants, wildlife, soil, and waters of local environments with emphasis on the teaching of their proper use and conservation. May be applied to the M.S. in biology in the interpretive track only and then within a six-hour maximum if combined with BIOL 605.

513 Food, Energy, and Insects (3:3:0). Prerequisite: BIOL 332 and permission of instructor. History and future of man's competition with insects in fields of agriculture and medicine.


520 Systematics in Complex Angiosperm Families (3:1:6). Prerequisite: BIOL 344 or 534 or permission of instructor. Morphology and speciation of the more complex families such as Poaceae, Cyperaceae, and Asteraceae. Lab emphasizes identification of specimens and acquaintance with taxonomic literature.

523 Reproductive Strategies (3:3:0). Prerequisite: Permission of instructor. Evolution of reproductive tactics, including sexual and asexual reproduction, sex ratios, parental investment, propagule sizes and numbers, mating systems and social structure. Animals and plants emphasized as appropriate.

526 Paleobotany (3:3:0). Prerequisite: Permission of instructor. Study of origin and evolution of interrelationships between components of the earth's major ecosystems.

527 Current Problems in Evolutionary Theory (1-4:1-3:0-6). Prerequisite: Course in evolution or permission of instructor. Course on contemporary evolutionary thought.

528 Selected Topics in Invertebrate Zoology (1-4:1-3:0-6). Prerequisite: Course in invertebrate zoology or permission of instructor. Different topics in different years. Possible topics include the biology of a specific group such as mollusks or crustaceans, or the comparison of one trait, such as larval survival, in diverse phyla.

529 Vertebrate Paleontology (4:2:6). Prerequisite: Course in vertebrate zoology or comparative anatomy or invertebrate paleontology, or permission of instructor. Study of evolutionary patterns of vertebrates. Emphasis on major adaptive radiations.

532 Animal Behavior (3:3:0). Prerequisite: BIOL 324 or permission of instructor. Study of the ecological aspects of animal behavior.

533 Selected Topics in Plant Biology (1-4:1-3:0-6). Prerequisite: 8 hours in 100-level BIOL, upper-division course in botany, and permission of instructor. Topic depends upon the specialty of the instructor. May be repeated only with permission of chair.

534 Speciation and Field Studies in Flowering Plants (3:1:6). Prerequisite: Course in plant taxonomy or permission of instructor. Identification of flowering plants. Lab emphasizes field trips, collection, preparation, and identification of plants.

535 Ancient Plants and Their Environment (3:3:0). Prerequisite: BIOL 304 or a course in paleontology or permission of instructor. Evolution of fossil plants, their origin, history, and extinction, including the physical and biological selective pressures responsible for these events.

536 Ichthyology (4:3:3). Prerequisite: Course in ecology or permission of instructor. Study of the systematics, evolution, physiology, ecology, and behavior of fishes.

537 Ornithology (4:2:6). Prerequisite: Course in ecology or permission of instructor. Study of the evolution, systematics, physiology, ecology, and behavior of birds, emphasizing field work. Spring of even-numbered years.

538 Mammalogy (4:2:6). Prerequisite: Course in ecology or permission of instructor. Study of the evolution, systematics, physiology, ecology, and behavior of mammals, emphasizing field work. Fall of odd-numbered years.

539 Herpetology (4:2:6). Prerequisite: Course in ecology or permission of instructor. Study of the evolution, systematics, physiology, ecology, and behavior of amphibians and reptiles, emphasizing field work. Spring of odd-numbered years.

542 Ecology of Animal Communities (3:3:0) Prerequisite: Course in ecology or permission of instructor. In-depth study of animal communities emphasizing community structures and functions, changes in composition over time and space, stability and equilibrium properties, disturbances, and insularization effects.

543 Tropical Ecosystems (4:3:3). Prerequisite: Course in ecology or permission of instructor. Terrestrial, aquatic and marine ecosystems in the tropics emphasizing plant communities and plant-animal interactions, and the role of man in the tropics. Field trip to the tropics is required as part of lab.

546 Estuarine and Coastal Ecology (4:3:3). Prerequisite: Course in ecology and permission of instructor. Emphasizes marine biology of estuarine and coastal habitats of the Chesapeake Bay region and factors affecting distribution and abundance of organisms. Lab provides training in field measurement of physical and chemical parameters and collection and identification of local organisms. Extended field trips made to mid-Atlantic sites. Summer.
547 Terrestrial Plant Ecology (4:3:3). Prerequisite: Course in ecology. Consideration of community organization, development, productivity and mineral cycling, interactions between plants and competitors, herbivores and various environmental factors, especially light, water, and soil. Field and lab emphasize data collection and statistical analysis.

550 Limnology (4:3:3) Prerequisite: General chemistry and a course in ecology. Study of the origin of freshwater ecosystems and the chemical, physical, and ecological processes occurring in them. The impact of human activities on freshwater ecosystems is also considered.

552/Chem 502 General Biochemistry (4:3:1). Prerequisite: CHEM 313-314 and BIOL 383 or permission of instructor. Survey course for graduate students in biology and chemistry that examines the chemical basis of biological systems emphasizing structure, function, and regulation of metabolic systems.

553 Advanced Topics in Immunology (1-4:1-3:0-6). Prerequisite: BIOL 452 or permission of instructor. Comprehensive study of immunologic mechanisms as they pertain to immunologic diseases and transplantation.

554 Plant Physiology (3:3:0). Prerequisite: BIOL 304 or permission of instructor. A study of transport processes, photosynthesis and metabolism, growth and development, and environmental physiology as related to higher plants.

556 Microbial Physiology and Metabolism (3:3:0). Prerequisite: BIOL 383 or permission of instructor. Comprehensive study of microorganisms covering aspects of growth, nutrition, transport, autotrophic and heterotrophic metabolism, regulation, and differentiation.

557 Experiments in Microbiology (2:0:6). Prerequisite: BIOL 566 or permission of instructor. Students perform a select group of experiments that illustrate techniques used in the study of microbial taxonomy, genetics, physiology, and metabolism.

560 Biological Ultrastructure (4:2:6). Prerequisite: BIOL 383, CHEM 313, 314, and permission of instructor. Introduction to techniques involved in electron microscopy and to the interpretation of electron micrographs of plants and animals.

561 Comparative Animal Physiology (3:3:0). Prerequisite: BIOL 326 or permission of instructor. Detailed study of selected physiological systems of invertebrates and vertebrates, emphasizing current research.

563 Virology (3:3:0). Prerequisite: BIOL 383 and 311 or permission of instructor. Fundamental concepts of the nature of viruses, virus classification, cultivation, and biochemistry. Bacteriophage and animal viruses emphasized.

564 Techniques in Virology (2:1:3). Co- or prerequisite: BIOL 563 or permission of instructor. Emphasis on propagation of animal viruses in embryonated eggs and cell culture, titration of animal viruses and bacteriophage, serological techniques used in virology and biochemical and biophysical characterization of viruses.

567 Molecular Genetics (3:3:0). Prerequisite: BIOL 311 or permission of instructor. Study of molecular structure of genetic material and control of gene expression in viruses, procaryotes, and eucaryotes.

568 Advanced Topics in Molecular Genetics (3:3:0). Prerequisite: BIOL 482 or permission of instructor. Comprehensive study of regulatory mechanisms controlling gene expression in viruses, procaryotes, and eucaryotes, emphasizing current research.

572 Human Genetics (3:3:0). Prerequisite: General genetics or permission of instructor. Study of the inheritance of man, emphasizing current problems, including genetic control of metabolic diseases, effects of radiation and chemical agents in the environment, and directed genetic change.

573 Developmental Genetics (3:3:0). Prerequisite: General genetics or permission of instructor. Study of genetic approaches to the problem of eucaryotic development emphasizing current research on the regulation of gene enzyme systems.

574 Population Genetics (4:3:3). Prerequisite: General genetics or permission of instructor. Study of the genetic structure of populations and the forces that affect that structure.

575 Selected Topics in Genetics (3:3:0). Prerequisite: General genetics or permission of instructor. Different topics in different years. Topics include molecular, developmental, physiological, and classical genetics emphasizing current problems and research. May be repeated once with permission of chair.

577 Biogeochemistry: A Global Perspective (3:3:0). Prerequisite: Introductory courses in ecology and chemistry or permission of instructor. Structure and function of ecosystems, their interactions as components of landscapes, and their contributions to the global environment. Course emphasizes biogeochemical cycles of natural, disturbed, and managed ecosystems, and their integration at the landscape and global level as related to current ecological problems such as transfer of non-point source pollutants, atmospheric deposition, stratospheric ozone depletion, and global change.

580 Computer Applications for the Life Sciences (3:3:0). Prerequisites: 12 hours of biology and 1 year college mathematics or permission of instructor. Study of the uses of computers in the biological sciences. Lectures are combined with supervised exercises on mainframe and microcomputers. Each student presents a seminar on an advanced application and completes a project using a computer to fulfill a major assignment associated with another course or with employment.

601 Advanced General Biology: Classical Principles and Modern Views I (3:3:0). Prerequisite: 24 hours in life sciences or permission of instructor. Intensive review of the fundamental concepts relating to cellular biology and to the structure and function of plants and animals. Available for credit toward M.S. with specialization in interpretive biology only.

602 Advanced General Biology: Classical Principles and Modern Views II (3:3:0). Prerequisite: 24 hours in life sciences or permission of instructor. Intensive review of the fundamental concepts relating to genetics, development, evolution, behavior, and ecology. Available for credit toward M.S. with specialization in interpretive biology only.

605 Special Skills in the Life Sciences (1-3:0:0). Prerequisite: Baccalaureate degree and 24 hours of biology or permission of instructor. Lectures, lecture-demonstra-
tions, laboratory, workshop, or field experiences in specific methods or techniques. Content varies. May be repeated with permission of chair. A maximum of three courses and six hours may be applied to the M.S. in biology in the interpretive track only.

606 The Clinical Laboratory: An Introduction for Teachers (3:0:0). Prerequisite: Baccalaureate degree, 34 hours of biology, and permission of instructor. Workshop on clinical laboratory topics with emphasis on applications of biological concepts, counseling for allied health careers, and development of teaching materials for the public school. May be applied only to the M.S. in biology in the interpretive track and only within a six-hour limit if combined with BIOL 504, 601, 602, or 605.

607 Fundamentals of Ecology (3:3:0). Prerequisite: Permission of department. An overview of concepts in physiological, population, community, and ecosystem ecology restricted to graduate students with little or no background in ecology.

622 Methods and Principles of Animal Taxonomy (3:1:6). Prerequisite: Course in evolution or permission of instructor. Theoretical basis of techniques used in animal classification with emphasis on their practical application to a lab problem dealing with a particular animal group.

624 Coevolution of Plants and Animals (3:3:0). Prerequisite: Course in evolution. Topics include the mechanisms of evolution of plant and animal interactions, chemical communication, population dynamics, energetics of ecosystems, and development of the interactions over time.

630 Selected Topics in Vertebrate Zoology (3:3:0) or (3:2:3). Prerequisite: Courses in vertebrate zoology or comparative anatomy and ecology or permission of instructor. Topic depends on specialty of instructor. May be repeated once.

640 Environmental Biology I (3:3:0). Prerequisite: Course in ecology or permission of instructor. Patterns of climate and weather, tectonics, soil formation, and surface and ground water movements. Fall.

641 Environmental Biology II (3:3:0). Prerequisite: Course in ecology or permission of instructor. Effects of human activities on environment. Airborne, waterborne, and solid "waste" material are considered with respect to sources, control, and effects on the ecosystem. Spring.

643 Microbial Ecology (4:3:3). Prerequisite: Course in microbiology or permission of instructor. Study of relationships between microorganisms and their natural environment, and methodology for observing their natural environment, and biochemical activities in those environments. Spring of odd-numbered years.

644 Wetland Ecology and Management (4:3:3). Prerequisite: Courses in ecology, chemistry, and physics; or permission of instructor. Structure and function of wetland ecosystems. Course emphasizes biogeochemical and hydrological processes, the effects of disturbance, and management implications.

645 Freshwater Ecology (3:3:0). Prerequisite: BIOL 550 or permission of instructor. Study of biotic and abiotic interactions affecting the structure and composition of freshwater ecosystems. Emphasis on the research literature and experimental and theoretical approaches.

648 Population Ecology (3:3:0). Prerequisite: Course in ecology or permission of instructor. Survey of ecological models and theory. Topics include population growth and regulation, competition, predator-prey relationships, and models of community structure. Fall.

649 Biological Resource Management (3:3:0). Prerequisite: Course in ecology or permission of instructor. Modern ecological theories and methods applied to biological resource management in developing and developed countries. Problems in achieving optimum productivity of specific resources and application of systems analysis.

650 Environmental Analysis and Modeling (4:3:3). Prerequisite: Calculus, course in ecology, or permission of instructor. Students learn to conceptualize ecological systems, to represent these conceptualizations mathematically, and to develop and test models against field data. Model applications are emphasized.

665 Environmental Hazards to Human Health (3:3:0). Prerequisite: Course in animal physiology and organic chemistry or permission of instructor. Health effects of chemical contaminants of air, water, and food resulting from industrialized society. Includes identifying, evaluating, and controlling hazards.

668 Advanced Techniques in Molecular Biology (4:2:6). Prerequisite: BIOL 383, 311; CHEM 313, 314, 563, 564; or permission of instructor. BIOL 302 is recommended. Experimental studies utilizing current methods for purification and characterization of biologically important compounds; designed to provide training for research in molecular biology.

669 Pathogenic Microbiology (3:3:0). Prerequisite: Courses in microbiology and in biochemistry. Molecular mechanisms of exotoxins, endotoxins, and viral pathogenicity and the immune response in infectious diseases.

670 Environmental Law for Biologists (3:3:0). Prerequisite: Course in ecology or environmental biology or permission of instructor. Study of environmental laws such as the National Environmental Policy Act and regulatory issues such as the Clean Water and Clean Air acts. Emphasis on critical evaluation of alternatives to unresolved issues in environmental policies.

680 Experimental Design and Analysis for the Life Sciences (4:3:3). Prerequisite: Course in bio-statistics or permission of instructor. Advanced course in application of probability and statistics to research in the life sciences. Examples drawn from environmental, medical, physiological, genetic, and chemical biology. Spring.

690 Introduction to Graduate Studies in Biology (1:1:0). Required of all new M.S. students in Biology. Fall.

691 Current Topics in Biology (1-4:1-3:0-6). May be repeated for credit.

692 Seminar in Environmental Biology (1:1:0). Topics vary. May be repeated for credit.

693, 694 Directed Studies in Biology (1-8:0:0). Prerequisite: Permission of instructor, chair, and student's graduate committee. Topic study not otherwise available in graduate program. May involve any combination of reading assignments, tutorials, lectures, papers, presentations, or lab or field study, determined in consultation with instructor. May not be used to fulfill explicit under-graduate prerequisite for graduate work.
695 Seminar in Molecular, Microbial, and Cellular Biology (1:1:0). Review and discussion of recent literature in a specialized area. Includes student presentations. May be repeated for credit.

741 Advanced Topics in Environmental Biology (1-4:1-3:0-6). Prerequisite: 8 hours of ecology or permission of instructor. Topics vary. May be repeated only with permission of chair.

745 Environmental Toxicology (3:3:0). Prerequisite: Courses in ecology and physiology or permission of instructor. Study of nature, distribution, and interaction of toxic chemicals released into the environment. Emphasizes effects on nonhuman biota, detection and fate of chemicals, and implications for government regulation.

793 Research in Biology (1-3:0:0). Prerequisite: 8 graduate hours in BIOL and permission of instructor and chair. Library, lab, or field investigation under supervisor's guidance. May be repeated for a total of 3 hours.

796 Master's Research Project (1-3:0:0). Prerequisite: Permission of instructor and chair. An experimental or theoretical research project chosen and completed under the guidance of a graduate faculty member. A comprehensive report acceptable to the student's advisory committee is required. Students who take BIOL 793 may receive no more than a total of six credits for both BIOL 793 and 796.

799 Thesis (1-6:0:0). Prerequisite: 8 hours of graduate credit in BIOL and permission of instructor and chair. Thesis research under direction of supervisor. Students who take BIOL 793 may receive no more than a total of six credits for both BIOL 793 and BIOL 799.

800 Studies for the Doctor of Philosophy in Education (variable credit). Prerequisite: Admission to the Ph.D. in Education program to study in biology. Program of studies designed by the student's discipline director and approved by student's doctoral committee, which brings the student to participate in research of discipline director and results in a paper reporting the original contributions of the student. The paper is presented in a subsequent Ph.D. summer seminar. Enrollment may be repeated.

Chemistry, M.S.

The Master of Science program in chemistry provides advanced training for recent college graduates, professionals in teaching, and technical workers in research organizations with interests in chemistry.

Admission Requirements

To be considered for admission to degree status, a student must have a bachelor's degree in chemistry or a related field from an accredited institution and must meet the general admission requirements for graduate study.

Admission is based on a departmental evaluation of the applicant's background as evidenced by transcripts and letters of recommendation. A resume must be submitted by each applicant who received the bachelor's degree more than five years before the date of application. Acceptable scores on the Graduate Record General and Subject Chemistry Examinations must also be submitted unless this requirement is waived on the basis of the applicant's record and experience.

Each entering student will be required to take proficiency examinations before registering for the first time. The results of these examinations are used in planning the program of study. A student whose performance on these examinations reveals serious deficiencies will be required to register for one or more remedial undergraduate courses,
which may not be used to satisfy the requirements for the M.S. degree. Each student must present evidence of computer literacy before completing 12 credit hours of graduate work.

Degree Requirements

Two tracks are available. The thesis track is for students planning to continue work for the Ph.D. degree or to begin or continue careers in chemical research. The nonthesis track is for those seeking to go on to professional schools, to teach chemistry in secondary schools, or to pursue other careers in which advanced work in chemistry is necessary or advantageous.

A student in the thesis track is required to complete 30 credit hours of graduate work. The thesis written by a student will be based on a laboratory or nonlaboratory research project which must be preapproved by the thesis or advisory committee. The student's thesis or advisory committee will be appointed during the first semester of registration in CHEM 799. A student in the nonthesis track is required to complete 32 credit hours of graduate work. For both thesis and nonthesis track students, 12 credit hours must be in core courses in chemistry (physical chemistry and one in each of three different areas chosen from analytical, biological, environmental, inorganic, and organic chemistry). An outline of minimum credit hours for each track is as follows:

<table>
<thead>
<tr>
<th>Thesis Track</th>
<th>Nonthesis Track</th>
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<tbody>
<tr>
<td>Core Curriculum</td>
<td>12</td>
</tr>
<tr>
<td>Electives in Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>Electives in Chemistry or Related Fields</td>
<td>6</td>
</tr>
<tr>
<td>CHEM 670</td>
<td>2</td>
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<tr>
<td>CHEM 790</td>
<td>3</td>
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<tr>
<td>CHEM 799</td>
<td>6</td>
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<tr>
<td>Total Credit Hours</td>
<td>30</td>
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</tbody>
</table>

Core courses (CHEM 513, 521, 614, 624, 633, 646, 651, and 663) may also be taken as electives beyond the 12-credit requirement. Credits obtained for courses CHEM 502-CHEM 510 are applicable toward the M.S. degree only with prior written approval of the department.

CHEM 500 and CHEM 501 are not applicable toward the M.S. degree.

Chemistry Courses (CHEM)

500 Selected Topics in Modern Chemistry (3:3:0).
Topics of interest in analytical, biological, environmental, geo-, inorganic, organic, and physical chemistry. May be repeated for credit with different topics. Credit is not allowed toward a major in chemistry.

501 Laboratory Demonstration Technique in the Teaching of Chemistry (3:3:0).
Course develops proficiency in conducting lab demonstrations. Recommended for teachers of chemistry and general science.

502 General Biochemistry (4:3:1).
Prerequisite: CHEM 313 and 314, BIOL 383 or permission of department. Survey course in general biochemistry for advanced undergraduate and graduate students in biology and chemistry dealing with the chemical basis of biological systems emphasizing the structure, regulation, and functions of cellular events.

504 Geochemistry of Environmental Hazards (3:3:0).
Prerequisite: CHEM 313 or permission of instructor. Introduction to the origins and reactions of hazardous substances in air, water, and soil environments. Movement of trace organic and inorganic substances in the geochemical cycle with particular reference to transport processes that influence air and water quality.

Prerequisite: CHEM 313 or Pol. Comprehensive review of those subjects most frequently encountered in hazardous chemicals management: science, law, and management.

509 Special Topics (1:3-1:3:0).
Prerequisite: CHEM 313 and 314 or Pol. Current topics in chemistry; the topic depends on the specialty of the instructor. Course may be repeated with different topics with approval of the department.

513 Synthetic and Mechanistic Organic Chemistry (3:3:0).
Prerequisite: CHEM 313 and 314. The course begins with a general review of synthetic pathways and then applies this background to new topics emphasizing applications to fused ring aromatics, heterocyclics, natural products, and biologically active compounds. The relationship of applied organic chemistry to consumer products, including drugs and agricultural chemicals, is also included. Organic core course.

Prerequisite: CHEM 422 or permission of the instructor. Theory of signal and noise, mass transport phenomena, thermodynamics, and ionics in analytical chemistry. Applications to Fourier transform techniques (FTIR, FTNMR), convolution and correlation spectroscopy, chemical sensors, chromatography, flow injection analysis, ion transport in membrane, and interpretation of analytical signals. Analytical core course.

529 Instrumental Techniques of Analysis (2:0:6).
Prerequisite: CHEM 321 and 422 or 521 or permission of department. Principles and operation of modern instrumentation with emphasis on applications to the analysis of chemical, biological, and environmental samples. Methods include combined capillary column gas chromatography/mass spectrometry, high performance liquid chromatography, optical methods, surface analysis methods, magnetic resonance spectroscopy, atomic emission and absorption spectrometry, and electroanalytical methods. The student, with approval of his or her research committee, is free to choose the methods studied.

610 Modern Instrumentation (3:2:2).
Prerequisite: CHEM 422 or permission of instructor. Methods of sensing and measurement of radiation, particles, pressure, concentrations of specific elements and compounds. Basic operational amplifier circuits for analog signals. Digitizing devices and computerized data collection.

http://catalog.gmu.edu
Noise and noise reduction methods. Specialized instrumentation systems for various areas of chemistry and physics.

614 Physical Organic Chemistry (3:3:0). Prerequisite: CHEM 314, or permission of instructor. The principles underlying molecular structure, reactivity, and reaction mechanisms. Topics include valence-bond and molecular-orbital theory, the electronic interpretation of organic reactions, stereochemistry, conformational analysis, the kinetics and thermodynamics of organic reactions, and photochemistry. Organic core course.

624 Principles of Chemical Separation (3:3:0). Prerequisite: CHEM 422 or 521, or permission of instructor. Theories and models of separation with applications to the analyses of a wide range of chemical, biological, and environmental samples. Topics include high resolution gas chromatography and high performance liquid chromatography. Emphasis on the theory of reverse-phase, normal-phase, ion-exchange, size-exclusion, and affinity-based separations. Instrumentation such as detectors, pumps, columns, and data acquisition and analysis are also presented. Analytical core course.


646 Bioinorganic Chemistry (3:3:0). Prerequisite: CHEM 441 or permission of instructor. Inorganic coordination chemistry and its application in the study of biological systems. Emphasis on molecular symmetry, electronic absorption and vibrational spectroscopy, redox stability. Topics include structure and function of selected metal ion sites in metalloproteins, inorganic model compounds, and electron transfer phenomena. Inorganic core course.

651 Environmental Chemistry (3:3:0). Prerequisite: CHEM 332 or permission of instructor. Chemical behavior of pollutants in air, water, and soil. Emphasis is on thermodynamic principles and chemical transformation pathways important in the fate and transport of organic substances in the environment. Major topics include partitioning, photolysis, biodegradation, and fate modeling. Environmental core course.

663, 664 Biochemistry (3:3:0), (3:3:0). Prerequisite: CHEM 313 and 314. CHEM 663 is prerequisite to CHEM 664. A previous course in biology is recommended but not required. Important biological compounds, including proteins, carbohydrates, lipids, and nucleic acids, and their interrelations. CHEM 663 is the biochemistry core course.

665, 666 Biochemistry Lab (2:1:3), (2:1:3). Prerequisite or corequisite: CHEM 663. CHEM 665 is prerequisite for CHEM 666. Introduction to experimental methods used to study chemical and physical properties of proteins, carbohydrates, lipids, and nucleic acids. Complements the corresponding lecture course (CHEM 663 and 664). Designed for those who have had no previous exposure to the specialized techniques used in biochemical research. One hour recitation.

670 Teaching Practicum (1-2:0:0). Prerequisite: Enrollment in the graduate program. Lecture and laboratory experience teaching chemistry in the laboratory. The student will work closely with a faculty member and will be responsible for all aspects of teaching undergraduate laboratory techniques.

711 Statistical Mechanics (3:3:0). Prerequisite: Permission of instructor. Statistical methods, systems of particles, thermodynamics, macroscopic parameters, the ideal gas, kinetic theory, quantum states, and transport processes.

723 Trace and Microanalysis (3:3:0). Prerequisite: CHEM 422 or permission of instructor. Principles and applications of currently used methods of analysis, including differential pulse polarography, stripping voltammetry, atomic absorption and emission spectrophotometry, fluorescence analysis, neutron activation analysis, and spark source mass spectrometry. Applications to the determinations of trace metals in environmental samples.

725 Electroanalytical Chemistry (3:3:0). Prerequisite: CHEM 321 and 331. Begins with a review of basic electrochemistry. Applications of modern electrochemical techniques such as chronocoulometry, cyclic voltammetry, pulse polarography, stripping voltammetry, AC voltammetry, coulometry, electrochemical sensors and instrumentation with emphasis on their use in analysis and research.


731 Modern Polymer Chemistry (3:3:0). Prerequisite: CHEM 513 or permission of instructor. Synthetic and analytical chemistry of synthetic macromolecules. Topics include polymer solutions, molecular weight determination, spectroscopy, thermal analysis, X-ray crystallography, crystallinity, types of polymerization, commercial polymers, and electroactive polymers.

732 Quantum Chemistry (3:3:0). Prerequisites: CHEM 332. The fundamental concepts of quantum mechanics are illustrated with applications to chemical systems, including atomic and molecular electronic structure and properties, molecular symmetry, and intermolecular forces.

736 Computational Quantum Mechanics (3:3:0). Prerequisite: PHYS 502, 510, or permission of instructor. Study of the fundamental concepts of quantum mechanics from a computational point of view, review of systems with spherically symmetric potentials, may electron-atom solutions to Schroedinger's equation, electron spin in many electron systems, atomic structure calculations, algebra of many electron calculations, Hartree-Fock, self-consistent field method, molecular structure calculations, scattering theory computations, and solid-state computations.

767 Protein Biochemistry (3:3:0). Prerequisite: 663 and 664, or permission of instructor. Topics include the structural, transport, and immunological behavior of proteins with emphasis on their roles as biological catalysts. Current theories of enzyme catalysis as well as pertinent experimental techniques. Important structural proteins from muscle and connective tissue as well as free- and membrane-bound transport proteins.

790 Graduate Seminar (1:1:0). Prerequisite: Attendance at a minimum of 70 percent departmental seminars in semester preceding each enrollment. Selected topics from recent chemical theory and applications, designed to inform students about current developments in the chemical sciences. A seminar presentation on the student's own research or another topic acceptable to the department is required in the student's last semester. Three credits of CHEM 790 are required for the M.S. degree; an additional three credits are required after admission to the Ph.D. program.

798 Research Project (3-6:0:0). Prerequisite: Permission of department. An experimental or theoretical research project is chosen and completed under the guidance of a graduate faculty member. A comprehensive report acceptable to the student's advisory committee and a final oral examination on that report are required. Six credits of either CHEM 798 or 799 are required, but credit will not be given for both.

799 Master's Thesis (1-6:0:0). Prerequisite: Permission of department. Laboratory and non-laboratory thesis research and writing under the direction of a supervisor.

800 Studies for the Doctor of Philosophy in Education (variable credit). Prerequisite: Ph.D. student admission to study in chemistry. Program of studies, designed by student's discipline director and approved by doctoral committee, which allows the student to participate in the current research of the discipline director and results in a paper reporting the original contributions of the student. The paper is presented in a subsequent Ph.D. summer seminar. Enrollments are repeated according to each student's program.

999 Doctoral Dissertation (3-12:0:0). Prerequisite: Enrollment in a doctoral program and permission of department. An experimental or theoretical research project is to be chosen and completed under the guidance of a graduate faculty member. A thesis acceptable to the student's thesis committee and an oral defense are required. May be repeated as needed; however, no more than a total of 24 hours may be applied toward satisfying doctoral degree requirements.

CHEM 610, 711, 728, and 736 are cross-listed with the Physics and Astronomy Department and CSI.

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Cultural Studies

Faculty
Albanese, Denise, Ph.D., Stanford University, 1986; Associate Professor of English
Bergmann, Hans, Ph.D., University of Connecticut, 1969; Professor of English and Associate Dean, College of Arts and Sciences
Bergoffen, Debra, Ph.D., Georgetown University, 1974; Professor of Philosophy
Brown, Lorraine, Ph.D., University of Maryland, 1968; Professor of English
Brunette, Peter, Ph.D., University of Wisconsin, 1975; Professor of English
Burr, Zofia, Ph.D., Cornell University, 1992; Assistant Professor of English
Burton, Stephen, M.M., Peabody Conservatory of Music, 1974; Associate Professor of Music
Carr, Robert, Ph.D., University of Maryland, 1993; Assistant Professor of English
Copelman, Dina, Ph.D., Princeton University, 1985; Assistant Professor of History
Cordero, Anne, Ph.D., George Washington University; Associate Professor of French
Cox, Brad, Ph.D., University of Chicago, 1973; Associate Professor of Social and Organizational Learning
Cruz, Dulce, Ph.D., Indiana University—Bloomington, 1993; Assistant Professor of English
Deshmukh, Marion, Ph.D., Columbia University, 1975; Chair, Department of History
Dietz, Tom, Ph.D., University of California—Davis, 1979; Professor of Sociology
Diner, Steven, Ph.D., University of Chicago, 1972; Professor of History
Dumont, Jean-Paul, Ph.D., University of Pittsburgh, 1972; Robinson Professor of Anthropology
Elston, Esther, Ph.D., Rice University, 1969; Professor of German
Elliot, Sheila, Ph.D., University of Pennsylvania, 1979; Associate Professor of Art History
Foreman, Joel, Ph.D., George Washington University, 1975; Associate Professor of English
Foster, John, Ph.D., Yale University, 1974; Professor of English
Froman, Wayne, Ph.D., Fordham University, 1975; Chair, Department of Philosophy and Religious Studies

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Fuchs, Cynthia, Ph.D., University of Pennsylvania, 1989; Assistant Professor of English
Gilbert, Paula, Ph.D., Columbia University, 1973; Professor of French
Gras, Vernon, Ph.D., University of Chicago, 1967; Professor of English
Guagnano, Gregory, Ph.D., University of California–Davis, 1986; Assistant Professor of Sociology
Hanrahan, Nancy Weiss, Ph.D., New School for Social Research, 1994; Assistant Professor of Sociology
Hodges, Devon, Ph.D., State University of New York–Buffalo, 1979; Professor of English
Holt, Mack, Ph.D., Emory University, 1982; Associate Professor of History
Horton, Lois, Ph.D., Brandeis University, 1977; Associate Professor of Sociology
Irvine, Lorna, Ph.D., The American University, 1977; Professor of English
Jacobs, Mark, Ph.D., University of Chicago, 1987; Associate Professor of Sociology
Jann, Rosemary, Ph.D., Northwestern University, 1975; Professor of English
Joseph, Tojo, Ph.D., Case Western University, 1993; Assistant Professor, Program on Social and Organizational Learning
Kaplan, Deborah, Ph.D., Brandeis University, 1979; Associate Professor of English
Kaufmann, David, Ph.D., Yale University, 1989; Assistant Professor of English
Lavoie, Donald, Ph.D., New York University, 1981; Professor of Economics
Mattusch, Carol, Ph.D., University of North Carolina, 1975; Professor of Art History
Melosh, Barbara, Ph.D., Brown University, 1979; Professor of English and History
Mobley, Marilyn, Ph.D., Case Western Reserve University, 1987; Associate Professor of English
Mones-Hattal, Barbara, M.F.A., Rhode Island School of Design, 1979; Associate Professor of Art Studio
Moylan, Tom, Ph.D., University of Wisconsin, 1981; Associate Professor of English
Nadeau, Robert, Ph.D., University of Florida, 1970; Professor of English
Neshati, Kristin Johnsen, M.F.A., Yale University, 1992; Assistant Professor of Theater
O'Connor, John, Ph.D., University of Virginia, 1974; Associate Professor of English
Palkovich, Ann, Ph.D., Northwestern University, 1978; Associate Professor of Anthropology
Rabin, Lisa, Ph.D., Yale University, 1993; Assistant Professor of Spanish
Rosenblum, Karen, Ph.D., University of Colorado, 1979; Associate Professor of Sociology
Rosenzweig, Roy, Ph.D., Harvard University, 1978; Professor of History
Stewart, Jeffrey, Ph.D., Yale University, 1979; Associate Professor of History
Sypher, Eileen, Ph.D., University of Connecticut, 1976; Associate Professor of English
Todd, Ellen, Ph.D., Stanford University, 1986; Chair, Department of Art History
Travis, Toni-Michelle, Ph.D., University of Chicago, 1983; Associate Professor of Government and Politics
Wood, Joseph, Ph.D., Pennsylvania State University, 1978; Chair, Department of Geography and Earth Systems Science
Yocom, Margaret, Ph.D., University of Massachusetts, 1980; Associate Professor of English

Cultural Studies, Ph.D.

This program, the first of its kind at the doctoral level in the United States, unites selected faculty from 10 different departments to serve students contemplating careers in scholarship and practice. Cultural studies is an emerging field of interdisciplinary inquiry, arising in response to dramatic historical and social changes. As the focus on cultural process transforms an entire range of disciplines in both the humanities and social sciences, scholars are embracing new conceptions of culture and new methods for its study.

George Mason's program in Cultural Studies is distinctive in several respects. Similar programs in other universities are usually departmentally based (in English, History, Sociology, or Communications), emphasizing either the humanities or the social sciences. By contrast, the Cultural Studies Program at George Mason explicitly seeks to link the social sciences and the humanities, combining methods of interpretation and explanation to explore the dynamics of intention and reception in the production, distribution, and consumption of cultural objects in their social contexts. With particular focus on theory and method in crafting this linkage, the program engages contemporary issues of nationality, class, race, and gender, while opening its scope to all forms of culture, past and present.
Admission Requirements

Students who already have M.A. degrees in relevant fields are eligible to apply to the Cultural Studies Program. Students with only bachelor's degrees should apply to M.A. programs in one of six departments—English, Sociology and Anthropology, History, Philosophy and Religious Studies, Foreign Language and Literatures, or Economics—which have established feeder tracks in cultural studies. All these feeder tracks culminate in CULT 802 as a capstone seminar. These students may, if they choose, apply simultaneously to the Cultural Studies Program, which reviews their academic promise and suitability of their interests to the program. Especially strong candidates with bachelor's degrees may be admitted into the doctoral program, conditional on performance in their M.A. programs—and in particular in CULT 802—indicative of readiness for doctoral work.

Students who complete CULT 802 as part of their M.A. programs are required to complete only 56 credits at the doctoral level.

The following application materials are required of all students:

1. The standard GMU graduate application form.
2. A transcript from the Educational Testing Service, indicating scores on the Graduate Record Examinations (only the general tests are required; subject tests are optional).
3. Official transcripts from all colleges and universities attended.
4. Three letters of recommendation from individuals who can judge the applicant's scholarly potential.
5. A statement of purpose.
6. A writing sample.

For applicants who are not native English speakers, an English language competency exam is required.

Students are required to demonstrate proficiency in at least one foreign language before being permitted to defend their doctoral dissertation proposal, but the foreign language requirement is not part of the application process.

Degree Requirements

As with all doctoral programs, the emphasis is on the development of intellectual mastery and professional competence. The most important requirements in the program are comprehensive exams and the completion of a doctoral thesis that reflects the student's ability to do original interdisciplinary work that meets professional standards.

The course of study consists of 60 credit hours beyond the M.A.

Core Requirement (15 credits):

- CULT 802 Ideas and Methods in Cultural Studies I (4 credits)
- CULT 804 Ideas and Methods in Cultural Studies II (4 credits)
- CULT 806 Research in Cultural Studies (3 credits)
- CULT 808 Faculty/Student Colloquium (4 semesters/4 credits)

Thematic Requirement (15 credits in one of five interdisciplinary tracks):
- Art, Artifacts, and Institutions
- The Social Construction of Identities
- Culture and Information Technology
- The Culture of Politics
- Theories of Culture

Interdisciplinary area-and-period concentration or a disciplinary concentration (15 credits)

Dissertation research (15 credits)

Each thematic track is anchored by a “theory and methods” course required of all students who select that track. However, since these tracks are so closely related to each other and to the general themes of the program, all students also take one theory and methods course outside their own chosen track. Under the guidance of faculty advisory committees, students select the remainder of their course work from departmental graduate offerings (600-level and above) and from independent study courses. The mixture of thematic, area/period, and departmental concentrations provides students with the disciplinary grounding necessary for interdisciplinary work and for career opportunities in traditional academic departments.

Cultural Studies Courses (CULT)

802 Ideas and Methods I (4:4:0). Prerequisites: Admission to program, to M.A. “feeder” track, or permission of instructor. Examination of various models for cultural studies that highlight the production, distribution, and consumption of cultural objects in their social contexts. Emphasis on contemporary issues emergent from case studies of local cultures.

804 Ideas and Methods II (4:4:0). Prerequisites: Admission to program and CULT 802. Examination of major traditions for defining culture and the theoretical issues underlying them.

806 Research Seminar in Cultural Studies (3:3:0). Prerequisites: CULT 802. Introduction to research methods in cultural studies. Specific topics vary.

808 Faculty/Study Colloquium in Cultural Studies (1:1:0). Prerequisites: Admission to program or permission of instructor. Forum for the presentation of original and current research in cultural studies. Students register for one credit per semester over a four-semester period.

810 Theory Track Course (3:3:0). Prerequisites: CULT 802 or permission of instructor. Historical intro-
duction to the tradition of "grand theory" in the nineteenth and twentieth centuries.

812 Arts Track Core (3:3:0). Prerequisites: CULT 802 or permission of instructor. Multidisciplinary approach toward construction of the aesthetic. Balances moments of emergence with contemporary formations and theoretical texts with case studies focusing on a wide variety of media, institutions, and audiences.

814 Identities Track Core (3:3:0). Prerequisites: CULT 802 or permission of instructor. Advanced introduction to the discovery, constitution, and contestation of "identity" in history, theory, and discourse, addressing issues of subjectivity and consciousness, race, ethnicity, gender, sexuality, nationality, and class.

816 Information Technology Track Core (3:3:0). Prerequisites: CULT 802 or permission of instructor. Examination of the historical, philosophical, and social background of the contemporary information technology revolution, exploring its implications as well as its relation to social organization, product design, and artificial intelligence.

818 Culture of Politics Track Core (3:3:0). Prerequisites: CULT 802 or permission of instructor. Introduction to major issues in the relationship between cultural forces and political power.

Economics

Faculty

Bennett, James T., Ph.D., Case Western Reserve University, 1970; William P. Snively Professor
Bloch, Howard R., Ph.D., Princeton University, 1964; Professor
Buchanan, James M., Ph.D., University of Chicago, 1948; Holbert Harris Professor of Economics
Chung, Jae W., Ph.D., New York University, 1972; Associate Professor
Congleton, Roger D., Ph.D., Virginia Polytechnic Institute and State University, 1978; Associate Professor
Cowen, Tyler, Ph.D., Harvard University, 1987; Associate Professor
Crain, W. Mark, Ph.D., Texas A & M University, 1976; Professor
Heiner, Ronald A., University of California, Los Angeles, 1975; Professor
Levy, David M., Ph.D., University of Chicago, 1979; Associate Professor
Meyer, Carrie A., Ph.D., University of Illinois, 1988; Assistant Professor
Phillips, Samuel H., Ph.D., University of Virginia, 1966; Professor
Ramirez, Carlos D., Ph.D., Harvard University, 1993; Assistant Professor
Reid, Joseph D., Ph.D., University of Chicago, 1974; Associate Professor
Roback, Jennifer, Ph.D., University of Rochester, 1980; Associate Professor
Rowley, Charles K., Ph.D., University of Nottingham, 1964; Professor
Thorbecke, Willem, Ph.D., University of California, Berkeley, 1988; Assistant Professor
Tollison, Robert D., Ph.D., University of Virginia, 1969; Duncan Black Professor of Economics
Vanberg, Viktor, Dr. Phil., Technische Universität Berlin 1974; Dr. habil., Universität Mannheim, 1981; Professor
Vaughn, Karen L., Ph.D., Duke University, 1971; Professor
Wagner, Richard E., Ph.D., University of Virginia, 1966; Holbert Harris Professor of Economics
Wiest, Philip R., Ph.D., University of Pittsburgh, 1976; Associate Professor
Williams, Walter E., Ph.D., University of California, Los Angeles, 1972; John M. Olin Distinguished Professor of Economics

Economics, M.A.

The Master of Arts in Economics strengthens students' knowledge of economic theory and improves their skill in using the theory to solve current economic problems. Graduates of the program are qualified to read and judge other research and to conduct their own, either individually or as members of research teams in government or business. They are also prepared to write policy analysis articles. Students who plan to pursue a Ph.D. in Economics should apply directly to the doctoral program.

Admission Requirements

- Undergraduate degree from an accredited institution;
- MATH 108 or equivalent;
- Grade point average of 3.0 in the last two years of undergraduate work and in all economics courses; and
- Satisfactory scores on the Graduate Record Examination, including the economics subject test.

Students should be familiar with intermediate microeconomics and macroeconomics, and with basic statistics and calculus, to participate in the master's program.

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All applicants must submit two letters of recommendation and a brief personal statement explaining their interest in the program. The application deadline for the fall semester is May 1. The Economics Department does not permit admission for the spring semester.

**Degree Requirements**

Students must complete 30 semester hours of graduate credit and pass a comprehensive examination in micro- and macroeconomics. The examinations are offered twice each year. All students are required to take ECON 611, 615, and 812 in the first year. In addition, ECON 630, Mathematical Economics, is strongly recommended. Although the university does not guarantee the availability of these courses every semester, a typical first-year sequence would include ECON 611, ECON 630, and an elective in the fall; ECON 812, ECON 615, and an elective in the spring.

If possible, part-time students should arrange their work schedules to take two courses per semester in the first year.

Master's degree students must enroll at the Arlington Campus for their core theory courses.

Up to 21 hours of electives may be chosen from any of the fields offered by the department. Students may receive departmental permission to substitute up to 6 hours of electives taken outside economics in closely related fields. Students may also elect the thesis track, which offers up to 6 hours of credit for independent research and writing under the supervision of a faculty member; that is, students may choose 15 hours of classroom electives and 6 hours of credit for thesis research (ECON 799).

**Economics, Ph.D.**

The Ph.D. in Economics prepares students for careers in academia, business, and government. The core courses of the program train students in modern theory and quantitative techniques. The field courses stress the application of theory to relevant economic problems. Dissertation work requires students to master and apply the skills of original research. The department emphasizes publishing, and many students have had articles accepted for publication in professional journals while in the graduate program. Research in the Economics Department covers a broad spectrum, from problems of immediate policy to fundamental questions of economic and social organization.

**Admission Requirements**

- Undergraduate degree from an accredited institution;
- One year of calculus and one year of statistics;
- Grade point average of 3.0 in the last two years of undergraduate work and in all economics courses;
- Satisfactory scores on the Graduate Record Examination, including the economics subject test.

Although it is not required, students find it helpful to complete a semester of matrix algebra and a semester of econometrics before entering the doctoral program.

Applicants must submit two letters of recommendation and a brief personal statement explaining their interest in the program. The application deadline for students desiring financial aid is February 1. The deadline for all other students for fall semester is April 1. The Economics Department does not permit admission for the spring semester.

**Degree Requirements**

Students are required to pass 72 semester hours of course work, of which no more than 24 hours may be dissertation credits. Students must pass comprehensive examinations in microeconomics and macroeconomics. In addition, students must pass field examinations in two of the fields listed below. Examinations are normally given in September and January. Students who enter with a master's degree may transfer up to 30 semester hours of credit at the discretion of the department. Credit is not given for comprehensive and field examinations from other universities. Students may receive departmental permission to substitute up to 6 hours of electives taken outside economics in closely related fields.

All doctoral students must take a year of microeconomics (ECON 611 and 812), a year of macroeconomics (ECON 715 and 816), mathematical economics (ECON 630), econometrics (ECON 637), and history of economic thought (ECON 820 or 821). Also required are two courses (beyond the required courses) in each student's two chosen fields in preparation for field examinations.

Although the university does not guarantee the availability of these courses every semester, a typical first-year program of study for a full-time doctoral student would include ECON 630, 611, and 715 in the fall; ECON 637, 812, and 816 in the spring; and micro and macro comprehensive examinations in September. A typical second-year program would include Field 1 and Field 2 in the fall; Field 1 (continued) and Field 2 (continued) in the spring; and field examinations in September.
To be eligible for continuing financial aid, students must attempt the comprehensive examinations in both microeconomics and macroeconomics by their third semester in the program. It is important for students to pass their comprehensive examinations in theory as soon as possible, because field examinations cannot be attempted until students attain a satisfactory score on the theory exams.

If possible, part-time students should arrange their work schedules to take two courses per semester in the first year.

Doctoral students may not enroll at the Arlington Campus for their required theory and mathematics courses.

Subject to course availability, the department offers examinations in the following fields of study:

- Austrian Economics
- Comparative Economic Systems
- Constitutional Political Economy
- Economic Development
- Economic History
- Industrial Organization
- International Trade and Finance
- Monetary Theory
- Public Choice
- Public Finance

### Economics Courses (ECON)

ECON 306 and 311, or equivalent, are prerequisites for all graduate courses except ECON 600 and 602. Undergraduates are not permitted to enroll in 600-level courses. Additional prerequisites are noted. With permission of the instructor, additional prerequisites may be waived.

#### 535 Introduction to Econometrics (3:3:0). Prerequisite: DESC 200 and 202 or permission of instructor. Applied introduction to estimating economic relationships. Simple equation and simultaneous equation system estimation along with their associated problems. (Students who take ECON 535 may not take ECON 637 for credit.)

#### 600 Current Issues in Economics (3:3:0) (B). Prerequisite: Graduate standing or permission of instructor. For students with little economic background. Topics include supply and demand, operation of a free market system, stock and bond markets, and U.S. role in world economy. May be used in partial fulfillment of the course requirement in the teaching discipline for the master's degree in education.

#### 602 Economic Analysis (3:3:0). Prerequisite: Baccalaureate degree. Course cannot be taken for credit toward a graduate degree in economics. A rigorous, concentrated introduction to micro- and macroeconomic analysis. Emphasized are economic concepts, tools of analysis, and business applications.

#### 611 Microeconomic Theory (3:3:0). Prerequisite: Admission to the doctoral or master's program or ECON 306, ECON 311, and MATH 113 or permission of graduate coordinator. Theory of behavior of consumers, firms, and resource suppliers. Theories of choice under conditions of risk and uncertainty. Partial equilibrium analysis of competitive and noncompetitive markets. General equilibrium analysis, welfare economics, and introduction to capital theory.

#### 615 Macroeconomic Theory (3:3:0). Prerequisite: Admission to the master's program in economics or ECON 306, ECON 311, and MATH 108, or permission of graduate coordinator. Master's-level survey course. Topics include monetary theory, theories of consumption and saving, budget deficits, economic growth, international finance, and monetary and fiscal policies.

#### 623 American Economic History (3:3:0). Prerequisite: ECON 611 and 615, taken concurrently, or permission of instructor. ECON 637 is recommended. Growth and development of the American economy as well as the evolution of economic institutions.

#### 630 Mathematical Economics I (3:3:0). Prerequisite: Admission to the doctoral or master's program or ECON 306, ECON 311, and MATH 113 or permission of instructor. Topics include set theory, function, differential calculus, integration, series, and matrix algebra, with special emphasis on the economic applications.

#### 637 Econometrics I (3:3:0). Prerequisite: Acceptance to the Ph.D. program, DESC 200 and 202 or permission of instructor. Techniques of estimating relationships among economic variables. Introduction to multiple regression and problems associated with the single equation model—autocorrelation, multicollinearity, and heteroscedasticity.


#### 715 Macroeconomic Theory II (3:3:0). Prerequisite: Admission to the doctoral program or permission of instructor. Classical, neoclassical, Keynesian, and post-Keynesian theories of income and employment determination. Theories of inflation and growth. The demand for money and its implications for the effectiveness of monetary vs. fiscal policy.

#### 799 Thesis (1-6:0:0). Students who take ECON 896 and then elect the thesis option receive three credits for ECON 799 upon completion of the thesis. Students who do not take ECON 896 receive six credits for ECON 799 upon completion of the thesis.

#### 800 Studies for the Doctor of Philosophy in Education (variable credit). Prerequisite: Admission to the Ph.D. in Education in study in economics. Studies designed by student's discipline director and approved by student's doctoral committee, which brings the student to participate in the current research of the discipline director and results in a paper reporting the original contributions of the student. Enrollments may be repeated.


#### 816 Macroeconomic Theory II (3:3:0). Prerequisite ECON 611 and 615 or permission of instructor. Aggregate economic activity and price levels with emphasis on dynamic models. Topics vary.
817 Monetary Theory and Policy (3:3:0). Prerequisite: ECON 615 and 637 or permission of instructor. Theory of the mechanisms through which central banking affects economic activity and prices. Analysis of the demand for money and its relationship to economic activity. The development of monetary theory with emphasis on current theories and controversies in the field.

820 History of Economic Thought (3:3:0). Major figures in the history of economic thought and the tools of analysis they created; emphasis on classical, neoclassical, and Keynesian theories.

821 History of Economic Thought II (3:3:0). Development of economic analysis from the "marginal revolution" of 1877 to present. Emphasis on the development of neoclassical economic theory.

823 Topics in Economic History (3:3:0). Prerequisite: ECON 611 and 615. Economic analysis of various historical epochs, such as the Industrial Revolution, Evolution of Political Reform, Rise of Unions, Growth of Government.

825 Political Economy and Public Policy I (3:3:0). Prerequisite: ECON 611 or permission of instructor. Economic process of public policy formulation and implementation. Economic behavior of principals in policy making and execution.

826 Political Economy and Public Policy II (3:3:0). Prerequisite: ECON 611, 615, and 825 or permission of instructor. Specific issues related to political economy of public policy. Topics include privatization, political economy of deficit spending, regulation and deregulation, and the economics of rent seeking.

827 Economic Philosophy (3:3:0). Prerequisite: ECON 611 or permission of instructor. Analysis of the philosophical organization. Interrelations between economics and legal and political institutions. Philosophical presuppositions of a capitalist economy under constitutional democracy. Consideration of alternative presuppositions for noncapitalist economies. Critical evaluation of history of ideas in social and moral philosophy.

828 Constitutional Economics (3:3:0). Prerequisite: ECON 611 or permission of instructor. Analysis of existing and proposed elements of the "economic constitution." Emphasis on fiscal, monetary, transfer, and regulatory powers of government and on constitutional limits on such powers, especially in the United States. Also includes analysis of proposed changes in these limits.

829 Economics of Institutions (3:3:0). Prerequisite: ECON 611 or permission of instructor. Analysis of the framework of rules and institutions within which economic activities and transactions are carried out. Emergence and working properties of different institutions. Comparative discussion of classical and contemporary approaches to an economic theory of institutions.

831 Mathematical Economics II (3:3:0). Prerequisite: ECON 630 or permission of instructor. Mathematical treatment of economic theories. Static and dynamic analysis of macro-models. Input-output analysis. Optimization techniques such as Lagrangian multipliers, linear programming, nonlinear programming, and game theory.

838 Econometrics II (3:3:0). Prerequisite: ECON 637 or permission of instructor. Econometric models and simultaneous equation systems. Identification of parameters and least squares bias; alternative estimation methods and block recursive systems.

842 Labor Economics (3:3:0). Prerequisite: ECON 611 and 615 or permission of instructor. ECON 637 is recommended. Formal models of labor demand, supply, utilization, and wage determination. The determination of factor shares in an open economy. The theory of collective bargaining and the impact of trade unions on wage rates and resource allocation. The measurement, types, and causes of unemployment. Benefit-cost analysis of manpower training and development projects.


849 Public Finance (3:3:0). Prerequisite: ECON 611 or permission of instructor. Theoretical and institutional analysis of government expenditure, taxation, debt management, and intergovernmental fiscal relations. Allocative and distributional effects of alternative tax and subsidy techniques. Principles of benefit-cost and cost-effectiveness analysis for government decisions.

851 State and Local Public Finance (3:3:0). Prerequisite: ECON 611 or permission of instructor. Analysis of public spending and taxation at the subfederal level. Theory of public goods, positive and normative explanatory models of public expenditure determination, and intergovernmental fiscal relations. Problems in the provision of specific state and local services, including education and police and fire protection.

852 Public Choice (3:3:0). Prerequisite: ECON 611 or permission of instructor. Application of economic theory and methodology to the study of nonmarket decision making.

853 Special Topics in Public Finance (3:3:0). Prerequisite: ECON 611 and 849. Topics vary; announced in Schedule of Classes.

854 Public Choice II (3:3:0). Prerequisite: ECON 611 or permission of instructor. This is the second course in the two course sequence in public choice. The public choice approach will be applied to study such topics as the causes and consequences of governmental growth, the behavior of public bureaucracies, and the economic reasoning behind constitutional limitations on the size and growth of government.

856 Urban and Regional Economics (3:3:0). Prerequisite: ECON 611 or permission of instructor. Regional development and metropolitan growth economics including the locational decisions of households and firms, and problems associated with high-density urban economic activity.

858 The Economics of Urban Transportation Planning (3:3:0). Issues and problems in urban transportation planning using various analytical techniques;
planning for the future; techniques of evaluation; environmental and socioeconomic impact.

860 Resource Economics (3:3:0). Resource management in the public sector with emphasis on development of water resources. Problems of uncertainty, time horizon considerations, joint costs, multiple benefits, non-quantifiable benefits and costs.


866 Economic Development (3:3:0). Prerequisite: ECON 611 and 615 or permission of instructor. Forces contributing to and restraining economic progress in developing countries. The role of foreign trade, economic integration, foreign investment, multinational corporations, and technological transfers.

869 International Trade and Policy (3:3:0). Prerequisite: ECON 611 or permission of instructor. Classical, neoclassical, and modern theories of international trade. A study of the theory and practice of world trade models such as project LINK. Analysis of foreign investment and economic growth, tariffs and nontariff barriers, and economic integration; recent developments with emphasis on natural resources.

871 International Monetary Economics (3:3:0). Prerequisite: ECON 615 or permission of instructor. Examination of the international adjustment mechanism, price and income effects, controls, and the monetarist approach. Development of the international monetary system, the demand for international reserves, capital movements, and the role of the International Monetary Fund.

872 Managerial Economics (3:3:0). Prerequisite: ECON 602 and BUAD 641. Economic theory as it applies to specific business situations and decisions. Production levels, price determination, cost, competition, profits, supply/demand.

876 Marxian Economics (3:3:0). Prerequisite: ECON 611 and 615. Major Marxian economic theories and criticisms of Marxian economics.


880 Austrian Theory of the Market Process I (3:3:0). Prerequisite: ECON 611. Economic theory developed by Menger, Mises, Hayek, and others of the Austrian School and comparison to other currently popular theories.

881 Austrian Theory of Market Process II (3:3:0). Prerequisite: ECON 611, 615 (ECON 880 is recommended). Continuation of ECON 880. Topics vary and include emphasis on market-process approach to analysis of capital accumulation, growth, money and credit institutions, inflation, unemployment, and industrial fluctuations.

895 Special Topics in Economics (3:3:0). Topics vary according to interests of instructor. Emphasis on new areas of the discipline. May be repeated for credit as topics vary.

896 Directed Reading and Research (3:0:0). Independent reading and research paper on a topic agreed on by student and faculty member.

918 Seminar in Monetary Theory and Policy (3:3:0). Prerequisite: ECON 817. Selected topics of current interest are discussed.

940 Seminar in Labor Economics (3:3:0). Prerequisite: ECON 611 and 615 or permission of instructor. ECON 637 is recommended. Union and management decision-making processes, government's role in labor negotiations and dispute settlement, economic analysis of discrimination and poverty, and effectiveness of wage-price controls.

945 Seminar in Industrial Organization (3:3:0). Prerequisite: ECON 611 or permission of instructor. Topics include centrifugal and centripetal forces affecting aggregate and industry concentration; the impact of market structure on the rate of innovation, concentration, and oligopolistic price behavior; constraints on oligopolistic pricing; vertical integration; traditional antitrust policy, regulation, and state ownership.

950 Seminar in Public Finance (3:3:0). Prerequisite: ECON 611 and 849. Important public finance issues treated in seminar format.

955 Seminar in Urban and Regional Economics (3:3:0). Prerequisite: ECON 611. Development of regional economics of metropolitan areas and larger regions.

965 Seminar in Economic Development (3:3:0). Prerequisite: ECON 611 and 615. Topics vary and include macroeconomic and trade policies, inflation, and labor migration.

970 Seminar in International Economics (3:3:0). Prerequisite: ECON 869 and 871. Topics vary and include subjects of current research and policy interests.

999 Doctoral Dissertation Research (credits vary). Prerequisite: Admission to Ph.D. economics program and permission of dissertation adviser. Research on an approved dissertation topic under the direction of dissertation committee. May be repeated. 24 credit hours may be applied to doctoral degree requirement.

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**English**

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**Faculty**

Albanese, Denise, Ph.D., Stanford University, 1986; Associate Professor

Bausch, Richard C., M.F.A., University of Iowa, 1975; Professor

Baxter, Ralph, Ph.D., Wayne State University, 1964; Professor

Bergmann, Johannes D., Ph.D., University of Connecticut, 1969; Professor

Brown, Lorraine A., Ph.D., University of Maryland, 1968; Professor

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http://catalog.gmu.edu
Graduate English Programs

The Department of English offers graduate programs in the study and practice of writing and lit-
erase. The M.A. in English (30 semester hours) provides concentrations in the following areas: (1) literature, (2) professional writing and editing, (3) the teaching of writing and literature. The department also offers a terminal degree, the M.F.A. in writing poetry or fiction (48 semester hours). In addition, the department offers an M.A. with a concentration in linguistics, a certificate in the teaching of English as a second language (TESL, 18 semester hours), and courses as part of the Ph.D. in Education and the Doctor of Arts in Community College Education degrees.

English, M.A.

Admission Requirements

In addition to fulfilling admission requirements for graduate study, applicants must submit one copy of a 1,000-word nonfiction writing sample and two letters of recommendation. For those applying in literature, professional writing and editing, and the teaching of writing and literature, the writing sample should be an interpretative paper on a literary text. In addition to the writing sample requirement, applicants must submit a statement of purpose (no more than 750 words). Applicants for the concentration in professional writing and editing must also submit two copies of a 10- to 15-page portfolio of their nonfiction work (a technical or business report, an essay, a term paper, an editing project, or any other material reflecting the student's interests and skills in nonfiction writing).

Applicants may submit scores on the GRE when they believe those scores will lead to a clearer presentation of their qualifications. Those with undergraduate majors in disciplines other than English are encouraged to apply, but may be required to make up deficiencies before entering the program.

Degree Requirements

Students must successfully complete 30 semester hours of credit in graduate English courses. With the approval of the department, up to 6 hours of graduate credit in courses in related disciplines may be substituted for 6 hours in English.

General Requirements for All Concentrations

1. ENGL 701 (normally in the first semester of study).
2. Nine hours in literature courses. For the concentration in the teaching of writing and literature only, ENGL 610 may be used to fulfill 3 hours of the literature requirement.
3. Foreign language proficiency demonstrated by course work equivalent to GMU's foreign lan-

guage 202 or 209, or by passing a translation test administered by the English Department.

Concentration Requirements

(one concentration must be completed)

1. Concentration in Literature
   a. General requirements (above).
   b. Six hours in critical theory.
   c. Nine hours in a core program organized by period, genre, theme, or some other principle approved by the student's adviser and the director of graduate studies in English. These hours will customarily be in addition to those used to satisfy the general requirements. In two courses of the core program, the candidate must write an M.A. paper—a substantial paper on a topic agreed upon with the course instructor at the beginning of the semester. The M.A. papers must receive a grade of B or better, and will be filed with the Department of English.
   d. Three hours of electives.
   e. Optional: 6 hours of thesis may be substituted for the core program.

2. Concentration in Cultural Studies
   Students planning to apply to the Ph.D. in Cultural Studies program should pursue the M.A. in English with a concentration in literature and make the following modifications to the above requirements
   a. Three of the six hours in critical theory in ENGL 676
   b. Nine hours in a core program designed around designated Cultural Studies courses. ENGL 676 may be also used as one of these courses.
   c. Three hours in Cultural Studies 802 in lieu of three hours of electives.

3. Concentration in Professional Writing and Editing
   a. General requirements (above).
   b. Three hours in nonfiction writing.
   c. Nine hours in professional courses (e.g., editing, technical writing, scientific writing, internship in writing or editing, or Northern Virginia Writing Project).
   d. Three hours of electives in writing or literature.
   e. Three hours of thesis.

4. Concentration in the Teaching of Writing and Literature
   a. General requirements
   b. Six hours in writing/publishing courses.
   c. Three hours in linguistics.
   d. Three hours in the teaching of writing and three hours in the teaching of literature.
   e. Three to six hours of electives from literature or writing; alternatively, a thesis may be ar-
ranged through the student's adviser and the director of Graduate Studies in English.

English: Linguistics, M.A.
The M.A. degree in English: Linguistics is an interdisciplinary program that combines courses in linguistics with courses in some related area of language study such as teaching English as a second language, bilingual education, or foreign language teaching. The course of study is designed to prepare students for teaching in one of these fields or for doctoral work. The certificate in teaching English as a second language can be earned concurrently.

Admission Requirements
The admission requirements are the same as those for the other concentrations in the Master of Arts in English. Students with undergraduate majors in any field are encouraged to apply. There are no specific prerequisites.

Degree Requirements
Students must successfully complete 30 semester hours of graduate credit distributed as follows:

1. Eighteen hours in the following core courses: ENGL 690, 691, 692, 785, 786, 787.
2. Twelve hours of graduate electives, chosen in consultation with an adviser, which reflect one or more areas of language study. The electives can be in such areas as linguistics, the teaching of reading or writing, literary criticism, bilingual education, or a foreign language, and may include six hours of thesis.

Students who have not already completed 12 hours of undergraduate credit (or its equivalent) in a foreign language must either do so or demonstrate equivalent proficiency by passing a translation test administered by the English Department.

Creative Writing, M.F.A.
The M.F.A. in Creative Writing has two tracks, Poetry and Fiction. Students should apply to only one track, although a student turned down by one concentration may subsequently apply to the other.

Admission Requirements
In addition to fulfilling admission requirements for graduate study, applicants must submit two letters of recommendation, one copy of a 1,000-word nonfiction writing sample, and two copies of a portfolio. For those applying to the M.F.A. in Fiction, the portfolio should consist of up to 50 pages of fiction. For those applying to the M.F.A. in Poetry, the portfolio should consist of 20 pages of poetry, but may include fiction as well. The nonfiction writing sample may be a paper written for an undergraduate class or any other work that gives evidence of basic writing skills. The additional portfolio should contain up to 20 pages of poetry or 50 pages of fiction.

Degree Requirements
Students must successfully complete 48 semester hours of graduate credit, including:

1. Twelve hours in literature;
2. Twelve to 18 hours of writing seminars in one genre, including either Form of Poetry or Form of Fiction and at least 3 hours of Advanced Workshop (ENGL 750 or 751);
3. Three to 9 hours in other genres;
4. Six hours in thesis. Thesis hours may be taken in the Summer Term only with the permission of the Thesis Committee.

Up to 9 hours of electives may be chosen in consultation with the writing program staff.

Students in poetry must pass a written M.F.A. exam based on the authors they have chosen. The authors are selected in collaboration with the writing faculty any time after the completion of 12 hours of course work and before the completion of 32 hours. The exam must be completed at least one semester before the thesis is submitted.

Students in fiction must pass either a written M.F.A. exam or complete an M.F.A. project. Students who elect to take the M.F.A. exam will select, after the completion of 18 hours of course work and with the approval of their faculty advisors, both a list of authors and an area of specialization (e.g., the European novel). Students who elect to complete an M.F.A. project (e.g., edit an anthology) must enroll in ENGL 798 and carry out the project under the direction of a faculty member. This ENGL 798 may not be used to fulfill the literature requirement or as thesis preparation. The exam or project must be completed at least one semester before the final thesis is submitted.

Students who have not completed the equivalent of GMU's foreign language 202 or 209 must either do so or demonstrate proficiency by passing a translation test administered by the English Department.
Graduate Certificate in the Teaching of English as a Second Language (TESL)
The TESL certificate prepares students to teach nonnative speakers of English in the United States or abroad. Certificate courses fulfill in part the requirements for an endorsement in ESL to the Virginia state teaching credential. (Students who want to earn this endorsement should consult with an adviser.)

Admission Requirements
Applicants interested in a Certificate in the Teaching of English as a Second Language must be admitted to graduate study through Graduate Admissions or approved for graduate course enrollment through Extended Studies. Students who initially enroll in the certificate program through Extended Studies must apply for regular admission through Graduate Admissions no later than the second semester of study. At the time formal admission to graduate study is sought, applicants must submit one copy of a writing sample of approximately 1,000 words and two letters of recommendation. The certificate may be pursued concurrently with any of several degree programs offered through the Graduate School of Education, the Department of English, and the Department of Foreign Languages and Literatures, and part of the work toward the certificate may be applicable toward degrees in those departments.

Students enrolled in another graduate degree program who want to work for the certificate must apply to the English Department for admission into the certificate program.

Certificate Requirements
Certificate candidates must complete the following series of graduate English courses, earning a grade of B or better in each.
1. ENGL 520, 521, 522, 523, and 582 (EDCI 519 may be substituted for ENGL 521);
2. One elective (a list of approved electives is available from the English Department).

Nondegree Status
Persons who are not yet certain about their plans for graduate study may apply for nondegree status. Only an undergraduate transcript is required for this application.

English Courses (ENGL)
503 Theory and Practice of Editing (3:3:0). Prerequisite: 60 hours of English courses numbered above 300, including one advanced writing course—309, 310, 397, 398, 458, 464, 489, 497—or permission of department. Instruc-
tion in revising, editing, and preparing specialized writing for printing. Emphasis on methods of achieving clarity, accuracy, and completeness. Lecture and discussion on editing and printing techniques, practical exercise in revision, layout, and production.

504 Internship in Writing and Editing (3:3:0). Prerequisite: Open to senior English majors and graduate students pursuing the M.A. in English or the M.F.A. Contact the English Department one semester prior to enrollment. Internships are approved work-study positions in writing or editing established by the English Department with specific employers. Variable credit. Variable prerequisites.

505 Computer-Assisted Publications Writing and Design (3:3:0). Theory and practice of using computer programs to design and produce publications including brochures, fliers, newsletters, and small magazines. Course work includes reading, writing papers, and producing and editing copy and original publications.

507 (EDCI 507) Internship in Applied Linguistics (3:3:0). Prerequisite: ENGL 521 or EDCI 519 and ENGL 582. Contact the English Department one semester prior to enrollment. Internships provide experience working in a language-teaching program or an educational research organization.

511 Styles and Modes in Literary History (3:3:0). A historical consideration (not a survey) of some of the principal styles, in prose and poetry, of English and American literature.

512 (PHIL 512) Issues in Literature and Philosophy (3:3:1). Prerequisite: Graduate or senior standing, 6 hours of upper-level English, 6 hours of philosophy, and permission of instructor. An interdisciplinary seminar that offers students an opportunity to arrive at a personal synthesis of work previously done in philosophy and literature. The topic will change yearly but will focus on themes and methodologies common to both disciplines.

513 Advanced Special Topics in English (3:3:0). Prerequisite: 15 hours of advanced undergraduate English courses and permission of department, or a baccalaureate degree. An intensive study of selected topics in English and American literature. May be repeated for credit once with permission of department.

514 (CL 514) Theories of Comparative Literature (3:3:0). Prerequisite: CLS 300 and senior standing, or baccalaureate degree, or permission of instructor. An intensive study of the major theories of comparative literature with special emphasis on international movements and their characteristic themes. Students work with texts in the foreign language of their competence; other texts are studied in translation.

520 Descriptive Linguistics (3:3:0). Introduction to the terminology and methodology of modern linguistic science and a detailed structural analysis of English phonology, morphology, and syntax.

521 Applied Linguistics: Teaching English as a Second Language (3:3:0). Prerequisite: ENGL 481, 520, 690, or 786. Theories and basic principles of the acquisition of a second language, especially as they relate to the English language, supplying students with methods of teaching English to speakers of other languages.

522 Modern English Grammar (3:3:0). Prerequisite: One course in linguistics or permission of instructor. Overview of the structure of modern English beginning with
word classes and ending with analyses of complex sentences. Most topics are introduced as problems of language description; in solving them, principles of syntactic argumentation are demonstrated as well. Students learn to tap their own intuitions about English to analyze grammatical structure.

523 Descriptive Aspects of English Phonetics and Phonology (3:3:0). Prerequisite: ENGL 520, 690, or permission of instructor. An in-depth description and analysis of the sound system processes of modern English. Segmental phonetics, syllable structure, connected speech, and prosodic phenomena are among the topics. Implications for language instruction are also addressed.

551 Literary Criticism (3:3:0). Studies of major critical theories and techniques with emphasis on the twentieth century.

556 Literary Style (3:3:0). Theory and practical analysis of English literary style. Several methodologies, including impressionistic, rhetorical, and linguistic, are examined and applied to the language of various literary texts, including essays, poems, and novels.

557 Old English (3:3:0). Study of Old English language, including its phonology, morphology, syntax and lexicology, aimed at preparing students to read Anglo-Saxon literature in its original form. Accompanied by reading from Anglo-Saxon prose and poetry of the seventh through the eleventh centuries. Selections from The Anglo-Saxon Chronicle, Aelfric's Homilies, The Legend of St. Andrew, and other prose works, as well as such verse as The Dream of the Road, The Seafarer, and Judith, are read and translated.

564 Form of Poetry (3:3:0). Prerequisite: ENGL 464 or equivalent and permission of instructor, except for M.F.A. students in the concentration. Students must submit a typed manuscript of original poetry at least one week before they intend to register. For specific guidelines, consult the department's Course Description Booklet, the instructor, or the department secretaries. Intensive study of and practice in the formal elements of poetry through the analysis of models and weekly or biweekly writing assignments. Intended for students already writing original poetry. Students study rhyme, meter, rhythm and other musical elements of poetry, lineation, stanza pattern, traditional and experimental forms, free verse and open-form composition, lyric, narrative, and dramatic modes.

566 Form of Fiction (3:3:0). Prerequisite: ENGL 458 or equivalent and permission of instructor, except for M.F.A. students in the concentration. Students must submit a typed manuscript of original fiction at least one week before they intend to register. For specific guidelines, consult the department's Course Description Booklet, the instructor, or the department secretaries. Intensive practice in the formal elements of fiction, through the analysis of models and weekly or biweekly writing assignments. Intended for students already writing original fiction. Students study description, narration, plot, dialogue, voice, point of view, style, epiphany, and antifiction techniques.

581/PSYC 581 Psycholinguistics (3:3:0). Prerequisite: ENGL 481, 520, 690, or 786, or permission of instructor. Study of mental and psychological aspects of human language, including aphasia, association, autism, language acquisition, verbal concept formation, and perception.

582 Second Language Acquisition (3:3:0). Prerequisite: ENGL 481, 520, 690, or 786, or permission of instructor. Second language (L2) acquisition examined from a linguistic perspective. First and second language acquisition are compared, and factors contributing to L2 variation are explored, including linguistic universals, transfer, age, input, and effective considerations.

592 History of the English Language (3:3:0). Introduction to the history and development of the English Language, including study of Indo-European language family and various stages of the English language from Old and Middle English to Early and Recent Modern English and American English; emphasis on historical principles and theory of language change as it affects phonology, morphology, syntax, and semantics.

610 Proseminar in Teaching the Reading of Literature (3:3:0). Methods of teaching literature. Includes study of methods of literary analysis and ways of developing student responses to literature, with some classroom practice. (Does not satisfy Virginia certification requirement in diagnostic or developmental reading.)

611 Studies in Rhetoric (3:3:0). Reading and discussion of several major texts that address patterns of discourse, communication, and other issues of rhetoric. Content varies. Recent offerings included 20th-century rhetoric and computers and rhetoric.

612 Cultures of Professional Writing (3:3:0). A course for students in the Professional Writing and Editing M.A. in English. Students will work as ethnographers, studying selected sites where people write professionally and analyze the ways in which the production and reception of writing both contribute to and result from the local culture of each site.

613 Technical and Scientific Writing (3:3:0). Prerequisite: ENGL 616 or permission of department. Intensive study of theory and practice of technical and scientific writing, with emphasis on writing for a variety of audiences. Focus on writing and evaluating formal reports, articles for lay as well as technical audiences, proposals, theses, manuals, and other forms of technical prose.

614 Internship in the Teaching of Writing (1-3:0:0). Internships provide experience working in a teaching program such as in a school or writing center. Students, under the direction of a faculty member, must secure the cooperation of the on-site supervisor. Students work a minimum of three hours per week per credit hour to be awarded, keep a weekly reflective and analytical log, and communicate regularly with the faculty director. Not repeatable for credit.

615 Proseminar in Composition Instruction (3:3:0). Methods of teaching expository writing. Includes consideration of planning of courses, practice in teaching and grading papers, and study of lab method of instruction.

616 The Writing of Nonfiction (3:3:0). Prerequisite: permission of instructor, except for M.A. and M.F.A. candidates in English. Writing of original essays, biographies, documentaries, reports, and other forms of nonfiction.

617 Poetry Writing Workshop (3:3:0). Prerequisite: ENGL 564, which may be taken concurrently, and permission of instructor, except for M.F.A. students in the concentration. Intensive practice in the craft of poetry and study of the creative process. Intended for students already familiar with traditional and contemporary poetic modes.
and already writing original poetry. At the discretion of the instructor, reading may be required. May be repeated once for credit with permission of department.

618 Fiction Writing Workshop (3:3:0). Prerequisite: ENGL 556, which may be taken concurrently, and permission of instructor, except for M.F.A. students in the concentration. Intensive practice in the craft of fiction and study of the creative process. Intended for students already familiar with traditional and contemporary fiction and already writing original fiction. At the discretion of the instructor, reading may be required. May be repeated once for credit with permission of department.

619 Special Topics in Writing (3:3:0). Prerequisite: Two graduate writing courses and/or permission of instructor, except for M.F.A. students in the concentration. A workshop course; intensive practice in creative writing and study of the creative process. Concentrates on a specialized literary type other than the short story or poetry (i.e., the essay, playwriting, film writing, children's literature, travel literature, autobiography, the gothic novel, translation); the concentration is announced in the department's Course Description Booklet. Intended for students already writing original creative work. May be repeated once for credit with permission of department.

625 Studies in English Medieval Literature (3:3:0). Selected literary authors, works or movements, generally excluding Chaucer, from between 1300 and 1500, studied in Middle English. Content varies. May be repeated once for credit with permission of department.

630 Studies in English Renaissance Literature (3:3:0). Selected literary authors, works, or movements, generally excluding Shakespeare and Milton, of the English Renaissance. Content varies. Recent offerings include Women in Shakespeare; The Golden Age and Earthly Paradise; and The Pastoral Tradition. May be repeated once for credit with permission of the department.

631 Seminar in Shakespeare (3:3:0). Intensive study of the achievement of Shakespeare and major critical approaches to his work. Usually comedies and histories are taught one year, and tragedies and romances the next. May be repeated once for credit with permission of the department.

635 Studies in Eighteenth-Century English Literature (3:3:0). Selected English literary authors, works or movements of the eighteenth century. Content varies. Recent offerings include Johnson and his Circle; Sympathy, Selfishness, and Self-Realization; and Sexual Motifs in Eighteenth-Century Poetry, Prose, and Drama. May be repeated once for credit with permission of department.

640 Studies in Nineteenth-Century English Literature (3:3:0). Selected English literary authors, works or movements of the nineteenth century. Content varies. Recent offerings include Romantic Visionary Poets; Youth and Identity; and Jane Austen, Charlotte Bronte, George Eliot. May be repeated once for credit with permission of department.

645 Studies in Twentieth-Century English Literature (3:3:0). Selected English literary authors, works or movements of the twentieth century. Content varies. Recent offerings include developments since WW II; Contemporary British Drama; British Novel to WW II. May be repeated once for credit with permission of department.

650 Studies in Seventeenth- and Eighteenth-Century American Literature (3:3:0). Selected literary authors, works, or movements of colonial and early federalist America. Content varies. May be repeated once for credit with permission of department.

655 Studies in Nineteenth-Century American Literature (3:3:0). Selected American literary authors, works or movements of the nineteenth century. Content varies. Recent offerings include The American Renaissance and The Novel and American Society. May be repeated once for credit with permission of department.

660 Studies in Twentieth-Century American Literature (3:3:0). Selected American literary authors, works, or movements of the twentieth century. Content varies. Recent offerings include The Federal Theatre Project; Gothicism in Southern Literature; Physics and Metaphysics in the Modern Novel; and The Wasteland Theme. May be repeated once for credit with permission of department.

666 Seminar in Major Figures of English Literature before 1800 (3:3:0). Intensive study of the work of one or two major figures of English literature before 1800. Content varies. Recent offerings include Chaucer; Milton; Blake; Fielding and Sterne. May be repeated once for credit with permission of department.

667 Seminar in Major Figures of English Literature after 1800 (3:3:0). Intensive study of the work of one or two major figures of English literature after 1800. Content varies. Recent offerings include Yeats; V. Woolf; Dickens and Gissing; Joyce; Elizabeth Gaskell and C. Bronte. May be repeated once for credit with permission of department.

668 Seminar in Major Figures of American Literature (3:3:0). Intensive study of the work of one or two major figures of American literature. Content varies. Recent offerings include Stevens; Hemingway; Eliot and Pound; Melville; Whitman; Bellow and Singer. May be repeated once for credit with permission of department.

670 Film History and Theory (3:3:0). Prerequisite: Introductory film course or permission of instructor. Advanced study of the history of film art and major theories concerning the nature of film. Specific topic varies. May be repeated once for credit with permission of department.

675 Feminist Criticism and Theory (3:3:0). Seminar designed for students who desire an introduction to criticism and theory which studies the role of gender in literature and in the practice of interpretation.

676 Introduction to Cultural Studies (3:3:0). An advanced introduction to the theoretical practice now known as "cultural studies," with particular attention given to its role in textual studies. The course is part of the interdisciplinary Cultural Studies Ph.D. program, as well as the M.A. in English.

685 Selected Topics, Movements, or Genres of Literature in English (3:3:0). Content varies. May be repeated for credit with permission of department.

686 Special Topics in Linguistics (3:3:0). Prerequisite: varies with topic. Detailed advanced study of selected area of linguistics. Content varies. May be repeated once for credit with permission of department.
690 Generative Phonology (3:3:0). Sound systems of English and other languages from the perspective of phonological theory. Topics include articulatory phonetics, distinctive features, the nature of phonological representations and processes, rule ordering, abstractness, the role of external evidence, and non-linear phonology.

691 Theories of Language (3:3:0). Prerequisite: ENGL 520, 690, or 786, or permission of instructor. A seminar course in linguistic metatheory. A wide range of theories about language and about linguistic theory are examined, including those of Saussure, Bloomfield, Chomsky, and others. Readings from original sources.

692 Phonology II (3:3:3). Prerequisite: ENGL 690. Recent trends in phonological theory. Topics include stress assignment, tone spreading, and vowel harmony, from within a nonlinear framework. Segmental structure and underspecification are discussed.

695/EDUC 695 Northern Virginia Writing Project In-service Program (1,2,3:0:0). Prerequisite: Admission to the graduate program or permission of department. Offered at the request of a school division or other education agency. Content varies. May be repeated once for credit with permission of department, but no more than six semester hours of credit in ENGL 695, EDUC 695 and/or ENGL 699 may be applied toward a master's degree in English.

696/EDUC 696 Northern Virginia Writing Project Teacher/Research Seminar (3:0:0). Prerequisite: ENGL 695/EDUC 695 or NWWP Summer Institute. Designed to acquaint classroom teachers with current findings related to the composing process and methods of studying writing in a school setting. Focus on development of a proposal investigating some aspect of the composing process. Teachers who have developed a proposal prior to enrolling will conduct the research during the course.

697/EDUC 697 Northern Virginia Writing Project Theory of Composition (3:3:0). Designed to acquaint classroom teachers with current theory relating to writing and the teaching of composition. Focus is on making explicit the theories of the participants, on reading the works of leading theorists, and on developing a statement describing the implications of theoretical consistency in the teaching of writing.

699 Workshop in English (1:3:0:0). Prerequisite: Admission to the graduate program or permission of department. Concentrated workshops, educational tours, and special seminars dealing with selected topics in writing, linguistics, film, the electronic media, and literature written in English. All tours are optional and may be replaced by specified work conducted on campus. May be repeated for credit with permission of the department, but no more than 6 semester hours of credit in ENGL 699 may be applied toward a master's degree in English.

701 Literary Scholarship (3:3:0). Methods and purposes of literary research, including study of library methodology, use of critical bibliographies, techniques of textual criticism, and evaluation of various approaches to literary history.

705 Literary Theory and Criticism (3:3:0). Major theories of literature and methods of analyzing and evaluating literary works. Content varies. Recent offerings include Recent Trends in Critical Theory. May be repeated once for credit with permission of the department.

750 Advanced Workshop in Poetry Writing (3:3:0). Prerequisite: ENGL 564 and ENGL 617 and permission of instructor, except for M.F.A. students in the concentration. Open to M.F.A. students only. Intensive practice in the craft of poetry for experienced writers. May be repeated for credit with permission of the department.

751 Advanced Workshop in Fiction Writing (3:3:0). Prerequisite: ENGL 566 and ENGL 618 and permission of instructor, except for M.F.A. students in the concentration. Open to M.F.A. students only. Intensive practice in the craft of fiction for experienced writers. May be repeated for credit with permission.

785 Semantics and Pragmatics (3:3:0). Prerequisite: ENGL 520, 690, or 786, or permission of instructor. Developments in theoretical linguistics which explore how language form is related to meaning and to context. Topics include reference, lexical semantics, logic, quantification, truth conditions and sentential meaning, presuppositions, and speech acts.

786 Syntax I (3:3:0). The nature and form of a syntactic theory, and an examination and analysis of the properties of several major natural language syntactic structures within a contemporary theoretical framework.

787 Syntax II (3:3:0). Prerequisite: ENGL 786. A theoretical treatment of syntactic phenomena that in the past few years have emerged as standard problems for syntactic analysis. Problems include binding, extraction, and quantification. Extensive reading in the primary theoretical literature.

790 Master's Seminar: Topics in Literary History (3:3:0). Prerequisite: 9 hours of graduate English courses including 701 or permission of department. Historical approaches to an understanding of literature and its relation to other elements of culture. Specific topics vary from term to term. May be repeated once for credit with permission of department.

791 Master's Seminar: Themes, Modes and Genres (3:3:0). Prerequisite: 9 hours of graduate English courses including 701, or permission of department. Nonhistorical approaches to an understanding of literature and its relation to other elements of culture. Specific topics vary from term to term. May be repeated for credit with permission of department.

798 Directed Reading and Research (3:0:0). Prerequisite: Open only to degree students who have completed 15 hours including ENGL 701 and have preregistered. Reading and research on a specific project under the direction of a department member. Oral or written report required. May be repeated once for credit with permission of department.

799 Thesis (1-6:0:0). Students who take ENGL 798 to develop a thesis topic and then elect the thesis option receive three credits for ENGL 799 upon completion of the thesis. Students who do not take ENGL 798, or who take it to work on a project unrelated to their thesis, receive up to 6 credits for ENGL 799 upon completion of the thesis.

800 Studies for the Doctor of Philosophy in Education (varied credit). Prerequisite: Admission to the Ph.D. in Education program to study in English. Program of studies designed by student's discipline director and approved by student's doctoral committee which prepares the student to do research and writing in the current area.
of interest of the discipline director. Enrollment may be repeated.

801 New Developments in English (3:3:0). Designed for students in the Doctor of Arts in Community College Education program. Focus is on major original texts that have influenced the discipline of English in the late 20th century. Readings will be from literary studies, composition/writing theory, and linguistics.

Environmental Science and Public Policy

Faculty

Adamkewicz, S. Laura, Ph.D., University of Virginia, 1968; Associate Professor, Biology.

Andrykovitch, George E., Ph.D., University of Maryland, 1968; Associate Professor, Biology.

Beach, Sheryl L., Ph.D., University of Minnesota, 1990; Assistant Professor, Geography and Earth Systems Science.

Birchard, Geoffrey F., Ph.D., Dartmouth Medical School, 1985; Associate Professor, Biology.

Botkin, Daniel B., Ph.D., Rutgers University, 1968; Professor, Biology and Director, Program on Global Change.

Bradley, Ted R., Ph.D., University of North Carolina, 1968; Associate Professor, Biology.

Brown, Luther, Ph.D., Ohio State University, 1978; Associate Professor, Biology.


Christensen, Alan H., Ph.D., Michigan State University, 1983; Assistant Professor, Biology.

Cozzens, Robert F., Ph.D., University of Virginia, 1966; Professor, Chemistry.

Diecchio, Richard J., Ph.D., University of North Carolina, 1980; Associate Professor, Geography and Earth Systems Sciences.

Dietz, Thomas M., Ph.D., University of California, Davis, 1979; Associate Professor, Sociology and Anthropology.

Emsley, Michael G., Ph.D., University of London, 1964; Professor, Biology.

Ernst, Carl H., Ph.D., University of Kentucky, 1969; Professor, Biology.

Foster, Gregory D., Ph.D., University of California, Davis, 1985; Assistant Professor, Chemistry.

Gifford, Jonathan L., Ph.D., University of California, Berkeley, 1983; Assistant Professor, Public and International Affairs.

Guagnano, Gregory A., Ph.D., University of California, Davis, 1986; Assistant Professor, Sociology and Anthropology.

Haack, Barry N., Ph.D., University of Michigan, 1977; Associate Professor, Geography and Earth Systems Sciences.

Harris, Carl M., Ph.D., Polytechnic Institute of Brooklyn, 1966; Professor, Operations Research and Engineering.

Hart, Jayne T., Ph.D., University of Wisconsin, 1969; Professor, Biology.

Jonas, Robert B., Ph.D., University of North Carolina, 1981; Associate Professor, Biology.

Jones, R. Christian, Ph.D., University of Wisconsin, 1980; Associate Professor, Biology and Program Director.

Kelso, Donald P., Ph.D., University of Hawaii, 1970; Associate Professor, Biology.

Kozlowski, John C., J.D., Ph.D., University of Maryland, 1980, 1986; Associate Director, Center for Recreation Resources Policy.

Lawrey, James D., Ph.D., Ohio State University, 1977; Associate Professor, Biology.

Litchfield, Carol D., Ph.D., Texas A&M University, 1969; Associate Professor, Biology.

Morowitz, Harold J., Ph.D., Yale University, 1951; Robinson Professor of Biology and Natural Philosophy.

Mose, Douglas G., Ph.D., University of Kansas, 1971; Professor, Chemistry.

Mushrush, George W., Ph.D., George Washington University, 1968; Professor, Chemistry.

Nadeau, Robert L., Ph.D., University of Florida, 1970; Professor, English.

Oates, Karen K., Ph.D., George Washington University, 1985; Associate Professor, Biology.

Palkovitch, Ann M., Ph.D., Northwestern University, 1978; Associate Professor, Sociology and Anthropology.

Rao, G.V.V., Ph.D., Montana State University, 1974; Affiliate Associate Professor, Biology.

Regan, Priscilla M., Ph.D., Cornell University, 1981; Assistant Professor.

Rockwood, Larry L., Ph.D., University of Chicago, 1972; Associate Professor, Biology.

Royt, Paulette A., Ph.D., University of Maryland, 1974; Associate Professor, Biology.
Ryan, Terry C., Ph.D., University of Illinois, 1974; Professor, Urban Systems Engineering.

Schreibels, John A., Ph.D., University of South Florida, 1979; Associate Professor, Chemistry.

Skog, Judith E., Ph.D., Cornell University, 1972; Professor, Biology.

Soyfer, Valery, Ph.D., Kurachatov Institute of Atomic Energy, 1964; Distinguished University Professor of Molecular Genetics.

Taub, Stephen R., Ph.D., Indiana University, 1960; Professor, Biology.

Torzilli, Albert P., Ph.D., University of Georgia, 1976; Associate Professor, Biology.

Walbridge, Mark R., Ph.D., University of North Carolina, 1986; Assistant Professor, Biology.

White, Louise G., Ph.D., The American University, 1974; Professor, Public and International Affairs.

Willett, James D., Ph.D., Massachusetts Institute of Technology, 1965; Professor, Biology.

Wilson, John W., Ph.D., University of Chicago, 1972; Associate Professor, Biology.

Wright, Brett A., Ph.D., Texas A&M University, 1985; Associate Professor and Director, Center for Recreation Resources Policy.

Environmental Science and Public Policy, Ph.D.

The Ph.D. program in Environmental Science and Public Policy is an interdisciplinary program within the College of Arts and Sciences centered in the Biology Department. The Departments of Public and International Affairs, Chemistry, Geography and Earth Systems Science, and Sociology and Anthropology also participate.

This program provides students with the training necessary to contribute to the solution of complex environmental problems. This goal requires development of knowledge and skills in the collection, analysis, and interpretation of scientific data as well as the integration of scientific understanding into the public policy process.

Admission Requirements

Applicants should have a bachelor's degree with an overall grade point average of at least 3.0 (on a scale of 4.0). Applicants should have taken at least two semesters of chemistry and three semesters of biology including ecology. Application deadline for admission in the fall semester is April 1 and for the spring semester is November 1.

All applicants must submit:

1. Scores on the aptitude portion of the Graduate Record Examination (this may be waived if the applicant has a master's degree in an appropriate field);
2. Three letters of recommendation (at least two of these should be from individuals with Ph.D.s);
3. Official transcripts from each college or university attended;
4. A recent resume;
5. A substantial statement of interest in the program including potential area of specialization and career goals.

In addition, it is recommended that each applicant schedule an interview with the program director or environmental faculty member in their area of specialization. Admission decisions are based on the student's qualifications and the availability of a faculty adviser.

Degree Requirements

The Environmental Science and Public Policy doctoral program requires a minimum of 78 graduate credits beyond the bachelor's degree. Students with a master's degree in an appropriate field may obtain a waiver of up to 30 hours of graduate coursework. To assure that all students obtain the necessary skills and knowledge to function as an environmental professional, the program requires all students to fulfill the following category requirements:

Category 1. Natural Sciences. A minimum of 12 credits in areas of natural science such as biology, chemistry, geology, geography, or environmental engineering.

Category 2. Public Policy. A minimum of 12 credits in areas related to public policy such as public affairs, economics, sociology, and business. A course in environmental law is required as part of this category requirement.

Category 3. Methods and Technology. A minimum of 6 credits in research skills such as statistics, remote sensing, geographic information systems, analytical chemistry, modeling, or information technology.

Beyond these basic requirements students should indicate whether they intend to specialize in either Environmental Science or Environmental Policy. Those specializing in Environmental Science should expect to take a total of 24 credits in natural science, whereas those specializing in Environmental Policy should take 24 hours of public policy coursework. A specific set of recommended
courses is provided for students in the Environmental Policy specialization.

In keeping with the general philosophy inherent in a Ph.D. degree, students are expected to adopt an individual program focus that is concentrated on a specific area of research. The student's course work must provide the knowledge base from which an original research project in their specific area of interest may be successfully completed.

Upon admission to the program each student is assigned an adviser from the Environmental Faculty. The adviser will guide the student through course selection. Advisers may be changed by mutual consent of student and their adviser or by petitioning the program director. Each student is required to complete a course work proposal by the end of their second semester of courses which must be approved by their adviser and the program director.

By the end of the fourth semester of course work, the student should assemble a dissertation committee of at least four graduate faculty members with representation from at least two academic departments. After reviewing the student's course work proposal, progress to date, and area of research specialization, the committee will make final recommendations concerning course work which will be codified in the program of study to be signed by all committee members.

Upon completion of all (or nearly all) course work, the student may request to take the qualifying exam. The qualifying exam will have both oral and written parts. The written portion will consist of questions submitted by each member of the dissertation committee. Successful completion of the written exam should be followed by the oral portion within one month. The qualifying exam may be repeated once at the discretion of the student's committee. Upon completion of all course work and passage of the qualifying exam, and submission of the program of study, the student is recommended for advancement to candidacy by the program director. Students must advance to candidacy within five years of admission to the program.

Students must complete a dissertation (12-24 credits). The dissertation is an original written work demonstrating mastery of subject matter, methodologies, and conceptual foundations on a specific problem in the general field of environmental science and public policy. The dissertation will generally involve collection and analysis of original data or the substantially new analysis and reinterpretation of existing data. Before the student may enroll in dissertation research, the student must have advanced to candidacy and a dissertation proposal must be approved by the dissertation committee and the program director, then sent to the dean of the college for approval. Guidelines for preparing the dissertation proposal and dissertation are available from the program director. (In preparation for the dissertation the student may enroll in doctoral dissertation proposal.) The student must present the completed dissertation in a public seminar and defend the work before the dissertation committee. Awarding of the degree is contingent on approval of the dissertation by the dissertation committee, program director, and the dean. The dissertation and defense must be completed within five years of advancement to candidacy.

Program on Global Change

The Program on Global Change is an interdisciplinary research initiative with the goal of developing a rational basis to understand and solve environmental issues. The program emphasizes applied research, new approaches to ecological theory, application of computational and numerical techniques, development of major data bases, and public policy methods that incorporate risk and uncertainty.

Courses

Course work for this program is drawn from numerous departments including Biology (BIOL), Chemistry (CHEM), Geography and Earth Systems Science (GECA), Public and International Affairs (PUAD), Sociology and Anthropology (SOCI), and Statistics (STAT).

Environmental Science and Public Policy Courses (EVPP)

894 Supervised Internship (3-12:0:0). Prerequisite: Permission of program director and student’s doctoral committee. Training in application of ecological skills to environmental management and policy under the supervision of a qualified environmental scientist at a governmental agency, consulting firm, industry, or other acceptable organization.

991 Advanced Seminar in Environmental Biology (2:2:0). Prerequisite: 8 hours of ecology or permission of instructor. Topics generally address the interface between environmental biology and public policy. May be repeated.

998 Doctoral Dissertation Proposal (1-6:0:0). Prerequisite: Admission to doctoral candidacy. Work on a research proposal that forms the basis for a doctoral dissertation.

999 Doctoral Dissertation Research (1-12:0:0). Prerequisite: Approval of dissertation proposal. Research on a basic or applied problem in environmental science and public policy.
Foreign Languages
and Literatures

Faculty
Aguera, Victorio G., Ph.D., The Catholic University of America, 1971; Professor
Berroa, Rei, Ph.D., University of Pittsburgh, 1983; Associate Professor
Chamberlain, Jeffrey T., Ph.D., University of Illinois, 1982; Associate Professor
Christensen, Julie A., Ph.D., University of California, Berkeley, 1974; Professor
Cordero, Anne D., Ph.D., The George Washington University, 1968; Associate Professor
Elstun, Esther N., Ph.D., Rice University, 1969; Professor
Francescato, Martha P., Ph.D., University of Illinois, 1970; Professor
Garrett, Nina, Ph.D., University of Illinois, 1982; Associate Professor
Gilbert, Paula R., Ph.D., Columbia University, 1973; Professor
Goldin, Mark G., Ph.D., Georgetown University, 1968; Associate Professor
Hecht, Leo, Ph.D., Columbia University, 1974; Professor
LePage, Raymond G., Ph.D., The George Washington University, 1972; Associate Professor
Levine, James S., Ph.D., University of Illinois, 1977; Associate Professor
Martinez-Lage, Ana, Ph.D., Pennsylvania State University; Assistant Professor
Meyer, Henry P., Ph.D., University of Maryland, 1970; Associate Professor
Ricouart, Janine, Ph.D., University of California at Davis, 1986; Assistant Professor
Wagner, Irmingard, Ph.D., Harvard University, 1970; Associate Professor
Warner, Keith Q., Doctorat de l'Universite (Caen), 1969; Professor; Department Chair
Wekerle, Inge B., Ph.D., The George Washington University, 1975; Assistant Professor
Winkler, Martin M., Ph.D., University of Southern California, 1982; Associate Professor

Foreign Languages
and Literatures, M.A.

The Master of Arts in Foreign Languages is designed to meet the needs and interests of prospective and practicing teachers and other professionals, and to prepare students for doctoral study in foreign languages at other institutions. The program offers three concentrations: (1) concentration in one language—French, German, or Spanish; (2) concentration in two of those languages; and (3) concentration in Spanish/Bilingual-Multicultural Education.

Admission Requirements
In addition to satisfying the general admission requirements for graduate study, applicants seeking degree status must hold a baccalaureate degree with a major in French, German, or Spanish; have at least a 3.0 grade point average (on a 4.0 scale) in the major; and submit two letters of recommendation from persons familiar with their qualifications.

Applicants whose baccalaureate degrees were earned in other fields or who otherwise do not meet the above requirements, but who provide evidence of a capacity to pursue graduate study, are encouraged to apply and may be admitted to the program with provisional status. Applicants in this category may be asked to appear for a personal interview and to take the appropriate part(s) of the Graduate Record Examination. They may also have undergraduate deficiencies to make up before being advanced to degree status.

Degree Requirements
Candidates who elect a concentration in one language must complete a program of 30 semester hours of study. Those who concentrate in two languages must complete a program of 42 semester hours. The concentration in Spanish/Bilingual-Multicultural Education requires 36 semester hours. In all three concentrations, 6 of the total hours may be earned with a thesis. Regardless of the concentration selected, all students must meet the core and distribution requirements given below, and must pass an oral comprehensive examination.

Concentration in One Language
Thirty semester hours, of which at least 18 must be earned in courses listed under a single rubric (FREN, GERM, or SPAN), to include the following distribution: at least 6 hours in literature courses covering two different periods and at least 6 hours in language/linguistics courses. The re-
main 12 hours are electives, of which up to 6 may be used for directed reading (798) and thesis (799).

Concentration in Two Languages
Forty-two semester hours, of which 18 must be earned in each of two languages, in courses listed under a single rubric (FREN, GERM, or SPAN), to include the following distribution: at least 6 hours in literature courses covering two different periods; and at least 6 hours in language/linguistics courses. The remaining 6 hours are electives, which may be used for directed reading (798) and thesis (799).

Concentration in Spanish/Bilingual-Multicultural Education
Thirty-six semester hours, of which 18 must be earned in courses listed under the SPAN rubric, to include the following distribution: at least 6 hours in literature courses covering two different periods and at least 6 hours in language/linguistics courses; 6 hours of bilingual education seminars, selected from among EDUC 517, 518, 519. The remaining 12 hours are electives, of which up to 6 may be used for directed reading (SPAN 798) and thesis (SPAN 799).

Graduate Certificate Program in Translation
The certificate program in translation provides professional training for students who wish to acquire proficiency in a specific language combination, either English-French or English-Spanish. Because of the interdisciplinary nature of translation, the program combines theoretical and applied course work in the departments of Foreign Languages and Literatures, English, and Communication.

Students applying to the program must be admitted to a George Mason University degree program or already hold a bachelor's degree and be admitted to the Graduate School in nondegree status. Acceptance into the program is based partly on a proficiency examination in English and one other language.

The certificate may be pursued concurrently with any of several degree programs offered through the Department of Foreign Languages and Literatures. Part of the work toward the certificate may be applicable toward degrees in other departments.

Students enrolled in degree programs outside the Department of Foreign Languages and Literatures who wish to work toward the certificate in translation must apply to the Department of Foreign Languages and Literatures for admission into the certificate program.

Certificate Requirements
Required core courses (12 credits):
- ENGL 410 Technical and Report Writing (3)
- COMM 505 Intercultural Communication (3)
- FRLN 525 Literary Translation (3)
- FRLN 565 Theory of Translation (3)

Language courses (9 credits):
- FREN 357 Introduction to Translation (3)
- FREN 576 Advanced Translation (3)
- GERM 580 Contemporary French Culture and Society (3)
or
- SPAN 359 Introduction to Translation (3)
- SPAN 576 Advanced Translation (3)
- SPAN 580 Contemporary Spanish Institutions (3)
or
- GERM 318 Translation of Texts (3)
- GERM 576 Advanced Translation (3)
- GERM 580 Contemporary German Culture and Society (3)

FRLN 590 Internship and Seminar
A translation project is required for completion of the program.

Foreign Languages and Literatures Courses (FRLN)
510 Bibliography and Research Problems in Foreign Languages and Literatures (3:3:0). Prerequisite: Graduate standing or permission of instructor. Use of basic bibliographical tools and methodologies necessary to do scholarly research in French, German, and Spanish. Taught in cooperation with the university library staff. Conducted in English.

525 Literary Translation (3:3:0). Prerequisite: Graduate standing or permission of instructor. Advanced work in literary translation. The critical approach to and analysis of diverse literary texts ranging from poetry, drama, and essay to excerpts from novels.

550 Special Topics (3:3:0). A special topics course for graduate students. Various themes, periods, or genres as announced from semester to semester. The focus will always be on topics that incorporate one or more of the languages taught in the department, but instruction is in English. May be repeated for credit with permission of department.

565 Theory of Translation (3:3:0). Lectures on the nature and function of the translating process. Evaluation of theories of translation with respect to text-typology. Critiques of selected translations from the target languages to English and vice versa.
571 The Role of Grammar in Language Learning and Teaching (3:3:0). Prerequisite: Graduate standing or permission of department; a language teaching methods course or language teaching experience, or permission of instructor. Explores the pedagogical and theoretical bases for the centuries-old debate about explicit grammar teaching. Reading focus on current positions and their theoretical grounds and offer a variety of other theories, pedagogical perspectives, and new approaches.

572 Integrating Technology into Language Learning (3:3:0). Prerequisite: Graduate standing or permission of department; language teaching experience, a language methods course, or permission of instructor. Prior experience with technology is not required. Course explores the pedagogical and theoretical basis for integrating interactive technologies into language learning programs, examining their potential for learning, teaching, testing, and research. Includes hands-on analysis and evaluation of materials.

573 Basic Issues in Language Pedagogy (3:3:0). Prerequisite: Graduate standing or permission of department; language teaching experience, a language methods course, or permission of instructor. Explores in depth a number of issues currently controversial in language pedagogy. Includes communicative competence as pedagogical goal, the role of explicit grammar teaching, the proficiency movement, cultural authenticity, student-centered learning, and the use of technology.

590 Internship and Seminar in Translation (3:3:0). Prerequisite: Admission to the Translation Certificate Program. Internships are nonpaying, work-study positions that focus on the practice of translation. Qualified students are placed with area institutions, interest groups, agencies, or corporations. Placement depends upon availability of positions.

600 Workshop in Foreign Languages (1-6:0:0). In-service workshops, tours, and seminars dealing with selected topics in literature, language, bilingualism, culture, methodology, etc. May not normally be applied toward the M.A. in foreign languages.

620 Literary Theory and Criticism (3:3:0). Study of the nature of the literary work; analysis of contemporary critical approaches to literature. May not be taken for credit by students who previously received credit for FRLN 615.

645 (545) The Study and Teaching of Literature (3:3:0). Current methodologies of literary analysis. Emphasis on role of literature in foreign language programs and on providing students with various methods of teaching literature. May not be taken by anyone who has previously taken and satisfactorily completed FRLN 545.

650 The Teaching of Culture in Foreign Language Programs (3:3:0). Purpose and methods of the study of culture, with emphasis on strategies and techniques for teaching culture in foreign language programs.

660 Approaches to the Study of Language (3:3:0). The discipline of linguistics and its relationship to other disciplines, including study of generative grammar with syntactic problems drawn from commonly taught foreign languages.

670 (570) Foreign Language Learning and Teaching (3:3:0). Theories, methods, and strategies of second and foreign language learning and teaching. May not be taken by anyone who has previously taken and satisfactorily completed FRLN 570.

French (FREN)

515 Medieval French Literature (3:3:0). Intensive study of the outstanding literary works of the Middle Ages. Course work in French.


518 Studies in Eighteenth-Century Literature (3:3:0). Selected writers, works, themes, or trends of French literature in the eighteenth century. Content varies. Course work in French. May be repeated for credit with permission of department.

519 Studies in Nineteenth-Century Literature (3:3:0). Selected works, themes, genres, and authors of nineteenth-century French literature. Content varies. Course work in French. May be repeated for credit with permission of department.

525 Studies in Modern French Literature (3:3:0). Selected writers, works, themes, or trends of French literature in the modern era. Content varies. May be repeated for credit with permission of department. A maximum of 6 hours of credit may be earned. Course work in French.

550, 551 Special Topics (3:3:0). Specialized topics relating to French culture and literature. Content varies. Course work in French.


561 Old French (3:3:0). Study of Old French phonology, morphology, syntax, and lexicon, aimed at preparing students to read medieval French literature in original versions. Linguistic study complemented by reading of Old French verse and prose texts from the ninth through the thirteenth centuries.


575 Grammatical Analysis (3:3:0). Study of characteristic features of contemporary French. Examination of spoken and written French, including syntactic analysis, distributional analysis, and generative-transformational grammar. Emphasis on problem areas for the American learner.

576 Advanced Translation (3:3:0). Advanced work in translation of topics selected from the humanities, the social and political sciences. Comparative terminology, sight translation, and precis writing. The importance, function, and techniques of documentation in translation. Translations from French to English and English to French.


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798 Directed Reading and Research (3:0:0). Prerequisite: Open only to degree students who have completed at least 18 credit hours. Reading and research on a specific project under the direction of a department member. Oral or written report required.

799 Thesis (1-6:0:0). Students who take FREN 798 and then elect the thesis option receive 3 credits for FREN 799 upon completion of the thesis. Students who do not take FREN 798 receive 6 credits for FREN 799 upon completion of the thesis.

800 Studies for the Doctor of Philosophy in Education (varied credit). Prerequisite: Admission to the Ph.D. in Education program to study in German. Program of studies designed by the student's discipline director and approved by the student's doctoral committee to prepare the student to do research and writing in the current area of interest of the discipline director. Enrollment may be repeated as required. Also see FRLN course listings.

German (GERM)

518 Studies in Eighteenth- and Early Nineteenth-Century German Literature (3:3:0). Major authors, movements, and themes in eighteenth- and early nineteenth-century German literature and critical reception. May be repeated for credit with department's permission.

525 Studies in Modern German Literature (3:3:0). Writers, themes, or genres of modern German literature. May be repeated for credit with department's permission.

550 Special Topics (3:3:0). Study of a special topic in German language, literature, or culture. Specific topics are announced in advance. May be repeated for credit with permission of department.

560 History of the German Language (3:3:0). Development of the German language from the eighth century to the present. Phonological, morphological, and syntactic structures characteristic of the various stages of development.

580 Contemporary Germany (3:3:0). Prerequisite: Graduate standing or permission of instructor. In-depth study of contemporary Germany in its political, economic, social, and cultural institutions. Special emphasis on post-unification issues and Germany's place in the European Community.

798 Directed Reading and Research (3:0:0). Prerequisite: Open only to degree students who have completed at least 18 credit hours. Reading and research on a specific project, under the direction of a department member. Oral or written report required.

799 Thesis (1-6:0:0). Students who take GERM 798 and then elect the thesis option receive 3 credits for GERM 799 upon completion of the thesis. Students who do not take GERM 798 receive 6 credits for GERM 799 upon completion of the thesis.

800 Studies for the Doctor of Philosophy in Education (varied credit). Prerequisite: Admission to the Ph.D. in Education program to study in German. Program of studies designed by student's discipline director and approved by student's doctoral committee which prepares the student to do research and writing in the current area of interest of the discipline director. Enrollment may be repeated.

Also see FRLN course listings.

Spanish (SPAN)

500 History of the Spanish Language (3:3:0). Scientific study of the evolution of the Spanish language from its origin in vulgar Latin to its present forms.

501 Applied Spanish Grammar (3:3:0). Analysis of Spanish grammar as a basis for teaching language skills. Terminology and methodology for the teaching of syntax are stressed.

502 Hispanic Sociolinguistics (3:3:0). Introduction to sociolinguistics with emphasis on bilingualism and language contact in the Spanish-speaking world including the United States.


520 Studies in Medieval Spanish Literature (3:3:0). Intensive study of a major work or a literary genre of this period.

525 Studies in Renaissance Literature (3:3:0). Study of a literary movement or selected authors of the Spanish Renaissance.


540 Studies in Nineteenth-Century Literature (3:3:0). Study of a writer, genre, theme, or movement of this period.

545 Studies in Hispanic Literature (3:3:0). Study of major writers in a particular generation or movement.

551 Special Topics in Spanish (3:3:0). Special studies in Spanish or Latin American language, literature, or culture. Specific topics are announced in advance. May be repeated for credit with permission of department.


565 Studies in Spanish American Drama (3:3:0). Study of playwrights who have made a major contribution to the development of the genre.

576 Advanced Translation (3:3:0). Prerequisite: Graduate standing or permission of instructor. Advanced work in translation of selected texts from diverse fields. Comparative terminology, sight translation, and precise writing. Emphasis on the function and technique of documentation in translation. Translation from Spanish to English and from English to Spanish.

580 Contemporary Hispanic Institutions (3:3:0). In-depth study of twentieth-century cultural, social, and political institutions in Spain and Spanish America with emphasis on language and terminology used to describe their functions, regulations, and conditions.

635 Seminar in DonQuijote(3:3:0). Intensive study of Don Quijote and the major critical approaches to the work.

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650 Seminar in Twentieth-Century Drama (3:3:0). Study of major dramatists in the Generation of 1898 and in the contemporary theater.

655 Seminar in Twentieth-Century Prose (3:3:0). Intensive study of a major writer, theme, or movement in the novel or the essay.


675 Seminar in Literature and Art (3:3:0). Comparative analysis of a literary theme or style in relation to other media (e.g., painting, architecture, film) for an integral understanding of the arts.

680 Seminar in Literature and Society (3:3:0). Intensive study of a literary topic, a genre, or selected authors in relation to a given economic, social, or political system in Spain or Latin America.

685 Seminar in Literature and Ideas (3:3:0). Study of major ideological-philosophical themes and their artistic expression in literature.

798 Directed Reading and Research (3:0:0). Prerequisite: Open only to degree students who have completed at least 18 credit hours. Reading and research on a specific project, under the direction of a department member. Oral or written report required.

799 Thesis (1-6:0:0). Students who take SPAN 798 and then elect the thesis option receive 3 credits for SPAN 799 upon completion of the thesis. Students who do not take SPAN 798 receive 6 credits for SPAN 799 upon completion of the thesis.

800 Studies for the Doctor of Philosophy in Education. (variable credit). Prerequisite: Admission to the Ph.D. in Education program to study in Spanish. Studies designed by student's discipline director and approved by student's doctoral committee which prepare the student to do research and writing in the current area of interest of the discipline director. Enrollment may be repeated. Also see FRLN listing.

Geographic and Cartographic Sciences

Faculty
Andrews, Alice C., Ed.D., George Washington University, 1975; Associate Professor Emerita
Beach, Sheryl Luzzadder, Ph.D., University of Minnesota, 1990; Assistant Professor
Fonseca, James W., Ph.D., Clark University, 1974; Associate Professor
Haack, Barry N., Ph.D., University of Michigan, 1977; Associate Professor
Harrington, James W., Ph.D., University of Washington, 1983; Associate Professor
Haynes, Kingsley E., Ph.D., Johns Hopkins University, 1971; Professor
Stough, Roger R., Ph.D., Johns Hopkins University, 1978; Professor
Wheeler, Douglas J., Ph.D., University of Utah, 1985; Affiliate Assistant Professor
Wong, David W. S., Ph.D., State University of New York, Buffalo, 1990; Assistant Professor
Wood, Joseph S., Ph.D., Pennsylvania State University, 1978; Associate Professor

Geographic and Cartographic Sciences, M.S.

The Master of Science in Geographic and Cartographic Sciences is offered by the Department of Geography and Earth Systems Science. The program provides courses for students with interests in the techniques of collection, analysis, and display of spatial data. Students may prepare for further study or for careers in geography and cartography with federal agencies, state and local government agencies, private corporations, and educational institutions.

Admission Requirements
In addition to meeting all admission requirements for graduate study, students should have a bachelor's degree in geography, cartography, or equivalent. An applicant without an undergraduate degree in geography or cartography may be required to take one course in each of the following: physical geography, human geography, regional geography, and cartography. All applicants must have a course in statistics. The program also requires GRE aptitude scores, three letters of recommendation, transcripts of all college course work, and a statement of interest in geography and cartography.

Degree Requirements
In general, students must complete a program consisting of four required core courses and a number of optional electives that are selected in consultation with an adviser. The required core courses are:

GECA 553 Geographic Information Systems
GECA 579 Remote Sensing
GECA 585 Quantitative Methods
GECA 680 Seminar in Thought and Methodology
In addition to these core courses, students select from a number of GECA electives to complete their programs. With departmental approval, up to 9 hours of course work from closely related disciplines may also be applied to the degree.

A thesis is optional and students may complete a 33-hour program that includes 6 hours of thesis, or they may complete a 36-hour program without a thesis. If the non-thesis option is selected, students are required to submit two papers as evidence of research proficiency at the graduate level. These papers are included in the student’s permanent file.

**Geographic and Cartographic Sciences Courses (GECA)**

**503 Problems in Environmental Management**

(3:3:0). Prerequisite: 6 hours of geography, including GEOG 102. Case studies of the impacts of human activities on atmospheric, hydrologic, geomorphic, and biotic processes.

**505 Transportation Geography**

(3:3:0). Prerequisite: 6 hours of geography. Structure, principles, location, and development of world transportation. Critical role of transportation in moving people, goods, and ideas at the international, national, regional, and urban levels.

**520 Geography for Teachers**

(3:3:0). Prerequisite: Graduate standing or permission of department. Emphasis on problems and techniques in teaching geography and current developments in research, methodology, and philosophy in the discipline.

**540 Medical Geography**

(3:3:0). Prerequisite: Course in statistics. Spatial approaches to the study of health and disease. Topics include disease ecology, disease diffusion, and geographic perspectives on improving health care delivery.

**550 Mapping Foundations**

(3:3:0). Prerequisite: Graduate standing or permission of department. Basic principles of mapping human and physical spatial patterns and using maps. Includes sources of spatial information such as existing maps, field work, and aerial photographs; techniques of cartographic compilation; map construction and design; and the analysis of spatial data. For students without previous course work in cartographic science.

**551 Thematic Cartography**

(3:3:0). Prerequisite: GECA 550 or permission of instructor. Analysis of the nature of perceptual organization and visual systems in thematic map communication portrayal, graphic handling, and data analysis.

**553 Geographic Information Systems**

(3:3:0). Prerequisite: GECA 550 or permission of instructor, and permission of department. Sources of digital geographic information, methods of storage and processing for cartographic display and geographical analysis.

**554 History of Cartography**

(3:3:0). History of cartographic portrayal of the earth from ancient times through the nineteenth century, with emphasis on the interrelation of human culture, technological development, and geographical knowledge as reflected in maps.

**562 Photogrammetry**

(3:3:0). Prerequisite: GECA 550 or permission of instructor, and permission of department. Treatment of photogrammetric problems, including least squares adjustments, image coordination refinements, collinearity equation, resection, relative orientation, and analytic aerotriangulation.

**563 Geographic Information Systems Applications**

(3:3:0). Prerequisite: GECA 553 or permission of instructor and permission of department. Course concentrates on utilization of geographic information systems software and hardware and requires considerable laboratory time to understand the functionality of GIS, its use for various applications, and available digital spatial data.

**579 Remote Sensing**

(3:3:0). Prerequisite: GECA 550 or a course in aerial photography, or permission of instructor, and permission of department. Analysis of the nature of electromagnetic radiation, principles and operations of sensors, techniques and systems of correction, enhancement, and production of imagery. Interpretation and applications in geomorphic, atmospheric, hydrologic, vegetation, land use, and regional analysis.

**580 Digital Remote Sensing**

(3:3:0). Prerequisite: GEOG 516 or GECA 579 or permission of instructor, and permission of department. Examination of the theory and techniques of using digital remotely sensed data for obtaining geographic information of the earth’s surface, including both image enhancement methods and classification strategies for a variety of physical and cultural features.

**581 World Food and Population**

(3:3:0). Topics include maldistribution of population, regional disparities in growth rates and income distribution, food production and, world hunger. Discussion of population policies, with emphasis on Third World countries.

**583 Spatial Dynamics of Political Systems**

(3:3:0). Topics include territoriality, reapportionment, spatial allocation of public facilities, perception of boundaries. Emphasis on the spatial impact of political process upon land use.

**585 Quantitative Methods**

(3:3:0). Prerequisite: GECA 550 or permission of instructor, and permission of department. Survey of quantitative methods commonly used in geographic research. Emphasis on spatial analysis techniques.

**590 Selected Topics in Geography and Cartography**

(3:3:0). Students analyze topics of immediate interest. Content varies. May be repeated.

**Graduate standing is prerequisite to all 600-level courses.**

**621 Human Ecology and the City (Same as SOCi 621)**

(3:3:0). Introduction to urban ecology. Origin and development of various types of cities; shape and structure of urban areas; inner and outer city and spatial patterning of urban institutions.

**652 Computer Applications**

(3:3:0). Prerequisite: GECA 553 or permission of instructor. Examination of computer applications for display and analysis of geographical data.

**655 Map Design**

(3:3:0). Prerequisite: GECA 550 or permission of instructor. Advanced examination of principles of map design, including discussions of map design research.
656 Terrain Mapping (3:3:0). Prerequisite: GECA 550 and permission of instructor. Advanced methods of relief and landform portrayal, slope mapping, digital terrain models, and other forms of terrain representation.

660 Geodetic Cartography (3:3:6). Prerequisite: GECA 550 and permission of instructor. Introduction to science of earth measurement, methods of establishing geodetic control for mapping and geodetic basis of map projections and coordinate systems.

661 Map Projections and Coordinate Systems (3:3:0). Prerequisite: GECA 550 and course in calculus or permission of instructor. Development of various map projections and coordinate systems; analysis of their properties, distortions, and applications.

670 Applied Climatology (3:3:0). Prerequisite: Course in weather and climate or permission of instructor. Application of climatic concepts to natural and human-modified environments. Analysis of climatic change.

671 Applied Geomorphology (3:3:0). Prerequisite: Course in geomorphology or permission of instructor. In-depth examination of interaction among land forming processes, settlement, and land-use patterns. Emphasis on planning and problem solving.


680 Seminar in Thought and Methodology (3:3:0). Prerequisite: GECA 585 or permission of instructor. Historical development of geographic thought and the current philosophy of geography. Analysis of the rationale for the discipline’s various subfields. Geographic research techniques and methods of analysis.


698 Directed Readings and Research (1-3:3:0). Prerequisite: Permission of instructor and department. Reading and research on a specific topic, under the direction of a faculty member. Written report is required; oral exam and report may be required. May be repeated.

785 Geographic Fieldwork (3:3:0). Introduction to the nature, scope, and objectives of geographic field methods and techniques, including use of base maps, acquisition of data, and field research design. The course is taught, as much as possible, in field situations with students required to develop and carry out relevant field research projects pertaining to both physical and cultural geography.

795 Seminar in Regional Analysis (3:3:0). Analysis and synthesis of physical and cultural elements of geography in a selected region. Should be taken near the end of the master’s degree program and should provide an opportunity for the student to apply selective knowledge gained in previous systematic courses to a specific region.

799 Thesis (1-6:0:0). Prerequisite: Degree candidacy and departmental approval of thesis proposal.
Wade, Rex A., Ph.D., University of Nebraska, 1963; Professor
Wilkins, Roger, L.L.B., University of Michigan, 1956; Robinson Professor
Zagarri, Rosemarie, Ph.D., Yale University, 1984; Associate Professor
Zhang, Xiaobo, M.Phil., Columbia University, 1992; Instructor

History, M.A.
The Department of History provides graduate training in historical methods and analysis for students with widely varying goals. The five M.A. tracks outlined below are designed to meet those goals.

Admission Requirements
Applicants to the Master of Arts in History program must fulfill the admission requirements for graduate study and the Department of History. These include (1) satisfactory scores on the GRE, and (2) two letters of recommendation from professors of history with whom the applicant has studied or from others directly familiar with the applicant's professional competence and interests. The GRE requirement is waived for students who received their undergraduate degrees 10 or more years ago or who hold another graduate degree.

Degree Requirements

Requirements for All Tracks
1. A minimum of 30 semester hours (36 hours in Track IV) of graduate-level work with a GPA of not less than 3.0;
2. Three semester hours of HIST 610 (The Study and Writing of History), taken within the first 9 hours of course work;
3. Except in Track IV, a specialized readings course (HIST 790, 792), designed individually by the student and a professor, taken during the last semester of course work and used to round out the student's general historical knowledge and to prepare him or her for the comprehensive exam;
4. A written comprehensive exam.

To remedy possible deficiencies in a student's undergraduate preparation, up to 21 additional hours of foundation courses (HIST 550, 601-606, Themes in U.S., Latin American, and Modern European History) may be required. This requirement applies particularly to students who did not major in history as undergraduates.

Track I Predoctoral
This track is for students planning to continue into doctoral studies. In addition to HIST 610, it requires:
1. Fifteen hours in a major field of concentration (U.S. or Modern European History), including a research seminar and the specialized readings course. The specialized readings course for students in Track I will generally require additional reading beyond what is required in the other tracks;
2. Six semester hours outside the major field, not including applied history courses (HIST 690, 691, 692, 693);
3. Six semester hours in HIST 799 (thesis) or 3 semester hours in HIST 798 (Directed Research and Writing in History). HIST 798 requires the completion of a major paper that is a substantial and original contribution to historical knowledge on the model of an article in a scholarly journal. If major paper option is chosen, student must complete an additional three semester hours in the major field;
4. Reading proficiency in a modern foreign language, as demonstrated by course work or an examination.

Track II Applied History
This track is for students seeking expertise in such applied history fields as archival management, museum studies, historic preservation, and historical editing. It is also suitable for professionally employed historians who desire to further their careers. In addition to HIST 610, this track requires:
1. Fifteen hours in a major field of concentration (U.S. or Modern European History), including a research seminar and the specialized readings course;
2. Six hours of applied history courses (historic preservation, museum studies, archives, or historical editing);
3. Three or six hours of internship (if the three-credit internship is selected, then the other three credits would be taken in applied history course work);
4. Proficiency in a relevant research tool (computers, statistics, or a modern foreign language) as demonstrated by course work or an examination.

Track III Enrichment
This track is for students who want to study history for intellectual self-fulfillment or for vocational reasons. It allows more flexibility in the selection of courses and does not require a foreign language. In addition to HIST 610, this track requires:
1. Fifteen hours in a major field of concentration (U.S. or Modern European History), including a research seminar and the specialized readings course;  
2. Twelve hours of electives.  
Six semester hours of thesis work is optional. If a thesis is elected, 3 hours in the major and 3 hours in electives are assigned to it.

Track IV Teaching  
This track is for students interested in elementary and secondary teaching or administration and includes course work in history and education. Unlike the other three tracks, it requires a minimum of 36 hours of course work and does not include the specialized readings course. Students intending to teach at the secondary level must also qualify for the Virginia Collegiate Professional Certificate (or its equivalent) in history. In addition to the general degree requirements, this track requires:

1. Twenty-four hours in history, including the 3 credits in HIST 610 The Study and Writing of History, and at least 3 hours each from U.S., European, and non-Western history course offerings, plus one research seminar;  
2. Twelve credits in graduate education courses, including EDCI 567.

Track V Cultural Studies  
This track is for students concerning future work in the Cultural Studies doctoral program. Completion of this M.A. track does not guarantee admission to the doctoral program; those interested in enrolling in that program should contact the Cultural Studies program directly. In addition to HIST 610, this track requires:

1. Fifteen hours in a major field of concentration (U.S. or Modern European History), including a research seminar and the specialized readings course for students in this track will generally require additional reading similar to that required in Track I.  
2. Cultural Studies 702/802: Ideas and Methods in Cultural Studies I  
3. A graduate history course in cultural history approved by the department.  
4. Six semester hours in HIST 799 Thesis or three semester hours in HIST 798 Directed Research and Writing in History as in Track I. Students are strongly encouraged to write their thesis or major paper in an area of cultural history.  
5. Reading proficiency in a modern foreign language, as demonstrated by course work or examinations.

History Courses (HIST)  
520 Social Revolution in Latin America (3:3:0). Analysis of revolutionary forces that are challenging traditional institutions and transforming all aspects of society in contemporary Latin America. Selected countries are studied in depth.  
525 Problems in Latin American History (3:3:0). Analysis of selected problems in Latin American history. Emphasis on reading and discussion of historical interpretations and development of bibliography. Maximum of six hours may be earned.  
528 Latin American Cultural and Intellectual History, Nineteenth Century (3:3:0). Iberian background and other foreign influences; ideas of independence leaders; midcentury Romanticism, Liberalism, and Traditionalism; secular and religious Positivism; and Marxian socialism. Intellectual developments traced in major Latin American thinkers, writers, and artists.  
550 Interpretations of History (3:3:0). Study of development of historical writings in the West from ancient to modern times. Introduction to historical methodology.  
555 Problems in Asian History (3:3:0). Subjects announced by instructor. Discussion of readings and historical interpretations and compilation of a comprehensive bibliography on given theme. Maximum of 6 hours may be earned.  
583 The Cultural History of the Islamic World (3:3:0). Government, science, philosophy, religion, literature, arts, and architecture of the Arabs of the Umayyad and Abbasid period, Persians of the Safavid period, Gaznavids of Afghanistan, grand Mughals of India and Pakistan, Timurids of Central Asia, Fatamids of Egypt, Moors of Spain, and the Turks. Important political and cultural movements in different parts of Islamic World are discussed.  
585 Problems in Middle Eastern History (3:3:0). Analysis of selected problems in Middle Eastern history. Emphasis on reading and discussion of historical interpretations and development of bibliography. Course may be repeated once when content differs.  
Prerequisites for 600-level courses: bachelor's degree in history or permission of instructor.  
601 Themes in United States History I (3:3:0). Survey of U.S. history prior to 1877. Designed for individuals entering the graduate program who need to strengthen their preparation in this area or who seek to enhance their knowledge of the latest interpretations in the field. Factual knowledge and its interpretation are stressed.  
602 Themes in United States History II (3:3:0). Survey of U.S. history since 1877. Designed for individuals entering the graduate program who need to strengthen their preparation in this area or who seek to enhance their knowledge of the latest interpretations in the field. Factual knowledge and its interpretation are stressed.
603 Themes in Latin American History I (3:3:0). Survey of Latin American history from the pre-Columbian era through the wars for independence. Designed for individuals entering the graduate program who need to strengthen their preparation in this area or who seek to enhance their knowledge of the latest interpretations in the field. Factual knowledge and its interpretation are stressed.

604 Themes in Latin American History II (3:3:0). Survey of Latin American history since the conclusion of the wars for independence in the early 1820s. Designed for individuals entering the graduate program who need to strengthen their preparation in this area and for those seeking to enhance their knowledge of the latest interpretations in the field. Factual knowledge and its interpretation are stressed.

605 Themes in European History I (3:3:0). Survey of European history from 1500 to 1815. Designed for individuals entering the graduate program who need to strengthen their preparation in this area or who seek to enhance their knowledge of the latest interpretations in the field. Factual knowledge and its interpretation are stressed.

606 Themes in European History II (3:3:0). Survey of European history from 1815 to present. Designed for individuals entering the graduate program who need to strengthen their preparation in this area or who seek to enhance their knowledge of the latest interpretations in the field. Factual knowledge and its interpretation are stressed.

610 The Study and Writing of History (3:3:0). Methodology of the historian, including techniques of research, use of documentation and other sources, development of bibliography, synthesis of material.


614 The Enlightenment in America (3:3:0). Study of Enlightenment as it was reflected in various aspects of American life in the eighteenth and early nineteenth centuries. Impact of the Enlightenment on development of new American nation.

615 Problems in American History (3:3:0). Readings and discussion of bibliographies, interpretations, and research trends in topics selected by instructor. Maximum of 9 hours may be earned.

616 U.S. Westward Movement (3:3:0). Course investigates continuity and change in the American West, focusing on such topics as economic development, ethnicity, rural and urban life, and the role of the federal government.

617 Topics in the American Civil War Era (3:3:0). Joint project of instructor and students, into the various aspects of a common topic in the Civil War era with emphasis on historiography and historical method.

618 The Age of Jackson, 1828-1848 (3:3:0). Inquiries, interpretations, and discussions of those elusive qualities of Jacksonian democracy which made the 1820s, 1830s, and 1840s a separate and distinguishable part of the American past. This course, conducted as a seminar, includes readings, discussions, oral reports, and a term paper based upon the issues of that transitional period.

619 The Constitution, Civil Liberties, and the Supreme Court (3:3:0). This course investigates the evolution of civil liberties in American history and the interaction of the three branches of government in applying various constitutional guarantees. Students read extensively in Supreme Court decisions as well as in the secondary literature, and undertake independent research.

620 Development of the Early Republic, 1783-1820 (3:3:0). Investigates the breakdown of the Confederation, the Constitutional Convention, and the role of the revolutionary ideology of republicanism. Also considers the leadership and policies of the republic in a hostile international context. Students read extensively in the monographic literature and prepare a research paper.

621 Virginia and the American Revolution (3:3:0). A detailed examination of Virginia society on the eve of the American Revolution and its role in the events from 1750 to 1789. The course combines lectures on and discussion of major themes, ideas, and personalities.

622 American Minds (3:3:0). An advanced introduction to major approaches to and themes in American intellectual history, rather than a survey of the subject. Avoids positing an American mind in the beginning and explores instead the diversity of American thinkers. Focuses on several pivotal decades in American thought and sees American thinkers in their social contexts. Also explores how nonelites have shaped American thought. As such, this course provides a diverse and multifarious look at who were the important American minds.

623 Topics in Recent U.S. History, 1945 to Present (3:3:0). Selected political, social, economic, diplomatic, and cultural forces that shaped the post-World War II American experience.

624 Interpretations in U.S. Diplomatic History (3:3:0). Study of American foreign policy and its analysis by both popular and scholarly interpreters. Conducted as a seminar, with selected issues chosen for special study.


626 Seminar in State and Local History (3:3:0). Prerequisite: HIST 610 or permission of instructor. Exposition of principles and techniques of local history followed by intensive investigation of selected aspects of the region, using area manuscript collections.

627 Urban Development of the United States (3:3:0). Examination of the growth of cities in the United States, the process of urbanization, and the significance of cities in American history. Students will become familiar with major issues and bibliography of American urban history.

628 Immigration and Ethnicity in the United States (3:3:0). Examines immigration and ethnicity in America since 1840. Considers why immigrants came, from where, under what circumstances, and the ways in which they adapted to America. Also examines immigration policy and American attitudes toward immigration and ethnicity. Conducted as a readings colloquium.
629 The Progressive Era (3:3:0). Examines the history of the United States from 1890 to 1918, with attention both to the history of reform movements and politics, and the social history of the period. Students become familiar with major issues and historical literature of the period.

635 Problems in European History (3:3:0). Investigation of selected problems in the history of Europe. Readings, discussions, development of bibliographies. Where possible, primary sources are used. Maximum of 6 hours may be earned.

636 Political Culture in Twentieth-Century Germany and Austria: Continuities and Discontinuities (3:3:0). Recent interpretations of key political events of the twentieth century. Focus will be on the question: Despite radical political changes, were there fundamental continuities in the structure of German and Austrian society that can be observed throughout the period under review?


638 Western Europe in the Post-War Period (3:3:0). Examines the process of reconstruction, reconciliation, and integration in Western Europe in the 20 years after the Second World War. Conducted as a readings colloquium.

639 Society and Politics in Western Europe, 1750-1914 (3:3:0). Focus on changes in social conditions and their ramifications in political life. Attention to urbanization of workers, changes in the peasantry, growth of middle classes, decline of nobility, as well as major political developments and expansion of liberal reforms.

642 Humanism and the Renaissance (3:3:0). Treats the Renaissance as a unique period in European cultural history from circa 1350-1520. Concentration on the Italian situation as the standard for the Renaissance, with consideration given to the manifestations of the Renaissance in northern Europe, especially Germany, until the Reformation. Focus on recent studies of political, social, intellectual, and religious changes of the period. Students write class reports and a larger bibliographic paper.

643 Religion and Society in the Reformation Era (3:3:0). The Reformation, from approximately 1500-1650, was a time of major religious, intellectual, social, and political upheavals in European history. Course investigates the reasons for these changes and the effects they had on European society. First half of course focuses on Germany, but major events throughout Europe are studied.

645 The Russian Revolution and the Origins of the Soviet State (3:3:0). The period between 1890 and 1924 with concentration of the sources of Bolshevism, problems of the old regime as they led up to the revolutions of 1905 and 1917, establishment of the new regime and its survival in an environment of foreign and civil war.

679 Seminar on Inter-American Diplomacy (3:3:0). Prerequisite: HIST 610 or permission of department. Seminar on geographic, political, economic, military, and other forces that have influenced inter-American relations. Study of the special relationship between U.S. and Latin America. May be applied toward the major or minor concentration in either U.S. or Latin American history.

690 The Administration of Archives and Manuscripts (3:3:0). Prerequisite: 6 hours of U.S. history or permission of department. Introduction to the principles and practices in the management of records and the administration of archival and manuscript collections, public and private. Designed for graduate students with a special interest in historical sources as well as for those specializing in applied history.

691 Museum Studies (3:3:0). Prerequisite: 6 hours of U.S. history or permission of department. General introduction to museums of history and museum studies in the United States, intended for the interested citizen as well as for assistance to students in course and career choices. Course explores the development, present state, and future possibilities of museums in the United States, with some reference to international developments.

692 Historical Editing (3:3:0). Introduction to the fundamentals of historical editing of documents, including the use of microform, word processing, and computer techniques. Designed for persons seeking an introduction to various areas of applied history and for persons intending to edit historical documents for publication.

693 Historic Preservation (3:3:0). Prerequisite: 6 hours of U.S. history or permission of department. General introduction to historic preservation in the United States, intended for the interested citizen as well as for assistance to students in course and career choices. Course explores the development, present state, and future possibilities of historic preservation in the United States, with some reference to international aspects of preservation.

695 History Symposium (3:3:0). Subject of academic and community interest pursued through discussions and lectures by distinguished guest instructors.

711 Research Seminar in United States History (3:3:0). Prerequisite: HIST 610 or permission of department. Research in specialized topics using primary sources. Maximum of 6 hours may be earned.

731 Research Seminar in European History (3:3:0). Prerequisite: HIST 610 or permission of department. Research in specialized topics using primary sources. Maximum of 6 hours may be earned.

771 Research Seminar in Latin American History (3:3:0). Prerequisite: HIST 610 or permission of department. Research in specialized topics using primary sources. Maximum of 6 hours may be earned.

790 Specialized Readings in United States History (3:3:0). To be taken in the final semester of the program. Designed to integrate the students' past work in the major field and to fill gaps in this area prior to comprehensive exam. After review of graduate experience, student and instructor design a reading list to round out preparation for the exam.

791 Specialized Readings in Latin American History (3:3:0). To be taken in the final semester of the program. Designed to integrate the students' past work in the major field and to fill gaps in this area prior to comprehensive exam. After review of graduate experience, student and instructor design a reading list to round out preparation for the exam.
792 Specialized Readings in European History
Since 1500 (3:3:0). To be taken in the final semester of the program. Designed to integrate the students' past work in the major field and to fill gaps in this area prior to comprehensive exam. After review of graduate experience, student and instructor design a reading list to round out preparation for the exam.

794 Internship in Applied History (3-6:0:0). Prerequisite: 3 hours of applied history in appropriate area and 12 hours in major field or permission of internship director. All internship placements must be approved by the department to ensure their suitability to the student's program. An introduction to applied history through work and study at a historical museum, site, library, archive, editing project, or other approved agency.

796 Directed Readings (3-6:0:0). Independent reading on a topic agreed to by student and faculty member. Maximum of 6 hours may be earned.

798 Directed Research and Writing in History (3:3:0). Intended for those students in the department's predoctoral track who are not writing a master's thesis. The goal of the course is to produce a substantial and original contribution to historical knowledge on the model of an article in a scholarly journal.

799 Thesis (1-6:0:0).

800 Studies for the Doctor of Philosophy in Education (various credit). Prerequisite: Admission to the Ph.D. in Education program to study in history. Program of studies designed by student's discipline director and approved by student's doctoral committee which brings the student to participate in research of discipline director and results in a paper reporting the original contributions of the student. Enrollment may be repeated.

801 New Developments in History (3:3:0). Prerequisite: Doctoral standing or permission of instructor and HIST 610 or equivalent. Survey of current developments in historical analysis and methodology.

802 Readings for Doctor of Arts in Community College Education (varied credit). Prerequisite: Admission to Doctor of Arts in Community College Education program to study history. Involves intensive reading of the recent scholarship in broad areas of historical study. With their advisers, students develop the readings list and define at least three areas in which to prepare readings courses. May be repeated.

Mathematics

Faculty

Alligood, Kathleen T., Ph.D., University of Maryland, 1979; Associate Professor
Beslagic, Amer, Ph.D., University of Wisconsin, 1986; Associate Professor
Colonna, Flavia, Ph.D., University of Maryland, 1985; Associate Professor
Fischer, Klaus G., Ph.D., Northwestern University, 1973; Associate Professor
Gabel, Michael R., Ph.D., Brandeis University, 1972; Associate Professor
Kan, Itai, Ph.D., University of Illinois, 1984; Associate Professor
Kiley, W. Thomas, Ph.D., Brown University, 1969; Associate Professor
Kulesza, John S., Ph.D., State University of New York, Binghamton, 1987; Associate Professor
Lawrence, James F., Ph.D., University of Washington, 1975; Associate Professor
Lawrence, L. Brian, Ph.D., State University of New York, Binghamton, 1984; Associate Professor
Levy, Ronald F., Ph.D., Washington University, 1974; Professor
Lim, Teck-Cheong, Ph.D., Dalhousie University, 1974; Associate Professor
Lin, Jeng-Eng, Ph.D., Brown University, 1976; Associate Professor
Loustauana, Philippe, Ph.D., University of Wisconsin, Milwaukee, 1988; Associate Professor
Morris, Walter D., Jr., Ph.D., Cornell University, 1986; Associate Professor
Sachs, Robert L., Ph.D., Courant Institute, 1980; Associate Professor
Saperstone, Stephen H., Ph.D., University of Maryland, 1970; Professor
Sauer, Timothy D., Ph.D., University of California, Berkeley, 1982; Associate Professor
Shapiro, Jay A., Ph.D., Rutgers University, 1975; Associate Professor
Singman, David H., Ph.D., McGill University, 1960; Associate Professor
Smith, John M., Ph.D., University of Maryland, 1970; Professor
Struppa, Daniele C., Ph.D., University of Maryland, 1981; Professor, Department Chair
Walnut, David, F., Ph.D., University of Maryland, 1989; Assistant Professor
Zoltek, Stanley M., Ph.D., State University of New York, Stony Brook, 1976; Associate Professor

Mathematics, M.S.

The Department of Mathematical Sciences offers courses in pure and applied mathematics leading to the M.S. in Mathematics. The program trains students in areas relevant to the needs of business, industry, government, and the teaching profession and provides the necessary background for advanced graduate work. Two specializations

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within the program allow the students, if they wish, to concentrate their studies in either operations research or statistics. Limited financial aid is available in the form of a research or teaching assistantship.

**Admission Requirements**

In addition to fulfilling the admission requirements for graduate study, applicants must have three letters of recommendation and extensive undergraduate training in mathematics that includes courses similar to MATH 315 and 316 Advanced Calculus, and MATH 322 Linear Algebra. MATH 611 and 612 Intermediate Analysis and Algebra present some of the highlights of these prerequisite courses and sharpen the skills necessary to enable a student to enter the degree program. GRE exams are recommended but not required.

**Degree Requirements**

In addition to fulfilling the degree requirements for graduate study, the candidate must:

1. Complete at least 30 semester hours of graduate work. Some of these hours may be from courses in related disciplines. See the graduate coordinator for the current list of approved courses.

2. Complete Algebra I (MATH 621) and Linear Analysis I (MATH 675).

3. Complete a research component of the degree: Thesis (MATH 799)/Seminar (MATH 795/796). This component must be at least 3 hours and may not exceed 9 hours. No more than 6 hours of either thesis or seminar may be applied toward the 30-hour minimum requirement for the degree.

4. Pass the departmental examination. This oral exam is to be taken near the completion of the degree and tests the cumulative skills acquired by the student. The student is examined on material from the two required courses and from one advanced topic beyond the basic courses. This advanced topic is chosen by the student in consultation with the graduate coordinator.

**Course Work**

The department offers courses in pure and applied mathematics, including Real and Complex Analysis, Algebra, Topology, Geometry, Differential Equations, and Computational Mathematics. These include all courses prefixed by MATH. A complete list appears below. Courses prefixed by OR and STAT are offered by and listed with the School of Information Technology and Engineering.

**Options in Operations Research and Statistics**

Students may specialize in operations research or statistics instead of the standard mathematics curriculum.

**Operations Research**

This specialization allows students to concentrate their studies on mathematical models and methods that are used to analyze complex real-world decision problems in both the private and public sectors.

In addition to satisfying the general degree requirements of the department, students must complete a minimum of four courses prefixed by OR. Three of these must be at the 600 level or higher. Students must complete OR 541 and 542 Operations Research I and II.

**Statistics**

This specialization allows students to concentrate their studies in the theory and practice of the methods and techniques of statistical analysis. The following requirements apply to this specialization:

1. In addition to satisfying the general degree requirements of the department, the student must complete the following:
   - MATH 651 Probability
   - STAT 652 Statistical Inference or MATH 752 Mathematical Statistics

2. The student must complete three of the following courses:
   - STAT 653 Survey Sampling
   - STAT 654 Applied Statistics
   - STAT 655 Analysis of Variance
   - STAT 656 Regression Analysis
   - STAT 657 Nonparametric Statistics
   - STAT 659 Topics in Statistics

**Mathematical Sciences Courses (MATH)**

A double number separated by a comma (MATH 771, 772) indicates that both graduate courses normally constitute a sequence and that the first semester is prerequisite to the second. The prerequisite may be waived by permission of chair. See also STAT and OR courses.

**600 Special Topics in Mathematics (1-3:1-3:0)**

Prerequisite: Permission of instructor. Mathematical workshops, special courses, or other projects.

**601 Principles of Analysis I (2:2:0)**

Prerequisite: The calculus sequence and permission of instructor. A fast-paced development of calculus including differentiation, integration, numerical methods, Fourier series, vector

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analysis, multivariate calculus. Prior exposure to some of the topics is assumed. Although open to all graduate students, the course is intended for those entering the graduate programs in the School of Information Technology and Engineering. Credit is not applicable toward the M.S. in Mathematics.

602 Principles of Analysis II (2:2:0). Prerequisite: The undergraduate calculus sequence and permission of instructor. A fast-paced development of topics from advanced calculus including ordinary differential equations, complex analysis, Laplace and Fourier transforms. Prior exposure to some of these topics is assumed. The course is intended for students entering the graduate programs in the School of Information Technology and Engineering. Credit is not applicable toward the M.S. in Mathematics.

603 Principles of Linear Algebra (1:1:0). Prerequisite: A course in linear algebra and permission of instructor. A fast-paced development of linear algebra including linear equations, matrices, vector spaces, linear transformations, inner products, and norms. Prior exposure to some of these topics is assumed. The course is intended for those entering the graduate programs in the School of Information Technology and Engineering. Credit is not applicable toward the M.S. in Mathematics.

604 Principles of Discrete Mathematics (1:1:0). Prerequisite: Permission of instructor. A fast-paced development of discrete mathematics including combinatorics, difference equations, graphs, trees, and digital systems. Prior exposure to some of these topics is assumed. The course is intended for students entering the graduate programs in the School of Information Technology and Engineering. Credit is not applicable toward the M.S. in Mathematics.

611 Intermediate Analysis (3:3:0). Development of the number system; review of the highlights of calculus, sequences, and series of functions. Credit not applicable toward the 30 credits required for the M.S. in Mathematics, but can be counted toward the master of education.

612 Intermediate Algebra (3:3:0). Linear algebra, vector spaces, linear independence, linear transformations, and matrix operations. Credit not applicable toward the 30 credits required for the M.S. in Mathematics but can be counted toward the master of education.

619 Topics in Mathematical Logic (3:3:0). Prerequisite: Permission of instructor. Special topics in the foundations of mathematics not included in the regular mathematics curriculum. May be repeated for credit.

620 Applied Matrix Analysis (3:3:0). Prerequisite: MATH 612, 203, 303, or 322. Review of vector and matrix arithmetic, Gaussian elimination, linear programming, eigenvalues, the Jordan form, linear differential systems, positive definite matrices, Markov processes, game theory, applications to numerical analysis, optimization, economic and ecological systems. Emphasis on modeling using matrix algebra to give full view to its applicability.

621 Algebra I (3:3:0). Groups, linear algebra, matrix groups.

623 Algebraic Coding Theory (3:3:0). Prerequisite: MATH 203, 303, or permission of instructor. Introduction to the mathematical theory of error-correcting codes including linear block codes such as Hamming, Golay, BCH, and Reed-Muller. Also included are the MacWilliams equations and t-designs.

625 Numerical Linear Algebra (3:3:0). Prerequisite: A course in linear algebra and some programming ability. Computational procedures for linear systems, least-squares problems, and eigenvalue problems, with an emphasis on error analysis.

629 Topics in Algebra (3:3:0). Prerequisite: Permission of instructor. Special topics in pure or applied algebra not covered in the regular algebra sequence. May be repeated for credit.


637, 638 Non-Euclidean Geometry I, II (3:3:0), (3:3:0). Prerequisite: Permission of instructor. Affine, projective, hyperbolic, elliptical, differential geometry; transformations and elementary combinatorics.

639 Topics in Topology and Geometry (3:3:0). Prerequisite: Permission of instructor. Special topics in topology and geometry not covered in the regular topology and geometry sequence. May be repeated for credit.

641 Combinatorics and Graph Theory (3:3:0). Prerequisite: Permission of instructor. Study of fundamental concepts in combinatorics and graph theory. Various methods of enumerative combinatorics, including the principle of inclusion-exclusion, the multinomial theorem, generating functions, recurrence relations, graphs and subgraphs, trees, connectivity, planar graphs, coloring, and matching.

644 Combinatorics and Convexity (3:3:0). Prerequisite: Permission of instructor. Separation theory of convex sets, polarity, duality theorems of convex optimization, valuation theory, combinatorial aspects of convexity, and applications to linear and integer programming.

651 Probability Theory (3:3:0). Axioms for a probability space, conditional probability, random variables, distribution functions, moments, characteristic functions, modes of convergence, limit theorems.


671 Fourier Analysis (3:3:0). The study of fundamental ideas in Fourier Analysis. Topics include orthonormal systems, Fourier series, continuous and discrete Fourier transform theory, generalized functions, and an introduction to spectral analysis. Applications to the physical sciences, linear systems theory, and signal processing are used to motivate and integrate these topics.


676 Linear Analysis II (3:3:0). Prerequisite: MATH 675 or permission of instructor. Analysis of bounded and unbounded operators, spectral theorems, differential operators, applications. A brief account of Lebesgue integration theory may be included.
677 Ordinary Differential Equations (3:3:0), (3:3:0). 

678 Partial Differential Equations (3:3:0). Prerequisite: MATH 203 or 303 and 214 or 304. Physical examples, characteristics, boundary-value problems, integral transforms, and other topics, such as variational, perturbation, and asymptotic methods.

679 Topics in Analysis (3:3:0). Prerequisite: Permission of instructor. Special topics in analysis not covered in the regular analysis sequence. May be repeated for credit.

681, 682 Systems Optimization and Control I, II (3:3:0), (3:3:0). Prerequisite: MATH 651 or equivalent and MATH 675 or permission of instructor. Systems of linear differential equations, optimization of linear dynamical systems, controllability and optimal control of linear systems, Gauss-Markov Processes, Kalman filtering. Applications to networks, aerospace, information processing.

685 Numerical Analysis (3:3:0). Prerequisite: Linear algebra, advanced calculus or its equivalent and some programming ability. A study of computational methods with an emphasis on error analysis in linear algebra, approximation theory, nonlinear equations, and numerical differentiation and integration.


689 Topics in Applied Mathematics (3:3:0). Prerequisite: Permission of instructor. Special topics in applied math not covered in the regular applied math sequence. May be repeated for credit.

697 Independent Reading and Research (1-3:0:0). Prerequisite: Graduate standing and permission of instructor. In areas of importance, but insufficient demand to justify a regular course, an individual student may undertake a course of study under the supervision of a consenting faculty member. A written statement of the content of the course and a tentative reading list is normally submitted by the student as part of the request for approval to take the course. A literature review, project report, or other written product is normally required. May be repeated for a maximum of 9 credits.

722 Algebra II (3:3:0). Prerequisite: MATH 621 or permission of instructor. Rings, fields, Galois theory.

752 Mathematical Statistics (3:3:0). Prerequisite: MATH 651. Sampling distributions, point and interval estimation (Cramer-Rao theorem), testing of hypotheses (Neyman-Pearson tests, uniformly most powerful tests, sequential tests), linear models, distribution free methods.

795, 796 Seminar (3:3:0), (3:3:0).

799 Thesis (1-6:0:0). Original or compulsory work to be evaluated by a committee of three faculty members.

800 Studies for the Doctor of Philosophy in Education (varied credit). Prerequisite: Admission to the Ph.D. in Education program to study in mathematics. Program of studies designed by student's discipline director and approved by student's doctoral committee, which brings the student to participate in the current research of the discipline director and results in a paper reporting the original contributions of the student. Enrollment may be repeated.

Music

Faculty

Brawley, Thomas M., Ph.D., Northwestern University, 1975; Associate Professor

Burton, Stephen D., M.M., Peabody Conservatory of Music, 1974; Professor

di Bonaventura, Sam, D.M.A., Peabody Conservatory of Music, 1964; Professor

Engebretson, Stanley P., D.M.A., Stanford University, 1980; Associate Professor

Gabriel, Arnald D., D.Mus., (honor.), 1989; M.S., Ithaca College, 1953; Professor

Giles, Martha M., D.Mus.Ed., University of Oklahoma, 1977; Assistant Professor

Hill, Thomas H., D.M.A., The Catholic University of America, 1970; Associate Professor

Kanyan, Joseph M., D.M.A., The Catholic University of America, 1972; Associate Professor; Interim Chair

Maiello, Anthony J., M.S., Ithaca College, 1967; Professor

Miller, Patricia A., M.M., New England Conservatory of Music, 1974; Associate Professor

Smith, Glenn E., D.Mus., Indiana University, 1973; Professor

Smith, James G., D.M.A., University of Illinois, 1973; Professor

Music, M.A.

The expansion of professional education in the arts is paramount for the growth and development of a rich and vital cultural community and a supporting network of individual artists. The dynamics of contemporary society suggest that the

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impact of the arts on public life will continue to expand well into the twenty-first century. Each year, despite the sagging economic situation, opportunities increase for creative work by performers, composers, sculptors, painters, dancers, actors, historians, theoreticians, and musicologists.

The Master of Arts with Specialization in Music has been developed by the Department of Music as an educational channel to meet the intellectual and career needs of qualified students. It is a comprehensive and advanced program of study with a choice of concentrations in performance, music education, composition, conducting, accompanying, and multiple instruments.

Admission Requirements
In addition to fulfilling the admission requirements for graduate study, the applicant is expected to hold a baccalaureate degree in music or in another discipline with courses equalling the music requirements for the Bachelor of Arts degree in Music offered at this university.

The following concentration admission requirements must also be met:
- **Performance:** Audition
- **Music Education:** Certification to teach music in the public schools
- **Composition:** Submission of a portfolio of compositions and an interview with a faculty committee
- **Conducting:** Audition
- **Accompanying:** Audition
- **Multiple Instruments:** Audition

All entering graduate students are required to take an entrance examination in music history and theory for advising purposes. The examination will be offered during a three-hour period on the Saturday preceding the first day of classes of the fall and spring semesters.

Graduate Exit Examination
All students completing the M.A. degree in music are required to pass a comprehensive examination, which will be administered during the graduation semester or, in the case of students selecting the thesis option in the music education concentration, upon completion of 24 hours of course work and immediately before beginning work on the thesis. The two-part examination will be based primarily on course work taken and will consist of a three-hour written examination followed within one week by a one-hour oral examination focusing on the student’s performance on the written portion, as well as his or her ability to articulate additional understandings relevant to the particular concentration.

Degree Requirements
A student must successfully complete 30 hours of credit in graduate music courses. With the approval of the department, 3 hours of nonmusic graduate credit may be taken.

The student must satisfy the following requirements:
- **General Requirements (11 credits):**
  - Introduction to Research in Music (3)
  - Analytical Techniques (3)
  - History and Literature of Music (3)
  - Ensemble (2)

- **Additional requirements for the concentration in Performance (19 credits):**
  - Graduate Private Music Instruction — Instrumental/Vocal (9)
  - Advanced Orchestration (3)
  - History and Literature of Music (3)
  - Graduate Recital (1)
  - Electives (3)

- **Additional requirements for the concentration in Music Education (19 credits):**
  - Psychology of Music Teaching and Learning (3)
  - Aesthetics of Music Education (3)
  - Thesis (6) or Orff Schulwerk certification (9)
  - Electives (4-7)

  Before receiving the degree, students in this concentration must complete the equivalent of one year of full-time public/private school music teaching.

- **Additional requirements for the concentration in Composition (19 credits):**
  - Graduate Private Music Instruction — Composition (9)
  - Advanced Orchestration (3)
  - History and Literature of Music (3)
  - Graduate Recital (1)
  - Electives (3)

- **Additional requirements for the concentration in Conducting (19 credits):**
  - Graduate Private Music Instruction — Conducting (6)
  - Advanced Topics in Conducting (3)
  - Advanced Orchestration (3)
  - Graduate Recital (1)
  - Electives (6)

  The number of students accepted as graduate conducting majors is limited by the extent to which it is possible to provide them with practical experience in conducting. In most cases, each student accepted is offered an opportunity to gain conducting experience by serving as assistant conductor of a GMU ensemble.
Additional requirements for the concentration in Accompanying (19 credits):

Graduate Private Music Instruction — Accompanying (9)
History and Literature of Music or Advanced Orchestration (3)
Chamber Ensembles (1)
Graduate Recital (Vocal Accompanying) (1)
Graduate Recital (Instrumental Accompanying or Chamber Music) (1)
Electives (4)

The entering graduate student in this concentration must show evidence of having completed one semester of study (or its equivalent) in each of the following foreign languages: French, German, Italian. Deficiencies in this area can be remedied by completing one semester of undergraduate study for each of the languages not previously studied. The recommended music history and literature courses are in the vocal, operatic, or chamber music areas.

Additional requirements for the concentration in Multiple Instruments (19 credits):

Graduate Private Music Instruction — Major Instrument (4)
Graduate Private Music Instruction — Secondary Instrument #1 (4)
Graduate Private Music Instruction — Secondary Instrument #2 (4)
Instrumental Pedagogy and Literature (3)
Graduate Recital–Multiple Instruments (1)
Electives (3)

Music Courses (MUSI)

511 Analytical Techniques (3:3:0). Prerequisite: Baccaulaureate degree in music or permission of instructor. A detailed formal and stylistic examination of music selected from the major style periods. Development of the analytical skills necessary for theoretical study at the graduate level.

512 Advanced Orchestration (3:3:0). Prerequisite: Baccaulaureate degree in music with a minimum of 3 hours of study in orchestration or permission of instructor. Intensive study through analysis and arranging of advanced methods of instrumentation. Scoring for large forces. Twentieth-century vocal and instrumental techniques such as multiphonics. Unusual instruments. New methods of notation. Late twentieth-century performance practices.

513 Advanced Topics in Music Theory (3:3:0). Prerequisite: Baccaulaureate degree in music or permission of instructor. Intensive study and analysis of music from the theoretical point of view, comparing trends in compositional techniques through various works. May be repeated for credit as topics change.

515 Introduction to Electronic Music (3:3:0). Prerequisite: Baccaulaureate degree in music or permission of instructor. This course is designed to give the graduate student a working knowledge of electronic music production with emphasis on the synthesizer as a computer interacting with other computers. Topics include a brief history of electronic sound production; acoustics of sound; the principles of musical instrument digital interface (MIDI) and its applications; the various kinds of synthesis; sound processing; and musical composition using the tape recorder and computer. Principles learned in class to be applied via student projects realized at the GMU MIDI facility.

525, 526 Performance Seminar for Singers and Accompanists I, II (2:3:0). Prerequisite: Audition. Seminar for vocal performance and accompanying/piano majors designed to develop and improve artistic and performance skills through a masterclass format. Course emphasizes diction, style, song preparation and execution, interpretation, phrasing, and overall stage presence. Each course may be repeated once for credit.

531 Advanced Topics in Music History and Literature (3:3:0). Prerequisite: Baccalaureate degree in music or permission of instructor. Thorough examination of a specific musical style, genre, composer, compositional school, or historical development. Primary and secondary source materials are studied in historical and/or analytical contexts. May be repeated for credit as topics change.

541 Chamber Music Literature (3:3:0). Prerequisite: Baccalaureate degree in music or permission of instructor. Historical and analytical study of the extensive literature for chamber ensembles (trios through nonets) in various instrumental combinations, from the seventeenth through the twentieth centuries.

543 Concerto Literature (3:3:0). Prerequisite: Baccalaureate degree in music or permission of instructor. Historical and analytical study of the concepts which produced the concerto form and its extensive literature, from the seventeenth through the twentieth centuries.

552 Vocal Pedagogy (2:2:0). Prerequisite: Graduate status in applied voice or permission of instructor. Instruction in the teaching of voice for all levels, through the study of vocal physiology and pedagogical methods.

553 Instrumental Pedagogy and Literature (3:3:0). Prerequisite: Baccalaureate degree in music or permission of instructor. Instruction in the teaching of instrumental music techniques for all levels through the study of pedagogical methods, standard literature, and musical instruments produced by present-day manufacturers.

561 Advanced Topics in Music Education (1-3:1-3:0). Prerequisite: Degree in music education or permission of instructor. Intensive examination of specific areas of concern to music educators engaged in teaching vocal, instrumental, and general music at all levels or functioning as private studio teachers. Individual research, group discussions, and participation in related activities. Field experience may be required.

562 The Psychology of Music Teaching and Learning (3:3:0). Prerequisite: Baccalaureate degree in music or permission of instructor. Study of the learner's musical behaviors (affective, cognitive, and psychomotor) in an effort to devise an empirically based teaching method founded on learning principles.

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571, 572 Techniques in Accompanying I, II (1:0:3). Prerequisite: Admission to graduate-level Private Music Instruction in a keyboard instrument or permission of instructor. The development of accompanying skills through collaboration with solo singers, instrumentalists, and small ensembles. Students will perform for each other, observe lecture/demonstrations and performances by professionals, and participate in masterclasses.

580 Wind Ensemble (1:0:3). Prerequisite: Audition. Highly selective group of instrumentalists performing works from the wind ensemble repertoire. Public concerts will be given. May be taken for credit four times.

581 Graduate Choral Ensembles (1:0:3). Prerequisite: Audition. Performance of works from the choral repertoire. Public concerts are given. May be taken for credit four times.

583 Symphonic Band (1:0:3). Prerequisite: Audition. Performance of works from the band repertoire. Public concerts are given. May be taken for credit four times.

585 Chamber Ensembles (1:0:3). Prerequisite: Audition. Performance of works from the chamber music repertoire. Public performances are given. May be taken for credit four times.

587 Symphony Orchestra (1:0:3). Prerequisite: Audition. Performance of works from the symphony orchestra repertoire. Public concerts are given. May be taken for credit four times.

589 Jazz Ensemble (1:0:3). Prerequisite: Audition. Provides practical experience in various aspects of jazz performance. Participation in section rehearsals and small and large jazz groups. Jazz improvisation is expected. Public concerts will be given. May be taken for credit four times.

592 Advanced Topics in Music (1-3:1-3:0). Prerequisite: Baccalaureate degree in music or permission of instructor. Intensive study of specific areas of concern to musicians engaged in performance, composition, and conducting. Individual research, group discussions, and participation in related activities. May be repeated for credit.

597 Advanced Topics in Conducting (3:3:0). Prerequisite: Baccalaureate degree in music with a minimum of two semesters' study in conducting, or permission of instructor. Intensive study of an advanced topic in conducting chosen according to interests of students and instructor from such topics as the following: (1) Choral Music Performance Techniques and Score Preparation; (2) Wind Ensemble Performance Techniques and Score Preparation; (3) Orchestral Performance Techniques and Score Preparation; (4) Performance Practices in Choral Music before 1750; (5) Rhythmic Analysis as a Guide to Score Interpretation in Music of All Periods. Maximum of 6 credits may be earned.

662 Introduction to Research in Music (3:3:0). Prerequisite: Baccalaureate degree in music or permission of instructor. Development of skills, attitudes, and understanding necessary in doing and reporting research in music, including philosophical bases, scope and organization, stylistic practices in writing the research report, the study of materials and resources in music and music education, and the proper use of library and other research services.

663 Aesthetics of Music Education (3:3:0). Prerequisite: Baccalaureate degree with certification to teach music or permission of instructor. Study of the philosophical foundations of contemporary music education, as well as a critical examination of music programs and activities in aesthetic education, and efforts by the music education establishment to enhance them.

684 Graduate Lecture-Recital (1-3:0:0). Prerequisite: Baccalaureate degree in music and permission of the music faculty and the department chair. Corequisite: Graduate Private Music Instruction at the 3-credit level. A combination of musical performance and scholarly presentation on a well-defined topic. A public presentation is required. Preparation of the program is directed by a member of the full-time music faculty in consultation with the student's private music instructor. May be taken for a maximum of 6 credits.

688 Advanced Musical Theater Techniques (1-3:1-2:6). Prerequisite: Audition and permission of instructor. Preparation and presentation of works or parts of works from the musical theater repertoire (opera, operetta, musical comedy). One hour of lecture per week and (for each credit pursued) 2 hours of practicum per week. Students will investigate applicable techniques through topically organized lectures and assignments, and in goal-oriented practicum sessions and rehearsals. Public performance(s) will be given.

699 Independent Study (1-3:0:0). Prerequisite: Baccalaureate degree in music and permission of the music faculty and the department chair. Individual research and study in one of the areas of concentration available in the master of arts degree with a major in music. May be taken for a maximum of 6 credits.

798 Graduate Recital (1:0:0). Prerequisite: At least 3 credits in Graduate Private Music Instruction in the area of concentration at the 3-credit level. Corequisite: Enrollment in Graduate Private Music Instruction in the area of concentration at the 3-credit level. A public performance in the area of concentration.

799 Thesis (1-6:0:0). Prerequisite: At least 12 hours of graduate study (including MUSI 511) and approval of the thesis topic. Students in the music education concentration must also have taken MUSI 562 and completed the comprehensive examination. Supervised research on an approved thesis topic.

800 Studies for the Doctor of Philosophy in Education (variable credit). Prerequisite: Admission to the Ph.D. in Education program to study in music. Program of studies designed by student's discipline director and approved by student's doctoral committee that brings the student to participate in the research, performing, or creative activity of the discipline director and results in a paper reporting the original contributions of the student. Enrollment may be repeated.

Graduate Private Music Instruction
All private music instruction is by arrangement. Students must consult the Applied Music Coordinator in the Department of Music for teacher assignment and registration numbers. The private music instruction fee applies. To earn 2 or 3 credits per semester, a student takes 14 one-hour private music lessons. In Graduate Private Music Instruction—Accompanying, a number of these may be spent in a group-practicum at the instructor's discretion.
cretion. The 3-credit sequence is designed for students who work toward the M.A. degree with a concentration in performance, composition, conducting, accompanying, or multiple instruments.

Private music instruction is offered in the following areas: accompanying, bassoon, cello, clarinet, composition, conducting, euphonium, flute, classical guitar, harp, harpsichord, horn, koto, oboe, organ, percussion, piano, saxophone, string bass, trombone, trumpet, tuba, viola, viola da gamba, violin, and voice.

Graduate Private Music Instruction—Composition. Prerequisite: Portfolio of compositions submitted to the faculty and an interview with a faculty committee.

Graduate Private Music Instruction—Accompanying. Prerequisite: Audition.

Graduate Private Music Instruction—Instrumental/Vocal. Prerequisite: Audition.

Graduate Private Music Instruction—Conducting. Prerequisite: Audition.

Physics and Astronomy

Faculty
Becker, Peter A., Ph.D., University of Colorado, 1987; Assistant Professor
Blaisen-Barojas, Estela, Ph.D., Universite de Paris VI, 1974; Professor
Ceperley, Peter H., Ph.D., Stanford University, 1973; Associate Professor
Dworzecka, Maria, Ph.D., Warsaw University, Poland, 1969; Professor
Ehrlich, Robert, Ph.D., Columbia University, 1964; Professor
Ellsworth, Robert, Ph.D., University of Rochester, 1965; Professor
Evans, John, Ph.D., University of Michigan, 1966; Associate Professor
Kafatos, Menas, Ph.D., Massachusetts Institute of Technology, 1972; Professor
Lankford, William, Ph.D., University of South Carolina, 1969; Professor
Lieb, B. Joseph, Ph.D., College of William and Mary, 1971; Professor
Mielczarek, Eugenie, Ph.D., The Catholic University of America, 1963; Professor
Satija, Indubala, Ph.D., Columbia University, 1983; Associate Professor
Trefil, James, Ph.D., Stanford University, 1966; Robinson Professor
Wallin, John F., Ph.D. Iowa State University, 1989; Assistant Professor

Applied and Engineering Physics, M.S.

The Master of Science in Applied and Engineering Physics contains both elements of traditional physics programs and the application of physics to a diversity of critical societal problems. The program is divided into two tracks. The applied physics track is intended for those who wish to apply the techniques and subject areas of physics to multifaceted problems encountered in the workplace, particularly in physics, engineering, computational science, and other related areas. The engineering physics track, jointly administered with the Department of Electrical and Computer Engineering, allows students to select a larger fraction of courses from electrical engineering.

All courses are offered during late afternoon or evening hours to allow students with full-time employment to attend easily. Persons employed at area high technology organizations may take up to 6 credits (out of 30) for work done “on the job” under the guidance of a faculty member. This employment-related research may be conducted either under an optional 3-credit research project or an optional 6-credit master's thesis. Master's students who are not employed full time may apply for financial aid or for a limited number of research assistantships.

Admission Requirements

Those holding a baccalaureate degree in physics or a related field from an accredited institution and who earned a GPA of 2.75 (out of 4.0) in their last 60 hours are invited to apply for admission. If the baccalaureate degree is in a field other than physics, the applicant should have taken several courses beyond the introductory physics courses, such as junior-level classical mechanics, electricity and magnetism, or electronics. An applicant may be required to make up one or two deficiencies, based on a graduate physics advisor's assessment, and still be permitted to enroll in the program. Two letters of recommendation must be submitted, preferably from former professors. The Graduate Record General Examination and the GRE subject test in physics are recommended for applicants who received their baccalaureate degrees within the last five years. A less recent bachelor's recipient may wish to present a statement of his/her work experience in lieu of the GRE.

Degree Requirements

Candidates for the degree must successfully complete 30 credit hours as follows:
1. For both tracks of the program, a 9-credit core consisting of PHYS 510, 513, and 732 or 736.
2. For the applied physics track, any three of the following courses: PHYS 512, 540, 575, 610, 612, 613, 620, 676, 701, 705, 711, 722, 728, 732, and 736.
3. For the engineering physics track, PHYS 610 and any 6 credit hours in electrical engineering courses (ECE prefix).
4. Electives amounting to 12 credit hours may be chosen from courses in physics, chemistry, mathematics, engineering, information technology, and computational sciences and informatics. However, no more than 6 credit hours may be chosen from areas outside physics and engineering, and no more than 6 credit hours of PHYS 799 may be applied to satisfy degree requirements.
5. Credit may be received for either ECE/PHYS 798: Research Project (3 credits) or ECE/PHYS 799: Master's Thesis (6 credits), but not both. The research project may be performed at a student's place of employment with the concurrence of a faculty adviser. The thesis is a more substantial piece of work performed under the supervision of a major professor and requires the student to make an oral defense. ECE/PHYS 798 may be taken only once.

Specializations in Computational Physics or Space Sciences in the Computational Sciences and Informatics, Ph.D.

Specializations in Computational Physics or Space Sciences exist as part of the doctoral program in computational sciences and informatics (see Computational Sciences and Informatics for degree and admission requirements).

Physics Courses (PHYS)

500 Physics for High School Teachers (3:3:0). Prerequisite: Certification as a secondary school physics instructor or permission of department. Techniques of teaching high school physics. Introduction to modern physics with emphasis on concepts rather than mathematical formalism. Recent developments in physics.

501 Physics Laboratory Techniques for High School Teachers (3:3:0). Prerequisite: Graduate standing. Theory and performance of experiments applicable to high school teaching with practical sessions on use of lab apparatus and computer. Recommended for high school teachers of physics.

502 Introduction to Quantum Mechanics and Atomic Physics (3:3:0) (Same as PHYS 402). Prerequisite: PHYS 303 or permission of instructor. Study of the conceptual basis, experimental basis, and mathematical formulation of quantum mechanics; the wave function; systems in one, two, and three dimensions.

510 Computational Physics I (3:3:0). Prerequisites: PHYS 303 and 305; FORTRAN programming. Study of diverse physical processes with emphasis on the application of various numerical algorithms and techniques for solution. Includes consideration of integral and differential equations, Cartesian tensors, problem solving of particle, many-body, statistical, and continuum processes. Consideration is also given to analysis of both experimentally and numerically-generated data.

512 Solid State Physics and Applications (3:3:0). Prerequisite: PHYS 402 or 502. Crystal structures, binding, lattice vibrations, the free electron model, metals, semiconductors and semiconductor devices, superconductivity, magnetism.

513 Applied Electromagnetic Theory (3:3:0). Prerequisite: PHYS 305, 306, MATH 313, 314 or equivalent. Classical electromagnetic theory with applications. Topics include electrostatics, magnetic fields and materials, electromagnetic wave propagation, wave guides, transmission lines, radiation, and antennas.

520 The Physics of Energy and Environmental Technology (3:3:0). Prerequisite: B.A. or B.S. degree in natural science or mathematics or permission of instructor. Contemporary problems of energy and the environment with emphasis on the underlying principles of physics within the constraints of engineering and economics. Intended for those pursuing careers in energy research and development, business administration, economics, ecology, and high school science instruction.

540 Nuclear and Particle Physics (3:3:0). Prerequisite: PHYS 502. Accelerators, detectors, and related electronics; nuclear and elementary particle structure; symmetries and conservation laws; the electromagnetic, weak, and hadronic interactions; nuclear models; the quark model; nuclear science and technology.


575 Atmospheric Physics I (3:3:0). Prerequisite: PHYS 305, 352, and 350 or equivalent. Introduction to basic physical and chemical processes that operate in Earth's atmosphere. Emphasis on those concepts that provide a global description of the current atmospheric state and those processes that relate to global change and atmospheric evolution. Topics include equilibrium structure, radiative transfer models, thermodynamics of various atmospheric state and the various processes defining these layers. Other topics include cloud formation, atmospheric dynamics, waves and turbulence, ozone photolysis, solar-terrestrial atmospheric circulation, modeling, predictability, and climate change. Introduction to numerical models governing the structure of the atmosphere.

590 Selected Topics in Physics (3:3:0). Prerequisite: Graduate standing or permission of department. Selected topics from recent theoretical developments and applications in physics and astronomy. Designed to satisfy the needs of the professional community to keep abreast of current developments in physics.

600 Special Topics in Physics (1-6:0:0). Inservice course to strengthen and update teachers' knowledge of physics and astronomy.
610 Modern Instrumentation (3:3:0). Prerequisite: PHYS 513 and an electronics course. Topics include sensors for radiation, particles, electric and magnetic fields, pressure, and motion; electronic instruments, computer data collection, instrumentation noise and noise reduction methods, and specialized instrumentation systems for various areas of applied physics.

611 Electrophysics (3:3:0). Prerequisite: PHYS 502 and 513. Optical modulators, display devices, types and operation of lasers, mode locking, Q-switching, photodetectors, and optical fibers.

612 Physics of Modern Imaging (3:3:0). Prerequisite: PHYS 513. Study of imaging methods using acoustic and electromagnetic waves to probe extended objects, and mathematical transformations to produce images from the scattered waves. Topics include classical imaging, physical optics, Fourier transform, holography, tomography, seismic mapping, underwater acoustic imaging and mapping, side-looking radar, antenna arrays, and applicable computer methods.

613 Computational Physics II (3:3:0). Prerequisite: PHYS 303, 305, and 510; FORTRAN programming: PHYS 502 and 511 recommended or equivalent. Study of diverse physical systems with emphasis on modeling and simulation. Study and development of numerical algorithms and techniques to obtain both numerical results and visualization of these results and the individual processes taking place in the system. Projects undertaken will draw from such areas as many-body orbital dynamics, molecular interactions, quantum systems, radiative transfer in high-temperature plasmas, stellar interiors, hydrodynamics, and cosmology.

620 Continuum Mechanics (3:3:0). Prerequisites: PHYS 510; FORTRAN programming. Study of continuum mechanics; topics include physical concepts, mathematical formulation and solution, elastic materials, ideal fluids, viscous fluids, waves in continuous media, turbulence, thermal convection, stability considerations, high-temperature gas flows, radiative processes for momentum and energy transport, shocks, and computational fluid dynamics.

676 Atmospheric Physics (3:3:0). Prerequisites: PHYS 303, 305, and 361, MATH 314. Introduction to basic physical and chemical processes that operate in the Earth's atmosphere. Emphasis on those concepts that provide a global description of the current atmospheric state and those processes that relate to global change and atmospheric evolution. Primary topics include equilibrium structure, radiative transfer models, thermodynamics of various atmospheric layers-troposphere, stratosphere, mesosphere, ionosphere, thermosphere, and the various processes defining these atmospheric layers. Other topics will include cloud formation, atmospheric dynamics, waves and turbulence, ozone photochemistry, solar-terrestrial relationships, the greenhouse effect, Gaia hypothesis, atmospheric circulation, modeling, predictability, and climatic change.

701 Theoretical Physics (3:3:0). Prerequisites: PHYS 502, 510, 513, or permission of instructor. Study of the physical basis for selection of particular mathematical tools in physics; topics include curvilinear coordinates, tensors, matrices, differential equations, special functions, complex variables, and group theory.

705 Classical Mechanics (3:3:0). Prerequisites: PHYS 502, 510, 513, or permission of instructor. Study of classical mechanics; topics include Lagrangian mechanics, Hamiltonian mechanics, canonical transformations, Hamilton-Jacobi theory, non-integral systems, rigid body dynamics, normal modes of vibration.

711/511 Statistical Mechanics (3:3:0). (formerly PHYS 511). Prerequisites: PHYS 502 and 510 or permission of instructor. Statistical methods, systems of particles, thermodynamics, macroscopic parameters, the ideal gas, kinetic theory, quantum statistics, and transport processes.

722 Electromagnetic Theory (3:3:0). Prerequisites: PHYS 513 and 510 or permission of instructor. Advanced study of electric and magnetic fields; topics include electrostatic fields, magnetostatic fields, boundary-value problems in field theory, multipoles, simple radiating systems, relativistic electrodynamics, and radiation by moving charges.

728/C511 Simulation of Large-Scale Physical Systems (3:3:0). Prerequisites: PHYS 510 or equivalent; FORTRAN or other high-level language programming. Study of diverse large-scale physical systems with emphasis on the modeling and simulation of these multifaceted systems. Study and development of numerical algorithms and techniques to obtain both numerical results and visualization of these results and the individual processes taking place in the system. Several projects will be undertaken which will be drawn from such areas as many-body dynamics, molecular dynamics and interactions, atmospheric structure and dynamics, high-temperature plasmas, stellar structure, hydrodynamics systems, galactic structure and interactions, and cosmology.

732 Quantum Mechanics (3:3:0); (formerly PHYS 514). Prerequisites: PHYS 502, or permission of instructor. Study of the fundamental concepts of quantum mechanics, time evolution, Schroedinger and Heisenberg formalism, harmonic oscillators, propagators, Feynman path integrals, rotations and angular momentum, angular momentum eigenvalues and eigenstates, Bell's inequality, symmetries, conservation laws, degeneracy, perturbation theory, WKB methods, and scattering theory.

736/516 Computational Quantum Mechanics (3:3:0). Prerequisites: PHYS 502, 510, or permission of instructor. Study of the fundamental concepts of quantum mechanics from a computational point of view, review of systems with spherically symmetric potentials, many-electron-atom solutions to Schroedinger's equation, electron spin in many-electron systems, atomic structure calculations, algebra of many-electron calculations, Hartree-Fock self-consistent field method, molecular structure calculations, scattering theory computations, and solid-state computations.

780 Topics in Computational Physics (3:3:0). Prerequisite: Permission of instructor. Selected topics in computational physics not covered in fixed-content computational physics courses. May be repeated for credit as needed.

790 Colloquium in Physics and Astronomy (1:1:0). Prerequisites: Admission to physics graduate program. Attendance of colloquium presentations in physics and astronomy by department faculty, staff, and professional visitors to the department. May be repeated twice for credit.
796 Directed Reading and Research (1-6:0:0). Prerequisites: Admission to master’s program and permission of instructor. Reading and research on a specific topic in physics or related field under the direction of a faculty member. May be repeated as needed.

798 Research Project (3:0:0). Prerequisite: 9 hours of graduate-level course work and permission of instructor. Project chosen and completed under the guidance of a graduate faculty member, which results in an acceptable technical report.

799 Master’s Thesis (1-6:0:0). Prerequisite: 9 hours of graduate-level course work and permission of instructor. Project chosen and completed under the guidance of a graduate faculty member, which results in an acceptable technical report and an oral defense.

800 Studies for the Doctor of Philosophy in Education (variable credit). Prerequisite: Admission to the Ph.D. in Education program to study in physics. Program designed by student’s discipline director and approved by student’s doctoral committee, which brings the student to participate in the current research of the discipline director and results in a paper reporting the original contributions of the student. Enrollment may be repeated.

Astronomy Courses (ASTR)

505 Fundamentals of Astronomy (3:3:0). Prerequisite: Graduate standing or permission of instructor. Emphasis on the connection of astronomy to other disciplines as well as recent developments in astronomy. Planet earth, its origin and past history, and the origin of life. Ancient, Renaissance, and modern astronomers. Basic physics. Tools of the astronomer. The solar system, the sun, stars, and our galaxy. Quasars, general relativity, and cosmology. Recommended for teachers of general science.

530 Astrophysics (3:3:0); (formerly PHYS 530). Prerequisites: PHYS 303, 305, 361; MATH 214. Survey of contemporary astrophysics; topics include physical concepts, stellar spectra, Hertzsprung-Russell diagram, stellar atmospheres, stellar structure, interstellar matter, stellar evolution, high-energy phenomena, hydrodynamical processes in astrophysics, accretion disk formation, and shock formation.


535 Space Instrumentation and Exploration (3:3:0), (formerly PHYS 535). Prerequisites: PHYS 352; MATH 213. Survey of the instruments, devices, and methods used for space and planetary exploration. Remote sensing of earth and other solar system bodies. Planned manned and unmanned missions by U.S. and other countries.

761/CSI 761 N-Body Methods and Particle Simulations (3:3:0). Prerequisites: CSI 801, or permission of instructor. Study of particle methods as a tool in solving a variety of physical systems. Study and development of the numerical results and visualization of these results in complex physical systems are emphasized. Applications and projects include stellar and galaxy dynamics, smoothed particle hydrodynamics, plasma simulations, and semiconductor device theory. Algorithms on parallel and vectorized systems are included.

764/CSI 764 Computational Astrophysics (3:3:0). Prerequisites: ASTR 530, or permission of instructor. Study of statistical mechanics concepts important in astrophysics. Presentation of unified approach to particle acceleration and interaction theory based on analytical and numerical analysis of Boltzmann and Liouville equations. Discussion of computational methods relevant for particle transport problems, with emphasis on Fokker-Planck and Monte-Carlo solution techniques. Applications from space sciences will include studies of cosmic ray acceleration, photon Comptonization, particle transport in the near-Earth environment, energy transport in stellar atmospheres, and self-gravitating system dynamics.


766/CSI 766 Relativity and Cosmology (3:3:0); (formerly PHYS 531). Prerequisites: ASTR 530 and MATH 314, or permission of instructor. Special relativity, 4-dimensional space-time, general relativity, non-Euclidean geometries, geodesic and field equations, test of general relativity theory, black holes, cosmic background radiation, thermodynamic considerations in cosmology, and cosmological models.

769/CSI 769 Topics in Space Sciences (3:3:0). Prerequisites: Permission of instructor. Selected topics in space sciences not covered in fixed-content space sciences courses. May be repeated for credit as needed.

Program on Social and Organizational Learning

Faculty

Addleson, Mark S., Ph.D., University of the Witwatersrand, 1992; Associate Professor

Baetjer, Howard B., Ph.D., George Mason University, 1993; Research Professor

Coppin, Clayton, Research Professor

Cox, Brad, Ph.D., University of Chicago, 1973; Associate Professor

Ellig, Jerome R., Ph.D., George Mason University, 1988; Assistant Professor

http://catalog.gmu.edu
The area of culture and information technology is addressed in:

LRNG 514 Introduction to Ethnography
LRNG 551 Economics of Discourse
LRNG 692 Special Topics in LRNG (on the topic "Teleculture")
LRNG 714 Ethnography of Corporate Culture

A focus on applications of the Austrian economic perspective can be gained in:

LRNG 530 Information and Organizational Intelligence
LRNG 592 Special Topics in LRNG: "Culture and Economic Change"
LRNG 676 Comparative Socio-economic Systems
LRNG 681 Interpretive Economics

The program's courses address social theory and software engineering, practical management and subtle questions in the philosophy of knowledge. In teaching and research, the faculty attack one question, albeit a big one: how learning processes work in human society. The methodological slant is interpretive, emphasizing ethnographic and archival approaches to empirical work. Theorizing is grounded in problem-solving and comparison with experience. What results are courses that examine the role of knowledge, markets, and information technology in social institutions and organizations.

Social and Organizational Learning Courses (LRNG)

514 Introduction to Ethnography (3:3:0). This course is aimed at preparing a student to conduct qualitative empirical research in the applied social sciences. Included will be ideas about and practice in field work, interviewing, participant observation, and the preparation of research reports. The course also covers the theoretical underpinnings of qualitative research (symbolic interactionism and phenomenology) as well as the various methodological phases of the research process.

520 Experts and Expert Status (3:3:0). Examines how we decide whom to regard as an expert when we do not understand completely what we hear. Focus on the resources that experts, and the people they talk to, bring to their conversations. Explores assumptions about experts, conventions of conversation, and issues of status. Students analyze traditional negotiations of expert status and develop alternatives.

530 Information and Organizational Intelligence (3:3:0). Information and uncertainty about both external and internal environments help shape organizations, and vice versa. This reciprocal relation, already observable in traditional and industrial society, is even more central to a society like our own in which information-processing comprises the core technology. After reviewing conceptions of organizational intelligence and communication, this course examines the uses of organizational intelligence, the systematic causes of its failure, and organizational strategies for improving the use and production of information.
551 Economics of Discourse (3:3:0). The application of economic and literary theory to the process of verbal communication, whether spoken, written, or otherwise. The transformation of literary criticism from the New Criticism toward Post-structuralism is examined with the use of theories from literary criticism itself, as well as from the field of economics. Examines the possible effects of changing technological conditions of production, or of changing composition of market demand conditions, or other economic circumstances, in the supply and demand of literary texts.

572 Taming the Electronic Frontier (3:3:0). Examines the history of major revolutions of the past from the viewpoint of economics and other social sciences, to extrapolate beyond the established paradigms of telecommunications, computer science, and software engineering to examine how the information revolution may unfold in the future. This broadly interdisciplinary course aims to establish, in a classroom setting, a productive dialogue between producers and consumers of information-age goods.

582 Risk, Mistakes, and Responsibility (3:3:0). An examination of how we come to label certain actions as mistakes, define risks in terms of those "mistakes," and assign responsibility. Consideration of personal mistakes, systemic errors, and paradigm conflicts. Analysis of the language used to describe mistakes, responsibility, and risk in different arenas. Relationship between organizational learning and alternative views of mistakes.

583 Groupware for Organizational Learning (3:3:0). Previous title: The Future of Meetings. What is it about meetings; they excite and frustrate. Course examines common elements among perspectives on group behavior, verbal and electronic communication, subjective understanding and learning, identity and status, and childhood experiences. Draws on theoretical literature and "how-to" books, students' ethnographic observations, videotape, and fiction. Connects meetings with nonmeeting activity. Focus on—and practice with—the possibilities of electronic media.

590 Global Financial Markets and Technological Change (3:3:0). An examination of the changes occurring in international trade, international finance, and the monetary systems of the contemporary world, occasioned by the revolution in electronic technologies. The ability investors now have of transacting in alternative currencies, and of moving capital around the globe in response to government regulation, are changing the very nature of the world's monetary systems. Alternative schemes for conducting monetary policy to take into account the impact of telecommunications technologies are examined.

492, 592 Special Topics in LRNG (1-3:3:0). Topics in social or organizational change seen from economic, historical, philosophical, literary, organizational, and/or information technology perspectives. New courses that will first appear under this heading include Information and Organizational Intelligence and Teleculture. Consult program office for descriptions. May be repeated for credit.

596 Independent Study (1-12:3:0). Research, analysis, and/or implementation within the realm of social and organizational learning. Work with a member of the program faculty. May be repeated for credit.

601 Organizational Learning (3:3:0). It is not only individuals who learn, but in an important sense organizations. Themes include organizational culture, diffusion of innovations, sociotechnical systems, market-based management, Japanese approaches, and the reflective practitioner. Case studies will emphasize changes wrought by the rapid advances in information systems. The course serves as an introduction to organizations and management as seen from the perspective of organizational change. Complements LRNG 672 Organizational Learning Laboratory.

610 Object Technology for Non-Programmers (3:3:0). Previous title: Object-oriented Programming for Economists. Computer programming is not just a specialized technique of interest only to software engineers. It is fast becoming a mode of cognitive organization in its own right, embodying fundamental principles for managing complex systems. The current revolution in programming that focuses on "object orientation" constitutes a major contribution to our understanding of organizational learning. This course introduces student in the social science, management, and other fields who need not have ever done any programming to the main ideas of object-oriented software design by way of the user-friendly programming environment known as Smalltalk.

612 Economics, Technology, and the Regulatory Process (3:3:0). The goal of this course is to convey some fundamental economic principals useful for understanding and analyzing the regulation of industries that are undergoing rapid technological change, with a special focus on the telecommunications industry. Topics include the history of economic regulation, the theory of natural monopoly, economic efficiency and the First Amendment, competitive contracting, cost analysis, and principles of efficient regulation. The course places a special emphasis on using economics to understand and interpret current technological and regulatory trends.

672 Organizational Learning Laboratory (3:3:0). Although the need for faster-learning organizations, and for individuals capable of expediting the process, is clearer than ever before, it is less clear how this ability is acquired. This course provides a laboratory setting for practicing organizational learning skills. Classroom time is partially devoted to the theory of organizational learning, but most of the emphasis is on laboratory work, actually changing a situation in the student's own organizational environment. Complements LRNG 601 Organizational Learning.

676 Comparative Socio-economic Systems (3:3:0). Examines extreme alternatives in socio-economic systems, such as Fascism, Communism, and Anarchism, with a view to improving our understanding of our own system by comparison and contrast. Focus is on the way socio-economic systems can be understood as social learning processes. Special attention is paid to the philosophy and history of Marxism, the theory of "market-socialism," the history of soviet-type economy, and the current social, political, cultural, and economic challenges of reforming formerly soviet-type systems.

681 Interpretive Economics (3:3:0). An introduction to the principles of economic reasoning, especially as presented in the so-called Austrian or market-process school. Special emphasis is placed on economics as an interpretive discipline and the interpretation of market-process theoretical concepts, such as action.
entrepreneurship, spontaneous order, opportunity cost, capital theory, monetary theory, and business cycle theory, and the application of these theoretical ideas to real world problems. Not for economics credit.

701 Competitive Strategy (3:3:0). This course combines economic theories of competition and monopoly with the analysis of strategic business decisions. It focuses on strategies that involve understanding and working with external market forces instead of trying to control them. Topics include analysis of a firm's core competencies, generic strategies, time and competitive advantage, and the relationship between competitive advantage and economic efficiency.

714 Ethnography of Corporate Culture (3:3:0). Contrary to popular usage, "corporate culture" is not a simple by-product of organization charts and advertising images, but rather the "web of meaning" that endows organizational action with its deepest significance. Like all other instances of local culture, then, corporate cultures must be studied by ethnographic methods of "thick description." After exploring conceptions of corporate culture, this course examines exemplary ethnographies of various organizations—including those of different societies—as preparation for students' own ethnographic fieldwork and writing.

720 Market-Based Management (3:3:0). This course utilizes concepts from market process economics to explore non-authoritarian forms of business organization and management. Topics include the difficulty of centralized planning, the evolution of management theory, corporate culture, teamwork, internal markets, incentives, and organizational learning. The course relies heavily on students' discussion and research to apply economic concepts to practical organizational problems.

731 Advanced Object-Oriented Technology (3:3:0). Previous title: The Economics of Software Re-use. This course is a sequel to SWSE 631 Object-oriented Software Development. This course defines the term object orientation inclusively to surface a far broader range of encapsulation and binding opportunities than programming languages usually provide. Object-oriented design is approached as a matter of making intelligent choices between the radically different kinds of objects and binding mechanisms at different levels of a heterogeneous architecture. This provides the basis for deploying commonly available software development tools in combination: from tightly-coupled, fabrication-intensive tools such as C++ to loosely coupled, assembly-intensive ones such as Smalltalk and Eiffel and others that are not generally thought of as languages, such as Fabrik, Macintosh, and Unix.

692, 792 Special Topics in LRNG (1-3:3:0). Topics in social or organizational change seen from economic, historical, philosophical, literary, organizational, and/or information technology perspectives. New courses that will first appear under this heading include Philosophy of Interpretive Social Science, Culture and Economic Change, and Computational Modeling of Social Learning Processes. Consult program office for descriptions. *May be repeated for credit.*

796 Independent Study (1-12:3:0). Research, analysis, and/or implementation within the realm of social and organizational learning. Work with a member of the program faculty. *May be repeated for credit.*

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**Psychology**

**Faculty**

Allen, John A., Ph.D., North Carolina State University, 1971; Associate Professor (Human Factors Master's Coordinator)

Barocas, Ralph, Ph.D., Pennsylvania State University, 1964; Professor (Director of Clinical Doctoral Program)

Blaha, John, Ph.D., Ohio State University, 1971; Associate Professor (School Psychology Master's Coordinator)

Boehm-Davis, Deborah A., Ph.D., University of California, 1980; Associate Professor

Boneau, Alan C., Ph.D., Duke University, 1957; Professor

Buffardi, Louis C., Ph.D., Kansas State University, 1970; Associate Professor (Director of Applied Experimental Doctoral Program)

Chrosniak, Linda, Ph.D., The George Washington University, 1991; Visiting Assistant Professor

Denham, Susanne, Ph.D., University of Maryland, 1985; Associate Professor

Erdwins, Carol J., Ph.D., Washington University, 1975; Associate Professor

Fleishman, Edwin A., Ph.D., Ohio State University, 1951; D.Sc. (Honorary), University of Edinburgh, 1982; University Professor of Psychology

Flinn, Jane M., Ph.D., The George Washington University, 1974; Associate Professor (Chair)

Friedman, Lee, Ph.D., Rice University, 1986; Associate Professor

Gerton, Manuel, Ph.D., Ohio University, 1972; Director, Psychological Clinic

Gessner, Theodore L., Ph.D., University of Maryland, 1971; Associate Professor

Hershey, Douglas A., Ph.D., University of Southern California, 1990; Assistant Professor

Holt, Robert W., Ph.D., University of Illinois, 1978; Associate Professor

Lehman, Elyse B., Ph.D., The George Washington University, 1970; Associate Professor (Director of Developmental, Physiological, and School Psychology Graduate Programs)

Maddux, James E., Ph.D., University of Alabama, 1982; Associate Professor

Mandes, Evans J., Ph.D., The George Washington University, 1966; Professor

http://catalog.gmu.edu
The human factors engineering specialization trains students in the application of psychological principles to "real-world" problems. Particular expertise can be developed in such areas as human-machine interfaces, training and simulation, and software technology.

The school psychology specialization prepares students for endorsement as fully certified school psychologists in Virginia and in most other states. It is approved by the Virginia Department of Education and meets the standards of the National Association of School Psychologists.

Within the life-span development specialization students may specialize in one of two areas: child development or gerontology. Students interested in gerontology may also earn a graduate certificate (see section on Programs and Additional Graduate Courses in this catalog).

The specialization in experimental neuropsychology emphasizes training in the neurobiological bases of behavior. Students are prepared for doctoral work or employment in government or industry research laboratories.

Admission Requirements

In addition to fulfilling admission requirements for graduate study, applicants are expected to have 15 hours in psychology, including a course in statistics and a laboratory course in psychology; in addition to these courses, School Psychology requires courses in personality or abnormal, developmental, and tests and measurements; results of the Graduate Record Examination taken within the last five years (applicants should plan to take the GRE at least two months before the deadline); three letters of reference from professors or supervisors; and a departmental application. In addition, applicants are asked to submit a biographical statement outlining their background and experience and describing their future goals in psychology. Generally, an overall GPA of 3.0 for the last 60 undergraduate hours, a minimum of 3.25 in undergraduate psychology courses, and combined GRE scores of 1000 or above are required. Work experience, publications, or special recommendations may compensate for deficiencies in other qualifications. M.A. application deadline is April 15. Since the number of students admitted to each program is limited, meeting these minimum requirements does not guarantee admission.

Financial Assistance

Financial assistance is available through graduate assistantships and various forms of grants, loans, or employment. Information and forms for finan-
cial aid are sent to applicants when their application is received. The application deadline for graduate assistantships and the M.A. scholarship is February 15.

Master of Arts in Industrial/Organizational Psychology

Students must complete the following requirements:

- 31 semester hours of graduate credit
- 3 hours from PSYC 701 or 703
- 4 hours of PSYC 553
- 3 hours of PSYC 653
- 12 hours of specialized content: PSYC 636 and 640; 3 hours from PSYC 557, 592, 631, 638, 733, or 736; and 3 hours from PSYC 533, 536, 592, 632, 639, 667, or 735

Practicum or Thesis (optional): 6 hours; thesis only with permission of chair
Electives: no more than 6 hours of department-approved electives from outside the department

Master of Arts in Human Factors Engineering

Students must complete the following requirements:

- 31 semester hours of graduate credit
- 3 hours from PSYC 701 or 702
- 4 hours of PSYC 553
- 3 hours of PSYC 653
- 12 hours of specialized content: PSYC 530 and 645; and 6 hours from PSYC 638, 734, 736, or 737

Practicum or Thesis (optional): 6 hours; thesis only with permission of chair
Electives: no more than 6 hours of department-approved electives from outside the department

Master of Arts in School Psychology

Students must complete the following requirements. Specific course requirements are listed in the School Psychology Brochure, which is available from the Graduate Psychology Office.

- 60 hours of graduate credit
- 50 hours of required courses. Students must pass core courses with a grade of B or better. These courses must be passed prior to the internship and the awarding of the master's degree.

One practicum is required during the second year of training at the Psychological Clinic of the university and the second may be completed in the school system. Students must be screened and approved by the department before they may conduct testing in the Psychological Clinic.

At the conclusion of course work, students may choose to complete a thesis or practical research project concurrent with the internship. All students must complete a full year of internship. An unsatisfactory evaluation at any time by the School Psychology Committee may result in separation from the School Psychology Program.

Master of Arts in Life-Span Development with Specialization in Child Development or Gerontology

Students must complete the following requirements:

- 31 semester hours of graduate credit
- PSYC 702 and 703
- PSYC 553
- 3 hours of research methods: PSYC 650, 653, or 654
- 9 hours of specialized content: PSYC 704; child development specialization, select 6 hours from PSYC 508, 513, 565, or 669; gerontology specialization, select 6 hours from PSYC 614, 684, or 786
- 12 hours of electives (6 hours of thesis only with permission of chair)

Students in both specializations may take 6 hours of approved electives from outside the department.

Master of Arts in Experimental Neuropsychology

31 hours of graduate credit including the following:

- 6 hours of core: PSYC 701 and 702 (704 is recommended)
- 4 hours of quantitative methods: PSYC 553
- 3 hours of research methods/statistics: PSYC 652, 653, 755, or 756
- 6 hours of specialized content: PSYC 558, 559, or 772
- 6 hours of electives
- 6 hours of practicum or thesis (unlike other tracks, practicum or thesis is required)

Nondegree Status

Applicants who qualify for degree status, but who are not applicants for a degree at the university may be admitted to nondegree status. Nondegree status is not intended to be used as a qualifying program for degree status. While consideration may later be given to the application of credits earned toward a degree program while in nondegree sta-
The developmental program emphasizes the application of psychological knowledge and methods in settings such as industry, government, consulting organizations, and research and development organizations. Students develop skills in such areas as human-computer interface design, training, personnel selection, and organizational psychology.

The clinical program focuses on educating clinical psychologists to deal with the unique demands of mental health systems and private practice.

The developmental program has two goals. The primary goal is to train students to do research and teaching on basic processes of development and on problems of development with employment in such settings as universities and teaching hospitals. Another goal is to train students to do applied work in Developmental Psychology (i.e., assessment and evaluation in schools and health care settings). Students accepted for this applied option are required to complete all the courses in the School Psychology M.A. program. Students in the developmental program may focus on early development, aging, or physiological aspects of development.

Admission

Criteria

Entering students are accepted only for fall semesters. The deadline for receipt of all application materials is February 1 of each year. Space in the program is normally limited to 24 new students each year—10 in applied experimental with specializations in industrial/organizational and human factors; 10 in the clinical specialization; and 4 in the developmental specialization. The department does not normally consider applications that fail to meet the minimum criteria of 3.0 undergraduate GPA, 3.25 in psychology course work, and combined GRE scores of 1100. (The clinical specialization does not have minimum requirements.) Applicants who meet this minimum receive continued consideration for the final candidate pool based on experience, letters of recommendation, objective test scores, and interview. No specific set of qualifications guarantees admission.

Documents

Each applicant must provide the Graduate Program with the following materials by February 1 to be considered for admission:

1. Completed Graduate Admission application, with $25 fee.
2. Completed Virginia Domicile Classification form.
3. Completed Department of Psychology application form.
4. All undergraduate and graduate transcripts.
5. Three letters of recommendation (forms are enclosed with general graduate application) from individuals who have first-hand knowledge of the applicant’s academic capabilities and/or work experience.
6. A two- to three-page typewritten personal statement, describing professional goals, past training history, and reasons for seeking the Ph.D.
7. Graduate Record Examinations taken within the last five years and before the February 1 deadline (applicants should plan to take the GRE at least by December since applications cannot be processed until these scores are received). Scores must be sent directly from Educational Testing Service, P.O. Box 955, Princeton, NJ 08541. Only the aptitude scores are required, but scores for the Advanced Test in Psychology may also be submitted.
8. A writing sample (optional) selected from academic papers, publications, or professional reports.
9. Applicants in the final candidate pool are required to participate in an interview.
All materials should be sent directly to the Office of Admissions, George Mason University, Fairfax, VA 22030-4444. Applicants are responsible for ensuring that all materials arrive before the February 1 deadline.

Requirements
In addition to fulfilling the admission requirements, applicants in the program are expected to have the following:

For the Ph.D. in Applied Experimental, at least 15 hours in psychology including a statistics course and a laboratory course. A tests and measurements course is recommended.

For the Ph.D. in Clinical Psychology, at least 15 hours in psychology including a statistics course, a laboratory course, and courses in personality and abnormal psychology. Courses in developmental, physiological, and tests and measurements are desirable.

For the Ph.D. in Developmental Psychology, at least 15 hours in psychology including statistics and a laboratory course in experimental psychology are required. Courses in personality, abnormal, developmental, and tests and measurements are also required for applicants to the School Psychology applied option.

Financial Assistance
Financial assistance is available through graduate assistantships; doctoral fellowships; and various forms of grants, loans, or employment. Information and forms for financial aid are sent to applicants when their application is received by the Graduate School. The application deadline for graduate assistantships and fellowships is February 1.

Transfer Credits
Transfer credits are reviewed by a committee only after acceptance to the Ph.D. program.

Degree Requirements
The program of doctoral training in psychology has four educational components: (1) core courses, (2) upper-level specialty courses, (3) supervised practica, and (4) dissertation.

Core Courses
The core requirement consists of four prosemesters, two quantitative courses, and a course in history and systems. The 12-semester-hour proseminal sequence covers the basic subject matter identified by the American Psychological Association as the sine qua non of doctoral training: biological bases of behavior, social bases of behavior, cognitive-affective bases of behavior, and individual behavior. After successful completion of 30 hours (including core courses), a student is awarded an M.A. in psychology.

Specialty Courses
The 700-, 800-, and 900-level courses provide doctoral candidates with greater depth of study in specific content areas.

Practica
Applied experimental, clinical, and developmental students are expected to perform at a satisfactory level in all practicum placements. The purpose of these practica is to provide a broad range of experiences in settings related to the students' fields of specialization.

Dissertation
The dissertation requirement is designed to demonstrate the student's ability to apply psychological principles to research problems.

Student Evaluation
A student in the doctoral program is evaluated on the basis of grades, comprehensive examinations, and communication skills. In doctoral courses, A and B are the only acceptable grades. In addition to satisfactory course performance, students in the doctoral program must successfully complete comprehensive examinations after they have completed the core requirements. These exams are administered each year in August and January. A student who successfully completes the comprehensive examinations is admitted to doctoral degree candidacy and is then permitted to begin work on a dissertation. The applied emphasis of this program requires the development of communication skills. Written and oral communication skills will be assessed by faculty continuously throughout the program in the form of papers and reports. Students judged deficient in either communication area are informed of the deficiency and may be required to leave the program if the deficiency cannot be remedied.

Highly qualified students interested in other than the traditional tracks listed below may be admitted to work with an individual faculty member.

Applied Experimental
Ph.D. in Human Factors Engineering
Students must complete 88 hours of graduate credit to include the following requirements:

9 hours of core: PSYC 701, 702, and 705
3 hours of core: PSYC 703 or 704
7 hours of quantitative and methods courses: PSYC 553 and 653
12 hours of advanced quantitative and specialized methods including PSYC 645 and 755 and one from PSYC 652, 654 or 756
18 hours of specialized content: PSYC 530, 636, 766, and 768; and 6 hours from PSYC 638, 734, 736, 737, 592/892
12-15 hours of practica and research from PSYC 730 or 897
3 hours of special topics in professional issues: PSYC 892
12 hours of dissertation proposal and dissertation: PSYC 998 and 999 (minimum of 3 hours of 998 and 6 hours of 999)
0-12 hours of electives, 9 of which may be taken outside the department from a department-approved list

Ph.D. in Industrial/Organizational
Students must complete 88 hours of graduate credit to include the following requirements:
9 hours of core: PSYC 701, 703, and 705
3 hours of core: PSYC 702 or 704
7 hours of quantitative and methods courses: PSYC 553 and 653
12 hours of advanced quantitative and specialized methods including PSYC 654 and 754 and one from PSYC 541, 633, 640, 652, 755, or 756
18 hours of specialized content: PSYC 530 and 636; 6 hours from PSYC 631, 638, 733, 736, 592/892; and 6 hours from PSYC 533, 536, 632, 639, 667, 735, 592/892
12-15 hours of practica and research from PSYC 730 or 897
3 hours of special topics in professional issues: PSYC 892
12 hours of dissertation proposal and dissertation: PSYC 998 and 999 (minimum of 3 hours of 998 and 6 hours of 999)
0-12 hours of electives, 9 of which may be taken outside the department from a department-approved list

Ph.D. in Clinical Psychology
The goal of our doctoral clinical training program is to prepare students to work as professional clinical psychologists. The necessary preparatory training requires all of the following:
A primary commitment, on the part of both faculty and students, to applied clinical work.
A broad knowledge of psychology. Clinical psychologists must possess a fundamental knowledge of their field.
Exposure to a variety of approaches in clinical psychology. Clinical psychologists must be conversant with a range of perspectives on psychopathology, assessment, and treatment so that they have an ample repertory of ideas and techniques to bring to bear on the problems they may encounter, and so that they may flexibly and creatively apply such techniques.
Acquisition of skill and experience in the major techniques of assessment and intervention.
Clinical psychologists should acquire skills and substantial experience in clinical settings.
A recognition of the need for skills for provision of service to special populations and opportunities for work with such groups.
The ability to conduct, evaluate, and apply research. Clinical psychologists must be able to appraise relevant findings in their field and apply new discoveries to the clinical problems with which they deal. They must be capable of and committed to evaluating the services they and their colleagues provide.
The Psychology Department is strongly committed to the support of cultural diversity within its programs. This includes both admission and training of students from diverse ethnic and racial backgrounds and exposure of all students to issues of cultural diversity and to work with diverse populations.
Students must complete the following requirements:
12 hours of prosemisars: PSYC 701, 702, 703, and 705
7 hours of quantitative and methods courses: PSYC 553 and 650
11 hours of assessment and basic skills: PSYC 810, 811, and 880
14 hours of supervision: PSYC 881
9 hours of theory and techniques of psychotherapy: PSYC 830, 831, and 832
6 hours of community PSYC: PSYC 840 and 841
6 hours of psychopathology: PSYC 822 and 823
6 hours of externship: PSYC 885
4 hours of professional seminar: PSYC 890
12 hours of electives Dissertation

Ph.D. in Developmental Psychology
15 hours of prosemisars: PSYC 701, 702, 703, 704, 705
7 hours of quantitative and methods courses: PSYC 553, and 650 or 653
12 hours of advanced and specialized methods including:
Quantitative methods: At least 3 hours from PSYC 651, 652, 754, 755, or 756;
Research methods: At least 3 hours from
PSYC 633 or 654; Specialized methods: PSYC 722*, 678*, 684, EDSE 782, or PUAD 640
18 hours of specialized content:
  Foundations: At least 9 hours from PSYC 508, 513, 565, 558, 559, 614, 669, or 772;
  Applications: PSYC 617, 709*, 710*, or 786
9-15 hours research/practicum
6-12 hours electives
12 hours dissertation
3 hours professional seminar
*Course open to only to students in the School Psychology applied option.

Psychology Courses (PSYC)

506 Theories of Personality (3:3:0). Prerequisite: PSYC 220. Comparative review of prevalent theories of personality with special emphasis on their fundamental models and their similarities and differences.

508 Theories of Development (3:3:0). Prerequisite: PSYC 313 or 211. Major theories of infant and child development including works of Piaget, Freud, Erikson, and Spitz.

513 Infant Development (3:3:0). Prerequisite: PSYC 313 or permission of instructor. Examination of current issues, research methods, and clinical evaluation techniques in the field of infant development.

530 Human Factors Engineering (3:3:0). Prerequisite: PSYC 313 or permission of instructor. Examination of complex man-machine interactions found in industry today. Extensive empirical research findings are examined.

533 Seminar in Industrial/Organizational Psychology (3:3:0). Prerequisite: PSYC 230 or PSYC 636 or permission of instructor. Rotating topics (e.g., leadership theories and management development, performance appraisal) announced in advance. May be repeated for credit.

536 The Psychology of Work Motivation (3:3:0). Prerequisite: PSYC 230 or permission of instructor. Examination of the psychological literature of (1) the need, cognitive, and reinforcement theories of motivation; (2) organizational attachment (commitment, absenteeism, and turnover); (3) job design and quality of work issues. Methodological and psychometric issues in the interpretation and evaluation of work motivation research receive particular attention.

541 Survey Research (3:3:0). Prerequisite: PSYC 300 or SOCI 221 or equivalent. This course is designed to acquaint students with the theory, method, and practice of survey research. The course requires students to complete a survey research project.

548, 549 Practicum in Gerontology (3:0:0), (3:0:0). Prerequisite: Completion of three of the required courses in the gerontology certificate program. Practical experience in a gerontological setting under supervision of a qualified professional. 150 contact hours per three semester hours credit.

553 Quantitative Methods I: Advanced Statistics (4:3:2). Prerequisite: A screening test is given on the first evening of the course. This test must be passed to take the course. Topics in introductory psychological statistics from an advanced perspective. Additional topics are included. Lab introduces use of computer packages in data handling and analysis. Required for degree students. Requirement may be satisfied by demonstrating competence on an independent examination.

557 Psychometric Methods (3:3:0). Prerequisite: PSYC 553 or permission of instructor. Examines the concepts of psychological measurement with emphasis on predictor test and criterion development. Reliability, validity, and specialized techniques used to develop tests of ability, interest, and personality are discussed.

558 Neuronal Bases of Learning and Memory (3:3:0). Prerequisite: PSYC 372 or permission of instructor. Examination of neuronal mechanisms involved in learning and memory, in animals ranging from invertebrates to humans.

559 Drugs, Hormones, and Behavior (3:3:0). Prerequisite: PSYC 372 or equivalent or permission of instructor. Overview of the chemistry of behavior, including neurotransmitters, mechanisms of action of therapeutic drugs such as antidepressants, actions of hallucinogens and other psychoactive drugs, chemical theories of memory, and effects of hormones on behavior.

565 Cognitive and Perceptual Development (3:3:0). Prerequisite: Six hours of developmental psychology or permission of instructor. Experimental study of child development. Topics include biogenetic factors in development, sensory processes, learning, perception, motivation, language, and cognitive development.

592 Special Topics (3:3:0). Prerequisite: Permission of instructor. Special topics reflecting interest in specialized areas.

614 The Psychology of Aging (3:3:0). Prerequisite: PSYC 100 and undergraduate or graduate course in aging. Review of the experimental literature in psychology of aging, including intellectual functioning, personality and adjustment, minor and major adjustment problems, and role changes in later life.

616 General Psychopathology (3:3:0). Prerequisite: PSYC 335. Intensive survey of the current psychiatric nomenclature (DSM-III) of major types of psychopathological disturbances.

617 Child Psychopathology (3:3:0). Prerequisite: PSYC 373 or 211 and 325. Intensive survey of major types of psychopathological disturbances of infancy and childhood.


633 Evaluative Research in Psychology (3:3:0). Prerequisite: PSYC 300 or permission of instructor. Examination of research techniques that are specifically designed for graduate students.
635 Topics in Organizational Psychology (3:3:0). Prerequisite: PSYC 230 or 632, or MGMT 610. Selected topics reflecting interest in a specialized area of organizational psychology, announced in advance. Emphasis on recent experimental research literature related to the selected topic.

636 Survey of Applied Psychology (3:3:0). Prerequisite: PSYC 300 or permission of instructor. Intensive survey of the historical and current issues in the major areas of applied (nonclinical) psychology: personnel, social-organizational, human factors/engineer psychology.

638 Training: Psychological Contributions to Theory, Design, and Evaluation (3:3:0). Prerequisite: PSYC 636 or permission of instructor. Focus on the application of learning theories derived from psychological research in the development of training models and techniques of skill acquisition. Discussion of research designs and empirical results appropriate to training evaluation.

639 Organizational Processes (3:3:0). Prerequisite: PSYC 230 or PSYC 632. Course trains students at both a theoretical and an experiential level in organizational processes. Includes intrapsychic, interpersonal, intragroup, and intergroup behavior as they exist in the context of organizational settings.

640 Techniques in Industrial/Organizational Psychology (3:3:0). Prerequisite: PSYC 300 or permission of instructor. A skill-oriented course that enables students to construct instruments and perform functions critical to both researchers and practitioners in I/O psychology. Course focuses on conducting job analysis interviews, developing and scoring task inventories, utilizing critical incident and KSAO methods, and constructing performance appraisal and selection instruments.

645 Research Methods in Human Factors Engineering (3:3:0). Prerequisite: PSYC 530 and 553. Survey of the methods and techniques in human factors presented with a hands-on approach. Topics include systems analysis techniques, accident/incident analysis techniques, reliability/error analysis, and theoretical and statistical design of experiments.

650 Clinical Research Methods (3:3:0). Open only to degree students. Prerequisite: PSYC 533 or permission of instructor. Overview and discussion of research design and strategy for the conduct of research on human adjustment processes.

652 Quantitative Methods II: Analysis of Variance (3:3:0). Prerequisite: PSYC 300 and either 304, 305, or 309. Basic concepts in experimental design, fundamental assumptions in analysis of variance, analysis of variance and covariance designs and multiple comparison tests are also reviewed.

653 Research Methods I: Experimental and Research Design (3:3:0). Open only to degree students. Prerequisite: PSYC 553. Overview of the various research designs used in psychology. The use of these designs in applied settings is discussed.

654 Naturalistic Methods in Psychology (3:3:0). Prerequisite: PSYC 300 and either 304, 305, or 309. Theory and techniques involved in studying people in their natural environment. Primary emphasis is on quasi-experimental designs and methods of systematic observation.

667 Small Group Behavior (3:3:0). Prerequisite: PSYC 231. Theories, methods, and topics relevant to individual behavior in a small group setting. Effects of the individual on the group, effects of the group on the individual, and interaction effects among individuals.

669 Social and Personality Development (3:3:0). Prerequisite: 6 hours of developmental psychology or permission of instructor. Survey of socialization theory and research relevant to infant and child social relationships, development of affective and altruistic behaviors, sex role development, moral development, parent and adult influences, social class, and cultural influences.

671 Role and Function of the School Psychologist (3:3:0). Open only to school M.A. students or by permission of instructor. Roles and functions of the school psychologist within the educational environment. Certification and ethical standards of the school psychologist are also considered together with current issues and trends.

673 Consultation and Behavior Modification (3:3:0). Prerequisite: Open to practicing school psychologists and students in school psychology or by permission of instructor. Examines the theory and practice of behavior modification and consultation in the school environment.

678 Topics in School Psychology (1-6:3:0). Open to practicing school psychologists and advanced students in school psychology or by permission of instructor. Selected topics reflecting interest in a specialized area of school psychology. Content varies.

684 Psychological Counseling Techniques (3:3:0). Prerequisite: Graduate standing or permission of instructor. Application of various counseling techniques generated by current approaches to counseling. Students will be given experience in techniques used in contemporary practice.

701 Cognitive and Affective Bases of Behavior (3:3:0). Open only to degree students. A survey of concepts in learning, cognitive, and affective processes, including theories and supporting data and their influences on behavior.

702 Biological Bases of Behavior (3:3:0). Open only to degree students. Survey of physiological bases of behavior, including such topics as neural conduction and role of specific neurotransmitters.

703 Social Bases of Behavior (3:3:0). Open only to degree students. Survey of social influences on behavior, including group processes, person perception, and attitude formation.

704 Life-Span Development (3:3:0). Open only to degree students. Survey of theories and research regarding life-span development and personality formation.

705 Historical and Philosophical Issues in Psychology (3:3:0). Open only to degree students. Important historical and systematic approaches to psychology and their relationship to the philosophy of science, structure of theory, and philosophical issues in psychology.

709 The Measurement of Intelligence (4:3:2). Open only to M.A. school students. Permission of department required. Prerequisites: PSYC 617 or 822 and PSYC 520 or equivalent. Administration, scoring and interpretation of
the major infant, child and adult intelligence tests, with emphasis on individual tests. Development of IQ tests; theories of intelligence; and current trends and developments in intellectual assessment.

710 Psychological Assessment (4:3:2). Open only to M.A. school students. Prerequisite: Satisfactory completion as certified by the School Psychology Committee of PSYC 709, 822 or 810, and permission of department. Study of major instruments used in clinical assessment; their nature, problems, and predictive value; administration and scoring of the major techniques for evaluation of personality and orthogonality; principles of interpretation of these procedures.

722 Advanced Child Assessment (4:3:2). Open only to Ph.D. or M.A. school students. Prerequisite: PSYC 709 and 710 or PSYC 810 and 811 and five intellectual assessments at the Psychological Clinic, and permission of department. Problems involved in diagnostic assessment of children with various handicapping conditions such as brain dysfunction, learning disabilities, retardation, and emotional disturbances.

730 Practicum in Applied Psychology (1-6:0:0). Open only to degree students in psychology. Prerequisite: Permission of department. Apply in writing to the area coordinator 60 days prior to the beginning of the semester. Practical experience in an organizational setting as assigned. Psy.D. students may repeat this course to a maximum of 15 hours; M.A. students to a maximum of 6 hours. Course is graded S, NC.

731 Motor Skills and Human Performance (3:3:0). Prerequisite: PSYC 530 or graduate experimental course in psychology or PSYC 701. A seminar in motor skills and human performance focusing on issues and topics of interest to human factors students (e.g., feedback, motor programs, tracking, discrete and sequential movements, etc.).

732 Attention and Performance (3:3:0). Prerequisite: PSYC 530 or graduate experimental course in psychology or PSYC 701. A human factors seminar focusing on theories, concepts, issues, methods, techniques, and research in the area of attention and performance.

733 Issues in Personnel Psychology (3:3:0) Prerequisite: PSYC 636 or permission of instructor. Examination of the psychological literature on (1) job analysis, (2) job evaluation and compensation, (3) performance appraisal, (4) training, and (5) EEOL selection issues. Methodological and psychometric issues in the interpretation and evaluation of personnel psychology research receive particular attention.

734 Seminar in Human Factors Engineering (3:3:0). Prerequisite: PSYC 530 or graduate experimental course in psychology or PSYC 701. Rotating topics (e.g., systems theory, human factors in computer systems, office automation) announced in advance. May be repeated for credit.

735 Psychological Perspectives on Organizational Development (3:3:0). Prerequisite: Three graduate credits in I/O psychology or permission of instructor. Theories and methods in I/O psychology as they relate to organizational change and development. Actual training in organizational diagnosis and change through supervised field work.

736 Research in Human Performance Assessment (3:3:0). Prerequisite: 3 graduate credits in I/O psychology or permission of instructor. This seminar reviews taxonomic issues in the description and prediction of human performance. Concepts and methods in assessment of human abilities are discussed. Emphasis is on the cognitive, psychometric, physical, and sensory-perceptual capacities required to perform human tasks.

737 Psychology of Human-Technology Interfaces (3:3:0). Prerequisite: PSYC 530 or permission of instructor. Investigation of psychological factors as they affect current human and technology interfaces of all kinds (e.g., aircraft traffic control systems, nuclear power plant control consoles, and personal computer-human interfaces). Considerable capabilities to minimize error and to optimize on a number of dimensions such as ease of learning, "user-friendliness," etc. Current literature is reviewed in depth, and practical applications are presented and discussed, including applications that serve as examples of design flaws.

738 Simulation and Training (3:3:0). Prerequisite: PSYC 530 or graduate experimental course in psychology or PSYC 701. A human factors seminar focusing on training issues from the perspective of the human factors professional. Special attention is given to the role of hardware and simulation techniques in the design of technical training programs.

750 School Psychology Practicum (1-6:0:0). Open only to M.A. school students. Prerequisite assessment courses: PSYC 709, 710, and 722; and testing experience in the Psychological Clinic. Apply in writing for permission of department 60 days prior to the beginning of the semester. Practical experience in school psychology.

754 Quantitative Methods III: Psychological Applications of Regression Techniques (3:3:0). Prerequisite: PSYC 553. Psychological applications of regression techniques will be reviewed in a variety of contexts including experimental, field, and survey settings.

755 Statistical Packages for Psychology (3:3:0). Prerequisite: PSYC 553, 652 or 653, or equivalent. Introduction to manipulation techniques of statistical analysis appropriate for applied problems in psychology with three widely used statistical packages—BMD, SPSS, and SOUPAC.

756 Quantitative Methods IV: Multivariate Techniques in Psychology (3:3:0). Prerequisite: PSYC 553 or equivalent; PSYC 755 recommended. Survey of multivariate statistical techniques as applied to psychological research. Emphasizing analysis of complex designs and interpretation of multivariate data analyses resulting from computer processing.

766 Sensation and Perception (3:3:0). Prerequisite: PSYC 309. Important trends and issues related to sensory and perceptual methods, process, models, and theories are surveyed. Classic papers and other original source materials of both historical and contemporary interest are emphasized.

768 Learning, Memory, and Cognition (3:3:0). Prerequisite: PSYC 304, 305, or 309. Discussion of past and current theories and research in the areas of learning, memory, and cognition. Areas of focus include verbal learning, organization in memory, concept identification, and the nature of human mental processes that en-
able the acquisition, organization, and use of knowledge, such as attending, remembering, and thinking.

768 Topics in School Psychology (1-6:0:0). Open to practicing school psychologists and advanced students in school psychology or by permission of instructor. Selected topics reflecting interest in a specialized area of school psychology. Content varies.

772 Seminar in Behavioral Assessment of Toxic Effects (3:3:0). Prerequisite: Graduate course in physiological psychology or animal behavior and a course in drugs and behavior or environmental hazards, or permission of instructor. Intensive introduction to methodology of behavioral assessment of adverse drug or chemical effects. In-depth discussion of major research in behavioral toxicology, such as the effects of heavy metals, inhalants, gases, and abused drugs on behavior.

786 Assessment and Treatment in Gerontology (3:3:0). Prerequisite: Course in the psychology of aging. PSYC 320 and PSYC 423, or equivalent courses. Functional assessment of older adults including the conceptual and methodological problems involved. Intervention strategies with older adults are examined, including interviewing, group work with older persons, milieu therapy, reality therapy, and the design of supportive environments.

790 School Psychology Internship (3-12:0:0), formerly PSYC 765 and EDUC 665. Prerequisite: Completion of required courses in school psychology and permission of program coordinator. One-school-year supervised field experience where the advanced school psychology student functions as a full-time staff member within a school system. Student completes a paper on a practical research project involving an alternative school psychology role in the school system. Enrollment is for a total of 9 hours (thesis option) or 12 hours (nonthesis option) in increments of 3 hours according to placement. Students enrolled in PSYC 799 are not required to complete the practical research project.

792 Practicum in Developmental and Physiological Psychology (1-6:1:0). Prerequisite: Three hours of graduate developmental or physiological psychology. Open to degree students in developmental or physiological M.A./Ph.D. programs. Interested students must apply to the area coordinator 60 days before registration. This course provides supervised experience in developmental or physiological settings, either within or outside the university.

799 Master's Thesis (1-6:0:0). Research on approved master's thesis topic under the direction of a thesis committee with approval of the chair.

800 Studies for the Doctor of Philosophy in Education (variable credit). Prerequisite: Ph.D. admission to study in psychology. Program of studies designed by student's discipline director and approved by student's doctoral committee, which brings the student to participate in the research of the discipline director and results in a paper reporting the original contributions of the student. The paper is presented in a subsequent D.A.Ed. summer seminar. Enrollments may be repeated.

810 Intellectual Assessment (4:3:2). Open only to Ph.D. clinical students. Course covers administration, scoring, and interpretation of individual adult and child assessment procedures. Problems of assessment and theories of intelligence are reviewed.

811 Personality Assessment (4:3:2). Open only to Ph.D. clinical students. Prerequisite: PSYC 810. Course covers administration, scoring, and interpretation of adult and child projective and objective tests of personality functioning.

812 Advanced Assessment (4:3:2). Open only to Ph.D. clinical students. Prerequisite: PSYC 810 and 811. Course covers the interpretation and integration of multiple test findings for purposes of differential diagnosis of mental disorders.

816 Neuropsychological Assessment (3:3:0). Prerequisite: PSYC 702, 810 and 811, or 709 and 710. Course explores the nature of brain-behavior relationships in adults and children. It concentrates on the major assessment techniques including Luria Nebraska, Halstead-Reitan, and Michigan Neuropsychological batteries.

822, 823 Seminar in Experimental Psychopathology I, II (3-3:0), (3:3:0). Open only to Ph.D. clinical students. A seminar that provides an intensive integration of the psychopathology literature with mastery of the current psychiatric nosology.

830 Theories of Psychotherapy (3:3:0). Open only to Ph.D. clinical students. Prerequisite: PSYC 822 and 823. Review of the major approaches to psychotherapy, including the psychoanalytic, humanistic-existential, and cognitive-behavioral approaches. Students study individual, group, and family therapy from each of these perspectives.

831 Behavior Therapy (3:3:0). Open only to Ph.D. clinical students. Survey of procedures for altering emotional distress and behavioral dysfunction within the conceptual framework of social cognitive theory and cognitive behavioral therapy.

832 Group and Family Psychotherapy (3:3:0). Open only to Ph.D. clinical students. Prerequisite: PSYC 822, 823, and 830. Introduction to the major models of group and family functioning as well as current approaches to group and family psychotherapy. In addition to formal course work, students will engage in experiential group exercises.

840, 841 Community Psychology: Theory and Practice (3:3:0) (3:3:0). Open only to Ph.D. clinical students. Introduction to the history, concepts, and practice of community psychology. Course work and practice focus on community mental health theory, consultation, prevention, program planning and evaluation, and human service management.

880 Clinical Foundations (3:3:0). Open only to Ph.D. clinical students. Focus on basic clinical/interactional skills, including basic therapy skills, psychodiagnostic interviewing, mental status exam, and interview management skills. Includes exposure to a variety of clinical settings and clients.

881 Assessment and Psychotherapy Supervision (3:0:0). Open only to Ph.D. clinical students. Prerequisite: Permission of clinical director. The course entails the administration, scoring, and interpretation of psychological tests for adults and children in a professional setting under supervision. Must be repeated three times for 12 hours of credit and may be repeated for up to 18 hours of credit.
885 Clinical Externship (3:3:0). Open only to Ph.D. clinical students in the third year of training. Students are placed in a local mental health facility, where they will have the opportunity to develop their psychodiagnostic and psychotherapy skills under the supervision of a clinical psychologist. Presentation of clinical material at department seminars is also required. May be repeated for credit.

890 Seminar in Professional Psychology (1:1:0). Prerequisite: Doctoral students in psychology. Each section limited to students in one track of Ph.D. program. See area coordinator for requirements for section in each track. Course is graded S, NC. May be repeated for credit.

892 Special Topics in Psychology (3:3:0). Open only to Ph.D. students. Selected topics reflecting specialized areas in psychology. Content varies. May be repeated.

897 Directed Reading and Research (1-3:3:0). Independent reading on a topic agreed to by a student and a faculty member. May be repeated once, except it may not be repeated for degree credit by students who also register for PSYC 799. (Clinical Ph.D. students may not take this for elective credit.)

998 Doctoral Dissertation Proposal (variable credit). Work on a research proposal that forms the basis for a doctoral dissertation. May be repeated. No more than 24 credit hours of PSYC 998 and 999 may be applied to doctoral degree requirements.

999 Doctoral Dissertation (variable credit). Research on an approved dissertation topic under the direction of dissertation committee. May be repeated. No more than 24 credit hours of PSYC 998 and 999 may be applied to doctoral degree requirements.

Public Administration

Faculty
Brown, Brack, Ph.D., Syracuse University, 1977; Associate Professor
Clark, Robert P., Ph.D., Johns Hopkins University, 1966; Professor
Cole, John D. R., M.A., University of Redlands, 1951; M.P.A., University of Southern California, 1983; Professor of Public Administration
Conlan, Timothy J., Ph.D., Harvard University, 1982; Associate Professor
Dawisha, Adeed, Ph.D., London School of Economics, 1974; Professor
Friedlander, Melvin A., Ph.D., The American University, 1982; Associate Professor
Gifford, Jonathan L., Ph.D., University of California, Berkeley, 1983; Assistant Professor
Gortner, Harold F., Ph.D., Indiana University, 1971; Professor

Hart-Nibbrig, Nand E., Ph.D., University of California, Berkeley, 1974; Associate Professor
Heclo, Hugh, Ph.D., Yale University, 1970; Robinson Professor
Katz, Mark N., Ph.D., Massachusetts Institute of Technology, 1982; Associate Professor
Knight, Barbara B., Ph.D., The George Washington University, 1971; Associate Professor
Mahler, Julianne G., Ph.D., State University of New York, Buffalo, 1976; Associate Professor
Mitchell, Christopher R., Ph.D., University of London (University College), 1977; Professor
Nguyen, Hung M., Ph.D., University of Virginia, 1965; Associate Professor
Paden, John, Ph.D., Harvard University, 1968; Robinson Professor
Pfiffner, James P., Ph.D., University of Wisconsin-Madison, 1975; Professor
Regan, Priscilla M., Ph.D., Cornell University, 1981; Assistant Professor
Rubenstein, Richard E., J.D., Harvard Law School, 1963; Professor
Sacco, John F., Ph.D., Pennsylvania State University, 1973; Associate Professor
Sandle, Dennis J. D., Ph.D., University of Strathclyde, 1979; Associate Professor
Travis, Toni-Michelle C., Ph.D., University of Chicago, 1983; Associate Professor
Wan, Ming, Ph.D., Harvard University, 1993
White, Louise G., Ph.D., The American University, 1974; Professor (Department Chair)

Master of Public Administration, M.P.A.

The Master of Public Administration program falls within the Public and International Affairs Department. The program increases students' competence in public service careers by improving their understanding of the processes of management and policy analysis within the public bureaucracy and the public policy system. As the standard professional credential in the public service field, the M.P.A. is designed to serve the career needs of those filling or expecting to assume responsible managerial and staff positions in public service in a wide variety of organizational settings.

All courses are available in the evening. While most are taught by a distinguished full-time faculty, part-time instructors who hold advanced de-
Degrees and positions of responsibility in the public sector teach some classes. Thus, a good balance between theory and practice is maintained.

Admission Requirements

Applicants must submit:
1. A grade point average of at least 3.0 on a 4.0 scale for the last 60 hours of undergraduate work or in the major field of study;
2. Three letters of recommendation (letters should assess the applicant’s academic and career potentials);
3. A resume detailing work and civic activities undertaken if the applicant is employed;
4. A statement of educational and professional goals;
5. Training certificates or other work-related or postbaccalaureate training information (no credit is given for this experience, but the information is used in making admissions decisions and to plan the student’s program);
6. GRE General Test scores (not required of persons who have completed another graduate degree, e.g., master’s, J.D.). GMAT or LSAT scores may be substituted for the GRE.

Degree Requirements

The M.P.A. program requires 42 semester hours of graduate course work. In addition, a student must demonstrate proficiency in statistics by completing an appropriate course or by passing an appropriate exam.

The structure of the program includes two sets of required courses:
1. General management theory and practice.
2. Methodology courses covering data analysis and decision-making techniques.

After completing these courses, students select among three concentrations:
1. Public management that includes courses in financial management, human resources management, program planning, and evaluation;
2. Policy studies that include courses in substantive policy areas as well as further work in analysis;
3. International management that includes study in development management, international security, economics, and technology transfer.

Students may also design, with advisement, a concentration tailored to their particular career needs. All students conclude the program by taking a course on the ethical dimensions of public administration.

Courses Outside the Public Administration Program

Courses from another graduate program of this university may be allowed, provided they are from a related field and prior approval is received from the faculty adviser and director of the public administration program.

With the approval of the student’s adviser, the chair of the Department of Public and International Affairs, and the dean of the Graduate School, graduate credits earned at other accredited colleges or universities may be accepted for transfer. Normally, a maximum of 6 hours of graduate credit may be transferred at the time of admission.

Program Requirements

All students are required to take seven M.P.A. core courses that provide a common body of knowledge about public administration, its political environment, and the special tools required in its study and practice. These courses are:

Management Theory and Practice courses:
- PUAD 502 Theory and Practice of Public Administration
- PUAD 620 Organization Theory and Management Behavior
- PUAD 660 Public Financial Management

Analytic and Decision-Making Skills courses:
- PUAD 610 Computer Uses in Managing Public Organizations
- PUAD 611 Methods of Analysis for Public Managers I
- PUAD 612 Methods of Analysis for Public Managers II

Ethical Dimensions course:
- PUAD 700 Ethical Dimensions of Public Administration (to be taken during last semester)

Then select one of the following concentrations:

Public Management Concentration:
- PUAD 621 Principles and Practices in Government Organization and Management
- PUAD 640 Public Policy Process
- PUAD 670 Personnel Administration in the Public Sector

Plus three of the following:
- PUAD 615 Administrative Law
- PUAD 622 Program Planning and Implementation
- PUAD 742 Program and Policy Evaluation
- PUAD 750 Policy Governance
- PUAD 661 Public Budgeting Systems
- PUAD 663 Managerial Accounting for Public

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Administrators
PUAD 671 Public Employee Labor Relations
PUAD 729 Issues in Public Management
DESC 601 Managerial Microeconomics
FNAN 601 Managerial Microeconomics
LRNG 612 Technology and the Regulatory Process
LRNG 720 Market-Based Management

Policy Studies Concentration:
PUAD 640 Public Policy Process
PUAD 643 Public Policy Research
PUAD 741 Policy Analysis

Plus three of the following:
PUAD 622 Program Planning and Implementation
PUAD 727 Risk Assessment and Decision Making
PUAD 742 Program and Policy Evaluation
PUAD 644 Public Policy Models
PUAD 732 Managing Technology Transfer
PUAD 733 Managing International Competition and Cooperation
PUAD 749 Issues in Public Policy
PUAD 750 Policy Governance
INFT 500 Quantitative Foundations for Information Systems Analysis
OR 540 Management Science
PUBP 818 Methods in Policy Analysis and Research
PUBP 819 Managerial Economics/Policy Analysis

International Management Concentration:
PUAD 504 Managing in the International Arena: Theory and Practice

Plus three of the following:
PUAD 622 Program Planning and Implementation
PUAD 632 Managing Development Programs and Projects
PUAD 634 Management of International Security
PUAD 731 International Political Economy
PUAD 732 Managing Technology Transfer
PUAD 733 Managing International Competition and Cooperation
PUAD 738 Issues in International Security
PUAD 739 Issues in International Management

When available, take section of courses designated for international issues.

Electives
Students will have 3-6 hours of electives. These can be chosen from courses throughout the M.P.A. curriculum or from relevant offerings throughout the university. Students must consult with an adviser to gain approval for electives. A thesis option and an internship are also available.

Doctoral Study in Public Administration
Faculty members in the Department of Public Affairs together with faculty in the Institute of Public Policy conduct the Governance and Public Management Policy Track of the Ph.D. Public Policy Program. See the Public Policy program in this catalog. The purpose of the track is to provide students with a sophisticated understanding of the values, processes, and institutions of public policy making in the United States. Doctoral students wishing to concentrate their studies in the areas of public management, governmental institutions, or policy processes might take this track. Courses for the Governance and Public Management Policy Track include PUAD courses at the 700 and 800 levels as well as designated PUBP courses offered by the Institute of Public Policy. Faculty from the Institute of Public Policy and the Department of Public Affairs teach courses in both programs.

Public Affairs Course (PUAF)
850 Studies for the Doctor of Philosophy in Education (variable credit). Prerequisite: Admission to the Ph.D. in Education program to study in public affairs. Program of studies designed by student's discipline director and approved by student's doctoral committee, which allows the student to participate in the research of the discipline director and results in a paper reporting the original contributions of the student. Enrollment may be repeated.

Public Administration Courses (PUAD)
502 Theory and Practice of Public Administration (3:3:0). Prerequisite: Graduate standing or permission of department. Survey and review of the field of public administration to include development of U.S. governmental administration, theories of administrative organization and behavior, administrative processes, management of people and money, administrative responsibility, and the public policy-making/public policy-implementation nexus.

504 Managing in the International Arena: Theory and Practice (3:3:0). Prerequisite: Acceptance in M.P.A. or permission of department. Theoretical and empirical examination of the international system that both affects, and is affected by, the decisions, behaviors, and subsystems of state and nonstate (organizational) actors.

610 Computer Uses in Managing Public Organizations (3:3:0). Prerequisite: Admission to graduate study or permission of instructor. Examines how managerial and analytical functions in public organizations can be performed via end-user computer applications. Provides in-depth coverage of selected data base and decision support packages. Gives attention to logic and integration of application software.
611 Methods of Analysis for Public Managers I (3:3:0). Prerequisite: Statistics proficiency and PUAD 610. Techniques and skills available to, and used by, public managers to solve policy-related problems or to analyze policy-related data. Focus on problem definition, research design, and problem solving under conditions of uncertainty in the public sector.

612 Methods of Analysis for Public Managers II (3:3:0). Prerequisite: PUAD 611. Techniques and skills available to, and used by, public managers to solve policy-related problems or to analyze policy-related data. Focus on data gathering and analysis, use of computers, systems theory and analysis, and operations research.


620 Organization Theory and Management Behavior (3:3:0). Consideration of behavior within the context of public organization and the consequent changes required in management. Focus on such issues as perception, attitude formation, motivation, leadership, systems theory, communication and information flow, conflict theory, and decision theory.


622 Program Planning and Implementation (3:3:0). Prerequisite: PUAD 620. Practical exploration of operationalizing public legislation in the American federal system. Construction of organizational apparatus, development of operational plans, and systems of control and evaluation necessary to implement government programs. Emphasis on coordination of tasks and resources required for effective program implementation.

632 The Political Economy of Development (3:3:0). Prerequisite: PUAD 502. Design, implementation, and evaluation of development projects and programs, with emphasis on management and organizational strategies and processes to accomplish development goals. Particular attention to socioeconomic-political environments and organizations' structures and routines in the Third World context.


635 Selected Problems of Development (3:3:0). Prerequisite: Graduate standing or permission of department. Third World development problems, including development management, a new international economic order, foreign aid, multinational corporations, and international organizations. May be repeated with permission of department.

640 Public Policy Process (3:3:0). Processes of making public policy, including detection of public issues, consideration of alternatives, and adoption and implementation of solutions. Highlights the major actors in the policy process, as well as the environment within which they work.

643 Public Policy Research (3:3:0). Examines major concepts, designs, and methods used in applied policy research. Explores the underlying logic of policy inquiry, and the use of quantitative and qualitative techniques. Includes case applications of each of the major styles of inquiry, and the steps in planning, administering, and reporting policy research.


651 Administration in the Commonwealth of Virginia (3:3:0). Cultural, demographic, constitutional, and socioeconomic environment of public administration in Virginia. Governmental agencies, legislative functions, executive leadership, staff agencies, state-local relationships, intrastate regionalism, and administrative customs peculiar to Virginia.

660 Public Financial Management (3:3:0). Survey of public financial management, including governmental accounting, budgeting, revenue administration, cash and investment management, debt management, procurement, and risk management.


663 Advanced Studies in Public Financial Management (3:3:0). Managerial concepts and techniques used in decision making by nonaccountant public administrators, both in the internal management of their governmental units and in that government's financial relations with private sector firms.


671 Public Employee Labor Relations (3:3:0). Prerequisite: PUAD 670 or permission of department. Public employee labor relations, including unionization, representational elections, bilateral policy negotiations, administration of agreements, management rights, union and membership security, the strike issue and grievance procedures, impact on public administration, and assessment of future developments.

672 Methods in Public Personnel Management (3:3:0). Prerequisite: PUAD 670. Introduction to some of the more important basic methods used in public personnel management and administration, including workforce planning and analysis, job evaluation and
compensation; examining and selection; workforce management; and training and development.

700 Ethical Dimensions of Public Administration (3:3:0). To be taken within the final two semesters of the M.P.A. program. Topics of ethical dimensions including constitutionalism, democratic values and traditions, standards of conduct and ethics, and conflicting values of public officials and social equity of public programs.

701 Cross-Cultural and Ethical Dimensions of International Management (3:3:0). Prerequisite: PUAD 504. Examination of normative issues in management of programs in international context. Emphasis on interplay of cultural, sociopolitical, legal, and ethical factors and on management and policy problems arising from conflicting goals, values, and inequities among nations and regions.

727 Seminar in Risk Assessment and Decision Making (3:3:0). Examination of decision making under risk and uncertainty. Reading introduces the major intellectual perspectives on the topic and are drawn from a variety of disciplines, including biology, economics, law, and psychology. Emphasis on the making of actual decisions under certainty.


731 International Political Economy (3:3:0). Theories and issues pertaining to the production and distribution of wealth and power in the modern world. Explores the history of political economy as a field of study and applies concepts to current issues.

732 Managing Technology Transfer (3:3:0). Examination of how governments, businesses, and international organizations manage cooperation and competition in the transfer of technology. Includes case studies on East-West, West-West, and North-South relations.

733 Managing International Competition and Cooperation (3:3:0). Alternative perspectives on the role of the public sector in stimulating international economic development. Emphasis on the role that governing institutions can play both to promote the productivity of businesses within the United States, and to facilitate cooperation in the international arena.

738 Issues in International Security (3:3:0). Prerequisite: PUAD 504. Examines issues of topical interest in the general area of international security. Possible topics include nuclear strategy, disarmament, American defense policy, international terrorism.

739 Issues in International Management (3:3:0). Examination of significant current issues in public international management. Emphasis on practical applications of theories and analysis of problems in the public international management arena. Competence in improving management practices in international management settings.

741 Policy Analysis (3:3:0). Prerequisites: PUAD 610, 611, and 612. Introduces concepts and techniques for formal policy analysis, develops skills in applying policy analysis techniques through case studies, and explores the legitimacy and utility of policy analysis.

742 Program Evaluation (3:3:0). Prerequisite: PUAD 611. Practical exploration of assessment techniques utilized in studying the results of public programs and policies, including evaluation of implementation strategies and impacts. Course draws on multiple approaches such as cost analysis, field research, experiments, productivity analysis, surveys and questionnaires, and qualitative studies.


750 Changing Patterns of Governance (3:3:0). Examines broad trends in governance, including both the theory and practice of various governance choices. These choices include privatization, decentralization of governmental activity, grants-in-aid and growth of mandates, changing role of state governments, proposals for reforming federalism, and regulatory reform.

759 Issues in Local Government Administration (3:3:0). Contemporary problems—such as land use, transportation, economic development, growth management, and environmental impact—in the management of counties, cities, towns, and special districts, with emphasis on local government in Virginia.

794 Internship (2-3:0:0). Prerequisite: Open to authorized graduate majors only; contact the department one semester prior to enrollment. Internships are work-study programs with specific employers. Credit is determined by the department.

796 Directed Readings and Research (3:0:0). Prerequisite: Permission of department and instructor. Reading and research on a specific topic under the direction of a faculty member. Written report required; oral examination over the research and report may be required. May be repeated once.

798 Research Project (3:0:0). Prerequisite: PUAD 795 and permission of department. Completion of an original research project related to public sector administration. On the basis of the approved research design each student prepares and defends a final report that is the result of the research project. Final report must be approved by the Department of Public and International Affairs.

801 Philosophical Theories of Communities and Their Administration (3:3:0). Prerequisite: Acceptance into doctoral program. Philosophical understandings of political states, authority, and community. Emphasis on theories that have been most influential in the tradition of Western thought and that serve as a foundation for public administration.


803 Postwar Analytic Approaches to Public Administration (3:3:0). Prerequisite: PUAD 801, 802, or permission of instructor. Examination of the different analytical approaches to public administration that became signifi-
cant with the rise of behavioralism. Includes attention to research implications and critiques of the approaches.

804 Conduct of Social Inquiry I: Research Design (3:3:0). Prerequisite: PUAD 801, 802, or permission of instructor. Assumptions and logic of different research designs and data collection techniques and research as an exercise in theory building. Designed to enable candidates to do original research and to critique the research of others.


820 Doctoral Seminar in Leadership (3:3:0). Prerequisite: Permission of instructor and adviser. Leadership in the political and administrative world with special emphasis on the leader’s social influence, intellectual guidance, and role in policymaking and organizational creation and direction. Inquiry is also made into the effect of internal and external forces upon leadership styles and effectiveness.

821 Doctoral Seminar in Theories of Organization and Bureaucracy (3:3:0). Prerequisite: PUAD 620 or equivalent, or permission of instructor. Examination of key issues in organization theory and behavior. Issues include organization design, interorganizational coordination, intelligence and decision-making systems, leadership and motivation theories, and theories or organizations as agents of political and social change. Case studies are used.

822 Doctoral Seminar in Change, Innovation, and Public Administration (3:3:0). Prerequisite: Permission of instructor and adviser. Analysis of economic, political, social, and technological change as it influences and is influenced by public administration. Nature of change, innovation, and creativity in society with the object of enhancing student sensitivity to and knowledge about the future. Ways for designing the structures and procedures of public organizations so they can adapt to change.

823 Doctoral Seminar in Policy Analysis and Evaluation (3:3:0). Prerequisite: Permission of instructor and adviser. Quantitative and qualitative approaches and techniques used in recognizing, defining, and assessing public issues and problems. Conceptualizing and assessing problems, employing and judging the strengths and weaknesses of tools and techniques, and identifying and categorizing the information required for competent analysis and evaluation.

824 Models of Policy Design and Implementation (3:3:0). Prerequisite: Permission of instructor or adviser. Approaches to the analysis of public policy, including the role of values in policy analysis, assumptions in modeling policy problems, the organizational context of policy studies, and institutions for designing and implementing policies.

825 Doctoral Seminar: Current Issues in Public Management (3:3:0). Prerequisite: Permission of instructor and adviser. Major issues confronting public management, such as civil service, leadership, and management reviews. Analysis of current proposals for reform of public management.

826 Doctoral Seminar in Future Issues in Public Administration (3:3:0). Prerequisite: Permission of instructor and adviser. Examination of an emerging issue or issues confronting public administration in the 1990s with an emphasis on issues that raise important analytic and theoretical questions. Emphasis on current literature and research on this issue.

830 Doctoral Tutorial in Leadership (1-3:0:0). Prerequisite: Permission of instructor and adviser. Individualized, intensive study of particular features of leadership. Study is arranged with and supervised by the appropriate tutorial professor.

831 Doctoral Tutorial in Theories of Organization and Bureaucracy (1-3:0:0). Prerequisite: Permission of instructor and adviser. Individualized, intensive study of particular features of theories of organization and bureaucracy. Study arranged with and supervised by tutorial professor.

832 Doctoral Tutorial in Change, Innovation, and Public Administration (1-3:0:0). Prerequisite: Permission of instructor and adviser. Individualized, intensive study of particular features of change, innovation, and public administration. Study arranged with and supervised by tutorial professor.

833 Doctoral Tutorial in Analysis and Evaluation (1-3:0:0). Prerequisite: Permission of instructor and adviser. Individualized, intensive study of particular features of analysis and evaluation. Study is arranged with and supervised by the tutorial professor.

840/PUBP 840 Research Seminar in Policy Governance I (2:2:0) to (4:3:1) variable credit. Prerequisite: Admission into Public Policy Ph.D. Program. An in-depth survey of the major institutions that formulate and implement public policy in the United States. Examines translation of public preferences into public policy and decisions about which societal and economic functions are most appropriately carried out by governments and which are best accomplished by private institutions and individuals.

841/PUBP 841 Research Seminar in Policy Governance II (2:2:0) to (4:3:1). This course is the second of a two semester sequence (PUAD 840, 841) in the Governance and Management Policy Track. Deals with the division of responsibilities among the several levels of government and between the public and private sectors. Focuses upon the impact of these divisions on the development of public policy in several policy areas, such as urban governance, environmental policy, and health care.

998 Doctoral Proposal Research (1-6:0:0). Prerequisite: Permission of adviser. Work on a research proposal that forms the basis for a doctoral dissertation.

999 Doctoral Dissertation I (1-24:0:0). Prerequisite: Permission of participant’s dissertation committee. Registration for the total credit hours may be spread over a multisemester contiguous period. Ph.D. candidates must register for at least 3 hours each semester until the dissertation is completed.
**Sociology**

**Faculty**

Avruch, Kevin A., Ph.D., University of California, San Diego, 1978; Professor

Bateson, Mary Catherine, Ph.D., Harvard University, 1963; Robinson Professor

Black, Peter W., Ph.D., University of California, San Diego, 1977; Professor

Borkman, Thomasina S., Ph.D., Columbia University, 1972; Faculty, 1973; Associate Professor

Colvin, Mark W., Ph.D., University of Colorado, 1985; Associate Professor

Dennis, Rutledge, Ph.D., Washington State University, 1975; Professor

Dietz, Thomas M., Ph.D., University of California, Davis, 1979; Professor

Dumont, Jean-Paul, Ph.D., University of Pittsburgh, 1972; Robinson Professor

Golomb, Jennifer, Ph.D., University of California, Berkeley, 1987; Professor

Guagnano, Gregory A., Ph.D., University of California, Davis, 1986; Assistant Professor

Hannahanan, Nancy W., Ph.D., New School for Social Research, 1994; Assistant Professor

Horton, Lois E., Ph.D., Brandeis University, 1977; Associate Professor

Jacobs, Mark, Ph.D., University of Chicago, 1987; Associate Professor

Kolker, Aliza, Ph.D., Columbia University, 1975; Professor

Lancaster, Roger N., Ph.D., University of California, Berkeley, 1987; Associate Professor

Lipset, S. Martin, Ph.D., Columbia University, 1949; Hazel Faculty Chair in Sociology and Public Policy

Palkovich, Ann M., Ph.D., Northwestern University, 1978; Associate Professor

Rader, Victoria F., Ph.D., University of Chicago, 1973; Associate Professor

Rosenblum, Karen E., Ph.D., University of Colorado, 1979; Associate Professor

Scimecca, Joseph A., Ph.D., New York University, 1972; Professor

Stone, John, Ph.D., Oxford University, 1969; Professor and Department Chair

Tavani, Nicholas J., Ph.D., University of Maryland, 1969; Associate Professor

**Williams, Thomas R., Ph.D., Syracuse University, 1956; Professor**

**Sociology, M.A.**

The Department of Sociology and Anthropology offers a master's degree in sociology. A student may choose a concentration in general sociology; applied sociology; sex and gender; crime, delinquency, and corrections; race and ethnicity; cultural studies; or conflict analysis and management. The general sociology concentration allows maximum flexibility in the application of sociological knowledge to the analysis of social processes and systems. The applied concentration serves as a professional degree for the practitioner. All concentrations are appropriate for those anticipating further graduate study leading to the Ph.D. in sociology. The department provides opportunities for students to develop expertise in a variety of areas, including applied methods, community, development and social change, deviance, environmental sociology, gerontology, medical sociology, occupations and professions, policy analysis, race and ethnicity, sociology of science and technology, cultural studies, and survey research.

**Admission Requirements**

In addition to meeting the general admissions requirements for graduate study, applicants must present:

1. A minimum of 3 semester hours each in undergraduate sociological theory, statistics, and research methods. Equivalent courses in other disciplines may be substituted for some of these requirements with permission.
2. Three letters of recommendation from people who have supervised your work. If possible at least one should be from an academic setting.
3. A written statement (approx. 200 words) explaining your interest in sociology.
4. Graduate Record Examination (GRE).

Acceptance of applicants to the program will depend upon assessment by the departmental graduate committee.

**Nondegree Status**

Students who do not wish to pursue a degree or who have not supplied all required documents may be admitted to nondegree status. Nondegree students may later apply for degree status. With approval, a maximum of 12 graduate credit hours earned in nondegree status may be applied to a master's degree.
Degree Requirements
All students are required to complete a master's thesis.

General Sociology
The degree requires 33 semester hours, including a core of 6 hours of social theory (SOC 611, 612) and 6 hours of research methods (SOC 620, 630).

Applied Sociology
The degree requires 33 semester hours, including a core of 6 hours of social theory (SOC 612), 6 hours of research methods (SOC 620, 630), and 9 hours of applied sociology (SOC 515, 632, 640).

Sex and Gender
The degree requires 33 semester hours, including a core of 6 hours of social theory (SOC 611, 612), 6 hours of research methods (SOC 620, 630), and 9 hours in the sex and gender concentration (SOC 505, 525, and 696).

Conflict Analysis
The degree requires 33 semester hours, including a core of 6 hours of social theory (SOC 611, 612), 6 hours of research methods (SOC 620, 630), and 9 hours in the sociology of conflict and conflict management.

Race and Ethnicity
The degree requires 33 semester hours, including a core of 6 hours of social theory (SOC 611, 612), 6 hours of research methods (SOC 620, 630), and 9 hours in the race and ethnicity concentration.

Crime, Delinquency, and Corrections
The degree requires 33 semester hours, including a core of 6 hours of social theory (SOC 611, 612); 6 hours of research methods (SOC 620, 630); and 9 hours in the crime, delinquency, and corrections concentration (SOC 607, 608, 609).

Cultural Studies
This concentration prepares students for the doctoral program in Cultural Studies. The degree requires 33 semester hours, including a core of 6 hours of social theory (SOC 611, 612); 6 hours of research methods (SOC 620, 630); SOCI 614 Sociology of Culture; and a three-credit, M.A.-level course, which similarly serves as an introduction to a cultural studies "feeder" track in a department other than Sociology and Anthropology; and CULT 802 Issues and Methods in Cultural Studies I.

The Master's Thesis
A master's thesis is required for the M.A. degree in sociology to demonstrate a candidate's capacity to carry out independent research. The thesis consists of a substantial sociological research or theoretical project that will contribute to sociological knowledge.

Financial Aid
The Department of Sociology and Anthropology offers a limited number of graduate assistantships. For information, please contact the department at 993-1440.

Sociology Courses (SOCl)
503 Family Law (3:3:0). Prerequisite: Undergraduate senior status in sociology, graduate standing, or permission of instructor. An examination of the salient aspects of the law as it affects the family in our dynamic society. Topics include the nature and formalities of the marital relationship, intra-family torts and crimes, termination of the marital relationship, child custody and support, adoption, separation agreements, and the economic and sociological aspects of marriage, separation, and divorce.

505 Sociology of Sex and Gender (3:3:0). Prerequisite: Graduate standing or permission of instructor. An advanced study of sex roles in contemporary society. Using historical and comparative data, course examines perceived, prescribed, and actual sex-differentiation in social, political, and economic roles.

510 Employees, Employers, and the Changing Labor Force (3:3:0). Prerequisite: Graduate standing or permission of instructor. Focusing on the nature and origin of recent developments, e.g., in technology, affirmative action policy and debates, migration and immigration, and public and private job training programs, the course examines their impact on the social structure of work.

515 Applying Sociology (3:3:0). Prerequisite: Undergraduate senior status in sociology; graduate status. Course provides overview of the ways sociologists have applied their theoretical and methodological skills and understanding in sociological practice in nonacademic settings.

523 Racial and Ethnic Relations: American and Selected Global Perspectives (3:3:0). Prerequisite: Graduate standing or permission of instructor. Demographic purview of racial and ethnic groups in the United States; nature and meaning of racial and ethnic groups; racial and ethnic groups as human-social-minority groups. Factors making for minority status including personality factors, group cultural factors, reactions of racial and ethnic minorities to minority status, programs, methods, social movements, and philosophies seeking to change minority group status.

525 Current Research in Sex and Gender (3:3:0). Prerequisite: Graduate standing or permission of instructor. An advanced study of current social science research and research methodology used in the study of sex and gender.

541 Survey Research (3:3:0). Prerequisite: PSYC 300 or SOCI 221 or equivalent. Course acquaints students with the theory, method, and practice of survey research design and analysis. Students must complete a survey research project.
599 Issues in Sociology (3:3:0). Prerequisite: Undergraduate senior status in sociology; graduate status. Course explores topics of contemporary interest in sociology. Topics change from one semester to next and include issues in sociological theory, crime and delinquency, advanced research methods, social and cultural change, urban sociology, medical sociology, sociology of aging, rural sociology. May be taken only once for credit.

602 Sociology of Formal Organizations (3:3:0). Prerequisite: Graduate standing or permission of instructor. Classical and contemporary theories governing formal organization, and issues such as nature of authority, implementation of change, and relationship between formal organization and society.

604 Sociology of Occupations and Professions (3:3:0). Prerequisite: Graduate standing or permission of instructor. Theories of occupations and professions. Issues include educational patterns and social mobility, occupational status and prestige, importance of the work setting, work satisfaction and alienation, and impact of the professions on society.

606 Socialization Processes (3:3:0). Prerequisite: Graduate standing or permission of instructor. Selected aspects of the cultural transmission process in specific local cultures selected from various world culture regions—e.g., Oceanic, Sub-Saharan Africa, India—emphasizing the origins, course of development, and present structure and functions of the intergenerational transmission of culture.

607 Criminology (3:3:0). Prerequisite: Graduate standing or permission of instructor. Crime and crime causation. Topics include social basis of law, administration of justice, and control and prevention of crime.

608 (508) Juvenile Delinquency (3:3:0). Prerequisite: Graduate standing or permission of instructor. Sociology of adolescent behavior. Sociological factors that determine which behaviors and social categories of adolescents are likely to be labeled and treated as delinquent.

609 Corrections (3:3:0). Prerequisite: Graduate standing or permission of instructor. Critical assessment of American adult and juvenile correctional systems. In-depth analysis of current American correctional ideological punishment and incarceration. Alternative models are advanced that stress community-based, community-controlled programming.

610 Qualitative Research Methods (3:3:0). Prerequisite: Graduate standing or permission of instructor. Examination of basic research methods involving observational techniques and procedures used in description and analysis of the patterns, configurations, ethos, eidos, structures, functions, and styles typical of whole societies and cultures, with an emphasis on case studies, unobtrusive methods, participant observation, long-term residence, choices of observer status—role, recording data, uses of technical equipment, key informants, interviewing techniques, and ethical considerations in employing such methods and procedures.

611 Classical Sociological Theory (3:3:0). Prerequisite: Graduate standing or permission of instructor. In-depth examination of major issues in classical (pre-1930) sociological theory. Durkheim, Marx, Weber, Mead, and others are analyzed and the social and intellectual context of their theories is emphasized.

612 Contemporary Sociological Theory (3:3:0). Prerequisite: Graduate standing or permission of instructor. Schools in contemporary sociological theory such as structural-functionalism, conflict, exchange, symbolic interactionism, ethnomethodology, humanist sociology, and critical theory are examined. Contemporary theorists are analyzed in relation to the schools.

614 Sociology of Culture (3:3:0). Prerequisite: Graduate standing or permission of instructor. Combines interpretive and explanatory approaches to study the nature of cultural objects and cultural processes. Explores the dynamics of intentionality and receptivity in the production, distribution, and consumption of cultural objects in their societal contexts.

615 Social and Cultural Change (3:3:0). Prerequisite: Graduate standing or permission of instructor. Social and cultural change in transnational and transcultural (or comparative) perspective, with particular attention to theories, research methods, and conclusions concerning development and modernization in post-Colonial and "Third World" societies and cultures.

616 Society, Culture, and Personal Character (3:3:0). Prerequisite: Graduate standing in sociology or permission of instructor. Transcultural (comparative) examination of the interrelations between social and cultural actors and individual personal character; focus on life history of individuals in particular social and cultural settings. Readings and discussions center upon theoretical concerns, methodological approaches, and current research in study of social/cultural factors in personal character.

619 Conflict and Conflict Management: Perspectives from Sociology (3:3:0). Prerequisite: Graduate standing in sociology or conflict analysis and resolution or permission of instructor. The course deals with the sociology of conflict. Such major sociological theories of conflict as those of Marx, Weber, Simmel, Dahrendorf, Coser, and Collins are presented. The role that sociological conflict theory plays in undergirding conflict management practices is stressed.

620 Design of Social Research (3:3:0). Prerequisite: Graduate standing and undergraduate statistics and research methodology, or permission of instructor. Introduction to advanced strategies of social research used in the area of social policy analysis, including sample design, theory and techniques of measurement, questionnaire design, and data collection. Includes an introduction to various types of social research: survey, participant observation, case study, and evaluation research.

621/GECA 621 Human Ecology and the City (3:3:0). Prerequisite: Graduate standing or permission of instructor. Introduction to urban ecology. Origin and development of various types of cities, shape and structure of urban areas, inner and outer city, and spatial patterning of urban institutions.

622 Metropolitan and Regional Development (3:3:0). Prerequisite: Graduate standing or permission of instructor. Process of social development in the context of metropolitan and regional social change. Social development is considered in the light of economic, political, demographic, and human resource dimensions.

623 The Suburban Community (3:3:0). Prerequisite: Graduate standing or permission of instructor. Systematic sociological study of the suburb: (a) its evolution and de-
velopment (demographic and geographic); (b) its varied types; (c) its relation to the inner city; (d) as part of the metropolitan area and megalopolis; (e) its structure as a community including its formal and informal social groupings, organization and voluntary associations, family and social institutions, social stratification, and social mobility; (f) social change.

630 Analytic Techniques of Social Research (3:3:0). Prerequisite: Graduate standing and undergraduate statistics and research methodology, or permission of instructor. Advanced strategies of social research used in the area of social policy analysis, focusing on analytic techniques such as analysis of variance and covariance, multiple regression and correlation, path analysis, and elaborative contingency table analysis.

632 Evaluation Research for Social Programs (3:3:0). Prerequisite: SOCI 620, SOCI 630, or permission of instructor. Study of methodological issues related to the evaluation of social programs. Conceptual and research design issues are explored in relation to social programs, particularly the delivery of social services. Includes the examination of methods used to assess the need for the programs, impact of delivery systems, and the efficiency and effectiveness of social programs.

633 Special Topics in Sociology (3:3:0). Prerequisite: Graduate standing or permission of instructor.

640 Social Theory and Social Policy (3:3:0). Prerequisite: Graduate standing or permission of instructor. Major theories of social organization and social change as a means of understanding social policy development. Concentration is on social policies in American society.

650 Health Systems Delivery (3:3:0). Prerequisite: Graduate standing or permission of instructor. Analysis of the social factors associated with the delivery of health care. Several theoretical perspectives are used to highlight relevant elements. Planning for health from individual to federal processes is studied. The processes and problems of measuring the quality of health care are investigated.

651 (551) Medical Sociology (3:3:0). Prerequisite: Graduate standing or permission of instructor. Social context of disease and medical care, the position of the professions in the medical care structure, the delivery of medical care, and the physician-patient relationship under different systems of practice.

680 Clinical Sociology (3:3:0). Prerequisite: Graduate standing or permission of instructor. Introduction to theoretical principles, methods and procedures necessary to practice clinical sociology as an independent consultant or within private or public organizations. Such specialized applications as family counseling, organizational change, medical sociology, and educational sociology are covered.

685 Sociology of the Disabled (3:3:0). Prerequisite: Graduate standing or permission of instructor. Overview of social movements relating to the disabled including questions on how persons with handicaps manage living in their homes, schools, and workplace. Analysis of legislation and public programs as they relate to various disabling conditions.

686 Sociology of Aging (3:3:0). Prerequisite: Graduate standing or permission of instructor. Analysis of sociological issues in aging. Issues include class and cultural fac-

tors, problems of work, of retirement, of attachment and of loss and ageism. Different theories of aging are examined.

696-697 Independent Study (3:0:0), (3:0:0). Prerequisite: Graduate standing or permission of instructor. Theoretical and research literature chosen by student and instructor.

799 Thesis (1-6:0:0).

800 Studies for the Doctor of Philosophy in Education (variable credit). Prerequisite: Admission to the Ph.D. in Education program to study in sociology. Program of studies designed by student's discipline director and approved by student's doctoral committee, which brings the student to participate in the current research of the discipline director and results in a paper reporting the original contributions of the student. Enrollment may be repeated.

Telecommunications

Faculty

Akwule, Raymond, Ph.D. Howard University, 1985; Associate Professor and Faculty Adviser, International Track

Cox, Brad J., Ph.D., University of Chicago, 1973; Professor and Director, Telecommunications Department

Drury, Richard, M.B.A., Old Dominion University, 1970; Professor and Faculty Adviser, Administration Track

Ellig, Jerry, Ph.D., George Mason University, 1988; Associate Professor and Faculty Adviser, Organizations and Policy Track

Jabbari, Bijan, Ph.D., Stanford University, 1981; Associate Professor and Faculty Adviser, Systems Engineering Track

Lont, Cynthia, Ph.D., University of Iowa, 1984; Associate Professor and Faculty Adviser, Production Theory and Practice Track

Sandhu, Ravi S., Ph.D., Rutgers University, 1983; Associate Professor and Faculty Adviser, Information Systems Track

White, Charles, Ph.D., Indiana University, 1985; Associate Professor and Faculty Adviser, Education Track

Telecommunications, M.A.

The Master of Arts in Telecommunications (M.A.T.) is an interdisciplinary program that includes courses in engineering, law, administration, education, and communication, recognizing that telecommunications is both a technical and a
humanistic endeavor. The program is designed for telecommunications professionals, individuals who wish to change careers into a telecommunications-related field, and others whose interests, talents, or curiosity bring them into contact with the world of telecommunications.

Admission Requirements
Applicants for the M.A.T. program should meet the following minimum requirements:
1. A baccalaureate degree from an accredited institution.
2. A grade point average of 3.0 or better in the last 60 hours.
3. Submission of the appropriate application form with three letters of recommendation from persons directly knowledgeable of the applicant’s professional and academic competence.
4. Submission of a 500-word essay addressing an important, substantive issue in telecommunications.

The Graduate Record Examination (GRE) is not required, but the results of it, or other standardized graduate admissions exams such as the GMAT, LSAT, and Miller Analogy Test can be a useful aid to the university in making admissions decisions.

Advising
With guidance from a faculty adviser, students are able to choose from a wide variety of courses available at the university to tailor course work to their particular interests and needs. Choice of an area of specialization also depends on the student’s undergraduate preparation. A student advising form, which outlines the student’s degree plan and serves as a guide, should be completed and submitted by the student soon after admission to the program. For more information about the program, contact the Office of Interdisciplinary Programs at (703) 993-1142.

Degree Requirements
The M.A.T. program requires the completion of a minimum of 33 hours of approved graduate work (11 courses). This requirement is satisfied by completing required core courses, track core courses, and electives.

Required Core Courses
LRNG 572 Taming the Electronic Frontier
INFS 513 Introduction to Telecommunications Systems
LAW 181 Telecommunications Law and Regulations
MGMT 791 Telecommunications Management
COMM 555 Theories of Telecommunications Production

Each student must also complete one of the following two courses:
TELE 750 Coordinating Seminar
TELE Thesis Research Project

LRNG 572 is generally taken at the beginning and the coordinating seminar or research project is taken near the end of the student’s course work.

Areas of Specialization
Students may choose from six specialization tracks: administration, education, information systems, international telecommunications, production theory and practice, and systems engineering.

Each student must complete a track core course(s) and track elective courses totalling 15 credit hours.

The Specialization Tracks, Track Core Course(s), and recommended electives are as follows:

Administration
Track Core Course:
MGMT 600 Organizational Behavior and Development

Recommended Electives:
ECON 600, DESC/FNAN 601, DESC/FNAN 700, BULE 700, MGMT 721, MGMT 722, MGMT 751, MGMT 761, MGMT 771, MGMT 796, PUAD 620, PUAD 634, PUAD 732, PSYC 632, PSYC 637, MIS 600, STAT 610.

Education
Track Core Courses:
EDCI 504 Introduction to Educational Technology or EDCI 699 Seminar: Computer Applications in Education
EDUC 600 Workshop in Education (Capstone Course)

Recommended Electives:
EDCI 630, EDCI 705, EDCI 730, EDUC 600, PSYC 701

Information Systems
Track Core Courses:
INFS 590 Program Design and Data Structure
INFS 600 Computer Architecture and Operating Systems

Recommended Electives:
INFS 714, INFS 722, CS 583, SWSE 619, SWSE 623, SWSE 635

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International Telecommunications

Track Core Course:
COMM 556 Global Communication

Recommended Electives:
COMM 505, COMM 506, COMM 554, MKTG 775, MKTG 777, PUAD 504, PUAD 701, PUAD 731, PUAD 732, PUAD 733, PUAD 739, INTL 714, INTL 717, INTL 754

Production Theories and Practice

Track Core Course:
COMM 556 Global Communication

Recommended Electives:
COMM 502, COMM 506, COMM 535, COMM 536, COMM 554, COMM 596, COMM 597, COMM 697, ENGL 503, ENGL 613, ENGL 616, ENGL 619, ENGL 670, EDCI 504, EDCI 705, ARTS 613, ARTS 650, ARTS 680

Systems Engineering

Track Core Course:
ECE 542 Computer Network Architectures and Protocols

Recommended Electives:
ECE 513, ECE 528, ECE 535, ECE 630, ECE 631, ECE 632, ECE 633, ECE 639, ECE 642, ECE 643, INFS 690

Visual Information Technologies

Faculty
Bloomenthal, Jules, Ph.D., University of Calgary, 1994; Assistant Professor
Loot, Cynthia, Ph.D., State University of Iowa, 1984; Associate Professor of Communication
Mones-Hattal, Barbara, M.F.A., Rhode Island School of Design, 1979; Director, Associate Professor
Turansky, Alan, M.S.M.A.S., Massachusetts Institute of Technology, 1993: Assistant Professor
Wegman, Edward J., Ph.D., University of Iowa, 1968; Dunn Professor of Computer Science

Visual Information Technologies M.A., M.F.A.

The Visual Information Technologies Program offers a Master of Arts or a Master of Fine Arts specializing in electronic and digital media technology. Computer Imaging and Animation provides students with a unique opportunity to integrate visual communication design with two- and three-dimensional computer modeling, animation, and image processing within a program that is grounded in both theory and application.

The M.A. degree requires 45 credit hours and is a professional program aimed at preparing students for employment in high-tech industries and businesses. These include computer animation and video production houses, graphic design firms, federal and local government training programs, and computer-related research industries, including those related to virtual reality and multimedia systems.

The M.F.A. requires 60 credit hours, during which time students explore an area of concentration in depth. The M.F.A. is a terminal degree that includes the benefits of the M.A. degree, in addition to preparing students to teach at the university level. Students are encouraged to explore new forms of expression by integrating electronic multimedia technology with fine art information media tools.

Admission Requirements

In addition to meeting the general requirements for admission for graduate study, candidates for the M.A. or M.F.A. in Visual Information Technologies must meet the following requirements:

- B.A. or B.F.A. degree
- Portfolio submission
- Statement of intent and professional goals
- Three letters of reference

Diversity among the group of students accepted for study is another consideration. Applicants with degrees in areas other than art are welcome, although they may be required to complete undergraduate core courses. Candidates without computer experience may be required to complete some undergraduate course work in computer imaging. Students with an M.A. degree seeking to earn M.F.A. must complete a minimum of 30 credits. Although an interview is not part of the formal review process, it is recommended and strongly encouraged.

The student's portfolio is a major selection criterion for graduate admission, regardless of area of concentration. Evidence of applications in the arts using emerging technologies for both the fine and applied arts is of particular interest. Portfolios from applicants must include 20 slides, labeled and numbered, with orientation information, and one optional 3/4" Umatic NTSC videotape, not exceeding four minutes in length.

Slides should represent the student's most accomplished work irrespective of studio application.
area. Some artwork representing skills in computer imaging must be included.

**Degree Requirements**

**Basic requirements** ................................ 15

M.A. students must complete the following courses for a total of 15 hours:

- ARTH 600 VIT Research Methods .................................. 3
- ARTH 620 Philosophy of Art ......................................... 3
- ARTS 670 Teaching Practicum
  and/or ARTS 693 Apprenticeship .................................. 6
- ARTS 696 Special Topics in
  Visual Information .................................................. 3

Students may take both ARTS 670 and 696, or take either one twice, for a total of 6 hours. M.A. candidates must complete a supervised apprenticeship in a professional business setting (ARTS 693). M.F.A. candidates are expected to complete a supervised classroom teaching practicum in the undergraduate program at GMU or in a community college art program (ARTS 670). M.F.A. candidates may also elect an apprenticeship in a business setting.

**Art Studio Core** ................................................. 12

Students must complete the following Art Studio Core courses for a total of 12 hours:

- ARTS 699 Special Topics in Studio Art .............................. 3
- ARTS 612 Design ...................................................... 3
- ARTS 622 Drawing ..................................................... 3
- ARTS 613 Conceptual Arts:
  Graphic Design or ARTS 680
  Conceptual Arts: Computer Imaging ............................... 3

Students whose area of concentration is computer graphics must take ARTS 613; those whose area of concentration is graphic design must take ARTS 680.

**Area of Concentration** ....................................... 15

Students must complete 15 hours in an area of concentration, Computer Graphics or Graphic Design, for their studio work:

- **Computer Graphics:**
  - ARTS 684 Two-Dimensional Computer Imaging .................... 5
  - ARTS 686 Three-Dimensional Computer Imaging ................... 5
  - ARTS 688 Computer Animation .................................... 5

- **Graphic Design:**
  - ARTS 614 Problems in Typography ................................ 5
  - ARTS 616 Hypertext and Hypermedia .............................. 5
  - ARTS 618 Problems in Graphic Design ............................ 5

The studio applications emphasize a series of intensive studio experiences in using electronic and digital processes as design tools for the graphic designer, the visual communicator, the computer artist, or any other creative artist who wishes to use these technologies for artforms.

**Electives in a cognate area** .................................. 3

**Total hours required for the M.A.** ............................ 45

**M.F.A. Comprehensive Experience** .......................... 15

Candidates for the M.F.A. must complete all of the M.A. requirements and the following:

- ARTS 796 Directed Project .......................................... 9
- ARTS 798 Directed Reading .......................................... 3
- ARTS 799 Thesis ...................................................... 3

The comprehensive experience involves a study of the historical basis for a studio project, an independent creative production suitable for public viewing, and a written thesis documenting the evolution of the creative problem and exploring the intention, purpose, and relative success of the finished production.

**Total hours required for the M.F.A.** .......................... 60

**Facilities and Equipment**

The Visual Information Technologies Program is situated in the Center for the Arts complex. The program has three computer labs, which contain Silicon Graphics Workstations and a variety of other platforms and personal computer computers, in addition to video editing, image scanning and digitizing facilities.

**Visual Information Technologies**

**Course Work**

Course work for the VIT program is currently supported by the ARTS and ARTH acronyms. Course descriptions can be found below.

**Art History Courses (ARTH)**

593 Art Internships (3-6:0:0). **Prerequisite:** B.A. or equivalent or permission of instructor. Internship with a professional arts institution, organization, or individual in the D.C. area. Project to be arranged by the student, in consultation with faculty instructor and field supervisor. Recommended for advanced Art History students seeking exposure to professional work in the visual arts. May be taken for three to six hours, or repeated for up to six hours of credit.

594 The Museum (3:3:0). **Prerequisite:** B.A. or equivalent or permission of instructor. Examination of the history, theory, practice, ethics, and current problems of collecting and displaying art and artifacts to the public. Emphasis on issues central to the D.C. museums or museums in other locations; specific focus may vary with instructor.
596 Independent Study (3:3:0). Prerequisite: B.A. or equivalent or permission of instructor. Independent reading and research on a specific project under the direction of a department faculty member. A written report is required. May be repeated for credit.

599 Special Topics in the History of Art (3:3:0). Prerequisite: B.A. or equivalent or permission of instructor. Topics vary and include women in art, art patronage, art criticism, and others.

600 VIT Research Methodologies (3:3:3). Prerequisite: Admission to the Visual Information Technologies program or permission of instructor. Explores methods of examining and interpreting works of art developed by art historians since the 19th century, as well as new ways of looking at art by using such computer tools as expert systems, computer analysis of pigments and other materials, and electronic search and retrieval of archived documents. The various lines of inquiry are examined through analytical and critical readings of both model texts and articles.

620/PHIL 356 Philosophy, Theory, and Criticism (3:3:0). Prerequisite: Admission to Visual Information Technologies program or permission of instructor. Basic problems that arise from an inquiry into the meaning and value of art and our response to it. Students in the VIT program write a supplemental paper and design an individualized project.

696/COMM 431/GOVT 431 Special Topics in Visual Information Technologies (3:3:0). Prerequisite: Admission to Visual Information Technologies program or permission of instructor. Study of the impact of the information network of wire and airless communications and computers on the political process in advanced industrial countries.

800 Studies for the Doctor of Philosophy in Education (variable credit). Prerequisite: Ph.D. student admission to study in art. Program of studies designed by student's discipline director and approved by student's doctoral committee. Course work allows the student to participate in the research activity of the discipline director and results in a paper reporting the original contributions of the student. The paper is presented in a subsequent Ph.D. summer seminar. Enrollment may be repeated.

Art Studio Courses (ARTS)

592 Exhibitions Projects (3:3:0). Prerequisite: Undergraduate degree in art or equivalent or permission of instructor. Planning, promotion, and production of visual art presentations and related events on the GMU campus. Exhibitions are produced by students who alternately serve in all operational capacities from proposal research and budget planning to the graphic design of announcements and the installation of exhibitions.

593 Art Apprenticeships (3:6:0:0). Prerequisite: Undergraduate degree in art or equivalent or permission of instructor. Introductory seminar followed by an apprenticeship or internship project with a professional individual or organization in the field of visual arts in the D.C. area. An apprenticeship may provide an introductory work experience in the professional area in which the student is considering a career.

596 Independent Study (3:3:0). Prerequisite: Undergraduate degree in art or equivalent or permission of instructor. Independent reading and/or research in any media on a specific project under the direction of a selected faculty member. A written report is required. May be repeated for credit.

601, 602 Graduate Drawing and Painting (3:0:0), (3:0:0). Prerequisite: Undergraduate degree in art or art education (B.A. or B.F.A.) or equivalent. Directed drawing and/or painting project with emphasis on individual development.

605, 606 Graduate Printmaking Studio (3:0:0), (3:0:0). Prerequisite: Undergraduate degree in art (B.A. or B.F.A.) or equivalent or permission of instructor. Directed printmaking project with emphasis on individual development.

612/ARTS 312 Design (3:0:6). Students investigate and experiment with visual communication in two- and three-dimensional forms. Emphasis is on developing an individual awareness of the relationship between concepts, communications, techniques, and media.

613 Conceptual Arts: Graphic Design (3:0:6). Combined lecture and studio course covering concepts in graphic design, digital typography, and hypermedia. Course intended for students whose area of concentration is other than graphic design to increase the scope of their technical expertise while developing their studio work. Students design a digital faceplate that is used in a self-promotional package consisting of both hardcopy and hypertext.


616 Hypertext and Hypermedia (5:2:6). Prerequisite: Admission to the Visual Information Technologies program or permission of instructor. Combined lecture and studio course in hypermedia and hypertext design. Solutions to perceptual problems in designing the presentation of visual and textual information for electronic display. Exploration of how design considerations are affected by changes in presentation media.

618 Problems in Graphic Design (5:2:6). Prerequisite: Admission to the Visual Information Technologies program or permission of instructor. Application of advanced technological design and production methods to complex graphic design problems. Students consider the social and cultural implications of their aesthetic choices. Taught as a series of studio problems.

622/ARTS 322 Drawing (3:0:6). Fundamentals of drawing with emphasis on perspective systems and skills in representing space, objects, and textures with a variety of methods.

670 Teaching Practicum (3:3:0 or 6:6:0). Prerequisite: Admission to Visual Information Technologies program or permission of instructor. Supervised classroom teaching practicum in the undergraduate program at GMU or in a community college program.
680 Conceptual Arts: Computer Imaging (3:0:6).
Combined lecture and studio/lab survey of 2-D and 3-D computer imaging and animation for students concentrating in an area other than computer graphics to increase the scope of their technical expertise while developing their studio work. Lectures integrate advanced technical and aesthetic material. Emphasis on developing an advanced studio portfolio.

Prerequisite: Admission to the Visual Information Technologies program or permission of instructor. Overview of 2-D computer imaging applications in the arts, including painting, printmaking, mixed media, illustration, video, animation, and others. Lectures combine technical and aesthetic material, including image processing for artists and color reproduction. Emphasis on developing an advanced studio portfolio.

Prerequisite: Admission to the Visual Information Technologies program or permission of instructor. Overview of 3-D computer imaging applications in the arts in fields such as sculpture, mixed media, video, and animation. Lectures combine technical and aesthetic material, including three-dimensional design, modeling, and rendering. Emphasis on developing an advanced studio portfolio.

688 Computer Animation (5:2:6). Prerequisite: Admission to the Visual Information Technologies program or permission of instructor. Description, representation, creation, and movement of three-dimensional environments using computers, including video production for animators. Lectures integrate advanced technical aesthetic material. Emphasis on developing an advanced studio portfolio.

693/ARTS 593 VIT Apprenticeships (3:3:0 or 6:6:0).
Prerequisite: Admission to Visual Information Technologies program or permission of instructor for ARTH 600, art studio major, or permission of instructor for ARTS 593. See ARTS 593. VIT students select a local business that conforms to their application interest in visual information technologies.

699 Special Topics in Studio Art (3:0:6). Prerequisite: Admission to Visual Information Technologies program or permission of instructor. Projects related to topics in visual information technologies.

796, 798, 799 Directed Project, Directed Reading, Thesis (9:0:0), (3:0:0), (3:0:0). Prerequisite: Admission to the Visual Information Technologies program or permission of instructor. Three courses comprising the M.F.A comprehensive experience for Visual Information Technologies students. Involves a study of the historical basis for a studio project, an independent creative production suitable for public viewing, and a written thesis documenting the evolution of the creative problem and exploring the intention, purpose, and relative success of the finished production.

800 Studies for the Doctor of Philosophy in Education (variable credit). Prerequisite: Admission to the Ph.D. in Education program to study in art. Program of studies designed by student's discipline director and approved by student's doctoral committee. Course work allows the student to participate in the research activity of the discipline director and results in a paper reporting the original contributions of the student. Enrollment may be repeated.
School of Business Administration

[Image of a man at a microphone with a "MCI" sign in the background]
School of Business Administration

Accounting and Taxation

Faculty
Brown, Victor H., Ph.D., State University of New York at Buffalo, 1957; CPA, Professor
Buchanan, Phillip G., Ph.D., Temple University, 1982; CPA, Associate Professor
Cao, Le T., D.B.A., University of Southern California, 1975; Associate Professor
Cheung, Joseph K., Ph.D., University of Michigan, 1977; Associate Professor
Coffinberger, Richard L., J.D., Wake Forest University, 1974; Associate Professor
Evanchik, Michael A., Ph.D., University of Washington, 1989; Visiting Assistant Professor
Godfrey, James T., Ph.D., University of Michigan, 1967; George Mason University Foundation Professor
Gopalakrishnan, V., Ph.D., University of North Texas, 1986; ACA, Assistant Professor
Heller, Kenneth H., Ph.D., University of Texas, Austin, 1977; CPA, Professor, Department Chair
Holt, Doris L., Ph.D., University of Michigan, 1984; CPA, Visiting Associate Professor
Millspaugh, Peter, J.D., American University, 1968; Associate Professor
Quarles, N. Ross, Ph.D., University of North Texas, 1988; CPA, Assistant Professor
Samuels, Linda B., J.D., University of Virginia, 1975; Associate Professor
Wilkie, Patrick J., Ph.D., University of Michigan, 1984; Assistant Professor
Young, James C., Ph.D., Michigan State University, 1988; CPA, Assistant Professor

The Department of Accounting and Business Legal Studies of the School of Business Administration offers both the Master of Science in Accounting (M.S.A.) and the Master of Science in Taxation (M.S.T.) programs. The programs are accredited by the American Assembly of Collegiate Schools of Business (AACSB). In granting the accreditation, the AACSB recognized George Mason's accounting curriculum, research and classroom facilities, quality of faculty, and success rate of graduates finding employment.

The M.S.A. program is designed to meet the 150-semester-hour education requirement adopted by many states and required by the American Institute of Certified Public Accountants after the year 2000. The graduate accounting curriculum provides quality academic instruction and professional orientation, emphasizing the accounting professional's role and responsibilities in the business environment. Conceptual understanding, analytical abilities, communication skills, and computer literacy are also emphasized.

The objective of the M.S.T. program is to provide a comprehensive, high-quality, and professionally oriented education for professionals who have made a career commitment to the field of taxation. The program is not intended to serve students who do not possess undergraduate business degrees, students who are changing careers, or those seeking an advanced degree solely to qualify for professional certification. Further, the program does not intend to serve full-time students, nor those who do not possess prior professional experience.

Admission Requirements
Students registering for graduate-level courses numbered 600 or higher offered by the School of Business Administration must have graduate standing.

Degree applicants must fulfill the general admission requirements for graduate study.

Admission to the M.S.A. programs is competitive. The admissions decision is based principally on
grades in undergraduate academic course work and performance on the GMAT. These criteria are applied flexibly to ensure that individuals with unusual academic qualifications are not denied admission.

Admission to the M.S.T. program is competitive and is based upon three criteria:
1. Professional experience in the field of taxation;
2. Undergraduate academic performance; and
3. Performance on the GMAT.

Accounting, M.S.

Degree Requirements

Foundation
The M.S.A program requires a minimum of 30 semester hours of graduate course work. However, students who have not earned a recent undergraduate degree in business administration with a major in accounting from an AACSB-accredited school may be required to take additional credit to satisfy the accounting and business administration foundation requirements. The exact number of credit hours for an individual is based on an evaluation by the program director at the time of admission.

The accounting and business administration foundation requirements include the following courses:
- Managerial Finance (FNAN 650)
- Marketing Management (MKTG 650)
- Management Information Systems (MIS 600)
- Managerial Statistics (DESC 600)
- Regulatory Structure/Ethics (BULE 700)
- Organizational Behavior and Development (MGMT 600)
- Strategy/Policy Management (MGMT 750)
- Managerial Microeconomics (FNAN/DESC 601)
- Operations Management/Management Science (DESC 650)
- Financial Accounting (ACCT 201)
- Managerial Accounting (ACCT 202)
- Cost Accounting (ACCT 311)
- Intermediate Accounting I (ACCT 331)
- Intermediate Accounting II (ACCT 332)
- Federal Taxation (ACCT 351)
- Auditing (ACCT 461)
- Legal Environment of Business (BULE 301)

In addition, students in each program must demonstrate an exposure to the international dimension of business through either previous academic work or an elective course.

Core
Each candidate must complete the following accounting core courses unless, in the opinion of the program director, the candidate has had previous comparable graduate-level course work that would justify substitution of other graduate accounting courses.
- ACCT 712 Accounting Systems
- ACCT 713 Managerial Accounting Theory
- ACCT 732 Financial Accounting Theory
- ACCT 762 Advanced Auditing Theory and Practice
- TAX 700 Federal Income Taxation

Electives
Candidates for the M.S.A. must choose between the accounting and taxation tracks. Either track requires satisfactory completion of at least 15 hours of graduate course work, which does not repeat previous academic work.

Accounting Track: Twelve hours must be taken from the courses shown below. The remaining 3 hours must be from graduate courses at the 700-level that is not redundant with prior academic work. Electives may include a course in international business, accounting, or taxation as approved by the program director.

Accounting:
- Any 700-level accounting or taxation course

Finance:
- Any 700-level finance course

Decision Sciences:
- Any 700-level decision science course

Management Information Systems:
- Any 700-level management information systems course

Taxation Track: The following nine additional credits must be taken in taxation:
- TAX 701 Accounting Methods and Periods (1.5 credits)
- TAX 702 Tax Practice and Procedures (1.5 credits)
- TAX 703 Corporate Taxation
- TAX 706 Partnership Taxation

The remaining 6 hours must be from 700-level courses that is not redundant with prior academic work. Electives may include a course in international business, accounting, or taxation as approved by the program director.
Taxation, M.S.

Degree Requirements
The program requires a minimum of 30 semester hours of graduate course work. However, prior to enrollment in M.S.T. core or electives, students must have documented course work in the fields of accounting, behavioral science, economics, and mathematics/statistics. The program director will evaluate the student’s prior education at the time of admission.

Core
Each candidate must complete the following core courses unless, in the opinion of the program director, the candidate has had previous comparable graduate-level course work that would justify substitution of other graduate courses.
1. TAX 700 Federal Income Taxation (3)
2. TAX 701 Accounting Methods and Periods (1.5)
3. TAX 702 Tax Practice and Procedures (1.5)
4. TAX 703 Corporate Taxation (3)
5. TAX 704 Corporate Mergers and Acquisitions (1.5)
6. TAX 705 Affiliated Corporations (1.5)
7. TAX 706 Partnership Taxation (3) or ACCT 780 Management of Professional Service Organizations (6)

Electives
Each student must complete 9 hours of acceptable elective course work including, at least, 6 credits in taxation selected from the following:
TAX 710 Federal Estate and Gift Taxation
TAX 711 International Taxation
TAX 712 Seminar in Advanced Tax Topics
TAX 713 State and Local Taxation
TAX 714 Pensions and Deferred Compensation

The remaining 3 semester hours may be selected from any 700-level or higher graduate course except ACCT 752.

Progress Requirement
To ensure that each student is making satisfactory progress toward completion of his/her degree, each M.S.T. student must complete at least 12 credits during the first calendar year of enrollment and a minimum of 21 credits by the end of the second year of enrollment.

Accounting Courses (ACCT)

General Prerequisites
1. Students who have not gained admitted status for graduate study may not register for graduate-level courses numbered 600 or higher offered by the School of Business Administration.
2. All students must satisfy ALL course prerequisites listed in the Schedule of Classes for courses offered by the School of Business Administration. Students who register for such courses without the prerequisites or without a written waiver from the associate dean of the School of Business Administration may be dropped from those courses.

600 Financial Accounting (3:3:0). Prerequisite: Graduate standing. All aspects of accounting from the basic concept of a transaction through financial statements and their interpretation.

650 Managerial Accounting (3:3:0). Prerequisite: Completion of all M.B.A. foundation courses including ACCT 600, and graduate standing. Topics include profit planning, relevant costing, budgeting, measurement of performance, and product costing.

712 Accounting Systems (3:3:0). Prerequisite: ACCT 650 or equivalent. Accounting systems design and integration with other information systems.

713 Managerial Accounting Theory (3:3:0). Prerequisite: ACCT 650 or equivalent. Controllership function in public or private organizations, particularly in regard to development of policy and evaluation of performance.


780 Management of Professional Services Organizations (6:6:0). Prerequisite: Completion of 18 credit hours of M.S.A./M.S.T. required course work. Focuses on the management of the modern professional services organization with special emphasis on the strategic, marketing, human resource, risk management, and the ethical and technological issues vital to management.
796 Independent Study and Directed Readings (3:3:0). Prerequisite: ACCT 650. By special arrangement with professor and approval of the M.S.A./M.S.T. program director.

Taxation Courses (TAX)

700 Federal Income Taxation (3:3:0). Prerequisite: Graduate degree status. Federal income tax concepts and procedures related to individual taxpayers and business entities. Emphasis is on research and planning based on the Internal Revenue Code, Treasury Regulations, and administrative and judicial sources of tax law.

701 Accounting Methods and Periods (1.5:1.5:0). Prerequisite: ACCT 739; may be taken concurrently. Tax accounting methods including the cash and accrual methods, inventory accounting, installment sales, accounting changes, and various book-tax differences. Tax accounting periods are also studied.

702 Tax Practice and Procedures (1.5:1.5:0). Prerequisite: ACCT 739; may be taken concurrently. Professional responsibilities and ethics, tax research, tax penalties, practice before the IRS, tax policy, and other issues.

703 Corporate Taxation (3:3:0). Prerequisite: ACCT 739; may be taken concurrently. Concepts and principles that relate to federal income taxation of corporations and their shareholders. Emphasis is on research of tax situations. Coverage includes organizing and capitalizing a corporation, nonliquidating and liquidating distributions, penalty taxes, collapsible corporations, and determinants of the income tax base of corporations.

704 Corporate Mergers and Acquisitions (1.5:1.5:0). Prerequisite: ACCT 741. An introduction to taxable and tax-deferred methods of combining, dividing, and recapitalizing existing corporations. The effects on the corporation(s), its attributes, and its shareholders are analyzed.

705 Affiliated Corporations (1.5:1.5:0). Prerequisite: ACCT 741. A study of consolidated tax return regulations and filing requirements for affiliated corporations. A study of consolidated tax return regulations and filing requirements for affiliated corporations.

706 Partnership Taxation (3:3:0). Prerequisite: ACCT 739; may be taken concurrently. Major aspects of taxation affecting partners and partnerships. Emphasis is on tax planning and detailed study of the Internal Revenue Code, Treasury Regulations, and case law governing these areas.

710 Federal Estate and Gift Taxation (3:3:0). Prerequisite: ACCT 739. Concepts and principles that relate to federal estate and gift taxation and the federal income taxation of estates, trusts, and beneficiaries. Emphasis is on estate tax planning and a detailed study of the Internal Revenue Code, Treasury Regulations, and case law governing these areas.

711 International Taxation (3:3:0). Prerequisite: ACCT 739. Taxation of individuals and corporations with foreign source income and tax liability to the United States.

712 Advanced Tax Topics (3:3:0). Prerequisite: ACCT 739. Selective analysis of current tax topics addressing important issues in contemporary tax practice. Two or three major topics are usually discussed. Consult Schedule of Classes. Course may be repeated for credit with different topics.

713 State and Location Taxation (3:3:0). Prerequisite: ACCT 739. Detailed analysis of the principal forms of state and local taxation.

714 Pensions and Deferred Compensation (3:3:0). Prerequisite: ACCT 739. Analysis of the structure, operation, and requirements for obtaining and maintaining IRS approval of tax qualified pensions, profit-sharing, and deferred compensation plans.

Business Administration

Faculty

Anderson, Evan E., Ph.D., Cornell University, 1970; Professor, Decision Sciences and M.I.S.

Boiney, Lindsley, Ph.D., Duke University, 1992; Assistant Professor, Decision Sciences and M.I.S.

Buchanan, Phillip G., Ph.D., Temple University, 1982; Associate Professor, Accounting

Buzzell, Robert D., Ph.D., The Ohio State University, 1957; Distinguished Professor, Marketing

Cao, Le Thi, D.B.A., University of Southern California, 1975; Associate Professor, Accounting

Chen, Minder, Ph.D., University of Arizona, 1988; Assistant Professor, Decision Sciences and M.I.S.

Cheung, Joseph K., Ph.D., University of Michigan, 1977; Associate Professor, Accounting

Coffinberger, Richard L., J.D., Wake Forest University, 1974; Associate Professor, Business Legal Studies; Associate Dean for Undergraduate Programs and Student Affairs

Cordell, Victor V., Ph.D., University of Houston, 1988; Assistant Professor, Marketing

Crawford, Peggy J., Ph.D., Purdue University, 1979; Associate Professor, Finance

Crockett, John H., Ph.D., University of North Carolina, Chapel Hill, 1975; Professor, Finance

Das, Sidhartha R., Ph.D., University of Houston, 1985; Associate Professor, Decision Sciences and M.I.S.

Dewan, Sanjeev, Ph.D., University of Rochester, 1991; Assistant Professor, Decision Sciences and M.I.S.

Domzal, Teresa, Ph.D., University of Cincinnati, 1981; Associate Professor, Marketing

Dutta, A., Ph.D., Purdue University, 1981; Professor, Decision Sciences and M.I.S.

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English, Jon, Ph.D., University of Florida, 1972; Professor, Management; Associate Dean for Graduate Programs and Faculty Affairs

Entriokin, Richard, Ph.D., St. Louis University, 1976; Associate Professor and Chair, Marketing

Eyler, Kel-Ann S., Ph.D., Georgia State University, 1990; Assistant Professor, Accounting

Fagenson, Ellen A., Ph.D., Princeton University, 1981; Associate Professor, Management

Ferri, Michael G., Ph.D., University of North Carolina, 1975; Professor, Finance

Fulmer, William E., Ph.D., University of Pennsylvania, 1974; Professor, Management

Godfrey, James T., Ph.D., University of Michigan, 1967; Professor, Accounting

Gopalakrishnan, V., Ph.D., University of North Texas, 1986; Assistant Professor, Accounting

Hanweck, Gerald A., Ph.D., Washington University, 1971; Professor, Finance

Harr, David J., Ph.D., University of Wisconsin, 1978; Assistant Professor, Accounting

Harvey, James, Ph.D., Pennsylvania State University, 1977; Associate Professor, Marketing

Haynes, Kingsley, Ph.D., Johns Hopkins University, 1971; Professor, Decision Sciences and M.I.S.

Heller, Kenneth H., Ph.D., University of Texas, Austin, 1977; Professor, Accounting

Hogan, Arthur M. B., Ph.D., University of Texas, Austin, 1988; Assistant Professor, Finance

Hysom, John L., Ph.D., The American University, 1973; Associate Professor, Finance

Johnston, Robert D., Ph.D., University of Alabama, 1974; Associate Professor, Finance

Kernan, Jerome B., Ph.D., University of Illinois, 1962; GMU Foundation Professor of Behavior Analysis, Marketing

Kieschnick, Robert L., Ph.D., University of Texas, 1987; Assistant Professor, Finance

Kovach, Kenneth A., D.B.A., University of Maryland, 1975; Professor, Management

McCrohan, Kevin F., Ph.D., City University of New York, 1978; Professor, Marketing

Michael, Stephen, Ph.D., Harvard University, 1993; Assistant Professor, Decision Sciences and M.I.S.

Millsbaugh, Peter E., J.D., The American University, 1968; Associate Professor, Business Legal Studies

Min, Chung-Ki, Ph.D., University of Chicago, 1992; Instructor, Decision Sciences and M.I.S.

Norton, John A., Ph.D., University of Texas at Dallas, 1986; Associate Professor, Marketing

Pearce, John A., II, Ph.D., Pennsylvania State University, 1976; Professor, Management

Quarles, N. Ross, Ph.D., University of North Texas, 1988; Assistant Professor, Accounting

Raphael, Coleman, Ph.D., Polytechnic Institute of Brooklyn, 1966; Dean Emeritus of the School of Business Administration

Richmond, William, Ph.D., Purdue University, 1988; Associate Professor, Decision Sciences and M.I.S.

Robbins, D. Keith, Jr., Ph.D., University of South Carolina, 1990; Associate Professor, Management

Ruth, Stephen R., Ph.D., University of Pennsylvania, 1970; Professor, Decision Sciences and M.I.S.

Samuels, Linda B., J.D., University of Virginia, 1975; Associate Professor, Business Legal Studies

Sisodia, Rajendra S., Ph.D., Columbia University, 1989; Assistant Professor, Marketing

Sugrue, Timothy F., Ph.D., University of Massachusetts, 1985; Associate Professor, Finance

Tetzlaff, Ulrich A., Ph.D., Technische Hochschule Darmstadt, Germany, 1990; Assistant Professor, Decision Sciences and M.I.S.

Tongren, Hale N., D.B.A., The George Washington University, 1968; Professor, Marketing

Wilkie, Patrick J., Ph.D., University of Michigan, 1984; Assistant Professor, Accounting

Yau, Jot K., Ph.D., University of Massachusetts, Amherst, 1988; Assistant Professor, Finance

**Business Administration, M.B.A.**

The Master of Business Administration degree, offered by the School of Business Administration, provides a high-level professional education in business administration. The program is oriented to management in business, government, and the nonprofit/service sector. Accredited by the American Assembly of Collegiate Schools of Business (AACSB), the M.B.A. program is available for full-time study during the day or evening and for part-time study in the evening only. Both full-time and part-time students are admitted for the fall semester. A small number of part-time students may be admitted for the spring semester.
Admission Requirements
All students registering for graduate-level courses offered by the School of Business Administration must have graduate standing (i.e., be admitted to the Graduate School). Nondegree student status is not available.

Admission to the M.B.A. degree program is highly competitive. Degree applicants must fulfill the general admissions requirements of the Graduate School. No previous course work in business administration is required, but an elementary-level calculus course must be successfully completed prior to matriculation. Applicants are evaluated primarily on undergraduate record and GMAT performance. These criteria are applied with a certain amount of flexibility to assure that people with unusual academic qualifications are not denied admission. Applications or further information may be requested from the School of Business Administration's Graduate Admissions Office in writing, by telephone (703) 993-2136, or by facsimile (703) 993-2145.

International Applicants: Candidates for SBA graduate programs are responsible for arranging to have all post-secondary international transcripts evaluated and translated by an international credentials evaluation service. Agencies that may be used for this service are listed on the application.

Degree Requirements
The M.B.A. program requires 57 semester hours of graduate course work. It is divided into 36 semester hours of required courses and 21 semester hours of elective courses as described below. A thesis option is not available.

Required Course Work (36 hours)
The required courses listed below may not be used for elective credit. Courses are taken in numerical sequence beginning with the 600s and progressing to the 700s. Students must satisfy ALL course prerequisites listed in the Schedule of Classes and/or Graduate Catalog for courses offered by the School of Business Administration. Students who register for such courses without prerequisites or without a written waiver from the appropriate associate dean of the School of Business Administration may be dropped from those courses.

**Decision Analysis Theory and Support:**
- ACCT 600 Financial Accounting
- ACCT 650 Managerial Accounting
- FNAN/DESC 601 Managerial Microeconomics
- FNAN/DESC 700 Applied Macroeconomics

**MIS 600 Management Information Systems**
**DESC 600 Managerial Statistics**

**Managerial Functions:**
- FNAN 650 Managerial Finance
- MKTG 650 Marketing Management
- DESC 650 Operations Management/Management Science
- MGMT 600 Organizational Behavior and Development

**Integrative Functions:**
- BULE 700 Regulatory Structure/Ethics
- MGMT 750 Strategy and Policy Management

**Elective Course Work (21 hours)**
Each M.B.A. graduate student must complete at least 21 hours of 700-level M.B.A. electives, including an international elective, in at least three separate disciplines. Disciplines include Accounting, Business Legal Studies, Decision Sciences, Finance, Management, Management Information Systems, and Marketing. The international elective is usually chosen from: ACCT 746, ACCT 782, FNAN 717, MGMT 775, MGMT 781, or MKTG 777. Other international electives may satisfy this requirement with written approval of the appropriate associate dean in the School of Business Administration.

**School Regulations**
Subject to general transfer policies of the Graduate School and approval from the appropriate associate dean of the School of Business Administration, up to 6 hours of graduate course work may be transferred from other institutions. However, to be considered for transfer, such work must have been completed within six years prior to the date of admission to the degree program. Alternately, up to 6 hours of graduate course work may be completed, with prior approval by the appropriate associate dean, through the Washington Metropolitan Area Consortium or in other graduate programs of this university. Such course work must be in graduate-level courses exclusively reserved for graduate students. Credit is not given for undergraduate course work in business administration and such course work will not waive required M.B.A. courses.

**Executive M.B.A.**
The Executive Master of Business Administration is a two-year general management program leading to the M.B.A. degree. It meets the needs of mid-career executives who are reaching for senior management, and it enhances the skills and effectiveness of senior executives.
The class schedule of alternating Fridays and Saturdays, and a four-week residency, allows participants to continue their careers while they study and master a broad range of functional and managerial skills. Two weeks of the four-week residency are spent studying abroad.

The course of study addresses all aspects of management issues. It examines and explains new methods for effective managing, including systematic approaches, creativity and innovation, competitive positioning, strategic analysis, decision-making methods, long-term planning, and organizational change. The faculty is prepared to explore the effects of international variables on management strategy, providing the necessary background for business planning in a fluctuating world market. Call (703) 733-2834 for further information.

Participants
The Executive M.B.A. is designed for persons with significant business and professional experience. Participants should be sponsored by their organizations. The sponsoring organizations for the first E.M.B.A. class included American Medical Laboratories, AT&T Bell Laboratories, Fujitsu America, Group Health Association, Hewlett-Packard, McDonnell Douglas Corporation, Price Waterhouse, Sallie Mae, Signet Bank, Westinghouse Electric Corporation, and Xerox.

Methods of Instruction
The program uses instructional methods tailored to the skills of the experienced manager. Study groups are an essential part of the Executive M.B.A. experience. Study groups usually meet off campus once a week to discuss current course work. The groups are assigned by geographic location of home address, with attention given to the diversity of skills represented.

Live-in sessions round out the curriculum. During a five-day residency at the beginning of the first year and the last semester, participants are exposed to the range of issues to be covered and the analytical skills to be developed. The week-long residency also allows participants to continue classroom discussion in a casual setting, expand their network of business contacts, and develop new friendships.

A European Study Program concludes the first year of study. This two-week program is designed to help the participants draw together and integrate the managerial disciplines studied during the year and enjoy the sights of Europe. The program includes one week of study-in-residence at Oxford University and one week in continental Europe where students visit a wide variety of European firms, research centers, and governmental institutions.

Classroom dialogue encourages the sharing of opinions and experiences about theoretical as well as practical problems facing the participants and their companies. This recognition of each individual's background as a major resource is an important aspect of the study group system. The program provides a balance of conceptual and applied materials through a mix of formal classroom participant-instructor studies, and of individual and group research and case analysis. The integration of work experience with classroom participation provides a learning environment far superior to that which excludes either aspect.

Program Schedule

**Fall Semester — First Year**
- One-week residency
- Financial Accounting
- Managerial Microeconomics
- Managerial Statistics
- Organizational Behavior and Development

**Spring Semester — First Year**
- Managerial Finance
- Marketing Management
- Operations Management/Management Science
- Theory and Policies of International Business
- European Study Program

**Fall Semester — Second Year**
- Applied Macroeconomics
- Management Information Systems
- Managerial Accounting
- Seminar in Labor Management Relations

**Spring Semester — Second Year**
- One-week Residency
- Strategy and Policy Management
- Marketing Decision Systems
- Federal Taxation and Business Planning
- Financial Markets
- Regulatory Structures/Ethics

**Accounting Courses (ACCT)**
Graduate courses in Accounting are listed under the Accounting section in the catalog.

**Business Legal Studies Courses (BULE)**

**General Prerequisites**
1. Students who have not gained admitted status from the Graduate School may not register for graduate-level
courses numbered 600 or higher offered by the School of Business Administration.

2. All students must satisfy ALL course prerequisites listed in the Schedule of Classes for courses by the School of Business Administration. Students who register for such courses without the prerequisites or without a written waiver from the associate dean of the School of Business Administration may be dropped from those courses.

700 Regulatory Structures and Ethics (3:3:0). Prerequisite: Completion of all 600-level M.B.A. program courses. Interrelationships between business organizations, their external environment, and the regulatory process. Emphasis on legal and ethical issues as well as their managerial implications.

702 Business and the Regulatory Process (3:3:0). Prerequisite: BULE 700. Regulatory process as it affects business; emphasis on interaction of legislative, administrative, and judicial policies and procedures as they influence the formulation and interpretation of regulations.

703 Land Use Control and Regulation (3:3:0). Prerequisite: FNAN 351 and BULE 700. Basic principles of law affecting the use of land and natural resources including legal remedies and defenses available to the private citizen. Emphasis on recent law and federal and state statutes.

770/MIS 770 Legal Aspects of Managing Technology (1-3:3:0). Prerequisite: MIS 600. Overview of the legal issues of managing technology (1 credit), with emphasis on contracting and intellectual property protection (2 credits). The one-credit segment introduces tort liability, contracting, and intellectual property policy issues. The two-hour segment provides greater depth of coverage.

Decision Sciences Courses (DESC)

General Prerequisites

1. Students who have not gained admitted status from the Graduate School may not register for graduate-level courses numbered 600 or higher offered by the School of Business Administration.

2. All students must satisfy ALL course prerequisites listed in the Schedule of Classes for courses by the School of Business Administration. Students who register for such courses without the prerequisites or without a written waiver from the associate dean of the School of Business Administration may be dropped from those courses.

600 Managerial Statistics (3:3:0). Prerequisite: 6 credits of math with calculus strongly recommended and graduate standing. The use of statistical methods as scientific tools in the analysis of practical problems in business decision making. Topics include descriptive statistics; probability theory; probability distribution; sampling distribution, inference-estimation and hypothesis testing; elementary decision theory; time series analysis; linear regression and correlation; the analysis of variance.

601 Managerial Microeconomics (3:3:0). Prerequisite: Graduate standing and college calculus; Corequisite: DESC 600. Provides a fundamental understanding of how economic principles are applied, along with mathematical and statistical analysis, to managerial decision making. Principle of microeconomic theory are thoroughly explored, including models of theories of choice under risk and uncertainty, market supply and demand, production and cost functions, monopoly, oligopoly, perfect competition, and product and resource pricing. (Same as FNAN 601).

650 Operations Management/Management Science (3:3:0). Prerequisite: Completion of all M.B.A. foundation courses including DESC 600 and graduate standing. Knowledge of calculus is strongly recommended. A systems approach that addresses a wide range of operations management decisions from long-term policy and systems design questions to daily scheduling, cost control, and quality control decisions. Emphasis is on modeling, quantitative analysis of systems, case studies, and using computer programs to solve operations management problems.

700 Applied Macroeconomics (3:3:0). Prerequisites: DESC 601, DESC 600, and FNAN 650. Applications of general equilibrium economic analysis to business management, and government economic policy. Topics include the use of national economic statistics, the interpretation of economic trends and developments, and forecasting, as applied to current economic problems. (Same as FNAN 700).

710 Business Forecasting (3:3:0). Prerequisite: DESC 650. Study of forecasting techniques that are employed in the private and public sector. The primary emphasis will be placed upon time series techniques; students will learn to model stationary and nonstationary processes with autoregressive, moving average, and mixed models. These techniques will be demonstrated and utilized through computer software.

720 Project and Cost Management (3:3:0). Prerequisite: DESC 650. Focus on project scheduling, time-cost tradeoffs, budgeting, cost control, and project monitoring. Special emphasis on cost-management aspects of projects in technology in intensive industries. Use of software and case studies.

735 Computer Simulation (3:3:0). Prerequisite: DESC 650. Introduction to the basic concepts of simulating complex systems by computer. Topics include Monte Carlo methods, discrete-event modeling, a specialized simulation language, and the statistics of input and output analysis.

741 Operations Planning and Control (3:3:0). Prerequisite: DESC 650. Focuses on operations planning and control problems in both manufacturing and services operations, and on linkages with other problem areas. Analysis of managerial issues associated with planning and controlling material flows and inventory levels.

743 Seminar in Applications of Management Science (3:3:0). Prerequisite: DESC 742. Model development and implementation involved in the practice of operations research in management science.

744 Contemporary Issues in Decision Analysis (3:3:0). Prerequisite: DESC 650. Application of analytic reasoning skills to practical problems in business administration. Topics include problem structure, analysis, and solution implementation, emphasizing contemporary approaches to decision analytic techniques.

745 Distribution and Logistics Management (3:3:0). Prerequisite: DESC 650. Application of modern logistics principles to productions, acquisition, physical distribu-
tion, and materials management. Develops an understanding of logistics concepts and their applications in the business world.

746 Operations Management in the Service Industry (3:3:0). Prerequisite: DESC 650. Provides an understanding of the basic concepts, techniques, and practices used in managing operations within a service organization, such as service strategies, service system design, capacity planning, scheduling of services, and quality management.

747 Decision Support Systems for Management (3:3:0). Prerequisites: MIS 600, DESC 600. Addresses tools and models of decision making. Problem formulation and model specification are discussed using decision trees, influence diagrams, econometric and simulation models. Examines data management, including the COMPUSAT database.

763 Seminar in Operations Management (3:3:0). Prerequisite: DESC 650. Aspects of productivity, technology, new processes, materials, products, equipment, and facilities. Implications of new technology in managing the operation (production) function. Lecture, discussion, cases, and problems.

796 Independent Study and Directed Readings (3:0:0). Prerequisite: DESC 650. By special arrangement with professor and approval of the Decision Sciences chair.

Finance Courses (FNAN)

General Prerequisites

1. Students who have not gained admitted status from the Graduate School may not register for graduate-level courses numbered 600 or higher offered by the School of Business Administration.

2. All students must satisfy ALL course prerequisites listed in the Schedule of Classes for courses by the School of Business Administration. Students who register for such courses without the prerequisites or without a written waiver from the associate dean of the School of Business Administration may be dropped from those courses.

601 Managerial Microeconomics (3:3:0). Prerequisite: Graduate standing and college calculus; corequisite: DESC 600. Provides a fundamental understanding of how economic principles are applied, along with mathematical and statistical analysis, to managerial decision making. Principles of microeconomic theory are thoroughly explored including models of theories of choice under conditions of risk, uncertainty, market supply and demand, production and cost functions, monopoly, oligopoly and perfect competition, product and resource pricing. (Same as DESC 601).

650 Managerial Finance (3:3:0). Prerequisite: ACCT 600, DESC 600, and DESC/FNAN 601. Introduction to the theories of finance, and their application to the formulation of business policy. Topics include internal financial analysis, financial forecasting, management of assets, rate of return analysis, and capital formation.

700 Applied Macroeconomics (3:3:0). Prerequisites: FNAN 601, DESC 600, and FNAN 650. Application of general equilibrium economic analysis to business management, and government economic policy. Topics include the use of national economic statistics, the interpretation of economic trends and developments, and forecasting as applied to current economic problems. (Same as DESC 700).

711 Corporate Financial Policy (3:3:0). Prerequisite: FNAN 650. Analysis of capital budgeting and long-term asset financing. Capital budgeting and financing techniques for the fixed asset portion of balance sheet are considered.

717 International Finance (3:3:0). Prerequisite: FNAN 650. Advanced analysis of management of the firm's international financial operations. Topics include currency risk, political risk, returns and funding of international projects, international markets and accounting, and the cost of capital. Lecture, discussion, readings, and cases.

721 Investment Analysis (3:3:0). Prerequisite: FNAN 650. The analysis of equity securities and debt instruments given the implications of the efficient market hypothesis and modern capital market theory.

722 Portfolio Analysis (3:3:0). Prerequisite: FNAN 650. Theory and mathematical techniques used in the management of investment portfolios.

731 Financial Markets (3:3:0). Prerequisite: FNAN 650. Allocation of funds process accomplished by financial markets. Money and capital markets, including the organization, relative efficiency, and interaction between market segments.

732 Financial Institutions (3:3:0). Prerequisite: FNAN 650. Financial institutions as intermediaries within the financial markets. Organizational and regulatory forces in terms of influences upon management.

741 Current Topics in Finance (3:3:0). Prerequisite: FNAN 650. Topics of interest in finance, including industrial, governmental, international, or institutional applications. Techniques and methods of financial practice and influences of new legislation.

746 Operations Management in the Service Industry (3:3:0). Prerequisite: DESC 650. Provides an understanding of the basic concepts, techniques, and practices used in managing operations within a service organization, such as service strategies, service system design, capacity planning, scheduling of services, and quality management.

747 Decision Support Systems for Management (3:3:0). Prerequisite: MIS 600, DESC 600. Addresses tools and models of decision making. Problem formulation and model specification are discussed using decision trees, influence diagrams, and econometric and simulation models. Examines data management including the COMPUSAT database.

751 Real Estate Finance: Mortgage Markets and Investment (3:3:0). Prerequisite: FNAN 650. Mortgage banking with emphasis on markets, instruments, and financial environment and techniques; and the real estate investment decision-making process and skills with emphasis on analysis and strategy. Microcomputer applications.

752 Real Estate Market Analysis (3:3:0). Prerequisite: FNAN 650. Real estate market analysis and sources of data; problems and techniques that apply to each of the analysis of various types of real estate. Students will develop analytical skills involving the use of the microcomputer and appropriate software.

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Management Information Systems Courses (MIS)

General Prerequisites
1. Students who have not gained admitted status from the Graduate School may not register for graduate-level courses numbered 600 or higher offered by the School of Business Administration.

2. All students must satisfy ALL course prerequisites listed in the Schedule of Classes for courses by the School of Business Administration. Students who register for such courses without the prerequisites or without a written waiver from the associate dean of the School of Business Administration may be dropped from those courses.

600 Computer Systems for Management (3:3:0). Prerequisite: Graduate standing. A course in computer programming is recommended. Examination of computer information systems and their interrelations with management processes. Emphasis on management information system life cycle from manager's perspective. Lecture and computing lab, including programming in BASIC and a variety of microcomputer software packages.

720 Business Systems Development (3:3:0). Prerequisite: MIS 600. Study methods and tools for analyzing and designing business information systems with an emphasis on business processes. Includes data modeling, process modeling, interaction analysis, and user interface.

725 Economics of Information Systems Management (3:3:0). Prerequisite: MIS 600, DESC 601. Focuses on the management of information systems in organizations; it explores investment in IT, the business value of information systems, hardware cost/performance trends, and the cost of software development.

740 Business Applications of Telecommunications (3:3:0). Prerequisite: MIS 600. Introduction to telecommunications technology and its applications in business, including LANs, PBXs, voice services, mobile communications, and ISDN. Applications in manufacturing and service sectors, along with regulatory issues and impact on globalization.

745 Strategic Applications of Information Technologies (3:3:0). Prerequisite: MIS 600 or equivalent. Strategic business and productivity issues in industrial, government, and educational uses of IT. Case studies drawn from accounting, marketing, manufacturing, and financial services.

750 Managerial Applications of Microcomputers (3:3:0). Prerequisite: MIS 600. Selection and use of microcomputer hardware and software for management applications such as word processing, spread sheet analysis, graphics, communications, file management, and data base management. Term project and laboratory.

760 Human Engineering Issues in Computer Systems Design (3:3:0). Prerequisite: MIS 600. Surveys the various human factors and ergonomic aspects of computer systems, including hardware and information displays as well as human factors principles of software design. Return on investment on alternative human factors decisions examined in applied settings. Cases and laboratory.

770/BULE 770 Legal Aspects of Managing Technology (1-3:3:0). Prerequisite: MIS 600. Overview of the legal issues of managing technology (1 credit), with emphasis on contracting and intellectual property protection (2 credits). The one-credit segment introduces tort liability, contracting, and intellectual property policy issues. The two-hour segment provides greater depth of coverage.

780 Knowledge-Based Systems for Business (3:3:0). Prerequisite: MIS 600. Introduction for system developers and managers to the concepts and techniques for building knowledge-based systems. Emphasis is on the use and application of knowledge-based systems in business and public section organizations. Term project.

785 International Business Issues in Information Technology (3:3:0). Prerequisite: MIS 600. Examines the complex business decisions in IT required in a global context. Guest speakers, direct linkages by Internet to international corporations, extensive use of case studies, and class projects.

790 Contemporary Issues in Management Information Systems (3:3:0). Prerequisite: MIS 600. Introduction to the concepts, techniques, and implementation of information resource management in businesses, government agencies (federal, state, local), and other organizations. Emphasis is on the use of contemporary techniques in IRM applied to the full spectrum of information resource issues, including equipment, systems, hardware, software, training, data communications, and human factors. Term project.

792 Topics in Management Information Systems (3:3:0). Prerequisite: MIS 600. A significant information resource management topic is selected for detailed coverage. Examples of such topics are computer security, life
cycle management of EDP systems, computer personnel management. Term Project.

795 Business Expert Systems (3:3:0). Prerequisite: MIS 600. Thorough introduction to applications of expert systems for advice, consultation, and decision-making. Emphasis is on the use and application of expert systems in business and public sector organizations. Term project.

Management Courses (MGMT)

General Prerequisites
1. Students who have not gained admitted status from the Graduate School may not register for graduate-level courses numbered 600 or higher offered by the School of Business Administration.

2. All students must satisfy ALL course prerequisites listed in the Schedule of Classes for courses by the School of Business Administration. Students who register for such courses without the prerequisites or without a written waiver from the associate dean of the School of Business Administration may be dropped from those courses.

600 Organizational Behavior and Development (3:3:0). Prerequisite: Graduate standing. Development, theories, and practice of management within organizations. Particular emphasis will be given to human behavior and how it influences organizational effectiveness and efficiency. Student skills will be improved through case studies, readings, exercises, and class discussion.

711 Organization Theory (3:3:0). Prerequisite: MGMT 600. A survey of the theoretical and empirical literatures in organization theory, including organization/environment relationships, organization structure, organization design, and dynamic processes in organizations. Focus is on understanding theory, evaluating research, and recognizing factors that influence organizational effectiveness.


722 Seminar in Staffing Planning (3:3:0). Prerequisite: MGMT 600. Introduction to the study of concepts and issues in human resource staffing and planning, which is a natural base for work in the general personnel function of an organization.

731 Seminar in Labor Management Relations (3:3:0). Prerequisite: MGMT 600. The U.S. labor movement and its present political-economic status. Legal environment surrounding labor relations and recent rulings by regulatory bodies. Executive orders and political forces influencing unions in the public sector. Emphasis on negotiations and administration of labor contracts at the local level.

741 Industry and Competitive Analysis (3:3:0). Prerequisite: MGMT 600. An examination of industry structure; industry evolution and population ecology; determinants of rivalry in industry; strategic group analysis; technological issues in competitive analysis; market signaling; stakeholder analysis; corporate and business strategy links; international business strategies; strategies for competing in diverse industrial settings.

742 Managing for Competitive Excellence (3:3:0). Prerequisite: MGMT 600. A managerial perspective and focus on the sequence of factors or events that shape human resource strategies, their implementation, and their evaluation. Hence, material will be integrated from the areas of human resource management, technology and innovation, strategic management, industrial relations and international management into a package that is appropriate for all managers, regardless of their specific areas of specialization or responsibilities.

750 Strategy and Policy Management (3:3:0). Prerequisite: Final 12 hours of M.B.A. program. Corequisite: BULE 700, FNAN/DESC 700. Course provides students with an integrative learning experience by examining the strategic management concepts and practices across all operational and functional areas. A generalist, senior-level executive perspective is emphasized. Case studies, lectures, group projects, and field work.


761 Management of Research and Development (3:3:0). Prerequisite: MGMT 600. Study of management concepts in R & D, including examination of selected international practices (e.g., Japan, West Germany, etc.) and possible adaptation, recognizing cultural differences. Emphasis on the incentives and disincentives for R & D climate and the organizational and management techniques that affect R & D performance. Economics affecting R & D programs, role of government and universities in industrial R & D activities.

771 Organizational Management and Public Policy (3:3:0). Prerequisite: MGMT 600. An examination of contemporary organizational management reflecting economic, social, political, and technological public policy concerns. Management issues treated include disclosure, governance, ethical behavior, employee citizenship rights, working life, governmental relations and political involvement, health, safety, and the environment.

781 Seminar in Comparative Business Management (3:3:0). Prerequisite: MGMT 600. Comparative analysis of business practices and management systems in different economic, social, and political systems. Generic characteristics of management and business enterprises as modified in varying environments.

785 Business and Organizational Interviewing (3:3:0). Prerequisite: MGMT 600. Study of management theory and concepts relevant to business and organizational interviewing. Introduction to relevant theory and research on the most commonly used forms of the business interview. Videotaping and role playing train students in the correct uses of the business interview. Focus on survey, selection, appraisal, counseling, discipline, and exit interviews from the perspective of the interviewer.

795 Managerial and Business Communication (3:3:0). Prerequisite: MGMT 600. Study of the concepts and issues in managerial and business communication. Introduction to the study of managerial communication as preparation for a career in human resource development. The study of managerial communication is a natural base for work in the general personnel function of an organization.

796 Independent Study and Directed Readings (3:0:0). Prerequisite: MGMT 600. By special arrangement with professor and approval of the Management Department chair.

798 Seminar in Business Research (3:3:0). Prerequisite: MGMT 600. Study of research design plans, methodologies, data collection and analyses, and their application to business research projects. Students prepare a written report covering an approved research topic in a specialty area.

800 Strategy Formulation (3:3:0). Prerequisite: Admission to the Ph.D. program in Business Administration and permission of instructor. A survey of the theoretical and empirical literature focusing on the nature and work of boards of directors, general managers, top management teams, and middle managers; organizational goal setting; and corporate- and business-level strategies.

810 Strategy Implementation and Control (3:3:0). Prerequisite: MGMT 800. Explores problems associated with the effective-efficient implementation and control of the strategic management process. Identifies current research issues and needs to introduce students to empirical findings, theoretical perspectives, and controversies in the field.

820 Seminar in Human Resources Management and Industrial Relations (3:3:0). Prerequisite: MGMT 721. Advanced seminar in human resource management and industrial relations emphasizing the dynamic and legal environment of the total employment condition. Course covers all key functions and components of HRM and introduces the field of industrial relations.

830 Seminar in Performance Appraisal and Compensation Administration (3:3:0). Prerequisite: MGMT 820. Study of concepts and issues in performance appraisal and compensation administration. The first half of the course focuses on the measurement and evaluation of both individual and group performance. Different methods of appraising performance are considered and evaluated in terms of their impact on the individual, the appraiser, and the organization. The second half focuses on management of employee compensation. Each major issue covered is discussed in the context of research and state-of-the-art practices that guide performance appraisal and compensation decision making.

840 Strategic Management of Innovation and Technology (3:3:0). Prerequisite: MGMT 810. Study of the relationship of innovation and technology to the strategic posture of the firm. Models and theories of management of innovation and technology are examined with an emphasis on the role of senior executives. Focus on examining processes associated with managerial decision making, and on appropriate research strategies in the field.

860 Advanced Seminar in Research in Management (3:3:0). Prerequisite: Completion of required doctoral methodology sequence. Examination of debates on philosophy of science and their implications for selection of research questions. Highlights judgment calls associated with the design, analysis, and presentation of research. Issues and appropriate methods in selecting dissertation topics and developing proposals are examined. Provides a forum for doctoral candidates to identify possible doctoral research topics.

999 Doctoral Dissertation Research (variable credit). Prerequisite: Admission to Ph.D. program in Business Administration and approval of dissertation supervisor. Research on an approved Ph.D. dissertation topic under the direction of the student's dissertation committee. May be repeated. No more than 24 semester credit hours may be applied to Ph.D. degree requirements.

Marketing Courses (MKTG)

General Prerequisites

1. Students who have not gained admitted status from the Graduate School may not register for graduate-level courses numbered 600 or higher offered by the School of Business Administration.

2. All students must satisfy ALL course prerequisites listed in the Schedule of Classes for courses by the School of Business Administration. Students who register for such courses without the prerequisites or without a written waiver from the associate dean of the School of Business Administration may be dropped from those courses.

650 Marketing Management (3:3:0). Prerequisite: ACCT 600, DESC 600, and DESC/FNAN 601. This course develops abilities to make marketing decisions through application of qualitative/quantitative concepts, with emphasis on marketing research, strategic planning, consumer behavior, and market determination. Case studies, readings, and projects.

723 Marketing Management Service and Nonprofit Organizations (3:3:0). Prerequisite: MKTG 650. Theoretical and practical aspects of marketing in service organizations (banks, consulting firms, law, medicine) and nonprofits (trade associations, health and social organizations, government). Emphasis on case analyses, discussion, and research projects.

724 Promotional Strategy in Marketing (3:3:0). Prerequisite: MKTG 650. Promotion activities as applied to both profit and nonprofit organizations. The approach is to develop basic issues in promotional strategy, then to focus on managerial issues and problems as encountered by promotion executives.

725 Marketing Research (3:3:0). Prerequisites: MKTG 650 and DESC 650. Concepts, theories, principles, techniques, and models underlying the marketing research process.

726 Advanced Consumer Behavior (3:3:0). Prerequisite: MKTG 650. Advanced study of the concepts and propositions that comprise consumer decision processes. Examination of extant literature and research applications for marketing strategy and public policy are stressed. Lecture and case analysis.

765 Marketing Decision Systems (3:3:0). Prerequisite: MKTG 650. Participants will gain an appreciation for the capabilities that exist today for the systematic management of the marketing function in the modern corporation. The course broadly addresses the various ways in which information technology impacts upon mar-
Marketing and how information technology can be deployed in a strategic manner to alter the way in which marketing is done. The course will cover marketing decision making, the integration of databases (internal as well as syndicated), statistical techniques, modeling, and optimization to provide enhanced decision support for marketing managers. The present and future role of expert systems will also be explored.


777 International Market Planning Practicum (3:0:0). Prerequisite: MKTG 650. Small groups of students act as unpaid consultants to local businesses to study problems related to foreign market expansion. Culminates in formal written report and presentation to senior management of firm.

796 Independent Study and Directed Readings (3:0:0). Prerequisite: MKTG 650. By special arrangement with professor and approval of the Marketing Department chair.

800 Marketing Theory/Philosophy of Science (3:3:0). Prerequisite: Admission to Ph.D. program in Business Administration and permission of instructor. Study of the philosophical underpinning of marketing theory, the historical development of marketing thought, and alternative paradigms and their resolution.

810 Special Topics Seminar (3:3:0). Prerequisite: Admission to Ph.D. program in Business Administration and permission of instructor. Study of specific issues and problems of contemporary interest to marketing scholars. Topics vary by semester.

820 Marketing Models (3:3:0). Prerequisite: Admission to Ph.D. program in Business Administration and permission of instructor. Applied study of the mathematical and statistical models relating to marketing.

830 Data Analysis (3:3:0). Prerequisite: Admission to Ph.D. program in Business Administration and permission of instructor; graduate multivariate statistics (3-4 credit hours), e.g., DESC or PSYC 756. Comprehensive, applications-oriented study of procedures used in analysis of marketing research data.

840 Doctoral Research Seminar (3:3:0). Prerequisite: Admission to Ph.D. program in Business Administration and permission of instructor. Review of procedures requisite to the development of a satisfactory Ph.D. dissertation proposal, focusing on topic selection, hypothesis development, and research design. Matters are considered in general and from the perspective of each student's research program.

999 Doctoral Dissertation Research (variable credit). Prerequisite: Admission to Ph.D. program in Business Administration and approval of dissertation supervisor. Research on an approved Ph.D. dissertation topic under the direction of the student's dissertation committee. May be repeated. No more than 24 semester credit hours may be applied to Ph.D. degree requirements.
Graduate School of Education
Community College Education

Faculty
Beyer, Barry K., Ph.D., University of Rochester, 1962; Professor of Education
Boileau, Don M., Ph.D., University of Oregon, 1972; Professor and Chair, Department of Communication
Chickering, Arthur W., Ph.D., Columbia University, 1958; University Professor of Education
Coleman, Gilbert I., Ed.D., University of Virginia, 1992; Associate Director, The National Center for Community College Education
Edwards, Randall, Ph.D., Virginia Polytechnic Institute and State University, 1970; Executive Vice President for Administration and Senior Scholar in Community College Education
Given, Barbara K., Ph.D., The Catholic University of America, 1974; Associate Professor of Education
Mellander, Gustavo A., Ph.D., The George Washington University, 1966; Professor and Dean, Graduate School of Education; Director, The National Center for Community College Education
Thaiss, Christopher J., Ph.D., Northwestern University, 1975; Associate Professor of English

Doctor of Arts in Community College Education

The Doctor of Arts in Community College Education is administered by The National Center for Community College Education. Course work leading to the degree educates prospective community college teachers and helps current community college faculty members become more effective teachers. The program emphasizes a broad knowledge base in the student's teaching field as well as courses in research and in the history and philosophy of the community college. Students select courses from designated departments in the university to develop a program of study. Knowledge areas include biology, business, computer science, economics, English, foreign languages and literatures, health and physical education, history, information systems, mathematics, nursing, operations research and applied statistics, psychology, public administration, and sociology. Applications for other fields are considered where appropriate course work is available. Under the guidance of faculty advisers and the center's staff, entering students develop individualized programs of study.

Admission Requirements
In addition to meeting the general admissions requirements for graduate study, applicants must fulfill the following:
1. Have experience in teaching at the community college level, or have teaching at the community college level as a career objective;
2. Submit a completed application (applications are available from The National Center for Community College Education or from the Office of Admissions);
3. Submit a short statement (1,000 words) describing the applicant's interest in the program and how it will help achieve career objectives;
4. Submit two writing samples if English is the applicant's knowledge area;
5. Submit GMAT scores if Business is the applicant's knowledge area;
6. Schedule an interview with the staff of The National Center for Community College Education; and
7. Submit three letters of recommendation.

Additional material may be required, depending on the applicant's background and teaching field.

Degree Requirements
The program requires a minimum of 55 hours beyond the master's degree. The basic components of the program for a faculty member holding a
master's degree in the current or proposed teaching field are as follows:

<table>
<thead>
<tr>
<th>Minimum Requirements</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Knowledge Area</td>
<td>24 credits</td>
</tr>
<tr>
<td>Core Curriculum</td>
<td>12 credits</td>
</tr>
<tr>
<td>Internship</td>
<td>5 credits</td>
</tr>
<tr>
<td>Doctoral Project</td>
<td>10 credits</td>
</tr>
<tr>
<td>Total</td>
<td>49 credits</td>
</tr>
</tbody>
</table>

The remaining 6 hours are completed in one or more of the above areas or in a field related to the student’s knowledge area. The designation of these 6 hours is determined by the director or associate director of The National Center for Community College Education in consultation with the student and the knowledge area adviser. The 6 hours may not be used to meet the minimum requirements in the knowledge area. For example, if a student is required to take more than 24 credits in the knowledge area, the credits are in addition to the 55 credits normally required in the program.

The number of credits assigned to the knowledge area, core curriculum, internship, and doctoral project may vary for individual students within the above guidelines. Departments may require additional course work in the knowledge area when the student has completed the master’s degree in a field other than the designated knowledge area or when prior academic preparation is considered inadequate.

Knowledge Area
The knowledge area consists of courses in the student’s teaching discipline and may contain courses in related fields when appropriate and when approved by the knowledge area adviser. Each knowledge area department, working with The National Center for Community College Education, sets its own requirements, specifying a core set of courses and working with the student to develop an individualized program of study consisting of advanced course work, directed readings, and independent study. The program of study usually includes, among other courses, the following: (a) a course in the theory and philosophical concepts of the discipline, (b) a course in the research methodology by which the discipline generates knowledge, and (c) a “new developments” course that focuses on recent significant advances in the knowledge area.

Core Curriculum
Students must complete a minimum of 12 credits in the core curriculum including EDCC 801 The Community College (3 credits). Each student also chooses at least three 3-credit hour elective courses from the list below.

<table>
<thead>
<tr>
<th>Courses</th>
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<tbody>
<tr>
<td>COMC 897 Directed Readings in Community College Education (1-3 credits)</td>
</tr>
<tr>
<td>EDCC 802 Community College Teaching through Learning Styles (3 credits)</td>
</tr>
<tr>
<td>EDCC 805 Teaching Thinking (3 credits)</td>
</tr>
<tr>
<td>EDCC 806 Seminar in Communication: Communication Skills for Teaching (3 credits)</td>
</tr>
<tr>
<td>EDCC 892 Special Topics in Community College Education (3 credits)</td>
</tr>
<tr>
<td>EDCC 850 Research: Using Research to Improve Teaching (3 credits)</td>
</tr>
<tr>
<td>EDUC 840 Adult Development and Learning (3 credits)</td>
</tr>
<tr>
<td>EDUC/ENGL 695 Writing Across the Curriculum (3 credits)</td>
</tr>
</tbody>
</table>

Internship
Students must satisfactorily complete a minimum of 3 credit hours in an internship. A maximum of 6 credits may be earned through the internship. This may be in a teaching internship in a community college or a non-teaching internship depending on the extent of the student’s teaching experience. Non-teaching internships may be in government or business organizations in which community college graduates are employed. Internships for experienced community college faculty also may involve work in course development.

Comprehensive Examination/Experience
Upon satisfactory completion of all course work and the internship, a student completes either a traditional comprehensive examination or a more nontraditional comprehensive experience demonstrating the student’s mastery of the knowledge area and the core curriculum. Students must satisfactorily complete the examination or experience to be advanced to candidacy for the degree. A student must complete all degree requirements within five years following the semester of advancement to candidacy.

Doctoral Project
Upon advancement to candidacy, a student completes a written doctoral project. The amount of credit assigned to the project reflects the extent of the undertaking. The project is synthesizing in nature and must contribute new knowledge or a reinterpretation of existing knowledge to the area being investigated. Projects must demonstrate high standards of scholarship and the ability to engage in independent research resulting in a substantial contribution to knowledge or practice in the field.

Advising
All students are advised by the staff of The National Center for Community College Education. In addition, each student is assigned an adviser in...
the knowledge area. Working with these advisers, each student prepares a program of study and completes all program requirements.

Residence

Doctoral students are required to spend a minimum of two consecutive semesters, not including summer session, in continuous registration. The doctoral program of study must include a minimum of 36 semester hours of graduate work taken at the university after admission to degree-seeking status.

Course Work at Other Institutions

Twelve hours of credit beyond the master's degree may, with the permission of the student’s knowledge-area adviser, be applied toward the Doctor of Arts in Community College Education degree provided that the course work is relevant and appropriate to the student’s program of study. Credit applied toward the degree must have been earned within six years prior to admission to the doctoral program. Students who have not used this provision at the time of admission to the program may complete up to 12 hours of approved course work at other institutions while enrolled in the doctoral program, and apply these credits to program requirements.

Graduate Diploma in Community College Education

The graduate diploma in Community College Education is designed for master's degree graduates who are planning (or exploring the possibility of) a career in community college teaching. It combines course work on pedagogy and the community college with a teaching internship under the guidance of an experienced teacher.

Completion of the diploma program does not guarantee the student a community college teaching position. Nonetheless, those who earn the diploma will enter competition for community college faculty positions with the advantage of having at least some classroom teaching experience.

Diploma Requirements

The diploma requires 18 units beyond the master's degree; the student may complete either 9 units of course work and 9 units of a teaching internship or 12 units of course work and 6 units of an internship. Students usually select course work from a core curriculum that focuses on applied teaching techniques. With the permission of the prerequisite department, however, students may substitute six units of graduate courses in their teaching field for six units of course work on teaching-related subjects. Core curriculum offerings include the following:

- EDCC 801 The Community College (3 credits)
- EDCC 802 Community College Teaching through Learning Styles (3 credits)
- EDCC 805 Teaching Thinking (3 credits)
- EDCC 806 Seminar in Communication: Communication Skills for Teaching (3 credits)
- EDCC 850 Research: Using Research to Improve Teaching (2 credits)
- EDCC 892 Special Topics in Community College Education (3 credits)

All students are required to complete EDCC 801 The Community College. A maximum of three 3 credits—with the permission of The National Center for Community College Education—be transferred from another institution. At least 6 hours of GMU course work must be completed before the student may enroll in the teaching internship. The internship is an independent study course listed as COMC 885 Internship in Community College Education (3-6 credits).

Students admitted to the diploma program must hold a master's degree from an accredited institution in a subject area that is taught at the community college level. (These subject areas include most arts and sciences disciplines. Please check with The National Center for Community College Education to be sure that the master's degree is applicable.) Graduate students who have not completed a master's degree may apply to the diploma program on the condition that they fulfill all master's degree requirements before enrolling in diploma courses.

Community College Education Courses (EDCC)

801 The Community College (3:3:0). Prerequisite: Admission to the D.A.C.C.E. program or permission of instructor. Study of the institutional character of the community college, including a review of the history, purpose, clientele, organization, finance, and social functions. Attention is given to current issues facing community colleges.

802 Community College Teaching Through Learning Styles (3:3:0). Prerequisite: Admission to the D.A.C.C.E. program or permission of instructor. Focus on the theory of multiple styles of learning and various ways in which individuals demonstrate ability. Emphasized are alternative instructional approaches to enhance and measure learning of community college students at risk for failure. Emphasis is placed on study, analysis, and application to teaching in the community college. Classroom format emphasizes participation by the student and application of course content to community college teaching.

805 Teaching Thinking (3:3:0). Prerequisite: Admission to the D.A.C.C.E. program or permission of instructor. Through lecture, discussion, and demonstration, students

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design, analyze, apply, and evaluate practical approaches to teaching critical thinking at the post-secondary level. Application to subject matter courses of the student's choice is stressed.

806 Seminar in Communication Skills for Teaching (3:3:0). Prerequisite: Admission to the D.A.C.C.E. program or permission of instructor. Study of principles and practices underlying effective lecturing and in leading instructional discussions. Application to the student's field of study is encouraged as a way of establishing the teaching environment.

850 Research: Using Research to Improve Teaching (3:3:0). Prerequisite: Admission to the D.A.C.C.E. program or permission of instructor. Course helps community college faculty members improve their teaching by developing skills as teacher-researchers and increasing knowledge of research methodology. Students conduct a research study related to their teaching.

892 Special Topics in Community College Education (3:3:0). Prerequisite: Admission to the D.A.C.C.E. program or permission of instructor. Content varies depending on interests of the center. May be repeated for credit when topics vary.

Community College Education Courses (COMC)

885 Internship in Community College Education (1-6:0:0). Prerequisite: Admission to the D.A.C.C.E. program and approval by The National Center for Community College Education. Supervised internship involving teaching at a community college or—in the case of experienced teachers—work in other non-teaching settings. Internships should be designed to improve teaching skills, upgrade knowledge in the teaching discipline, or both.

897 Directed Reading in Community College Education (1-6:0:0). Prerequisite: Admission to the D.A.C.C.E. program and approval by The National Center for Community College Education. Independent reading on a topic agreed to by the student and a faculty member assigned by The National Center for Community College Education.

998 Doctoral Project Preparation (1-3:0:0). Prerequisite: Admissions to the doctor of arts program and permission of the director or associate director of The National Center for Community College Education. Independent study leading to the development of a proposal for a doctoral project.

999 Doctoral Project Research (credits vary). Prerequisite: Advancement to candidacy and permission of the director or associate director of The National Center for Community College Education. Independent study on the doctoral project.

Education

Faculty

Anderson, Bonita, M.Ed., George Mason University, 1985; Assistant Director, Office of Teacher Education

Bartholomew, Cheryl, Ph.D., Syracuse University, 1980; Associate Professor

Behrman, Michael M., Ed.D., Columbia University, 1978; Associate Professor

Beyer, Barry K., Ph.D., University of Rochester, 1962; Professor Emeritus

Bonfadi, John E., Ph.D., Virginia Polytechnic Institute and State University, 1976; Associate Professor

Bowen, Larry S., Ph.D., Ohio State University, 1970; University Professor, Dean Emeritus

Brown-Azarowicz, Marjory, Ph.D., University of Washington, 1961; Professor Emeritus

Chickering, Arthur W., Ph.D., Columbia University, 1958; University Professor

Chu, Harold, Ph.D., University of Minnesota, 1973; Associate Professor

Coller, Virginia P., Ph.D., University of Southern California, 1980; Associate Professor

Coleman, Gilbert L., Ed.D., University of Virginia, 1992; Associate Director, The National Center for Community College Education

Dede, Christopher J., Ed.D., University of Massachusetts, 1972; Professor

Dobson, Edward C., Ph.D., Florida State University, 1972; Associate Professor, Assistant Dean

Duck, Lloyd E., Ph.D., University of Virginia, 1974; Associate Professor

Dunkley, Dennis R., Ph.D., Kansas State University, 1985; Associate Professor

Dzama, Mary A., Ed.D., University of Virginia, 1972; Associate Professor

Edgemon, Albert W., Ed.D., Columbia University, 1964; Professor Emeritus

Ford, Martin E., Ph.D., University of Minnesota, 1980; Professor; Associate Dean

Gilstrap, Robert L., Ed.D., George Peabody College, 1963; Professor

Given, Barbara K., Ph.D., The Catholic University of America, 1974; Associate Professor

Isenberg, Joan P., Ed.D., Rutgers University, 1978; Professor
Master of Education Programs, M.Ed.

The Graduate School of Education offers four Master of Education degree programs: Counseling and Development, Curriculum and Instruction, Education Leadership, and Special Education. Within each of these degree programs is a variety of specializations reflecting a wide range of educational and community agency roles. Programs are available to meet the needs of:

1. Persons seeking initial teacher licensure with the option of earning a master's degree;
2. Persons licensure as teachers, who wish to complete a master's degree for personal enrichment or professional advancement; as well as for endorsement in an additional teaching area, counseling, administration, or supervision; and
3. Persons seeking preparation in a specialization not requiring a Virginia teaching license or endorsement.

The Graduate School of Education and other units at George Mason University also offer courses for educators' continuing professional development and/or relicensure. However, relicensure requirements are determined by the Virginia Department of Education or the employing school division.

These programs are approved by the State Board of Education and accredited by the Southern Association of Colleges and Schools and the National Council for the Accreditation of Teacher Education.

Program requirements in the Graduate School of Education are subject to change, especially in those programs leading to licensure or endorsement in teaching, school counseling, school administration or supervision. It is the student's responsibility to know the university and program requirements in effect at the time of admission, and to have these requirements confirmed by the assigned academic adviser. Lists of specific course requirements for each degree program and licensure area are available from the Graduate School of Education. Admitted students who do not know the name of their academic adviser should contact the Office of Academic Student Affairs in

Wang, Sherwood, Ph.D., University of Colorado, 1992; Assistant Professor
White, Charles, Ph.D., Indiana University, 1985; Associate Professor
Williams, Herma, Ph.D., Iowa State University, 1976; Professor

Jacob, Evelyn J., Ph.D., University of Pennsylvania, 1977; Professor
Jones, Edward V., Ed.D., Virginia Polytechnic Institute and State University, 1977; Associate Professor; Director, Office of Adult Learning and Professional Development
Lecos, Mary Anne, Ed.D., Virginia Polytechnic Institute and State University, 1980; Associate Professor; Director, Office of Teacher Education
Lepard, David, Ed.D., University of Massachusetts, 1971; Research Associate Professor
Levy, Jack, Ph.D., University of Massachusetts, 1968; Professor
Martin, William R., Ph.D., University of Minnesota, 1973; Associate Professor
Mellander, Gustavo, Ph.D., George Washington University, 1966; Professor, Dean, and Director, The National Center for Community College Education
Montebello, Mary S., Ph.D., Ohio State University, 1964; Professor Emeritus
Mosier, Tolula, M.Ed., George Mason University, 1989; Assistant Director, Office of Adult Learning and Professional Development
Pierce, Lorraine Valdez, Ph.D., Georgetown University, 1984; Associate Professor
Rosegrant, Teresa J., Ph.D., University of Illinois, 1979; Associate Professor
Schuchman, Betty Jane, Ed.D., Indiana University, 1967; Associate Professor Emeritus
Sears, Carol J., Ph.D., The American University, 1976; Associate Professor Emeritus
Seligman, Linda H., Ph.D., Columbia University, 1974; Professor
Smith, Donald F., Ed.D., The American University, 1968; Associate Professor
Sockett, Hugh T., Ph.D., Kings College, University of London, 1974; Professor
Spikell, Mark A., Ed.D., Boston University, 1972; Professor
Sterling, Donna R., Ed.D., George Washington University, 1992; Assistant Professor
Thomas, Charles L., Ph.D., Johns Hopkins University, 1971; Associate Professor
Thomas, Wayne P., Ph.D., Virginia Polytechnic Institute and State University, 1980; Associate Professor
Wallace, Gerald, Ed.D., University of Oregon, 1969; Professor

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the Graduate School of Education before attempting to register for courses.

The degree programs in Counseling and Development, Curriculum and Instruction, and Special Education require successful completion of a comprehensive examination in the final semester of study. Students interested in research may elect to prepare a thesis in lieu of the comprehensive examination, but must receive program approval for this option prior to the final semester of study. They must also include EDRS 590 and EDUC 599 within the requirements of their programs.

Course Work
Prefixes for courses in the M.Ed. programs offered in the Graduate School of Education are:

EDAS: Education Leadership
EDCD: Counseling and Development
EDCI: Elementary/Middle/Secondary Curriculum and Instruction
EDIT: Instructional Technology
EDRD: Reading
EDRS: Research
EDSE: Special Education
EDUC: Foundations/Support Courses

Curriculum and Instruction, M.Ed.
The Master of Education degree with a major in Curriculum and Instruction is offered as an option for persons preparing for initial teacher licensure, and also in seven specializations for persons who are licensed or experienced educators.

Initial Teacher Licensure with M.Ed. Degree Option
The Graduate School of Education offers the following state-approved programs for initial licensure or add-on endorsement. Through reciprocity agreements, Virginia licensure is recognized fully or partially by more than 30 other states.

Early Childhood Education (Nursery-Grade 3)
With or without endorsement for Teaching English as a Second Language
Middle Education (Grades 4-8)
With or without endorsement for Teaching English as a Second Language
Secondary Education (Grades 8-12)
Biology, Chemistry, Earth/Space Science, English, English as a Second Language, French, Geography, German, Government, History, History/Social Sciences, Latin, Mathematics, Physics, Russian, Russian Studies, Spanish; and for add-on endorsement only—Economics, Psychology, Sociology, and Speech Communication

Special Education (Grades K-12): Emotional Disturbance, Learning Disabilities, Emotional Disturbance/Learning Disabilities, Severe Disabilities, Early Childhood Special Education

In addition, the Office of Teacher Education supports the following undergraduate initial teacher certification programs, which are offered through other units at the university.

Music Education (Grades NK-12): Instrumental, Vocal and General (offered through the Department of Music in the College of Arts and Sciences)
Physical Education (Grades NK-12): With endorsement for Health Education (offered through the College of Nursing and Health Science)

Students also may partially meet Virginia licensure requirements through the M.A. Track IV program offered by the Department of History in the College of Arts and Sciences or through the Teaching English as a Second Language Graduate Certificate program offered by the Department of English in the College of Arts and Sciences.

Admission Requirements for Teacher Licensure Programs
All graduate-level teacher licensure programs provide the M.Ed. option through the completion of course work beyond what is required for licensure. Whether or not applicants seek the degree, they must meet the following admission requirements for graduate study:

1. A baccalaureate degree from an accredited institution
2. A grade point average (GPA) of 3.0 on the last 60 hours of undergraduate study. (Students may be admitted provisionally with a GPA of at least 2.75, if there is additional evidence that the applicant can succeed in a graduate-level program.)

In addition, applicants must submit the following:

1. An expanded goals statement concerning professional plans and career objectives;
2. Three letters of recommendation from individuals qualified to assess potential for success as a graduate student or teacher;
3. Scores on the Communications Skills and General Knowledge components of the National Teacher Examination (NTE) or the Praxis Academic Skills Tests; and
4. A transcript analysis (called the departmental form) showing unmet requirements for the desired licensure area;
5. Be recommended for acceptable, possibly after an interview.
Detailed instructions about the admissions process are available in program handbooks and at group information sessions provided by the Office of Teacher Education (703) 993-2080. Distributed at these monthly sessions are Graduate School applications, NTE/Praxis registration forms, program handbooks, course requirements, and other essential information.

Application deadlines are Fall: May 1; Spring: November 1; and Summer: March 1 (except the Professional Development School Model, for which the deadline is January 1).

Teacher Licensure Program Requirements

All initial teacher licensure programs have general education requirements, professional course work, and additional course work for the M.Ed. degree. Early Childhood and Middle Education licensure programs also have prerequisite course work. Most professional course work includes school-based field experience and internships. The requirements for each program are summarized below. Lists of specific courses for each licensure area are available from the Office of Teacher Education, Robinson Hall, Room A307.

Early Childhood/Middle Education

General Education Prerequisites: 51-53 semester hours in English/Communications, Social Sciences, Math/Statistics/Logic, Natural Sciences, Fine Arts/Philosophy, and Health/Physical Education. For Middle Education, applicants should have concentrations of at least 12 to 15 hours in two of the disciplines taught in grades 4-8.

Prerequisite Professional Course work: 9 semester hours (May be taken as an undergraduate).

Professional Course work: 30-39 semester hours of course work and internship in the Professional Development (PDS) or Flexible Alternative (FLEX) model.

The PDS model includes full-time study and work in public schools for a summer and regular school year. A stipend is paid for the intern's service as an instructional assistant and substitute teacher.

The FLEX model includes a fall, spring, summer, and fall of part-time study, culminating in a 15-week, full-time internship. No stipend is paid.

Additional Course work for M.Ed.: 6 semester hours.

For add-on endorsement in Teaching English as a Second Language: 24 semester hours of professional course work, 6 of which may be foreign language.

Secondary Education

General Education Prerequisites: 46 semester hours in the humanities and social sciences, laboratory science/math/analytical reasoning, and health/physical education. Study of a foreign language is recommended.

Content Area Prerequisites: Vary according to endorsement area. Codetermined by departmental faculty from the College of Arts and Sciences.

Professional Course work: 27 semester hours, including a full-time, 15-week internship. Six hours may be taken as an undergraduate.

Additional Course work for M.Ed.: 15 semester hours.

Special Education

General Education Prerequisites: Same as for Secondary Education.

Prerequisite Professional Course work for licensure: 15 semester hours, 6 semester hours of which may be taken as an undergraduate.

Master's Licensure Specialization: 28-31 semester hours, according to endorsement area, including at least 15 weeks of internship.

Additional Course work for M.Ed.: 12-21 hours, depending on the area of licensure.

FAST-TRAIN Program

FAST-TRAIN is an alternative teacher licensure program that prepares teachers for international assignments. The curriculum consists of six required education courses offered over a one-year period. Upon successful completion of course work and passing scores on the National Teachers Exam, participants receive a Letter of Eligibility, and upon employment apply for provisional Virginia teaching licensure at the PK–8 (Elementary/Middle Education) level. Once students have also completed one year of teaching abroad, they are eligible for the Collegiate Professional License, the regular license for Virginia teachers.

All course have an international, multicultural emphasis reflecting the student populations abroad. Two courses are offered each semester, and the six can be completed in one year. All courses have a 20-hour, field-experience component, half of which is spent in K-3 classrooms and the other half at the 4–8 level. Program enrollees are not eligible for student teaching due to the alternative nature of the curriculum.

For further information about admission and program requirements, contact the coordinator of FAST-TRAIN, Robinson Hall, Room A451, (703) 993-3689.
M.Ed. Programs for Persons Licensed or Experienced as Educators

The curriculum and instruction major includes the following specializations:

- Early Childhood Education (NK-3)
- Middle Education (4-8)
- Secondary Education (8-12)
- Bilingual/Multicultural Education (NK-12)
- Teaching English as a Second Language (NK-12)
- Reading (NK-12)
- Instructional Technology (IT) (NK-Postsecondary)

(The IT specialization has several tracks that prepare individuals for a variety of instructional technology roles in education and training.)

The Reading specialization meets state requirements for licensure as reading specialist. The other programs prepare students who have completed beginning level study and practice for leadership roles — such as lead teacher or trainer, resource teacher, or curriculum coordinator — and partially meet state licensure requirements for instructional and supervisory personnel.

Reflective Practice with a Subject Specialization

The Reflective Practice specialization is normally offered only to practitioners from school divisions that contract with the Office of Adult Learning and Professional Development. Practitioners are enrolled in teams from designated schools and follow a two-and-a-half-year integrated programs of school-based research linked to a subject specialization.

Admission Requirements

Applicants for the M.Ed. degree in Curriculum and Instruction must:

1. Meet the general admissions requirement of a GPA of 3.0 for the last 60 hours of undergraduate study;
2. Be licensed as teachers or have several years successful experience as a teacher/trainer or educational administrator;
3. Submit recommendations by three persons qualified to judge the applicant's professional competencies;
4. Submit an expanded goals statement; and
5. Be recommended for acceptance, possibly after an interview

Program Requirements

All of the Curriculum and Instruction M.Ed. specializations require 9 semester hours of course work in Foundations, Research, and Advanced Seminar with the exception of the Reading Specialization, which requires a Practicum of 6 semester hours instead of the Advanced Seminar. The number of specialized courses and electives varies by specialization. Thus, the total requirements for the M.Ed. in Curriculum and Instruction range from 30 semester hours for the specialization in Early Childhood Education, Middle Education, Secondary Education, Bilingual/Multicultural Education, and Teaching English as a Second Language to 36 semester hours for the specializations in Reading and Instructional Technology.

The specific course work required for each specialization is available from the Office of Teacher Education, Robinson Hall, Room A307, (703) 993-2080, and the Office of Academic Student Affairs, Robinson Hall, Room A307, (703) 993-2034.

Counseling and Development, M.Ed.

The M.Ed. program in Counseling and Development prepares students for careers as counselors and human development professionals in a variety of work settings, including elementary, middle, and secondary schools; colleges and universities; and community mental health agencies. The program develops students' competencies in a broad range of counseling skills, including group and individual counseling, career counseling, and assessment. The program emphasizes the integration of theory and practice, and prepares knowledgeable and capable helping professionals for a wide range of employment settings. The culmination of the students' program is an internship in an educational or mental health agency counseling setting similar to that in which they hope to be employed. This offers students the opportunity to test and refine their counseling skills while experiencing the counselor role.

Degree applicants must have an undergraduate grade point average of at least 3.0, at least one year of experience relevant to the profession of counseling, and evidence of personal and professional qualities compatible with the role of the counselor. In addition, the applicant must:

1. Possess a baccalaureate degree from an accredited institution;
2. Have successfully completed a minimum of 12 semester hours in the behavioral sciences (courses taken to make up undergraduate pre-

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requisites cannot be used to fulfill degree requirements);  
3. Submit three letters of recommendation from supervisors or professors regarding the applicant's potential as a counselor;  
4. Submit a statement of interests and objectives;  
5. Be interviewed and recommended for acceptance.

Applicants preparing for school counseling positions and seeking the M.Ed. degree also must:  
1. Provide evidence of valid teacher licensure in Virginia or its equivalent from another jurisdiction.  
2. Have completed two years of successful work experience, one year of which must be in an appropriate school setting. 

Individuals with a master's degree in education or in a helping profession may wish to apply to the program as a non-degree student. Qualified non-degree students may plan programs leading to Virginia endorsement as a school counselor or to licensure as a professional counselor in Virginia. Applicants for non-degree status must submit two letters of recommendation from supervisors or professors and a statement of interests and objectives.

The M.Ed. program in Counseling and Development offers the following areas of specialization: 

**School Counseling and Development.** Prepares students for careers as elementary, middle, and secondary school counselors. The program ensures that graduates possess the academic and experiential prerequisites for endorsement as a school counselor by the Virginia State Department of Education.

**Higher Education Counseling and Development.** Prepares counselors and student development professionals who share with teaching faculty the responsibility for humanizing and personalizing each student's experience in higher education. Graduates of the program are employed in a wide variety of positions in post-secondary education.

**Community Agency Counseling and Development.** Prepares counselors for employment in a wide range of settings, including community mental health centers; agencies specializing in career counseling; family counseling centers; rehabilitation agencies; and counseling programs in business, industry, federal, state, and local governments.

The M.Ed. degree program in Counseling and Development usually requires 40 semester hours. The specific requirements in each area of specialization are available in the Faculty Support Office, Robinson Hall, Room A339, (703) 993-2020, or Office of Academic Student Affairs, Robinson Hall, Room A307, (703) 993-2034, Graduate School of Education.

**Education Leadership, M.Ed.**

The M.Ed. in Education Leadership offers programs for persons interested in school positions in administration and supervision (including such positions as principal, assistant principal, department chairperson, team leader, supervisor, or director of instruction).

Degree applicants must satisfy the following requirements:  
1. A grade point average of at least 3.0 in the last 60 hours of undergraduate study;  
2. Three letters of recommendation about your leadership potential, including at least one from a current or former supervisor; and  
3. Two years of successful teaching experience; including a portion at the level at which Virginia endorsement is desired.

The M.Ed. in Education Leadership usually requires 33 or 36 hours of graduate credit. These include course work in educational research, computer technology, leadership, school administration, supervision of instruction, and a culminating 3 or 6 credit hour internship or practicum.

Candidates for Virginia endorsement in school administration or supervision must complete the program approved by the State Board of Education. Specific requirements for the M.Ed. in Education Leadership and for Virginia endorsement are available in the Faculty Support Office, Robinson Hall, Room A339, (703) 993-2020, or the Office of Academic Student Affairs, Robinson Hall, Room A307, (703) 993-2034, Graduate School of Education.

**Special Education, M.Ed.**

The M.Ed. in Special Education program is designed to enable qualified individuals to become specialists in learning disabilities (LD), emotional disturbance (ED), early childhood special education (ECSE), severe disabilities (SD), special education technology (SET), and learning disabilities/emotional disturbance combined (LD/ED). Completion of program course work in LD, ED, ECSE, SD, and LD/ED allows the student to meet endorsement requirements in Virginia. The specialization in SET does not lead to teacher licensure or endorsement.

Degree applicants must have an undergraduate grade point average of at least 3.0. In addition, the applicant must satisfy the following requirements:
1. Submit three letters of recommendation by persons qualified to judge the applicant's potential as a special educator;
2. Possess a baccalaureate degree from an accredited institution, preferably in a human services area such as education, psychology, sociology, or allied health services;
3. Submit a written autobiographical narrative; and
4. Be interviewed and recommended for acceptance.

A total of 55-67 graduate credit hours is required depending upon the requirements of each area of specialization and previous course work. The specific requirements for these areas are available in the Faculty Support Office, Robinson Hall, Room A339, (703) 993-2020; Office of Academic Student Affairs, Robinson Hall, Room A307, (703) 993-2054; and the Educational Study Center, Robinson Hall, Room A353, (703) 993-2044, of the Graduate School of Education.

**Education: Doctor of Philosophy in Education, Ph.D.**

The Graduate School of Education, in cooperation with the College of Arts and Sciences, offers a Doctor of Philosophy in Education degree as its major degree in education. The Ph.D. degree provides advanced liberal arts professional education for experienced educational practitioners pursuing or planning careers in nontraditional as well as traditional educational settings.

The Ph.D. requires a minimum of 85 semester hours of study beyond the baccalaureate degree or a minimum of 55 semester hours beyond the master's degree. A limited number of graduate hours taken previously may be applied to the program. However, an individual's total program may require more semester hours than these minimum requirements depending on the individual's goals, program requirements, and previous preparation.

With the guidance of the graduate faculty, students develop individual programs of study in concert with their goals, program requirements, and self-assessed skills and knowledge. Each student's program must include interdisciplinary study; study in a professional education field; and study in one of the liberal arts, sciences, and humanities that may support his or her professional specialization.

**Program Requirements**

Students in the program participate in a common core of required courses and seminars. These include:

- EDUC 800, 802; EDRS 810, 811, 812; EDUC 895 (or its equivalent); and EDUC 994, 998, and 999.

A sequence of at least three courses (9 semester hours) must also be taken in a specific area of specialization that supports the student's professional area of expertise (e.g., public affairs or sociology for an administrator, English for an English teacher).

Students may choose to study in one of the following: anthropology*, art (computer graphics; drawing and painting; photography; printmaking; or sculpture)* or art history, biology, chemistry, communication, conflict resolution, economics, English (literature/literary criticism; writing/rhetoric; or linguistics*), foreign language and literature (translation; literature/literary criticism; or linguistics in French, German, or Spanish)*, geography, history, mathematics**, music (performance; composition; accompanying; conducting; or history)*, philosophy*, physics, psychology (cognitive; developmental; organizational; physiological; or school psychology)***, public administration, or sociology.

* Prior experience required — master's degree or equivalent expertise.
** Bachelor's degree in this field required, but bachelor's and master's degrees in the field preferred.
*** At least 15 prior credits in psychology required, including a lab course in psychology and a course in statistics.

Preparation of a research paper or papers demonstrating proficiency in the chosen subject culminates this study.

Students also elect to specialize in a field of professional specialization such as educational administration, educational technology, special education, curriculum, instruction, bilingual education, counseling and development, early childhood education, and so on. The specific nature of courses is determined by the student in conjunction with his or her faculty doctoral advising committee during the first year of study.

**Program Goals**

To complete the Ph.D. program, each student must demonstrate competence in oral and written English; computer literacy; mastery of the knowledge and skills of an area of special scholarship and of an area of professional expertise; and the ability to apply general and specific knowledge and skills to significant educational problems. Stu-

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Students demonstrate these competencies by successful completion of courses and seminars, by passing a special written comprehensive qualifying examination at the conclusion of program course work, and by preparing and orally defending a doctoral dissertation.

Students have five years from the time they enroll in their first class to complete all course work and the comprehensive examination. Five additional years, starting with the date on which students are advanced to candidacy, are allowed to complete the dissertation.

Residency
The purposes of residency are achieved in the Ph.D. program through a combination of core courses and special seminars, and through continuous enrollment. These requirements include successful completion of the Leadership seminar and the Ways of Knowing seminar. Students must enroll in at least one approved course each semester they are in the program.

Internship
Candidates enroll in at least one and up to three internships designed to broaden their professional expertise. These internships may occur in a variety of settings. One three-credit internship must be taken in a setting that differs from the student's work setting. In all internships, the student works with university and on-site supervisors.

Admission Requirements
Candidates are admitted to study by the Graduate School of Education and by a department offering study in a field of special scholarship chosen by the applicant. Admission is highly selective.

Applicants must fulfill the following program admission requirements:
1. A minimum of three years of successful experience as a practitioner in an educational setting;
2. A baccalaureate and/or master's degree from an accredited institution;
3. Demonstration of high intellectual capability;
4. Minimum requirements established by the various areas of special scholarship;
5. Demonstrated leadership potential;
6. Three letters of recommendation;
7. Graduate Record Examination or Miller Analogies Test scores;
8. A written goals statement relating study in the Ph.D. program to the applicant's educational and career plans.

Guidelines for preparing this statement should be obtained from the program director.

For further information about admission and program requirements, contact the Office of Admissions, (703) 993-2400, or the director of the Ph.D. in Education program, Robinson Hall, Room A253, (703) 993-2011. Completed applications must be submitted to the university's Office of Admissions by February 1 for admission the following summer or fall, or by November 1 for admission the following January.

Leadership/Supervision Courses (EDAS)
500. See EDUC 500.
598. See EDUC 598
600. See EDUC 600.
611 Schools and Communities (3:3:0). Study of schools from historical, political, psychological, sociological, and anthropological perspectives. Equal attention to theories and practices of effective school and community relations. (EDAS 611 and 621 should be first courses taken in school administration/supervision programs.)
612 Education Law (3:3:0). Prerequisite: EDAS 611 and 621. Basic course in law related to education.
621 School Administration (3:3:0). Analysis of the principalship with particular attention to assessment and development of leadership skills. (EDAS 611 and 621 should be first courses taken in school administration/supervision programs.)
624 Curriculum Development and Evaluation: Elementary/Middle Education (3:3:0). The study of curriculum design and evaluation at the elementary and middle/junior high school levels, with emphasis on instructional leadership (should not be taken by a degree student who has successfully completed EDAS 626 or 627 or its equivalent).
625 Curriculum Development and Evaluation: Middle/Secondary Education (3:3:0). A study of curriculum design and evaluation at the middle/junior high and secondary school levels, with emphasis on the roles of educational leaders (not available to students who have completed EDAS 627 or 628 or its equivalent).
631 Supervision and Evaluation of Instruction (3:3:0). Prerequisite: EDAS 611 and 621. Analysis of instructional elements and processes; theory and practices in evaluation/supervision of instructional programs and staff.
725 School Business Management (3:3:0). Prerequisite: EDAS 611 and 621. Research, theories, and practices in the management of finances in education. Emphasis on school-site tasks; attention to site-based management.
740 Personnel Administration in Education (3:3:0). Prerequisite: EDAS 611 and 621. Study of theory, research, and practice relating to personnel administration in education.
789 Education Leadership (3:3:0). Prerequisite: EDAS 611 and 621. Study of basic theories and models of leadership with application to leadership in education. Major emphasis on shared leadership in professional environments.
791 Practicum in Education Leadership (3:0:3 or 6:0:6). Prerequisite: Permission of adviser. Students apply administrative and supervisory theory to practice and analysis of practice through approved field experiences. May be repeated.

792 Internship in Education Leadership (3:0:3 or 6:0:6). Prerequisite: Permission of adviser. Students translate administrative and supervisory theory into practice through approved field experiences. (Candidates for endorsement as school administrators in Virginia must meet special requirements; consult adviser.) Usually represents full-day, extended-time experience. May be repeated.

895 Emerging Issues in Administration and Supervision (3:3:0). Prerequisite: Admission to the Ph.D. program or permission of the instructor. A seminar devoted to the study of selected emerging issues in educational leadership. Students engage in research, study, discussion, and writing about the various topics selected for study.

Elementary/Secondary Education Courses (EDCI)

500. See EDUC 500.

501 Curriculum and Instruction in Early Childhood Education (3:3:0). Prerequisite: Admission to Graduate School; open to upper-level undergraduates with permission of instructor. Emphasis on designing curriculum based on the social studies unit, as well as health, nutrition, and safety issues. Focus on evaluating and planning appropriate environments and instruction. Historical foundations, model programs, and early education initiatives are examined. Field experience in public schools is required.

502 Developing Concepts in Early Childhood Mathematics and Science (3:3:0). Prerequisite: Admission to teacher education program or permission of instructor. Examines preoperational and concrete operational thought processes of conservation, seriation, comparison, classification, and early number concepts. Uses concrete science materials and experiences to foster development of quantitative thinking in geometry, measurement, graphing, and whole number arithmetic. Field experience in public schools is required.

503 Language and Literacy in Early Childhood Education (3:3:0). Prerequisite: Admission to Graduate School; open to upper-level undergraduates with permission of instructor. Stresses the interconnectedness of reading, writing, listening, and speaking and provides opportunities for developing appropriate instructional strategies for early childhood levels. Focuses on creative development and critical thinking in communication. Field experience in public schools is required.

507 Internship in Applied Linguistics (3:0:3). Prerequisite: Graduate standing in the Graduate School of Education or Department of English, and EDCI 519 or ENGL 521 (ESL methods course). Internship requires 100 hours completed over at least a five-week period for 3 hours of credit. Provides practical experience in the field of English as a Second Language and Applied Linguistics as, e.g., teacher, administrator, counselor, or researcher. For placement, consult instructor before semester starts.

511 Developing Curriculum and Designing Instruction in Early Childhood Education (3:3:0). Study of procedures, materials, and organization of environments for young children. Field experiences required for students without previous teaching or administrative experience at the pre-elementary levels.

512 Family, School, and Community Relationships (3:3:0). Examination of patterns and problems of family life for the purpose of improving communication between teachers and parents.

513 Play in Applied Settings (3:3:0). Focuses on play as an approach to teaching and learning; examined as an intellectual, social, and emotional function in children's development.

514 Administering and Supervising Pre-Elementary Education (3:3:0). Examines programs and techniques relating to the administration and supervision of pre-elementary education programs. Emphasis on the director's role in staff recruitment, hiring, development, and evaluation. Leadership and management techniques.

516 (formerly EDUC 532) Bilingualism and Language Acquisition Research (3:3:0). Examination of research in first and second language acquisition, including the interaction of a bilingual person's two languages, with implications for the classroom.

517 Bilingual Education (3:3:0). Examines the historical, legal, and legislative foundations of bilingual education, with analysis of theory, research, and current educational programs for language minority students, including English as a Second Language (ESL) programs.

518 Multicultural Education (3:3:0). Examines the historical and theoretical foundations of multicultural education through focus on the concept of cultural pluralism in an ethnically, linguistically, and culturally diverse society. Emphasis on the development of a multicultural curriculum for diverse classroom settings and the verbal and nonverbal communication skills necessary for cross-cultural functioning. Field experience in public schools is required.

519 Methods of Teaching in Bilingual/English-as-a-Second-Language Settings (3:3:0). Prerequisite: EDCI 516. Examines approaches, methods, and techniques for teaching English as a Second Language (ESL) in bilingual and ESL classrooms, as well as resources available in the field. Participants critically analyze and demonstrate teaching approaches based on second language acquisition research, including teaching language through content. Field experience in public schools is required.

520 Assessment in Bilingual/English-as-a-Second-Language Settings (3:3:0). Prerequisites: EDCI 516, 519. Examines federal, state, and local education policies and practices in the assessment of language minority students and English language learners. Topics include identification, placement, monitoring student progress, developing authentic performance-based measures, designing portfolios, applying measurement concepts, and analyzing existing assessment instruments.

521 Curriculum Development in Bilingual/English-as-a-Second-Language Settings (3:3:0). Prerequisites: EDCI 516, 519. Examines current approaches to curriculum development for second language learners and language minority students. Participants review, eval-
uate, and develop curricular materials, with primary emphasis on learner-centered activities, cooperative learning, interdisciplinary and thematic approaches, authentic and problem-based learning, integration of language and content, and linking assessment and instruction.

528 Teaching and Learning Mathematics in Middle Education (3:3:0). Prerequisite: Admission to the Teacher Education program or permission of instructor. Focuses on the learning processes fundamental to the development of mathematical thinking. A variety of instructional strategies and materials are examined in relation to the broad scope of mathematical content taught in the middle grades. Field experience in public schools is required.

529 The Teaching and Learning of Social Studies and the Humanities in Middle Education (3:3:0). Prerequisite: Admission to the Graduate School and the Teacher Education program. Focuses on the design and delivery of an integrated curriculum centered on knowledge and skills from history and the social sciences for citizenship education. The development of the social studies unit as the unifying core of the middle grades (4-8) curriculum is examined. Field experience in public schools is required.

549 Foreign Language Immersion in the Elementary School (3:3:0). Study of theories and methods of teaching foreign language through the elementary school curriculum, as well as curriculum development, assessment, and community relations in foreign language immersion classes.

550 (formerly EDUC 450) Teaching Foreign Languages in the Secondary School (3:3:0). Study of theories and methods of foreign language teaching, with practical application to the classroom. Field experience in public schools is required.


600. See EDUC 600.

601 Applied Study of Young Children's Language Development (3:3:0). Prerequisite: Admission to Graduate School. Focus on analyzing the language development of preschool, kindergarten, and primary children and on designing individual and group language experiences.

Language development is studied in relation to cognitive, social, and emotional development.

602 Technology Applications in Early Childhood Education (3:3:0). Prerequisite: Admission to Graduate School and permission of program coordinator. Examines criteria and methods for integrating microcomputers into all areas of the early childhood curriculum. Emphasizes the use of computer-assisted instruction to facilitate cognitive and social growth through the development of online and off-line computer activities.

603 Trends, Issues, and Research in Early Childhood Education (3:3:0). Prerequisite: Admission to Graduate School and EDRS 590. Examines current trends, present and recurring issues, research findings, and resulting program development in the field.

605 Problem Solving in Early Childhood Mathematics and Science (3:3:0). Prerequisite: Admission to Teacher Education program or permission of the program coordinator. Focuses on preoperational and concrete operational children, developing specific problem solving strategies useful in mathematics and science. Emphasizes the use of concrete materials to solve problems in mathematics and science in the primary grades. Field experience in public schools is required.

606 Creative Expression and Play in Early Childhood Education (3:3:0). Prerequisite: Admission to Graduate School and Teacher Education program, or permission of program coordinator. Studies children's creative expression and psychomotor development through play, developmental stages of art in two- and three-dimensional forms, musical chants, rhythms, and instruments, listening and interpreting music as an integral part of the total curriculum. Field experience required.

607 Literacy and Literacy in Early Childhood Education (3:3:0). Prerequisite: Admission to Graduate School and Teacher Education program, and permission of program coordinator. Guides students in developing and applying criteria for evaluating children's literature. Examines stages of reading development, assessment procedures, teaching strategies, print environments, reading materials, and classroom organizational patterns. Field experience in public schools is required.

608 The Teaching and Learning of Science in Middle Education (3:3:0). Prerequisite: Admission to Graduate School and Teacher Education program. Emphasis on collecting, organizing, and interpreting data as a result of inquiry into activity-oriented explorations. This is a "hands-on" activities course in the biological, physical, and earth sciences and requires student demonstrations for the appropriate content level. Field experience in public schools is required.

609 Problem Solving in Mathematics in Middle Education (3:3:0). Prerequisite: Admission to Teacher Education program or permission of program coordinator. Focuses on the development of higher-order thinking skills as they are used to solve problems in grades 4-8. A variety of techniques and materials develop specific problem-solving strategies. Field experience is required for those without full-time teaching experience.

610 Literature and Literacy in Middle Education (3:3:0). Prerequisite: Admission to Graduate School and Teacher Education program. Emphasis on the interrelatedness of the language arts and their natural bond with literature. Listening, speaking, reading, and writing are
featured as the means for encoding and decoding. Books and authors are highlighted, leading to appreciation of books and reinforcing the art and skill of written, oral, and nonverbal communication. The use of literature to nurture cognitive, personal, and social development is examined. Critical thinking permeates. Field experience in public schools is required.

612 Content Area Reading in Middle Education (3:3:0). Study of theory, methods, diagnostic instruments, and evaluation practices to individualize content area instruction in grades 4-8. Included are review of testing instruments, techniques for instruction and an understanding of study skills. Field experience in public schools is required.

620 Teaching Thinking Skills Across the Curriculum (3:0:0). Through lecture, discussion, and demonstration, students design, analyze, apply, and evaluate a range of approaches to teaching thinking skills and strategies in grades K-12. Application to selected subject matter is stressed.

650 Curriculum Development in the Elementary School (3:3:0). Study of development of curriculum in the pre-elementary and elementary grades, historical backgrounds, present programs, development of new programs, methods of implementing new programs, and evaluative methods and procedures.

651 Curriculum and Instruction in Middle Education (3:3:0). Study of development of curriculum in the middle grades, historical backgrounds, present programs, development and implementation of new programs, program evaluation, instructional and organizational implications. Field experience in public schools is required.


657 Teaching Language Arts in the Elementary School (3:3:0). Study of methods, curricula, current issues, and research literature in English-language arts programs of the elementary school. Emphasis on recent innovations in methodology and traditional concerns of the communication arts.

658 Teaching Social Studies in the Elementary School (3:3:0). Prerequisite: Course in teaching social studies in the elementary school. Study of methods, materials, content, and organization of social studies programs in the elementary school.

660 The Diagnostic Teaching of Reading in the Elementary School (3:3:0). Prerequisite: Course in reading. Use of diagnostic techniques, diagnostic instruments, and evaluation to individualize the reading instruction in the classroom. Primarily designed for classroom teachers.


663 Teaching Science in the Elementary School (3:3:0). Prerequisite: Course in teaching science in the elementary school and/or permission of instructor. Advanced course in the methodology and materials involved in the teaching of the biological, physical, and earth sciences.


701 Educational Program Development (3:3:0). Prerequisite: Completion of student teaching or bachelor's degree from an accredited undergraduate institution. Analysis and application of principles and procedures essential to the planning, design, testing, evaluation, revision and implementation of instructional programs for use in schools, community colleges, public agencies, museums and business settings. Studies selected theory, research and exemplary practice regarding program development, and investigates alternative strategies for developing instructional programs.

705 Instructional Design (3:3:0). Prerequisite: Teaching experience. Analysis, application, and evaluation of the principles of instructional design to develop education and training materials spanning a wide range of knowledge domains and instructional technologies. Attention will be given to a variety of instructional design models, with emphasis on recent contributions from cognitive science and related fields.

723 Assessment and Guiding Behavior in Early Childhood Education (3:3:0). Prerequisite: Admission to Graduate School and Teacher Education program; corequisite: EDCI 790A. Examines strategies and techniques related to guiding young children's behavior. Guidance principles, communication strategies, parent conferencing, and behavior management techniques are presented, analyzed, and applied in classroom settings. Attention is given to the administration and interpretation of informal and formal evaluation tools.

737 Observing, Assessing, and Guiding Behavior in Middle Education (3:3:0). Prerequisite: Admission to Graduate School and Teacher Education program; corequisite: EDCI 790B. Examines strategies and techniques related to guiding the behavior of students in middle education. Guidance principles, communication strategies, parent conferencing, and behavior management techniques are presented, analyzed, and applied in classroom settings. Attention is given to the administration and interpretation of informal and formal evaluation tools.

781 Advanced Seminar in Early Childhood Education (3:3:0). Prerequisite: Completion of graduate program except for seminar, or permission of program coordinator. Application of graduate course work to instructional situations through discussion, projects, and reports related to practice and/or research.

782 Advanced Seminar in Middle Education (3:3:0). Prerequisite: Completion of graduate program except for seminar, or permission of program coordinator. Application of graduate course work to instructional situations through discussion, projects, and reports related to practice and/or research.

783 Advanced Seminar in Secondary School Teaching (3:3:0). Prerequisite: Completion of graduate program except for seminar, or permission of program coordinator. Application of graduate course work to instructional situations through discussion, projects, and reports related to practice and/or research.
790-A Internship in Early Childhood Education
(6:6:0). Prerequisite: Admission to Graduate School and Teacher Education program; corequisite: EDCI 723. Intensive, supervised clinical experience of a full semester in a Virginia public school. Experiences in both kindergarten and grades 1, 2, or 3 must be included. Additional experiences are structured to meet preprofessional needs. Must be taken twice in PDS model.

790-B Internship in Middle Education (6:6:0). Prerequisite: Admission to Graduate School and Teacher Education program; corequisite: EDCI 737. Intensive, supervised clinical experience of a full semester in a Virginia public school. Experiences in both upper grades of an elementary school and in a middle school. Additional experiences are structured to meet preprofessional needs. Must be taken twice in PDS model.

790-C Internship in Secondary Education (6:6:0). Prerequisite: Admission to and completion of all additional course work in the secondary education licensure program, and/or permission of instructor and adviser. Intensive, supervised clinical experience of a full semester in an approved Virginia school. Experience at the secondary level.

895 Emerging Issues in Curriculum and Instruction (3:3:0). Prerequisite: Admission to the Ph.D. program or permission of the instructor. A seminar devoted to the study of current issues in the fields of curriculum and instruction through individual and group research, discussion and writing and presentations by experts. Each student conducts an in-depth critical analysis of a specific field.

Counseling and Development Courses (EDCD)

500. See EDUC 500.

598. See EDUC 598.

599. See EDUC 599.

600. See EDUC 600.

525 Advanced Human Growth and Development (3:3:0). Study of human development throughout the life span, including emotional, physical, and cognitive development; emphasizing personal adjustment and achievement.

604 Analysis of the Individual (3:3:0). Prerequisite: Admission to the Counseling and Development Program or permission of instructor. Development of a framework for understanding the individual in counseling, including methods of gathering and interpreting data; choosing, administering, and interpreting individual and group tests; the study of individual differences; use of case study technique.

605 Introduction to Counseling Theory and Practice (3:3:0). Introduction to counseling theories, principles, and practices. Students study, discuss, and analyze four of the basic therapeutic approaches to individual and group counseling with clients. Emphasis on learning basic counseling skills through supervised practice and critique sessions. Includes lab.

607 Advanced Counseling Theory and Practice (3:3:0). Prerequisite: EDCD 525 or equivalent and EDCD 605. Advanced course in M.Ed.—Counseling and Development Program. In-depth study of selected counseling theories, principles, and topics. Intensive practice in advanced counseling techniques and approaches with emphasis on supervised practice sessions. Includes lab.

608 Group Processes and Analyses (3:3:0). Prerequisite: EDCD 605. Theories appropriate to various types of groups and descriptions of group practices, methods, dynamics, and facilitative skills. Attention to application of theory to practice.

610 Career and Educational Counseling (4:3:2). Prerequisite: EDCD 604, 605 and 607. Study of vocational choice theory, sources of occupational and educational information, approaches to career decision-making processes, and career development exploration techniques. Attention to application of theory to practice. Includes lab.

623 Principles and Practices of Elementary School Counseling (3:3:0). Introduction to school counseling programs at the elementary school level. Philosophy, principles, and practices of effective elementary school counseling. Developmental needs of students 5-10 years of age.

625 Principles and Practices of Middle School Counseling (3:3:0). Introduction to school counseling programs at the middle school level. Philosophy, principles, and practices of effective middle school counseling. Developmental needs of students 10-14 years of age.


644 College Student Development (3:3:0). Introduces theory, nature, and background of the student personnel profession in higher education. Structure, organization, and administration of services and programs.

654 Counseling in the Community, Agency, and Business Settings (3:3:0). Emphasis on the types of services and facilities provided, needs and problems of the client population served, role and function of the counselor in the agency setting, and personnel needs of the individual agency.

656 Diagnosis and Treatment Planning for Mental Health Professionals (3:3:0). Prerequisite: EDCD 605. By using actual and hypothetical cases, the course helps the student develop written plans and simulate implementation for overall diagnosis and treatment of clients and their families.

658 Couples and Family Counseling (3:3:0). Prerequisite: EDCD 605 and 607, taken previously or concurrently. Introduces major approaches to counseling couples and families. Case studies and simulations facilitate the transition from theory into practice.

660 Counseling and Development for Special Populations (3:3:0). Prerequisite: EDCD 605 or permission of instructor. Study of the nature, characteristics, and needs of special groups seeking counseling and development.
services. Analysis of content, techniques, and goals of programs developed to serve these groups.

668 Counseling and Development Programming (3:3:0). Prerequisite: EDCD 605 or permission of instructor. Needs assessment, planning, implementation of counseling and human development programs including the development of workshops, group and individual sessions. Attention is given to consultation and collaboration with other professionals in efforts to facilitate human development and self-direction.

754 Practicum in Counseling and Development (3-6:6:0). Prerequisite: EDCD 605, 607, and permission of adviser. Focus on basic counseling skills through simulated and actual counseling experiences. Students are required to volunteer in a counseling setting and spend time in class meeting for presentation, analysis, and practice of techniques. Those taking EDCD 754 in a school setting must have prior or concurrent teaching or other experience at the placement level or must have completed the specialization course on counseling at that level.

790 Internship in Counseling and Development (6-0:0). A: Elementary; B: Middle; C: Secondary; D: Higher Education; E: Agency. Prerequisite: Completion of the graduate program except for internship; permission of adviser; overall GPA of 3.0 and no more than two grades of C in all graduate course work required by the program. Supervised practice of counseling in a setting similar to that in which the student plans to work. (School placements open to certified personnel only.)

895 Emerging Issues in Counseling and Development (3:3:0). Prerequisite: Admission to the Ph.D. program or permission of the instructor. Examines current and controversial issues in the counseling profession, including counseling theory and methodology, developing client groups, new roles and settings for counselors, emerging assessment procedures, and new understanding of diagnosis, as well as the impact of societal changes on the counseling profession.

Instructional Technology Courses (EDIT)

504 Introduction to Educational Technology (3:3:0). Prerequisite: Admission to Graduate School or senior standing and permission of instructor. Examines uses of and issues in educational technology, explores curriculum integration of technology, and focuses on learning and using commercially available applications software.

530 Use of Scripting Languages in Authoring Educational Materials (3:3:0). Students will develop computer-based educational materials using a widely known educational scripting language. Students explore basic authoring capabilities and learn to apply those capabilities by designing and producing materials using the commands, procedures, and functions of the scripting language.

532 Software Evaluation and Curriculum Integration (3:3:0). Students examine and apply fundamental evaluation criteria to assess the quality and appropriateness of software in light of instructional objectives. Techniques for effective curriculum integration of software within a wide range of classroom settings are explored, as well as the means to gauge effective software use in support of instructional objectives.

593 Educational Hardware Systems (3:3:0). Students learn the basic technical features of computer-based hardware systems used in educational settings, including stand-alone computers, peripheral devices, and networking systems.

611 Distance Learning via Networks and Telecommunications (3:3:0). Students explore educational opportunities distance learning affords through electronic networks and telecommunications. Hands-on activities with these technologies focus on issues associated with planning, implementation, and evaluation. Students discuss emerging applications in distance learning and how new approaches to learning can be integrated into today's classrooms.

630 Coordinating School-Based Educational Technology (3:3:0). Prerequisites: EDIT 532 and 593, or permission of instructor. Students examine the responsibilities and knowledge/skill demands of school-based technology coordinators. Broad educational technology issues will be addressed, as well as resource and facilities management, staff development, curriculum integration, and planning for new technologies.

699 Information Tools for Personal and Organizational Productivity (1:1:0). Introduces graduate students to the instructional and data base management uses of microcomputers. Focus is on study and exploratory application in laboratory classes of selected concepts of computer usage to achieve objectives common to a variety of formal educational settings.

720 Leadership Issues in Educational Technology (2:2:0). Students examine how educational technology can provide an infrastructure for creating, managing, and evaluating innovative types of teaching/learning environments. New assumptions about learning, instructional technology, and organizational development will be explored as a foundation for planning how schools can use technology to evolve beyond conventional approaches.

730 Instructional Design of Technology-Based Educational Materials (3:3:0). Prerequisites: EDIT 530 and EDCI 705, or permission of instructor. Students design, implement, and evaluate technology-based education and training materials using advanced computer-based authoring tools.

732 Advanced Instructional Design and Development (3:3:0). Prerequisites: EDIT 530, EDCI 705, and EDIT 730 or permission of instructor. Capstone course of a three-course sequence on the theory and practice of instructional design. Students apply the ideas developed in prior courses to completing a major instructional design project. Leading-edge ideas in the evolution of instructional design are also discussed.

750 Emerging Educational Technologies (3:3:0). Prerequisites: EDCI 705 and EDRS 590, or permission of instructor. Students examine a range of educational technologies expected to become important applications within the next three to eight years. The potential of these emerging technologies to improve practice and to alter the mission and content of education will be assessed, and skills in strategic planning will be developed.
Reading Education Courses (EDRD)

500. See EDUC 500.

559 Teaching Developmental Reading in the Elementary School (3:3:0). Advanced course in the study of foundations of reading; principles, techniques, and materials for developmental reading programs.

600. See EDUC 600.

611 Remedial Reading (3:3:0). Prerequisite: EDRD 559 or 614. Includes nature and causes of reading difficulties, organization of remedial reading programs, use of remedial techniques, teacher aids and learning centers, psychological and health services, and innovative methods and materials.

613 Diagnostic and Evaluative Techniques in Reading (3:3:0). Prerequisite: Admission to graduate program in reading, EDRD 611, and permission of adviser. Historical review of assessment of reading problems. Procedures in testing, scoring, and evaluating standardized and informal tests, individual and group tests, physical and psychological tests, and techniques of reporting test results.

614 Teaching Reading in the Secondary School (3:3:0). Emphasis on reading in content areas; reading problems: causes, diagnosis, remediation; study skills and speed reading.

615 Teaching Reading/Writing in Multicultural/Multilingual Settings (3:3:0). Develops instructional competencies in reading/writing approaches for students from culturally and linguistically diverse backgrounds. Examines teaching reading/writing across the curriculum, biliteracy acquisition, historical and current reading/writing approaches for second language learners, preliteracy skills for younger and older English language learners, and special issues in developmental and diagnostic reading for language minority students.

616 Teaching Reading to Adults (3:3:0). Includes history of adult education, assessment techniques, and reading methods and materials that meet the special needs of adult students.

618 Organization and Administration of Reading Programs (3:3:0). Prerequisite: EDRD 559 or 614, EDRD 611, EDRD 613, or permission of instructor. Examines the roles of reading administrators (consultants, specialists, or language arts supervisors), the organization and implementation of reading programs and services, a review and analysis of management techniques, and the development of skills necessary to implement reading programs.

790 Practicum in Instructional Technology (6:0:0). Prerequisite: Completion of IT track requirements except for practicum and permission of adviser. Supervised practice in applying the knowledge and skills of the student's chosen track through placement in an appropriate work setting.

895 Emerging Issues in Instructional Technology (3:3:0). Prerequisites: Admission to the Ph.D. program or permission of instructor. Seminar devoted to the study of selected emerging issues in instructional technology. Course examines ways instructional technology provides an infrastructure for creating, managing, and evaluating innovative types of teaching/learning environments.

Education Research Courses (EDRS)

531 Educational and Psychological Measurement (3:3:0). Emphasis on techniques and principles used in the construction, administration, and quantification of measuring devices for evaluation purposes; interpretation of standardized tests of ability, aptitude, achievement, interest, and personality.

590 Education Research (3:3:0). Development of skills, insights and understandings basic to performing research, with emphasis on interpretation and application of research results. Critique of research and use of findings in educational settings.

591 Education Statistics (3:3:0). Introduction to practical and applied aspects of statistics in education. Includes selected descriptive and inferential statistics; also statistical data processing.

690 Research in Practice (3:3:0). Prerequisite: EDRS 590 or permission of instructor. Enables practitioners to develop skills for conducting research related to their professional practice. Involves examining examples of such research, identifying research questions, identifying and using appropriate research designs and methods, writing up the results of the research, and exploring rationales for such studies.

810 Problems and Methods in Education Research (3:3:0). Prerequisite: Admission to the Ph.D. program or permission of instructor. Advanced course in the interpretation and application of education research methods. Emphasizes comparing alternative philosophies of research, ways of formulating questions/hypotheses, research plans and analysis procedures. Students evaluate existing studies and investigate a range of research approaches. Offered each fall semester.

811 Quantitative Methods in Educational Research (3:3:0). Prerequisite: Satisfactory completion of EDUC 810 or its equivalent or permission of instructor. Emphasizes advanced methods of conducting research using quantitative methods of data collection and analysis appropriate for research in education. Includes the design of experimental and quasi-experimental research studies.
and methods of analysis appropriate to these studies, including the analysis of variance and multiple linear regression. Offered each spring semester.

812 Qualitative Methods in Educational Research (3:3:0). Prerequisite: Satisfactory completion of EDUC 810 or its equivalent, or permission of instructor. Students study and apply qualitative data collection and analysis procedures used in educational research, including ethnographic and other field-based methods, and unobtrusive measures. Emphases vary depending on the interests and needs of the students. Offered each fall semester.

820 Evaluation Methods for Educational Programs and Curricula (3:3:0). Prerequisite: Satisfactory completion of EDUC 810 or its equivalent, or permission of instructor. Explores the development and types of current systems and models for evaluating educational programs and curricula. Emphasis is on procedures for evaluation of public and private elementary and secondary schools, colleges and universities, and government and industrial education programs. Offered every other fall semester, in even-numbered years.

890 Research in Practice (3:3:0). Prerequisite: EDRS 810 or permission of instructor. Enables practitioners to develop skills for conducting research related to their professional practice. Involves examining examples of such research, identifying research questions, identifying and using appropriate research designs and methods, writing up the results of the research, and exploring rationales for such studies.

895 Emerging Issues in Qualitative Research (3:3:0). Prerequisite: EDRS 812 or its equivalent. This advanced seminar examines current issues in qualitative research, such as designing and writing a qualitative research proposal, interviewing, collecting video data, using qualitative computer programs, analyzing data, and writing qualitative reports. Provides students with opportunities to apply new skills and knowledge to projects related to their own interests and to design relevant individualized components.

Special Education Courses (EDSE)

500. See EDUC 500.

517 Computer Applications for Special Populations (4:3:1). Prerequisite: Graduate standing or permission of instructor. A lecture/laboratory course for teachers of special populations (e.g., children with disabilities, bilingual) in applications of computer technology for instructional programs and computer skills. Students learn to use computer technology designed specifically for special populations.

544 Career, Transition, and Vocational Planning (3:3:0). Overview of career, transition, and vocational planning programs for students with special needs. Special consideration is given to legislative requirements, training and placement options, curriculum content, scheduling, and personal relationships.

551 Classroom Management: Theory and Practice (3:3:0). Focuses on identifying, recording, evaluating, and changing social and academic behaviors of diverse student populations. Theories of classroom management are explored and various approaches to instructional, behavioral, and environmental management are presented. Development of individual education programs and their impact on management issues is addressed. Field experience in public schools is required.


554 Adaptive Methods in Education (3:3:0). Prerequisite: EDUC 523. Adaptation of social studies and science texts, materials, and instructional approaches to address the specific learning needs of students with emotional disturbances and/or learning disabilities. Emphasis is placed on the development of lesson plans that include manipulative devices and experiential learning.

600. See EDUC 600.

615 Early Intervention for Infants and Toddlers with Disabilities (3:3:0). Explores current public policy initiatives for coordinating services for infants and toddlers. Discusses models of services delivery and approaches to family-centered service.

620 Advanced Applied Behavioral Analysis and Social Learning Theory (3:3:0). Prerequisite: Graduate standing and permission of advisor. Focus on application of behavior analysis principles and social learning theory to increase learning by students with special needs. Emphasis on single subject research designs.

622 Augmentative Communication (3:3:0). Prerequisite: Graduate standing, EDSE 552 (can be taken concurrently), and permission of advisor. Focus on alternative language and communication techniques for children with severe language and speech impairments.

644 Characteristics of Students with Emotional Disturbances and Learning Disabilities (3:3:0). Theories of deviance and specific conditions in emotional disturbances and learning disabilities will be presented. The impact of the manifestations of these learning and behavioral differences on academic and social/emotional performances will be studied. Diversity within student populations will be addressed throughout the course. Field experience is required.

647 Medical and Health Aspects of Handicapping Conditions (3:3:0). Prerequisite: EDUC 523 or permission of advisor. Nature and causes of disabling and/or special health conditions. Examines screening and evaluation techniques, treatment goals, and intervention procedures. Field experiences required.

648 Introduction to Psychoeducational Assessment (3:3:0). Basic statistical procedures and test characteristics are introduced. Appropriate terminology and practices related to formal and informal assessment are applied throughout course. Students practice administration, scoring, and interpretation of tests including the impact of multicultural diversity on assessment. Field experience is required.

649 Clinical Psychoeducational Assessment in Special Education (3:3:0). Administration, scoring, and interpretation of education evaluation instruments with emphasis on the generated educational plan and written
report. Supervised experiences required in the Educational Study Center on selected Saturdays.

655 Curriculum and Methods—Emotional Disturbances/Learning Disabilities (3:3:0). Application of research on teaching effectiveness, teacher accountability, and instructional approaches with specific attention to language arts instruction. Cooperative learning models are investigated.

658 Cognitive Instruction and Learning Strategies (3:3:0). Prerequisite: EDSE 644 or permission of instructor. Focus on developing metacognitive and self-regulated learning techniques in students with limited academic motivation and/or achievement. Integrated strategies instruction through individual learning styles are emphasized for content across the curriculum.

659 Curriculum and Methods—Early Childhood Special Education (3:3:0). Prerequisite: Permission of adviser. Emphasis on planning, organizing, implementing, and evaluating programs for young children with special needs.

661 Curriculum and Methods—Severe Disabilities (3:3:0). Prerequisite: Permission of adviser. Formulation, implementation, and evaluation of individualized education programs for individuals with severe disabilities.

662 Educational Consultation (3:3:0). Prerequisite: Teaching licensure or enrollment in a graduate degree program in education. Provides professionals in special education, regular education, and related fields with the knowledge and communication skills necessary to provide collaborative consultation and technical assistance to other educators and service providers.

663 Seminar in Special Education (3:3:0). Advanced course work for selected populations in special education. Study of population characteristics, current best practices for programming, evaluation, and planning. Students participate in research, development of presentations, writing, and discussion of selected topics. May be repeated.

665 Family Intervention Programs for Children with Disabilities (3:3:0). Focus on strategies for developing family-professional partnerships for the benefit of children with special needs. Theories and research that support a family-centered approach are explored. Cultural sensitivity and procedural safeguards are emphasized.

669 Transdisciplinary Approach for Students with Physical Disabilities (3:3:0). Prerequisite: Graduate standing and permission of adviser. Introduction to neurodevelopmental and sensory integrative treatment approaches for students with physical disabilities. Emphasis on positioning and handling techniques. Application of transdisciplinary model in educational and therapeutic settings.

671 Special Topics in the Education of Exceptional Children (1:1:0). A variable topics course. No more than 3 credits may be applied to the M.Ed. degree.

671A Special Topics in the Education of Exceptional Children: Creative Methods of Solving Problems (1:1:0). Systematic creative methods of problem solving processes are learned cognitively and experientially.

782 Comprehensive Topics in Special Education: Trends and Issues (3:3:0). Prerequisite: Approval of adviser and permission of Special Education Committee. Synthesizes course work, theory, and practical application. Focus on current trends and issues, foundations and preparation for traditional area specialization comprehensives, which can be taken in the same or a separate semester. Offered only in the fall and spring.

790 Internship in Special Education (1-6:0:0). Prerequisite: Permission of the Special Education adviser. Supervised internships include the design and implementation of educational programming for youngsters in campus-based program, public school, approved private school, hospital, institution, or clinic. Students enroll in two separate internships appropriate to the area of study for a total of 6 credits. Applications for field internships are due as follows: Fall—February 15, Spring—September 15, Summer—March 1.

School Psychology Course (EDSP)

790 School Psychology Internship (3, 6, 9, 12:0:0) (formerly PSYC 765 and EDUC 665). Prerequisite: Completion of required courses in school psychology and permission of program coordinator. One-school-year supervised field experience where the advanced school psychology student functions as a full-time staff member within a school system. Student completes a paper on a practical research project involving an alternative school psychology role in the school system. Enrollment is for a total of 9 hours (thesis option) or 12 hours (nonthesis option) in increments of 3 hours according to placement. Students enrolled in PSYC 799 are not required to complete the practical research project.

Education Courses (EDUC)

500 In-Service Educational Development (1-6:0:0). Prerequisite: Employment in professional capacity by sponsoring division or agency. Offered at request of school division or other educational agency. Content varies. May be repeated.

509 Advanced Child Development: Infancy to Middle Childhood (3:3:0). Prerequisite: Admission to Graduate School or permission of instructor. Advanced course in the physical, psychological, cognitive, and personality development of the child from birth to age 12. Emphasis is on the critical review of contemporary theories of human development and their relevance to educational practice.

521 Foundations of Education (3:3:0). Prerequisite: Admission to Graduate School or permission of instructor. An overview of the various ways of educating and of the socialization processes operating within American educational institutions and other organizations. Current educational practices analyzed in terms of history, philosophy, psychology, sociocultural factors of formal and informal learning. Emphasis on trends, issues, alternative futures.

522 Introduction to Secondary Education (3:3:0). Prerequisite: Admission to Graduate School or permission of instructor. Analysis of the philosophical assumptions, curriculum issues, learning theories, and history associated with current teaching styles. Emphasis on applications to all disciplines taught in secondary schools.

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Current educational trends and issues examined in relation to the sociology of secondary school settings. Field experiences required.

529 Pluralism and Exceptionality in U.S. Education (3-3:0). Prerequisite: Admission to Graduate School or permission of instructor. Examination of cultural pluralism in American education, with a focus on the nature of linguistic and cultural diversity in public schools, including special education settings, the relationship between nonverbal communication and language systems, and interpersonal skills needed for encouraging harmony between the dominant culture and culturally and linguistically diverse communities in the United States.

530 Contemporary Social Issues in Education (3-3:0). Prerequisite: Admission to Graduate School or permission of instructor. Examination of selected social issues in education. Uses concepts and information from social sciences to understand the social issues and suggest possible remedies through practice and policy.

539 Psychological Foundations of Adolescent Learning and Development (3-3:0). Prerequisite: EDUC 522. Simultaneous enrollment in a methods course is encouraged. A synthesis of the psychological foundations of secondary education. Emphasis is on principal theories and practices in contemporary educational settings.

598 Directed Reading, Research, and Individual Projects (1-6:0:0). Prerequisite: Admission to a degree program and permission of dean. Various subjects and projects, principally by directed study, discussion, research, and participation under the supervision of a member of the graduate faculty. May be repeated. No more than 6 hours of EDUC 500 (may also be listed as EDAS, EDGC, EDRD, or EDSE), 598 and/or 600 may be applied to degree credit.

599 Thesis (6:0:0). Prerequisite: EDUC 590 and 591. Study of a problem of significant interest to the student, using accepted research methods under the supervision of a member of the graduate faculty.

600 Workshop in Education (1-6:0:0). Full-time workshops and weekend seminars dealing with selected topics in education, education tour seminars. May be repeated.

606 Education and Culture (3-3:0). Prerequisite: Admission to the Graduate School of Education or permission of instructor. Examination of research in educational anthropology, focusing on its applications to educational practice. Topics include culture and learning, cultures in the schools, social interaction patterns, culture contact, and variability within cultures. Students acquire alternative ways of viewing educational processes, learn skills in analyzing and reflecting on educational settings, and develop strategies to improve educational practice.

681 Organization and Administration of Vocational Education (3-3:0). Study of principles and practices of organizing and administering vocational educational programs in the public schools. Areas of concern are planning, policies, personnel professional development, program development, budgeting, public relations, teacher evaluation, program evaluation, and research.

682 Curriculum Development in Vocational Education (3-3:0). Curriculum development for teachers of vocational subjects. Program development, implementation, and evaluation are studied with emphasis on current trends in vocational education. The impact of the Virginia Vocational State Plan and competency-based instruction are stressed.

688 Internship in Vocational Education (1-6:0:0). Prerequisite: Completion of undergraduate degree or appropriate educational requirements. Opportunity to complete a total of 6 hours placed in education, industry or business associated with the area of teaching responsibility. Students research the various technical and professional skills required for successful employment and develop recommendations for curriculum revisions. Projected program changes are presented to peer groups at regularly scheduled seminars.

695/ENGL 695 Northern Virginia Writing Project In-service Program (1-3:0:0). Prerequisite: Admission to the graduate program or permission of the dean. Offered at the request of a school division or other educational agency. Content varies. May be repeated with the permission of department, but no more than 6 semester hours of credit in EDUC 695, ENGL 695, and/or ENGL 699 may be applied toward a master's degree.

696/ENGL 696 Northern Virginia Writing Project/Research Seminar (3:0:0). Prerequisite: EDUC 695/ENGL 695 or NVWP Summer Institute. Acquaints classroom teachers with current findings related to the composing process and methods of studying writing in a school setting. Focus on development of a proposal Investigating some aspect of the composing process. Teachers who have developed a proposal prior to enrolling will conduct the research during the course.

697/ENGL 697 Northern Virginia Writing Project/Theory of Composition (3:3:0). Acquaints classroom teachers with current theory relating to writing and the teaching of composition. Focus is on making explicit participants' theories, on reading the works of leading theorists, and on developing a statement describing the implications of theoretical consistency in the teaching of writing.

754 Seminar in Computers for Educational Administration and Research (3:2:1). Prerequisite: EDUC 699 or its equivalent or permission of instructor. Mastery of BASIC. Emphasizes the principles and techniques of using microcomputers, minicomputers and large mainframe computers for purposes of record keeping, management information, instructional supervision and data analytic research in instructional settings in education and industry.

Doctor of Philosophy in Education Interdisciplinary Courses (EDUC)

800 Ways of Knowing (3:3:0). Prerequisite: Admission to Ph.D. program. Provides an understanding of the characteristic ways of knowing in various liberal arts disciplines, examining the disciplines' subject matter, scope, key concepts, principles, methods, and theories. Analyzes selected philosophical traditions underlying educational practice and research. Required during first spring semester of study in the program.

802 Leadership Seminar (3:3:0). Prerequisite: Admission to the Ph.D. program. Intensive study of leadership emphasizing concepts of leadership, decision and change processes, and the assessment and development of leader-
ship skills. Required during first fall semester of study in
the program.

805 Doctoral Seminar in Education (2:2:0). Prerequisite:
Admission to the Ph.D. program. In-depth study of se-
lected topics in education. Students participate in an
information exchange with other students, faculty mem-
bers and other scholars about current research interests
and ideas. Students also present their own research in a
professional forum. A maximum of 8 credits in EDUC
805 may be credited toward minimum Ph.D. require-
ments.

840 Seminar in Adult Development and Learning
(3:3:0). Prerequisite: Admission to the Ph.D. program or
permission of instructor. An advanced course in the na-
ture of the adult learner and the processes of adult learn-
ing and development. Emphasizes adults as learners,
motivations of adult learners and their participation pat-
terns in adult education activities, and learning theory
implications for adult learners.

881 Seminar in Bilingual Education: Policy (3:3:0).
Prerequisite: Admission to the Ph.D. program. Examines
the historical development of education for language mi-
nority students in the United States, including federal
and state legislation and court decisions. Policy issues re-
arding administrative program models, instructional ap-
proaches, curricular reform, and assessment policies for
language minority students, developed in response to
legal mandates, legislative decisions, and the school re-
form movement, are explored in depth from federal,
state, and local points of view.

882 Seminar in Bilingual Education: Theory and Re-
search (3:3:0). Prerequisite: Admission to the Ph.D. pro-
gram. Examines the theoretical foundations of
bilingual/ESL education through focus on linguistics, an-
thropology, sociology, psychology, and education re-
search addressing language minority students.

890 Doctoral Internship in Education (3:3:0) or
(1:1:0 to 6:6:0). Prerequisite: Admission to the Ph.D.
program and prior approval of adviser and Ph.D. direc-
tor. Requires 100 hours of on-site internship completed over
at least a five-week period. Interns work with an appro-
priate staff member in a cooperating school, school sys-
tem, or other educational institution, agency, or setting. Up to
6 hours of EDUC 890 may be applied toward Ph.D. de-
gree requirements.

895 Seminar in Emerging Issues of Education
(3:3:0). Prerequisite: Satisfactory completion of EDUC
800. Focus on the study of selected emerging issues or
problems in education. Students engage in research,
study, discussion, and writing about various aspects of
the topics selected for study. May be repeated. Up to 6
hours of 895 course work may be applied to Ph.D. re-
quirements.

896 Doctoral Seminar in Curriculum Areas (2:2:0).
Prerequisite: Successful completion of EDUC 800. Focus
on research, theory, and exemplary practice in specific
subject areas of education. Students engage in research,
study, discussion, and writing in the designated subject
area to analyze trends, assumptions, and important im-
plications for the educational area today and in the fu-
ture. Usually taken near the end of Ph.D. course work.

897 Independent Study for the Doctor of Philoso-
phy in Education (varying credit). Prerequisite: Admis-
sion to the Ph.D. program and prior approval of adviser
and Ph.D. director. A structured learning experience to
extend and develop skills and knowledge relative to a
field of professional expertise.

994 Advanced Internship in Education (3:3:0). Prer-
erequisite: Admission to the Ph.D. program and prior ap-
proval of adviser and Ph.D. director. Requires internship
in a setting related to the student's major area of study.
Requires a minimum of 100 hours completed over at
least a five-week period. Each intern works with an ap-
propriate staff member in a cooperating school, school
system, or other educational institution or agency. Must
be in a setting that differs from regular employment.

998 Doctoral Dissertation Proposal (2:2:0). Prere-
quisite: Admission to candidacy in the Ph.D. program, suc-
cessful completion of the doctoral qualifying
examination and EDRS 810, 811, and 812 or their equiv-
alents.

999 Doctoral Dissertation Research (1-9:1-9:0). Prer-
erequisite: Admission to candidacy in the Ph.D. program
and faculty approval of dissertation proposal. Continued
faculty assistance on an individual basis in the comple-
tion of the dissertation planned in EDUC 998 and the
initiation of new projects. May be repeated. No more
than 11 hours of EDUC 998 and 999 may be applied to-
ward the minimum Ph.D. degree requirements.

Other courses. For other Ph.D. courses see EDUC 840,
881, 882; EDRS 810, 811, 812, 820, 895; EDCI 701 and
705; EDAS 895; EDCD 895; EDCl 895.
School of Information Technology 
and Engineering
School of Information Technology and Engineering

Computer Science

Faculty
Acquah, James B., D.Sc., George Washington University, 1990; Assistant Professor
Carver, Richard, Ph.D., North Carolina State University, 1989; Assistant Professor
De Jong, Kenneth A., Ph.D., University of Michigan, 1975; Associate Professor
Denning, Peter, Ph.D., Massachusetts Institute of Technology, 1968; Associate Dean, SITE; Chairman, Computer Science
Frieder, Ophir, Ph.D., University of Michigan, 1987; Assistant Professor
Hamburger, Henry J., Ph.D., University of Michigan, 1971; Associate Professor
Littman, David, Ph.D., Yale University, 1989; Ph.D., Cornell University, 1976; Assistant Professor
Michalski, Ryszard, Ph.D., Politechnical University of Silesia, Poland, 1969; PRC Professor
Norris, Eugene M., Ph.D., University of Florida, 1969; Associate Professor
Pachowicz, Peter, Ph.D., Stanislaw Staszic University, Poland, 1984; Assistant Professor
Quammen, Donna J., Ph.D., University of Pittsburgh, 1986; Assistant Professor
Rine, David C., Ph.D., University of Iowa, 1970; Professor
Sood, Arun K., Ph.D., Carnegie-Mellon University, 1972; Professor
Tanner, Michael C., Ph.D., Ohio State University, 1989; Assistant Professor
Tecuci, Gheorghe, Ph.D., University of Paris South, France, 1988; Assistant Professor
Wang, Pearl Y., Ph.D., University of Wisconsin, 1980; Associate Professor

Wechsler, Harry, Ph.D., University of California, Irvine, 1975; Professor

Computer Science, M.S.

The Master of Science in Computer Science is for individuals who are interested in computer software technology. The program encompasses the depth of knowledge needed to pursue more advanced work in computer science or allied areas.

Graduate classes are offered in the late afternoon and evening to accommodate the professionally employed student. Financial aid in the form of graduate assistantships may be available for full-time, degree-seeking students.

The department offers courses in the core area of computer science with an optional M.S. specialization in courses in the areas of artificial intelligence, software engineering, parallel/distributed computing, image processing/graphics, or computer systems.

The department actively participates in the program leading to the Ph.D. degree in Information Technology in School of Information Technology and Engineering. A certificate in Software Systems Engineering is also available with an M.S. in Computer Science.

Appropriate courses may be transferred, with advisor approval, into the GMU degree program. Refer to section on Programs and Additional Graduate Courses in this catalog. Students may take courses through the Cooperative Graduate Engineering Program, which is affiliated with the University of Virginia and Virginia Tech.

University Computing Capability

Academic computing capability is provided by a number of laboratories offering a large number of individual student computers, as well as campus-wide networked timesharing facilities. All laboratories are networked and include access to local

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and remote servers as well as the Internet. Equipment includes personal computer stations (MS-DOS compatible) and UNIX-based workstations from Sun Microsystems and other manufacturers, as well as a large DEC 5900 UNIX-based systems, which supports the entire campus.

Software includes compilers for a variety of programming languages and software tools supporting engineering design, graphics, neural networks, and high performance/parallel computing. Specialized facilities are available for artificial intelligence, software engineering, image processing and computer vision, and parallel and distributed computing research.

Admission Requirements

Students seeking admission to the M.S. in Computer Science program must satisfy the following requirements:

1. Fulfill admission requirements for graduate study at George Mason University.
2. Hold a baccalaureate degree. Students with some deficiencies in preparation may be admitted provisionally pending completion of foundation courses in mathematics or computer science. Undergraduate credit earned for this purpose may not be applied toward the graduate degree.
3. Have a cumulative grade point average of 3.0 for the last two years of undergraduate work, preferably with a major in a technical field such as computer science, mathematics, physics, engineering, or information systems.
4. Submit transcripts of all post-secondary education; a self-assessment form (normally included in the application package or available from the department); three letters of recommendation; and an official Graduate Record Examination (GRE) report, which is strongly recommended and encouraged but not required.

Degree Requirements

In addition to the general requirements of the university, completion of this program requires the following:

1. Completion of 30 hours of graduate course credit, including:
   a. 12 hours comprising the following courses:
      - CS 540 Language Processors
      - CS 571 Operating Systems
      - CS 580 Artificial Intelligence
      - CS 583 Analysis of Algorithms
   b. 12 or more hours of CS courses at the 600 level or above, which have at least one CS course as a prerequisite (excluding CS 798 and 799).
   c. At least one course taken from three of the five specialization areas listed below. Courses listed under more than one specialization count only once for satisfying this requirement.
   d. Either 3 credit hours of CS 798, or 3 to 6 credits of CS 799, or one additional 600-level or above CS course, which has at least one CS course as a prerequisite. Additional graduate-level courses in computer science or in closely related fields, chosen with the written consent of the adviser.
2. For students electing the project or thesis option, presentation of the project or thesis at an appropriate forum approved by the department graduate committee.

Specializations

The Computer Science Department currently supports the following specialization areas: artificial intelligence; software engineering; parallel/distributed computing; image processing/graphics; and computer systems. A list of the courses in each of these specializations is obtainable in the department office. A student can specialize by taking at least 12 noncore credits, including M.S. thesis or project from one specialization.

Certificate in Software Systems Engineering

Students may also pursue a certificate in Software Systems Engineering. For information on this certificate, please refer to the Software Systems Engineering program in this catalog.

Computer Science Courses (CS)

531 Theory of Computation (3:3:0). Prerequisite: CS 330 and MATH 305. CS 331 is strongly recommended. Theory of computability, Turing machines, computable functions, recursive functions, unsolvable decision problems and Godel's Incompleteness Theorem, computational complexity.

540 Language Processors (3:3:0). Prerequisite: MATH 305, CS 330 and 265. Basic programming language processors: assemblers, interpreters, and compilers. Topics include design and construction of language processors, formal syntactic definition methods, parsing techniques, and code generation techniques. Lab includes construction of language processors and experience with programming environments.

555 Computer Communications and Networking (3:3:0). Prerequisite: CS 365 or equivalent. Techniques and systems for the communication of data among computational devices. Protocols of the seven-layer ISO reference model. Topics include the role of various media and software components, local and wide area network protocols, network design, performance, and cost considerations, and emerging advanced commercial technologies.
571 Operating Systems (3:3:0). Prerequisite: CS 365. Models of different operating systems. Major functions include processes, memory management, I/O, inter-process communication, files, directories, shells, distributed systems, performance, and user interface.

580 Introduction to Artificial Intelligence (3:3:0). Prerequisite: CS 330. Principles and methods for knowledge representation, reasoning, learning, problem solving, planning, heuristic search, natural language processing, etc. and their application to building intelligent systems in a variety of domains. LISP, PROLOG, or expert systems programming languages.

583 Analysis of Algorithms I (3:3:0). Prerequisite: CS 330 and MATH 305. Topics include the analysis of sequential and parallel algorithmic strategies (such as greedy methods, divide and conquer strategies, dynamic programming, search and traversal techniques, approximation algorithms), the analysis of specific algorithms falling into these classes, NP-Hard and NP-Complete problems.


621/SWSE 621 Software Design (3:3:0). Prerequisite: SWSE 619. See SWSE 621.


625/SWSE 625 Software Project Management (3:3:0). Prerequisite: SWSE 619. See SWSE 625.

631/SWSE 631 Object-Oriented Software Development (3:3:0). Prerequisite: CS/SWSE 619 or 540, or equivalent. Principles of object-oriented analysis and design, development, and programming. Includes relationships between object-oriented design concepts and software engineering principles, techniques of object-oriented design and programming, and applying object-oriented techniques.

632/SWSE 632 User Interface Design and Development (3:3:0). Prerequisite: SWSE 619 or equivalent. See SWSE 632.

635 Foundations of Parallel Computation (3:3:0). Prerequisite: CS 583 and CS 540 or 571, or equivalent. Survey of the field of parallel computation. Three major parallel computing paradigms (MIMD computation, SIMD computation, and dataflow computation) are covered. Emphasis is placed on the interfaces between algorithm design and implementation, architecture, and software. Parallel algorithms and parallel programming languages are examined relative to the architecture of particular parallel computers.

640 Advanced Program Development (3:3:0). Prerequisite: CS 540 or equivalent. This course examines advanced compiler techniques such as code optimizations for sequential machines, and parallel machines; compilers for logical, functional, and object-oriented languages; and other selected topics in the current literature.

650 Database and Knowledge Engineering (3:3:0). Prerequisite: CS 540, 583, and 571. Data models for network, hierarchical, object-oriented, and relational management information systems. Development (including internal structures) of a database system.


668 Computer Architecture Systems (3:3:0). Prerequisite: CS 571 or 540 or equivalent. Examines the principles and practices relating computer architecture to programming execution and efficiency. A new approach that stresses the performance and cost of architecture is presented. The principles of compiler and OS implications, instructions sets, basic processors, pipelines, and memory-hierarchy are examined. Specific topics include RISC machines, cache memories, register usage, VAX architecture, and vector machines.

671 Advanced Operating Systems (3:3:0). Prerequisite: CS 571, MATH 351, or permission of instructor. Advanced computer systems concepts, including models and mechanisms of operating and distributed system structure and techniques of modeling and analysis.

672 Computer System Performance Evaluation (3:3:0). Prerequisite: CS 571 and MATH 351. Theory and practice of analytical models of computer systems. Topics include queuing networks, single and multiple class mean-analysis, models of centralized and client-server systems, and software performance engineering.

680 Natural Language Processing (3:3:0). Prerequisite: CS 540 and 580. Principles of the design of computer programs that respond appropriately to questions, commands, and statements expressed in human language, particularly English. Role of knowledge representation and linguistic theory. Students become familiar with current literature to implement a limited natural language processor.


682 Computer Vision (3:3:0). Prerequisite: CS 686. Study of computational models of visual perception and their implementation on computer systems. Topics include early visual processing, edge detection, segmentation, intrinsic images, image modeling, representation of visual knowledge, and image understanding.

683 Parallel Algorithms (3:3:0). Prerequisite: CS 583; CS 635 recommended. Examines the design and analysis of parallel algorithms. Material to be covered will focus on algorithms for both theoretical and practical models.
of parallel computation. Algorithm design and analysis for the PRAM will be considered, as well as for existing SIMD and MIMD type architectures. Topics to be covered include sorting, graph algorithms, numerical algorithms, and computational complexity.

684 Graph Algorithms (3:3:0). Prerequisite: CS 583. Data structures and analytical techniques for the study of graph algorithms. Data structures discussed include disjoint sets, heaps, and dynamic trees. Algorithms treated include minimum spanning trees, shortest path, maximum flow, and graph planarity.

685/ECE 651 Intelligent Systems for Robotics (3:3:0). Prerequisite: CS 580 or ECE 650 or equivalent. Review of recent developments in the area of intelligent autonomous systems. Study of the applications of artificial intelligence, computer vision, and machine learning to robotics. Topics include analysis and design of algorithms and architectures for planning, navigation, sensory data understanding, sensor fusion, spatial reasoning, motion control, knowledge acquisition, learning of concepts and procedures, self-organization, and adaptation to the environment.

686 Image Processing and Applications (3:3:0). Prerequisite: CS 583 and either STAT 344 or MATH 351, or equivalent. Concepts and techniques used in image processing. Methods for image capture, transformation, enhancement, restoration, and encoding are discussed. Students complete projects involving naturally occurring images.

688 Neural Network Principles (3:3:0). Prerequisite: CS 580 or equivalent. Study of neural network models, algorithms, and applications. Several connectionist and biologically based models are introduced, and their capabilities and limitations are discussed. A variety of application areas are presented. A network simulation project is required.

689 Intelligent Tutoring Systems (3:3:0). Prerequisite: CS 580. Principles, design, and development of computer-based tutoring systems and learning environments, with emphasis on the application of techniques from artificial intelligence. Organizing and representing subject matter and expertise in forms structured for presentation and communication. Diagnosing a learner's actions to obtain information that can usefully guide tutorial decision making about subject matter, problem generation, and various forms of assistance. Case studies and evaluation strategies.

697 Independent Reading and Research (1-3:0:0). Prerequisite: Graduate standing, completion of at least two core courses (CS 540, 571, 583), and permission of instructor. In areas of importance but insufficient demand to justify a regular course, a student may undertake a course of study under the supervision of a consenting faculty member. A written statement of the content of the course and a tentative reading list is normally submitted by the student as part of the request for approval to take the course. A literature review, project report, or other written product is normally required.

699 Advanced Topics in Computer Science (3:3:0). Prerequisite: Completion of at least two core course and permission of instructor. Special topics in computer science not occurring in the regular computer science sequence. The course may be repeated for credit when the subject is distinctly different.

706 Concurrent Software Systems (3:3:0). Prerequisite: CS 571 and CS 635 or 619, or equivalent. Studies issues related to the development of concurrent software systems. Topics include concurrent programming languages and constructs, and the specification, design, verification, and validation of concurrent programs. Students are required to solve concurrent programming problems and to check their solutions by using verification, testing, and debugging tools.

720/SWSE 720 Advanced Software Requirements (3:3:0). Prerequisite: CS/SWSE 620 or equivalent. See SWSE 720.

721/SWSE 721 Advanced Software Design Methods (3:3:0). Prerequisite: CS/SWSE 621 or equivalent. See SWSE 721.

735 Concurrency (3:3:0). Prerequisite: CS 635 or equivalent. Description of the formal specification of concurrent systems and algorithms, using formal methodology based on the theory of communicating sequential processes. Emphasis is placed on using the occam programming language for the implementation of formal specifications of concurrent systems.


773 Real-time Systems Design and Development (3:3:0). Prerequisite: CS 571 and 621 or equivalent. Real-time systems and the fundamental principles supporting the design of real-time systems and specific techniques for their implementation. Emphasis is placed on modern higher-order language features and describing asynchronously executing processes, for accessing underlying low-level hardware features, and for controlling process synchronization and time deadlines. Three of the most important real-time software design and development aspects are covered: design approaches, higher-order language support, and run-time kernel implementation requirements.

782 Machine Learning (3:3:0). Prerequisite: CS 580 and CS 681 or equivalent. Survey of the field of machine learning. Topics provide broad coverage of past and current developments in machine learning.

785 Knowledge Acquisition and Problem Solving (3:3:0). Prerequisite: CS 681 or equivalent. Principles and major methods of the basic stages of knowledge acquisition (systematic elicitation of expert knowledge, knowledge-base refinement, and knowledge-base optimization), in the context of general problem-solving methods. Case studies of successful knowledge acquisition and problem-solving systems. Projects: development or application of knowledge acquisition tools for expert systems.

798 Project Seminar (3:3:0). Prerequisite: 18 hours of credit applicable toward the M.S. in Computer Science. Master's degree candidates undertake a project using the knowledge gained in the M.S. program. Topics are chosen in consultation with an adviser. The project is in-
tended to meet the project or thesis requirement for the M.S. in Computer Science.

799 Thesis (1-6:0:0). Prerequisite: 18 hours of credit applicable toward the M.S. in Computer Science. Original or expository work is evaluated by a committee of three faculty members.

### Electrical and Computer Engineering

#### Faculty

- Athale, Ravindra A., Ph.D., University of California, San Diego, 1980; Associate Professor
- Auletta, Richard J., Ph.D., University of Virginia, 1987; Assistant Professor
- Baraniecki, Anna Z., Ph.D., University of Windsor, 1980; Associate Professor
- Beale, Guy O., Ph.D., University of Virginia, 1977; Associate Professor
- Berry, Alok K., Ph.D., University of Missouri, 1985; Associate Professor
- Black, W. Murray, Ph.D., Pennsylvania State University, 1971; Professor, Interim Associate Dean for Graduate Studies and Research, SITE
- Ceperley, Peter H., Ph.D., Stanford University, 1973; Associate Professor
- Chang, Shih-Chun, Ph.D., University of Hawaii, 1977; Associate Professor
- Cole, Eric, Ph.D., Virginia Polytechnic Institute and State University, 1988; Assistant Professor
- Cook, Gerald, Sc.D., Massachusetts Institute of Technology, 1965; Earle C. Williams Professor
- Ephraim, Yariv, Ph.D., The Technion, Israel Institute of Technology, 1984; Associate Professor
- Gertler, Janos, Sc.D., Hungarian Academy of Sciences, 1980; Professor
- Haney, Michael, Ph.D., California Institute of Technology, 1986; Associate Professor
- Hintz, Kenneth J., Ph.D., University of Virginia, 1981; Associate Professor
- Ioannou, Dimitris E., Ph.D., University of Manchester, 1978; Associate Professor
- Jabbari, Bijan, Ph.D., Stanford University, 1981; Associate Professor
- Levis, Alexander H., Sc.D., Massachusetts Institute of Technology, 1968; Professor
- Manitius, Andrej Z., Ph.D., Polytechnical School of Warsaw, 1968; Professor
- Mulpuri, V. Rao, Ph.D., Oregon State University, 1985; Professor
- Orsak, Geoffrey C., Ph.D., Rice University, 1990; Assistant Professor
- Olurolimi, Oluseyi O., Ph.D., Stanford University, 1990; Assistant Professor
- Paris, Bernd-Peter, Ph.D., Rice University, 1990; Assistant Professor
- Schaefer, David, B.S., Tulane University, 1949; Associate Professor
- Sutton, William G., Ph.D., Air Force Institute of Technology, 1981; Associate Professor
- Tabak, Daniel, Ph.D., University of Illinois, 1967; Professor
- Van Trees, Harry L., Sc.D., Massachusetts Institute of Technology, 1961; Distinguished Professor

#### Electrical Engineering, M.S.

Graduate programs leading to the master of science and doctor of philosophy degrees with majors in engineering prepare students for careers in industry, government, or academia. The M.S. degree in Electrical Engineering is offered by the Department of Electrical and Computer Engineering. The Ph.D. degree in Information Technology is offered by the School of Information Technology and Engineering, which includes the Department of Electrical and Computer Engineering.

While firmly committed to high standards of teaching and research excellence in the traditional areas of communications and signal processing, control and robotics, computers, and electronics, the department also recognizes the need to augment and enhance these areas through the use of modern information technology. Graduate students are offered a progressive environment with ample opportunities for the type of multidisciplinary research that will be needed to confront the complex realities of the twenty-first century.

The courses in this program are offered during the evening or late afternoon hours to permit persons who are employed full-time to enroll in the program. For those who enter the program on a full-time basis, some financial aid may be available in various forms such as teaching assistantships, research assistantships, work-study, or co-op agreements with local industry.

Students may take courses through the Cooperative Graduate Engineering Program, in affiliation with the University of Virginia and Virginia Tech. Appropriate courses may be transferred, with advisor approval, into this GMU degree program.
Refer to the section on Programs and Additional Graduate Courses in this catalog.

Admission Requirements

Admissions are strictly competitive. The department's policy is to admit only those students who have demonstrated a potential for outstanding performance in their graduate work. To be considered for admission to the master's program, applicants should have the following:

1. An earned baccalaureate in electrical engineering, computer engineering, or a closely related discipline from an accredited program with a reputation for high academic standards.
2. A grade average of B or better during the last 60 semester hours.
3. Three letters of recommendation, preferably from academic references, or from references in industry or government who are holders of advanced degrees and are familiar with the applicant's professional accomplishments.
4. A detailed statement of career goals and aspirations.
5. For students who have not earned a bachelor's degree from a U.S. university, satisfactory performance on the Graduate Record Examination; and for those students whose native language is not English, a score of 575 or higher on the TOEFL. (A minimum score of 600 is required for applicants who wish to be considered for a graduate teaching assistantship.)

Admission Categories

Students may be admitted into one of the following categories: degree, provisional, or nondegree. Provisional admission is for students whose past performance provides reasonable, but not strong, evidence of their capacity to pursue graduate work. To be advanced to degree status, provisionally admitted students must achieve a 3.0 grade point average after 12 semester hours, must remove all undergraduate deficiencies (by taking the corresponding course(s) from the following list with a B average or better before taking any graduate courses:

1. Circuit Theory (ECE 285, 286)
2. Digital Electronics (ECE 331, 332)
3. Linear Electronics (ECE 333, 334)
4. Signals and Systems (ECE 360)
5. Matrix Algebra (MATH 203)
6. Differential Equations (MATH 214)
7. Probability (MATH 351 or STAT 344)
8. Data Structures C++ (CS 211)

In addition to the above core areas, students must display some competence in two or more of the following areas: communications, controls, computers, and semiconductors, before being granted the master's degree. The following undergraduate courses correspond to these areas:

1. Control Theory (ECE 421)
2. Device Theory (ECE 430)
3. Computer Architecture (ECE 445)
4. Communications (ECE 460)

Transfer of Credit

Up to 12 hours, the maximum credit hours permitted, may be transferred from the University of Virginia or Virginia Tech as part of the Cooperative Graduate Engineering Program.

Student Advising

Newly admitted graduate students must consult with the ECE graduate coordinator before they register for classes. Students should make an appointment by calling the ECE office. Each student is expected to select a major area of concentration from one of the department's four specialty areas: communications and signal processing, computer engineering, control and robotics, or electronics. The student then is assigned an academic adviser from that area. Before the end of the first semester, each student must submit a plan of study (approved by his or her academic adviser) to the graduate coordinator's office.

Degree Requirements

Course Work—Each student must complete a minimum of 30 semester hours of graduate-level credits beyond the bachelor's degree. A minimum grade point average of 3.0 is required. The plan of study for the degree includes the following:

1. A minimum of two core courses (with B or better in each) from the following list:
   a. ECE 521 Modern Systems Theory
   b. ECE 528 Random Processes in ECE
   c. ECE 546 Parallel Computer Architectures
or ECE 548 Sequential Machine Theory
d. ECE 584 Solid State Device Theory
or ECE 565 Introduction to Optical
Electronics
2. A minimum of three courses with a grade of B
or better at the 600 or 700 level (not including
ECE 798 or 799) from a chosen area of specializa-
tion.
3. A maximum of six credit hours of non-ECE
courses, subject to prior departmental approval.
A maximum of two courses with a C grade may be
applied toward the degree. However, all graduate
courses are counted in the computation of the
student's GPA.
Seminar Requirement — All degree candidates
must attend a minimum of 10 department semi-
nars.
Options
To complete the requirements for graduation, stu-
dents may select one of the following options:
Thesis option. Thesis students must complete
ECE 799 Master's Thesis (6 credit hours) and 24
hours of course work. The thesis is particularly
recommended for those students who wish to de-
velop and document their research skills, and/or
who contemplate subsequent enrollment in a
Ph.D. program. The thesis involves a research ef-
fort, which is conducted under the guidance of a
faculty adviser. In some cases, permission may be
granted to complete a portion of the work at the
student's place of employment. The final written
thesis and oral defense are approved by the
student's advisory committee. This committee con-
sists of at least three full-time faculty members,
including two from the student's major area and one
from outside the area. Thesis students may not
register for ECE 798 Research Project.
Scholarly paper option. Students who select this
option must complete 30 credits of course work
and must present a scholarly paper. The scholarly
paper is a technical report on an independent
study, laboratory or computer experimentation, or
literature search done by the student on a current
scientific or technological topic, such as survey of
some new technologies, or new methodologies, or
a case study of new applications, on a theme se-
lected under the guidance of a faculty adviser. The
student must demonstrate knowledge of the topic
and make a satisfactory technical presentation of
the paper in the Graduate Seminar. One way of
satisfying the scholarly paper option is to com-
plete 9 courses plus ECE 798 Research Project. In
that case, the ECE 798 project report would be
the scholarly paper. An alternative way to com-
plete this option is for the student to take 10
courses and write the scholarly paper on their
own. The Scholarly Paper and the final presenta-
tion must be approved by the student's Advisory
Committee.

Electrical and Computer
Engineering Courses (ECE)
500 Signals and Systems: Theory and Applications
(3:3:0). Prerequisite: MATH 203, 213, 303, 313, 351; not
open to Electrical and Computer Engineering students.
Fundamental and advanced techniques for system analy-
sis; review of Fourier series and integral; convolution,
correlation, power spectrum, bandwidth; communication
systems and modulation techniques; sampling and quanti-
zation; discrete-time signals and systems, Z-transform;
discrete Fourier Transform and FFT algorithms; analysis
and design of digital filters.
511 Microprocessors (3:3:0). Prerequisite: ECE 445 or
equivalent. Introduction to microprocessor architecture
and structure. Intel 8080/8085 and Z-80 architecture and
programming. Microcomputer bus structure. Microcom-
puter memory. Microcomputer I/O, interrupt, DMA, in-
terface. Microcomputer development systems.
Applications examples. Introduction to 16-bit micropro-
cessors. The course includes a project involving hands-on
experience with microcomputer systems.
512 Real-Time Microprocessor Systems (3:3:0). Pre-
requisite: ECE 421 and 511 or equivalent. A course on
real-time microprocessor systems with emphasis on con-
trol, interfacing techniques, real-time operating systems,
and related applications. Topics include basic input-output,
interfacing the peripheral analog circuitry, operating
systems, programming techniques, process control with
microcomputers, and microcomputers for communica-
tions. The course includes a simulation and design
project.
513 Applied Electromagnetic Theory (3:3:0). Pre-
requisite: ECE 305 or equivalent. Maxwell's equations, elec-
tromagnetic wave propagation, wave guides, transmission
lines, radiation, and antennas.
516 Advanced Microprocessors (3:3:0). Prerequisite:
ECE 511 or equivalent. 16-bit and 32-bit microprocessors.
Detailed study of the Intel 8086 and Motorola 68000
families (up to 80386 and MC68020). Auxiliary chips of
the above families, microcomputers, and applications.
Brief coverage of NS32000, Z8000, Z80000, AT&T
WES32100, NEC V70, V71, DEC MicroVAX 78032.
520 Electronic Systems Analysis (3:3:0). Prerequisite:
ECE 443. A study of electronic circuits from a systems
viewpoint. Topics consist of the analog building block
circuits used in system design including operational am-
plifiers, voltage regulators, video amplifiers, oscillators,
modulators, phase-locked loops, multiplexers, active fil-
ters, A/D and D/A converters, and optoelectronic circuits.
521 Modern Systems Theory (3:3:0). Prerequisite:
ECE 360 or equivalent. Introduction to linear systems the-
ory. Review of linear algebra. State variables. State space
description of dynamic systems. Analysis of continuous-
time and discrete-time linear systems. Controllability and
observability of linear systems. Nonlinear systems.
Stability theory. Introduction to the design of linear feed-
back control systems.

http://catalog.gmu.edu
528 Random Processes in Electrical and Computer Engineering (3:3:0). Prerequisite: ECE 360, and MATH 351 or STAT 344, or equivalent. Topics include random signals and noise in communications, stationary and ergodic random processes, spectral analysis, Gaussian processes, Brownian motion, mean square estimation, Kalman and adaptive filtering, Markov processes, and Poisson processes. Applications are drawn from computer, communication, control, and signal processing.

535 Digital Signal Processing (3:3:0). Prerequisite: ECE 360, 528, or permission of instructor. Representation, analysis, and design of digital signals and systems. Sampling and quantization. Z-transform and Discrete Fourier Transform. Digital filter realizations. Design techniques for recursive (IIR) and nonrecursive (FIR) filters. The Fast Fourier Transform algorithms. Spectrum analysis. Additional topics may include adaptive filtering, homomorphic digital signal processing, digital interpolation and decimation; VLSI signal processors.

542 Computer Network Architectures and Protocols (3:3:0). Prerequisite: STAT 344 or MATH 351 or equivalent, and graduate standing in SITE. Introduction to the architectures and protocols of computer networks and the concept of packet switching. Topics include ISO standard layer model, physical interfaces and protocols, data link control, multiaccess techniques, packet switching, routing and flow control, network topology, data communication subsystems, error control coding, local area network, satellite packet broadcasting, packet radio, interconnection of packet-switching networks, network security and privacy, and various examples of computer networks.

546 Parallel Computer Architectures (3:3:0). Prerequisite: ECE 445. Study of computation schemata, Petri nets, parallel floating, point operations, instruction handling techniques, pipeline systems, functional parallelism, memory organization, arbitration and deadlock, pipeline computer architecture, and massive parallelism.

548 Sequential Machine Theory (3:3:0). Prerequisite: ECE 331 and MATH 305, or permission of instructor. Theoretical study of sequential machines. Topics include sets, relations and lattices, switching algebra, functional decomposition, iterative networks, representation, minimization and transformation of sequential machines, state identification, state recognizers, and linear and stochastic sequential machines.


563 Introduction to Microwave Engineering (3:3:0). Prerequisite: ECE 305 or permission of instructor. Study of the generation, control, and propagation of microwave signals. Topics include transmission lines, waveguides, resonators, scattering microwave signals, scattering parameters, Smith charts, measurement techniques, instrumentation, and microwave devices.

564 Modern Optical Engineering (3:3:0). Prerequisites: ECE 305 and ECE 360. Introduction to optical physics from a wave propagation perspective. Topics include coherence, interference and diffraction, polarization, birefringent materials, coherent and incoherent imaging systems, Fourier optics, and holography.

565 Introduction to Optical Electronics (3:3:0). Prerequisite: PHYS 352, ECE 333, and ECE 305. Introduction to optical systems for information gathering, transmission, storage, and processing. Topics include introduction to lasers, solid-state detectors, and optical fibers; variety of optical sensors, imaging and nonimaging; optical data storage techniques and optical signal processing; optical communications.

567 Optical Fiber Communications (3:3:0). Prerequisite: ECE 565 or permission of instructor. Study of the components and integration of fiber-optic transmission systems. Topics include optical fibers, signal degradation, optical sources, power launching and coupling, photodetectors, receiver circuits, link analysis, and optical measurements.

571 Network Analysis (3:3:0). Prerequisite: ECE 333 or permission of instructor. Study of linear active and passive networks. Topics include graph theory, network properties, scattering parameters, frequency and time domain representation, sensitivity measures, Tellegens' theorem, and computer-aided design.

584 Solid-State Device Theory I (3:3:0). Prerequisite: ECE 430 or permission of instructor. Study of the theory of semiconductor devices based on solid-state physics. Topics include physics and properties of semiconductors, p-n junction diode, metal semiconductor contacts, MIS diode and CCD, bipolar and field effect transistors.

586 Digital Integrated Circuit Analysis and Design (3:3:0). Prerequisite: ECE 331, ECE 430, or permission of instructor. A study of the devices and circuit topologies used in digital integrated circuits. Topics include large signal active device models, MOS and BJT gates, regenerative logic circuits, semiconductor memories, LSI and VLSI circuits.

587 Analog Integrated Circuit Analysis and Design (3:3:0). Prerequisite: ECE 333, ECE 430, or permission of instructor. A study of the devices and circuit topologies used in analog integrated circuits. Topics include active device models, differential amplifiers, current sources, output stages, operational amplifiers, frequency response, noise, and computer-aided design.

590 Selected Topics in Electrical Engineering (3:3:0). Prerequisite: Graduate standing or permission of department. Selected topics from recent developments and applications in electrical engineering.

620 Optimal Control Theory (3:3:0). Prerequisite: ECE 521 or permission of instructor. Detailed treatment of optimal control theory and its applications. Topics include system dynamics and performance criteria, the calculus of variations and Pontryagin's minimum principle, computational methods in optimal control, and applications of optimal control.

621 Estimation, Identification, and Adaptive Control (3:3:0). Prerequisite: ECE 521 and ECE 528 or permission of instructor. A detailed treatment of stochastic control theory and its applications. Topics include state space models with random inputs, optimum state estima-
622 High-Frequency Electronics (3:3:0). Prerequisite: ECE 305, 433, or permission of instructor. Study of devices and circuits used in high-speed communications systems. Topics include microwave bipolar transistors, GaAs MESFET's, and high-speed integrated circuits; the design of linear and power amplifiers using S-parameter techniques and computer simulation.

624 Computer Control Systems (3:3:0). Prerequisite: ECE 421 and 521 or permission of instructor. Analysis, design, and implementation of digital feedback control systems. Topics include discrete-time models, pole-placement, controller design methods, MIMO system decoupling and observer design. The course may include a simulation and design project.

630 Statistical Communication Theory (3:3:0). Prerequisite: ECE 528. Introduction to optimum receiver design in the additive white Gaussian noise environment. Topics include efficient signal set design, modulation techniques, matched filter, correlation detector, coherent and noncoherent detections, fading and diversity channels, random amplitude and phase, diversity techniques, performance bounds of communications, and waveform communications.


632 Information Theory (3:3:0). Prerequisite: ECE 528 or permission of instructor. Comprehensive study of information with emphasis on concepts of reliable, efficient communication systems. Measure of information, efficient representation of message sources, communication channels and their capacity. Coding for reliable transmission over noisy channels.

633 Coding Theory (3:3:0). Prerequisite: ECE 528 or permission of instructor. Mathematics of coding; groups, rings, and fields; polynomial algebra. Linear block codes: generator and parity check matrices, error syndromes. Binary cyclic codes. Convolutional codes, implementation of encoders and decoders.

634 Detection and Estimation Theory (3:3:0). Prerequisite: ECE 630. Introduction to detection and estimation theory with communication applications. Topics include M-estimates, Bayes, minimax, Neyman-Pearson criterion, detection of signals in AWGN and ACGN, Bayes estimations, ML estimations of signal parameters in AWGN and ACGN, estimations of Gaussian waveforms in Gaussian noise, linear MSE estimations, Kalman and Wiener filters.


636 Secure Telecommunication Systems (3:3:0). Prerequisite: ECE 632 and ECE 633. Introduction to secure data and voice communications. Topics include theoretical basis of cryptography, random cipher systems, practical security schemes, linear and nonlinear shift registers and encryption algorithms, block cipher and NBS data encryption standard (DES), public key cryptography, RSA, knapsack algorithms, digital signatures and authentication, security of computer networks, cryptographic protocols, key management, speech security, voice scrambling.

637 Spread Spectrum Communications (3:3:0). Prerequisite: ECE 631. Introduction to spread spectrum communications. Topics include pseudonoise spread spectrum systems, feedback shift registers, jamming strategy, code acquisition, synchronization, tracking, Gold codes, burst-communication systems, time-hopping, frequency-hopping, and multiple access communications.

638 Fast Algorithms and Architectures for Digital Signal Processing (3:3:0). Prerequisite: ECE 535 or permission of instructor. Study of recent advances in development of signal processing algorithms and relevant computational architectures. Topics include fast polynomial transforms, Winograd's algorithms, multirate processing of digital signals, spectral estimation, adaptive filtering, parallel and pipeline computational arrays, and mapping of signal processing algorithms into systolic arrays.

639 Satellite Communications (3:3:0). Prerequisite: ECE 631 or permission of instructor. Introduction to the theory and applications of modern satellite communications. Topics include satellite channel characterization, channel impairments and transmission degradation, link calculations, modulation, coding, multiple access, broadcasting, random access schemes, demand assignment, synchronization, satellite switching and onboard processing, integrated service digital satellite networks, and satellite transponder, ground stations, packet switching, and optical satellite communications.

640 Massively Parallel Computers (3:3:0). Prerequisite: ECE 546 or permission of instructor. Topics include basic concepts of parallelism, two-dimensional computation schemata, types of intercommunication networks between processing elements, single instruction stream multiple data stream computers, computers with massive parallelism, pyramid computing structures, multiple instruction stream multiple data stream computers, and parallel processing of images.

641 Computer System Architecture (3:3:0). Prerequisite: ECE 546 or equivalent. Advanced course in computer architecture. Definitions, multiple processors, VLSI architecture, data flow, computation, the semantic gap, high-level language architecture, object-oriented design, RISC architecture, current trends in computer architecture.

642 Design and Analysis of Computer Communication Networks (3:3:0). Prerequisite: ECE 542 and ECE 528 or equivalent. Introduction to queuing theory. Other topics include concentrator design, multiplexing, capacity assignments, random access schemes, polling and probing techniques, topology design, flow control and routing, packet radio, protocol specification, and validation.

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644 Architectures and Algorithms for Image Processing (3:3:0). Prerequisite: ECE 511 or equivalent. Architectures and algorithms for the analysis and processing of pictorial information. Topics include systems and techniques for the digital representation of images; image scanning methods and their applications; picture processing languages; image data structures; feature detection, extraction, and reconstruction; detection of symmetries; systems and methods for regular decomposition, image deconstruction, object thinning, real-time orthogonal transformations, and applications. The course includes a design project.

650 Robotics (3:3:0). Prerequisite: ECE 521 or permission of instructor. Introduction to robotics and advanced automation from an electrical engineering standpoint. Topics include hardware overview; coordinate systems and manipulator kinematics; differential motion and the inverse Jacobian; manipulator path control and motion planning; design and control of articulated hands; sensory feedback; machine vision; applications to industrial automation.

651 Robotics II (3:3:0). Prerequisite: ECE 650 or permission of instructor. In-depth study of the theoretical aspects of robotics. Emphasis on the integration of topics from control theory and machine intelligence. Topics include manipulator dynamics; optimal, self-organizing, and distributed control of manipulators; stability of legged locomotion; mathematical modeling of uncertain knowledge; knowledge-based control of robot systems.

662 Microwave Electronics (3:3:0). Prerequisite: ECE 513 and ECE 563 or permission of instructor. Study of the generation, control, and propagation of microwave signals. Topics include solid-state microwave devices and high-power microwave devices and microwave applications.

663 Antennas and Propagation (3:3:0). Prerequisite: ECE 513 or permission of instructor. Study of the electromagnetic antennas and the waves which radiate from them. Topics include types of antennas and their characterization, radiative E-M fields, transmission loss, propagation near and around obstacles, and phased arrays.

665 Optical Signal Processing (3:3:0). Prerequisite: ECE 564 and ECE 565. Study of optical systems for processing temporal signals as well as images. Topics include use of coherent optical systems for image processing and pattern recognition, principles of holography, acousto-optic systems for radar signal-processing optical computers.

670/SYST 680 Principles of Command, Control, Communication, and Intelligence (C3)—Part I (3:3:0). Prerequisite: ECE 528 and 542, or equivalent. See SYST 680.

671/SYST 681 Principles of Command, Control, Communication, and Intelligence (C3)—Part II (3:3:0). Prerequisite: ECE 670/SYST 680 or permission of instructor. See SYST 681.

680 VLSI Circuit Analysis and Design (3:3:0). Prerequisite: ECE 584 and 586 or permission of instructor. Physics and modeling of various semiconductor devices and fundamental building block circuits that are extensively used in VLSI design. Topics include review of MOSFETs and BJTs, SPICE device modeling, inverter and logic circuits, logic minimization, PLA implementation, static and dynamic RAM and problems in VLSI.

684 Advanced Solid-State Device Theory (3:3:0). Prerequisite: ECE 584 or permission of instructor. Study of the theory of special microwave and optoelectronic semiconductor devices based on solid-state physics. Topics include tunnel devices, IMPATT diodes, transferred-electron devices, LED and semiconductor lasers, photodetectors, and solar cells.

689 Semiconducting Materials (3:3:0). Prerequisite: ECE 584 or permission of instructor. Course on semiconducting materials that are of interest for present and future device applications. Topics include crystal and electronic structure, elemental semiconductors, group III-V and group II-VI compound semiconductors, various material growth techniques, ion implantation, material characterization techniques, and novel device structures.


698 Independent Reading and Research (3:3:0). Prerequisite: Graduate standing, completion of at least two core courses, and permission of instructor. Study of a selected area in electrical and computer engineering under the supervision of a faculty member. Written report required. May be taken no more than twice for a graduate credit.

720 Multivariable and Robust Control (3:3:0). Prerequisite: ECE 620 or ECE 621. Eigenstructure assignment for multivariable systems, the Smith-McMillan form, internal stability, modeling system uncertainty, performance specifications and principal gains, parametrization of controllers, loop shaping and loop transfer recovery, and the H_

732 Mobile Communication Systems (3:3:0). Prerequisites: ECE 542 and 630. Provides an introduction to mobile communication system design and analysis. Topics include modeling of the mobile communication channel, signal set and receiver design for the mobile communication channel, access and mobility control, mobile network architectures, connection to the fixed network, signalling protocols for mobile communication systems. Examples of mobile communication systems will be presented, including the pan-European GSM system, the North American D-AMPS system, and Personal Communication Systems.

734 Detection and Estimation Theory (3:3:0). Prerequisite: ECE 630. Introduction to detection and estimation theory with communication and radar/sonar applications. Topics include classical detection and estimation theory, detection of known signals in Gaussian noise, signal parameter estimation, linear waveform estimation, Wiener and Kalman filters.

735 Advanced Coding Theory (3:3:0). Prerequisites: ECE 630 and 633. Theory and practice of advanced error-control coding techniques. Topics include trellis codes, multidimensional codes, Leech lattice, rotationally invariant codes, spectral analysis and transform coding. Applications of contemporary coding theory in mobile communications, magnetic and optical recording, high-speed modem, and high-density data storage design.

738 Advanced Digital Signal Processing (3:3:0). Prerequisite: ECE 638. Theory and practice of advanced digital signal processing techniques. Topics include computationally efficient high speed algorithms for convolution, correlation, orthogonal transforms, multirate processing of digital signals, filter banks, multiresolution time-frequency and time scale analysis of one- and two-dimensional signals, and parallel signal processing.


744 Computer Vision and Expert Systems (3:3:0). Prerequisite: ECE 511 and 644. Brief review of image analysis; vision system architectures (human visual system, computer visual systems); vision system operations (focus and zooming); picture recognition languages; introduction to knowledge-based systems; learning algorithmic schemes; applications to text processing/analysis (as expert systems). Design project will be conceived, simulated, and tested by the students.

745 ULSI Microelectronics (3:3:0). Prerequisites: ECE 684 and 689. A study of Ultra-Large-Scale-Integration (more than one million devices in a single chip) by considering the limits of packing density, the modeling of the devices, and the circuit topology. Si MOS, Si bipolar, and GaAs field effect transistor 'second order' effects and their impact on ULSI will be thoroughly discussed.


798 Research Project (3:0:0). Prerequisite: 9 hours of graduate-level course work. Research project to be chosen and completed under the guidance of a graduate faculty member, and which results in an acceptable technical report.

799 Master's Thesis (1-6:0:0). Prerequisite: 9 hours of graduate-level course work and permission of instructor. Research project chosen and completed under the guidance of a graduate faculty member, and which results in a technical report acceptable to a three-faculty-member committee and an oral defense.

Information and Software Systems Engineering

Faculty

Ammann, Paul E., Ph.D., University of Virginia, 1988; Assistant Professor
Baum, Richard, Ph.D., University of Michigan, 1969; Associate Professor
Brodsly, Alexander, Ph.D., Hebrew University, 1991; Visiting Assistant Professor
Brouse, Peggy S., Ph.D., George Mason University, 1992; Research Assistant Professor
Dede, Christopher, Ed.D., University of Massachusetts, 1972; Professor
Fletcher, J. Dexter, Ph.D., Stanford University, 1973; Visiting Associate Professor
Gomaa, Hassan, Ph.D., Imperial College, London University, 1976; Professor
Jajodia, Sushil, Ph.D., University of Oregon, 1977; Professor

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sues associated with building computer-based information systems for modern organizations. Information is the lifeblood of every enterprise, both private and public, and the MSIS program addresses the theoretical and practical aspects of specifying, designing, implementing, and managing information systems. The program prepares students for research and professional practice in the above areas. The MSIS program is unique in two respects: 1) it provides a balance between the technical and management aspects of information systems, and 2) it accepts students with ranging baccalaureate degrees in disciplines such as business, arts and sciences, computer science, and engineering.

The MSIS student studies the core topics of computer organization, programming languages, operating systems, operations research and management, database management, computer communication networks and distributed applications, systems analysis and design, and information system policy and administration.

Through elective courses the student may acquire knowledge and skills in the areas of office information systems, secure information systems, software systems engineering, information systems engineering, data engineering, knowledge engineering, information retrieval, decision support systems, user interface design, artificial intelligence, computer graphics, and object-oriented analysis, design, and programming.

An MSIS graduate may pursue a career in areas such as database administration, management and engineering, database application programming, systems analysis and design, information engineering, knowledge engineering, network design and administration, systems integration, and the management of information systems.

The program is offered by the faculty of the Department of Information and Software Systems Engineering (ISSE). Many classes are scheduled in the late afternoon and early evening to accommodate the professionally employed student.

**Foundation Requirements**

The MSIS program prepares students for research and practice in Information Systems. The program emphasizes a balance of technical and management skills. In order to ensure that students have an adequate background in mathematical methods, computer technology, and business knowledge, the program requires three foundation courses.

These foundation courses are the following three George Mason University courses, or equivalent:
INFS 501 Discrete and Logical Structures for Information Systems
INFS 515 Computer Organization
INFS 590 Program Design and Data Structures

and, one of the three courses listed below:

- ACCT 600 Accounting and Reporting
- MGMT 600 Organizational Behavior and Development
- MKTG 650 Marketing Management

When a prospective student applies to the MSIS program, he or she is asked to fill out a departmental self-evaluation form, indicating whether previously taken courses may satisfy these foundation requirements. Upon acceptance, the student is advised of the necessary foundation courses to be satisfactorily completed, as articulated courses, to meet this requirement. Foundation courses do not earn credit toward the MSIS degree.

Students may take courses through the Cooperative Graduate Engineering Program in affiliation with the University of Virginia and Virginia Tech. Appropriate courses may be evaluated, with advisor approval, into this GMU degree program. Refer to the section on Programs and Additional Graduate Courses in this catalog.

Admission Requirements

Applicants for the MSIS program should meet the following minimum entrance requirements:

1. Hold a baccalaureate degree from an accredited institution;
2. Have earned a grade-point average of 3.0 or better in the last 60 hours;
3. Show proof of a satisfactory score on the Graduate Management Admission Test (GMAT) or the Graduate Record Exam (GRE). The applicable test should have been taken within five years of applying for admission. The GRE/GMAT requirement is waived if the applicant already has a master's degree in a related field;
4. Submit the appropriate application form with three letters of recommendation from persons directly knowledgeable of the applicant's professional and academic competence; and
5. Submit a completed MSIS self-evaluation form that is essential to evaluation of foundation requirements by the department faculty. This form may be obtained from the department office.

Advising

Before the beginning of each semester, the ISSE Department holds an orientation meeting to advise incoming and continuing students. These meetings are held before the registration period begins. Incoming students are required to attend the orientation meeting. Registration forms are signed at this time.

The department also provides an advising function to students, as outlined in the Student Advising Form available from the department. Each student is assigned a faculty advisor with whom the student may confer on matters related to degree requirements. A Plan of Study form for the MSIS degree should be completed and submitted by the student soon after admission to the program. The plan serves as a planning guide for the student.

Degree Requirements

Completion of the MSIS program requires a minimum of 30 approved graduate semester hours (10 courses). This requirement is satisfied by the following:

Required Courses

To provide a common background in the fundamentals of information systems, the following five courses are required of all students:

- ORAS 540 Management Science
- INFS 601 Operating Systems Theory and Practice
- INFS 612 Data Communications and Distributed Processing
- INFS 614 Database Management Systems
- INFS 622 Information Systems Analysis and Design

Students must also take one of the following two courses:

- INFS 790 Information Systems Policy and Administration
- INFS 798 Research Project

The research project is intended for research-oriented students who have discussed a project with a graduate faculty member who has agreed to supervise the project.

Electives

In order for students to pursue their individual interests, they may elect four courses. Guidelines for selecting elective courses are available from the department office. A thesis option is available; students may elect to complete a thesis for up to 6 hours of elective credit.

Students may earn a Certificate in Software Systems Engineering by replacing the INFS 622 core course with SWSE 620, and by taking the following SWSE courses as electives:

http://catalog.gmu.edu
Information and Software Systems Engineering

SWSE 619 Software Construction
SWSE 621 Software Design
SWSE 623 Formal Methods and Models in Software Engineering
and either
SWSE 625 Software Project Management
or
SWSE 635 Software Testing and Quality Assurance

Information Systems Courses (INFS)

501 Discrete and Logical Structures for Information Systems (3:3:0). Prerequisite: 6 credits of undergraduate mathematics. Study of discrete and logical structures for information systems analysis and design including basic set theory and proof techniques, propositional and predicate logic, trees and graphs, finite state machines, formal languages and their relation to automata, computability and computational complexity.

515 Computer Organization (3:3:0). Prerequisites: Undergraduate courses or equivalent knowledge in structured programming in a high-level language. Computer hardware organization: arithmetic and logical operations; combina- tional and sequential logic; machine representation of numbers, characters, and instructions; addressing techniques; microprogramming; reduced instruction set computers. Symbolic assembly language. Interrupts and input/output organization. Credit cannot be applied toward any graduate degree in SITE.

590 Program Design and Data Structures (3:3:0). Prerequisite: Undergraduate courses or equivalent knowledge in structured programming in a high-level language. Study of the fundamentals of data structures and algorithms applied in programming solutions to application problems. Stresses structured programming in a modern high-level language. Laboratory required.

601 Operating Systems Theory and Practice (3:3:0). Prerequisites: INFS 501, 515, and 590; or equivalent. Fundamental concepts including process synchronization and scheduling, interprocess communication, memory management, virtual memory, deadlocks, security and access control, file and disk management, performance analysis, and distributed systems. Impact of computer architecture on operating systems. Case studies and comparative analysis of operating systems.

612 Data Communications and Distributed Processing (3:3:0). Prerequisite: INFS 501, 515, and 590; or equivalent. Concepts and applications of telecommunications technologies, networks, and distributed information systems. Includes regulatory issues, network pricing, and management. Case studies.

614 Database Management (3:3:0). Prerequisite: INFS 501, 515, and 590; or equivalent. Principles of database systems, with emphasis on the relational model of data, and covering both the user and the system perspectives. User issues include data modeling, formal and commercial query languages and the theory of database design. System issues include file structures, query optimization, and transaction processing. Computing lab.

622 Information Systems Analysis and Design (3:3:0). Prerequisite: INFS 501, 515, and 590; or equivalent. Integration of computing technologies, systems analysis, system design practices, and management criteria in the design of large scale information management and decision support systems. Cases and computing lab.

623 Information Retrieval (3:3:0). Prerequisite: INFS 614. Examines models and theories used for the design of information systems for textual and less well-structured databases; covering hardware, software and the design, implementation, and evaluation of such systems. Laboratory (computer programming).

650 Object-Oriented Applications for Information Systems (3:3:0). Prerequisites: INFS 501, 515, and 590; or equivalent. Principles and applications of object-oriented methods in information systems. The study of a variety of languages and design methods used for class construction. Consideration of higher-level tools for system construction. Investigation of applications through program construction and case studies in varied settings, such as database systems, graphical user interfaces, knowledge-based systems, simulations, and prototyping. Programming projects.

680 Technical and Administrative Issues in Office Automation (3:3:0). Prerequisite: INFS 590 (may be taken concurrently). Examines office automation as an issue in applying the concepts of MIS in an organization. Focuses on technical issues of hardware and software selection as well as administrative problems associated with successful integration of the appropriate technolo­gies. Lecture and major class project.

696 Directed Readings (3:3:0). Prerequisite: Graduate standing in information systems with at least 12 prior credit hours in MSIS program. Research and analysis of a contemporary problem in information system development. Prior approval required by a faculty sponsor who supervises the student's work. Written report or thesis proposal to be prepared.

699 Advanced Topics in Information Systems (3:3:0). Prerequisite: Permission of instructor. Special topics not occurring in the regular INFS sequence will be presented. May be repeated for credit where distinct offerings of the course differ in subject.

750 Object-Oriented Applications for Information Systems (3:3:0). Prerequisites: INFS 600. Principles and applications of object-oriented methods in information systems. The study of a variety of languages and design methods used for class construction. Consideration of higher-level tools for system construction. Investigation of applications through program construction and case studies in varied settings, such as database systems, graphical user interfaces, knowledge-based systems, simulations, and prototyping. Programming projects.

760 Advanced Database Management (3:3:0). Prerequisites: INFS 614. Study of advanced database models and languages, database design theory, transaction processing, recovery, concurrency, distributed database, security, and integrity. Discussion of recent developments and research directions.

782 Information Systems Security (3:3:0). Prerequisites: INFS 601, 612, and 614; or permission of instructor. Study of security policies, models, and mechanisms for secrecy, integrity, and availability. Operating system models and mechanisms for mandatory and discretionary controls. Data models, concepts, and mechanisms for database security. Basic cryptography and its applications. Security in computer networks and distributed sys-
tems. Control and prevention of viruses and other rogue programs.

**770 Methods for Information Systems Engineering**
(3:3:0). **Prerequisite:** INFS 622. Study of the information systems engineering lifecycle. Methodologies and methods for data, knowledge, and information engineering. Information systems planning including strategic information, critical success factors, and enterprise models. Object modeling including data semantics, entity/relationship models, and knowledge acquisition. Process modeling including hierarchical function and process decomposition. Case studies and semester group project.

**790 Information Systems Policy and Administration**
(3:3:0). **Prerequisite:** Completion of all core courses for the M.S.I.S. preferably taken in final semester prior to graduation. Capstone course, integrates the technical and executive policy issues of information systems. Critical executive issues are examined through case studies and a comprehensive individual project.

**798 Research Project**
(3:3:0). **Prerequisite:** 18 hours of credit applicable towards M.S.I.S. Research project is chosen under the guidance of a full-time graduate faculty member, resulting in a written technical report. Prior approval required by a faculty sponsor who supervises the student's work.

**799 Thesis**
(1-6:0:0). **Prerequisite:** 18 hours of credit applicable toward M.S.I.S. degree. Original or compiary work evaluated by a committee of three faculty members.

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**Foundation Requirements**

Students entering the MS-SWSE program must have course work or equivalent knowledge in the following areas: a modern, block-structured programming language such as Ada, C, or Pascal; data structures and algorithms; machine organization (e.g., as given in computer system architecture or assembly language courses); and topics in discrete mathematics including sets, relations, functions, trees, graphs, and inductive proofs. The level of knowledge required in these areas is equivalent to that taught in undergraduate courses in the indicated topics, and may also be achieved by taking the following George Mason University courses, which are referred to as the SWSE foundation courses:

- INFS 501 Discrete and Logical Structures for Information Systems
- INFS 515 Computer Organization
- INFS 590 Program Design and Data Structures

In addition, it is desirable, though not required, that entering students have at least one year of work experience in building and/or modifying software systems.

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**Admission Requirements**

In addition to the general admission requirements of the university, applicants to the MS-SWSE program must meet the following minimum entrance requirements:

1. Hold a baccalaureate degree in an appropriate discipline from an accredited institution;
2. Have earned a grade point average of 3.0 or better in the last 60 hours of undergraduate study;
3. Provide a brief (one- to two-page) statement of educational and work experience in the computing field that includes a statement of career goals in software systems engineering;
4. Submit a departmental self-assessment form, which can be obtained from the department. This form provides summary information concerning background and preparation for the program; and
5. Show proof of a satisfactory score on the Graduate Record Exam (GRE). The applicable test should have been taken within five years of applying for admission. The GRE requirement is waived if the applicant already has a master's degree in a related field.

Acceptance into the MS-SWSE program is based on an overall assessment of the applicant's potential ability to complete the program of study in a satisfactory manner. Well-qualified students with minor deficiencies may be admitted to the program in provisional status, with certain conditions (e.g., specified course work) to be completed.

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within a specified time. Applicants with more serious deficiencies may be placed in deferred status and reconsidered when those deficiencies are corrected.

Advising

Before the beginning of each semester, the ISSE department holds an orientation meeting to advise incoming and continuing students. These meetings are held before the registration period begins and students are urged to attend. Registration forms for new students are signed at this time.

The department also provides an advising function to students, as outlined in the Student Advising Form available from the department. Each student is assigned a faculty adviser with whom the student confers on matters related to degree requirements. A Plan of Study form for the MS-SWSE degree should be completed and submitted by the student soon after admission to the program. The plan serves as a planning guide for the student.

Degree Requirements

The M.S. in Software Systems Engineering requires a minimum of 30 semester hours of graduate-level courses. The following six core courses (18 semester hours) are required:

- SWSE 619 Software Construction
- SWSE 620 Software Requirements and Prototyping
- SWSE 621 Software Design
- SWSE 623 Formal Methods and Models
- SWSE 625 Software Project Management
- SWSE 626 Software Project Lab

and either the professional track, consisting of four electives, or the research track, consisting of two electives and a 6-semester-hour thesis, which is primarily intended for students planning to pursue a Ph.D. degree with emphasis on software systems engineering.

Electives

Students choose electives from offerings within the School of Information Technology and Engineering with consent of the faculty adviser. Electives provide students the opportunity to gain in-depth knowledge in a selected area, to gain breadth of knowledge, or, by careful selection, to complete some of the core course requirements for the Ph.D. program.

Certificate in Software Systems Engineering

The graduate certificate program in software systems engineering is for individuals who have a master's degree in a scientific or engineering discipline, or who are enrolled in an appropriate master's degree program. The certificate program provides knowledge, tools, and techniques to those who are working in, or plan to work in, the field of software systems engineering, but do not want to complete all of the requirements for a master's degree in software systems engineering. The certificate in software systems engineering may be pursued concurrently with any of the graduate degree programs in the School of Information Technology and Engineering. However, the certificate is not awarded until all requirements for both the graduate degree and certificate programs have been completed.

Admission Requirements

Applicants to the graduate certificate program in software systems engineering must hold a master's degree in a scientific or engineering discipline from an accredited university or be in graduate degree status in an appropriate master's program. In addition, each applicant must possess knowledge equivalent to the following undergraduate courses: structured programming in a modern programming language, data structures, discrete mathematics, and machine organization. The level of knowledge may also be achieved by taking the following George Mason University courses, which are referred to as the SWSE foundation courses:

- INFS 501 Discrete and Logical Structures for Information Systems
- INFS 515 Computer Organization
- INFS 590 Program Design and Data Structures

In addition, it is desirable, but not necessary, for applicants to have at least one year of appropriate work experience in building and/or modifying software systems.

Applicants are required to submit a brief (one- to two-page) statement of educational and work experience in the computing field that includes a statement of career goals in software systems engineering. Applicants also need to complete a self-assessment form, which can be obtained from the Department of Information and Software Systems Engineering. This form provides summary information concerning background and preparation for the program. For those students not enrolled in a graduate degree program at GMU, application for the certificate program in software systems engineering is made through the Graduate

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Admissions Office of the university. Students enrolled in a graduate degree program at GMU should apply to the Department of Information and Software Systems Engineering for admission into the certificate program.

Certificate Requirements
Certificate candidates must complete the following set of courses, with an average grade of B or better in each, for a total of 15 credits of graduate study.

SWSE 619 Software Construction
SWSE 620 Software Requirements and Prototyping
SWSE 621 Software Design
SWSE 623 Formal Methods and Models in Software Engineering or either
SWSE 625 Software Project Management or SWSE 635 Software Testing and Quality Assurance

Applicants may obtain more information by contacting the SWSE certificate program adviser in the Department of Information and Software Systems Engineering, Room 430, Science and Technology II, (703) 993-1640.

Software Systems Engineering Courses (SWSE)

619 Software Construction (3:3:0). Prerequisite: SWSE foundation courses or equivalent. In-depth study of software construction using a modern language. Concepts such as information hiding, data abstraction, concurrency, and object-oriented software construction are discussed.

620 Software Requirements and Prototyping (3:3:0). Prerequisite: SWSE foundation courses or equivalent. In-depth study of software requirements. Students participate in a group project on software requirements.

621 Software Design (3:3:0). Prerequisite: SWSE 619 or permission of instructor. Concepts and methods for the architectural design of large-scale software systems. Fundamental design concepts and design notations are introduced. Several design methods are presented and compared, with examples of their use. Students participate in a group software design project.

623 Formal Methods and Models in Software Engineering (3:3:0). Prerequisite: SWSE foundation courses or equivalent. Formal mechanisms for specifying, validating, and verifying software systems. Program verification through Hoare’s method and Dijkstra’s weakest preconditions. Formal specifications, including initial specification and refinement towards implementation. Integration of formal methods with existing programming languages, and the application of formal methods to requirements analysis, testing, safety analysis, and object-oriented approaches.

625 Software Project Management (3:3:0). Prerequisite: SWSE foundation courses or equivalent. Lifecycle and process models; process metrics; planning for a software project; mechanisms for monitoring and controlling schedule, budget, quality, and productivity; and leadership, motivation, and team building.

626 Software Project Laboratory (3:3:6). Prerequisite: SWSE 619, 620, 621, and 625, or permission of instructor. Students are involved in analysis, design, implementation, and management of a software project system. Students work in teams to develop or modify a software product, applying sound principles of software systems engineering. Both industrial and academic standards are used to assess the quality of the work products.

630 Software Engineering Economics (3:3:0). Prerequisite: SWSE 625. Covers quantitative models of the software lifecycle; cost-effectiveness analysis in software engineering; multiple-goal decision analysis; uncertainty and risk analysis; software cost estimation; software engineering metrics; and quantitative lifecycle management techniques.

631 Object-Oriented Software Development (3:3:0). See CS 631.

632 User Interface Design and Development (3:3:0). Prerequisite: SWSE 620 or permission of instructor. Principles of user interface design, development, and programming. Includes user psychology and cognitive science, adaptive user interfaces, icon and window design, command language design, user guidance systems, and collaborative working.

635 Software Testing and Quality Assurance (3:3:0). Prerequisite: SWSE 620 or permission of instructor. Concepts and techniques for testing software and assuring its quality. Software testing at the unit, module, subsystem, and system levels. Automatic and manual techniques for generating and validating test data. The testing process, static vs. dynamic analysis, functional testing, inspections, and reliability assessment.

699 Special Topics in Software Systems Engineering (3:3:0). Prerequisite: Permission of instructor. Special topics not occurring in the regular SWSE sequence. May be repeated for credit when semester topic is different.

720 Advanced Software Requirements (3:3:0). Prerequisite: SWSE 620 and 621. State-of-the-art and state-of-the-practice in software requirements engineering. In-depth coverage of selected methods, tools, notations, or validation techniques for analysis and specification of software requirements. The course work includes a project investigating or applying approaches to requirements engineering.

721 Advanced Software Design Methods (3:3:0). Prerequisite: SWSE 620 and 621. Study of advanced design methods for large-scale software systems, including concurrent, real-time, and distributed systems. Course work includes a project investigating or applying software design methods.

information Technology

The general doctoral requirements of George Mason University apply to this program.

When the term Information Technology and Engineering is used at George Mason University to describe our school and its activities, it is intended to mean information technology and information engineering. These aspects of technology are emphasized in this geographic region and we will develop excellence in precisely these areas. Our focus is on the information, systems, and architectural design approaches to technology. These complement and enhance the more traditional approaches that are more strongly based on the physical and materials sciences.

Information technology and engineering at GMU involves an external design function and an internal design function. Electrical and computer engineering and computer science involve the hardware and software aspects of the internal design function. The human element and the external design functions are also important for successful system design and operation. Our efforts in information systems, software systems engineering, and systems engineering primarily concern working with people to assist them in knowledge organization. These efforts involve systems, including information systems, and the entire life cycle of systems from initial conceptualization and specification of information and architectural requirements through system evaluation and redesign. They include the analysis capability that is needed to quantitatively determine operational characteristics of existing and future systems and processes. Our activities in operations research and applied statistics are focused on these important endeavors.

Our tasks in information technology and engineering vary from requirements definition and specification to conceptual and functional design and development of systems. They concern such topics as architectural definition and evaluation. These occur at considerably different points in the system life cycle and are needed for functional integration, maintainability, reliability, and the appropriate interfaces that ensure system design for human interaction. This human interaction with systems and processes, and the associated information processing activities, may take any of several diverse forms. It may involve human supervisory control of physical processes, such as the robots that are used in automated manufacturing. It may involve typically cognitive tasks at the operational levels of fault diagnosis, detection and correction, or at the level of strategic planning.

Admission Requirements

Doctoral students in information technology are selected on the basis of scholarship and potential from among applicants with appropriate degrees from institutions of high standing. Generally, a master's degree in an information technology-related area is required for admission to the program. Students without an appropriate master's degree who otherwise satisfy admission requirements will usually be encouraged to first seek such a degree in one of the seven master's programs offered through this school. Application packets are available from the Office of Admissions and from the Office of the Dean of SITE.

An undergraduate grade average of B (3.0/4.0) and a graduate grade average of 3.5/4.0 are nominal and normative requirements for applicants to the program. The admissions process includes submission of the application for admission, undergraduate and graduate transcripts from previous colleges and universities attended, GRE test results when available, three letters of reference, a resume and detailed statement of career goals and aspirations, and a self-assessment of past background. All of an applicant's background is examined prior to making an admissions decision.

Among appropriate fields of study that provide an immediate basis for doctoral study in information technology are engineering, computer science, operations research, statistics, mathematics, physical sciences, economics, and psychology.

To ensure a common ground of fundamentals, students should have a background in topics such as calculus, differential equations, linear algebra, discrete structures, probability, and statistics. In addition, students entering the doctoral program in information technology must have a sound working knowledge in computing as demonstrated by examples of programs or applications developed and tested in at least one high-level programming language environment. Since much of the course work within this program requires computational proficiency, experience with a variety of languages and computer hardware is useful, as is an understanding of computer architecture. Highly qualified students who do not present evidence of
appropriate course work for the program may be admitted and then required to take appropriate articulation courses.

Plan of Study
The Ph.D. program in information technology is made up of a core curriculum and in-depth study and research in the student’s field of concentration, followed by preparation of a dissertation. Generally, a student will have obtained a master’s degree in a field appropriate to information technology. This master’s program often contains many of the doctoral core courses.

Under the guidance of the doctoral supervisory committee, the student prepares a plan of study. This lists the intended courses and their expected timing in both the breadth and advanced specialty parts of doctoral study. The plan should also contain the intended date of the comprehensive examinations and the tentative subject of the dissertation research.

An evaluation of previous efforts is given to students with an explanation of how these satisfy both the fundamental entrance requirements and the breadth requirements for the Ph.D. degree.

Completion of the broad scope and in-depth advanced doctoral studies is followed by a comprehensive examination on the advanced work. In addition, preparation and oral presentation of a dissertation proposal is required. The doctoral program is completed with successful presentation and defense of a doctoral dissertation representing an important contribution to fundamental or applied knowledge in information technology.

Core Curriculum
The core curriculum is comprised of six courses that are to be completed from the several M.S. programs of the School of Information Technology and Engineering. The core curriculum forms a significant part of the coherent Plan of Study that is required for each student. As such, these courses should be carefully planned and, with the exception of courses necessary for the distribution requirement, are to be selected from the prerequisite courses for INFT 800- and 900-level courses. The minimum requirements for the core curriculum are as follows:

1. All students must take one course from OR 541 or STAT 644 or STAT 654 or a course with a higher number from the offerings of the Operations Research and Engineering Department or Applied and Engineering Statistics Department. This course may not be waived barring extraordinary circumstances (e.g., the student is ABD from another institution in a highly technical field).

2. In addition to the course in item #1 to be taken by all students, one course must be taken from three of the five SITE departments for a total of three courses. The departments are listed below:
   a. Computer Science
   b. Electrical Engineering
   c. Systems Engineering
   d. Information and Software Systems Engineering
   e. Operations Research and Engineering
   f. Applied and Engineering Statistics

3. Two additional courses taken from the offerings of M.S. degree programs in SITE are required to complete the core curriculum.

4. No more than two courses may be taken from one M.S. program.

5. A GPA of 3.5 is required in core courses taken at George Mason.

6. Waiver options may be requested for up to four core courses. Waivers must be approved by the departmental doctoral coordinator and the Office of the Dean based on a review of student provided supporting material to assure that the course waived was equivalent to the appropriate GMU course.

7. Waiver candidate courses must have been taken within five years of acceptance to the Ph.D. program or the student must attest to using the material from the course during the most recent five year period (Honor Code invoked). A GPA of 3.5 is required for waived courses.

8. Final examinations may be taken to obtain waivers for up to four Core Courses. A GPA of 3.5 is required for core courses satisfied by this mechanism.

Doctoral Supervisory Committee
Upon admission to the program, a student is assigned a temporary adviser. The student is responsible for working with the temporary adviser until the student selects a dissertation director and an advisory committee as soon after student’s admission as is feasible. This is especially important for students who have completed a considerable amount of graduate work elsewhere.

The doctoral supervisory committee includes the dissertation director plus a faculty member from the student’s intended major area, who is selected by the student to become chair of the doctoral supervisory committee. The chair of the committee need not be the dissertation director. Other committee members are selected to form a committee of at least four people from the regular full-time
Comprehensive Examination

The comprehensive examination is taken after the student has satisfactorily completed all of the course work requirements in the approved Plan of Study filed by the student. To initiate this the student meets with the committee chair and the entire committee to prepare a memorandum to be forwarded to the Office of the Dean requesting the comprehensive examination. The requesting memorandum lists all courses taken by the student that form the program of study for the Ph.D. degree and proposes a suggested structure for the comprehensive examination. This is generally structured by four central areas, to include all comprehensive courses taken, to be covered on the examination and is reasonably explicit about the scope of the examination. The memo describes an advanced specialty area(s) and briefly comments upon the courses that the student has taken in the area and upon the independent study taken under the direction of a faculty member. This memo also defines the coverage for the comprehensive examination. The objective of the comprehensive examination is to allow the examining committee to assess a student’s readiness for and ability to complete doctoral research in an area of specialization.

After completing the advanced specialty part of the studies, the student requests appointment of a comprehensive examination committee and the comprehensive examination. This request is transmitted through the supervisory committee to the Office of the Dean. Generally conducted by the doctoral supervisory committee, the examination covers the student’s area of specialization and includes both a written and an oral part. The result of the comprehensive examination is a grade of pass or fail with recommendations for removing any deficiencies.

After satisfactorily completing the written portions of the comprehensive examinations, the student arranges the oral portion. The entire advisory committee meets with the student and asks him or her questions concerning basic and advanced areas of study.

Dissertation Proposal Presentation

Near the end of the course work each doctoral student prepares a written dissertation proposal, which is presented in an oral public presentation to the doctoral supervisory committee. The student may enroll in INFT 998, Doctoral Dissertation Proposal, to complete this effort. During the term the student expects to present the dissertation proposal to the committee, the student should enroll in INFT 990, Dissertation Topic Pre-
sentations. After successfully completing this requirement, the student is formally admitted as a "candidate" for the Ph.D. degree. The application for candidacy is submitted to the Office of the Dean on a standard form.

**Dissertation and Final Defense**

With concurrence of the advisory committee, the student proceeds with the doctoral research, during which time the student must continuously enroll in INFT 999, Doctoral Dissertation. The student must complete a minimum of 24 credits from among INFT 990, 998, and 999, with a minimum of 12 credits of INFT 999. When the central portions of the research have been completed to the point that the student is able to describe the original contributions of the dissertation effort, the final oral presentation of the dissertation research may be scheduled. A candidate submits the dissertation to the doctoral supervisory committee one month before the scheduled date of the dissertation defense. The dissertation is then presented to the committee in a public oral presentation.

Following a satisfactory evaluation of the oral defense of dissertation by the supervisory committee, the student must prepare, with supervision from the dissertation director, a final publishable dissertation that represents a definitive contribution to knowledge in information technology. This document must meet format guidelines specified by the Guide for Preparing Graduate Theses, Dissertations and Projects.

If the candidate successfully defends the dissertation, the dissertation defense committee recommends completion of the final form of the dissertation, and that the faculty of the School of Information Technology and Engineering and the graduate faculty of George Mason University accept the candidate for the conferral of the degree of doctor of philosophy.

**Residence Requirement and Research in Industrial Laboratories**

The term residence indicates that the student is "at home" intellectually with the faculty community. The student is expected to "reside" at George Mason University and associate with the GMU faculty for at least two full academic years. The advisory committee determines the equivalent of two academic years of effort at GMU. The basis for residency, as here defined, is effort in the intellectual community at GMU to complete the basic or core study area requirements of the comprehensive examinations, and preparation of a dissertation proposal that defines a definitive research contribution.

Student research in industrial and government laboratories is encouraged to the extent that these facilities support quality "independent" research by the doctoral student. The greater Washington area is home for the largest group of information technology professionals in the world, many of whom have made definitive contributions to research in this area. Area professionals with outstanding credentials and interests in information technology are solicited as Visiting Industrial Professors at GMU. They may serve on doctoral advisory committees and, where permitted by available time and interests, direct doctoral dissertations.

**Information Technology Courses (INFT)**

Graduate courses listed under the departments of Computer Science, Electrical Engineering, Information and Software Systems Engineering, Systems Engineering, and Operations Research and Engineering and Applied Engineering Statistics are appropriately considered as courses forming an inherent part of this program.

**500 Quantitative Foundations for Information Systems Analysis (3:3:0)**

Prerequisite: MATH 108 or an equivalent one-semester undergraduate introductory calculus course covering both differential and integral calculus. Provides a common background in basic quantitative areas focused on decision making and information processing. Topics include a review of basic calculus, matrix algebra, problems in optimization, and the calculus of probabilities.

**746/CSI 776 Stochastic Calculus (3:3:0)**

Prerequisites: STAT 652 or ECE 630 or ECE 632. Introduction to modern theory of stochastic calculus such as stochastic integrals, martingales, counting processes, diffusion processes, and Ito-type processes in general. Applications of the methods to engineering and biology. The focus is on developing the necessary concepts rather than mathematical proofs. This course is suited for graduate students in information technology, electrical engineering, mathematics, operations research, and statistics who would like to develop expertise in applied probability. It is part of a two-course sequence. The second course in concerned with inference and stochastic processes and its applications.

**776/CSI 778 Measure and Linear Spaces I (3:3:0)**

Prerequisites: STAT 652, ECE 620, 621, and 630. Modern parametric and nonparametric statistical theory relies on measure and theory and the theory of linear spaces. Focuses on the elements of measure theory and integration including theory of measure spaces, r-fields, measures, measurability, convergence theorems including Fatou's lemma and Radon-Nikodym derivatives. Also covered is the theory of linear spaces including basic axioms, geometry of function spaces, Cauchy sequences and completeness, normed linear spaces, inner product spaces, bases, Banach and Hilbert spaces including L1, L2, Lp, and L∞.
null and dual spaces, reproducing kernels, and adjoining operators.

796, 797 Directed Reading and Research (1-3:0:0). Reading and research on a specific topic in information technology under the direction of a faculty member. May be repeated as needed.

800, 801 Doctoral Seminar in Information Technology (1:1:0). A weekly seminar in information technology with interactive participation by students, faculty, and invited specialists. May be repeated as needed.

803, 804 Doctoral Tutorial in Information Technology (3:3:0). Individualized intensive study of particular aspects of information technology. May be repeated as needed.

811 Principles of Machine Learning and Inference (3:3:0). Prerequisite: CS 580, CS 681, or permission of instructor. Study principles, research directions, and methods for machine learning and inference. Topics include basic learning strategies and underlying inference types (deduction, induction, abduction, and analogy), synthetic and analytic learning methods, conceptual clustering, discovery systems, comparison of symbolic neural net and genetic algorithm approaches, multistrategy learning, and applications.

812 Advanced Topics in Natural Language Processing (3:3:0). Prerequisite: CS 680. Advanced treatment of topics in syntax, semantics and generation of linguistic output. Implementation and applications are also discussed.

813 Seminar: Intelligent Tutoring Systems (3:3:0). Prerequisite: CS 689. Current research topics in intelligent tutoring systems and learning environments, including case studies in selected domains, such as medicine and foreign language. Relevant recent advances in closely related subfields of artificial intelligence, as appropriate. Topics may include semantically constrained exploration, student modeling, example generation, formalization of pedagogical decision-making, and with evaluation strategies. Course may be repeated for credit with change in topic.

814 Foundations of Computational Science (3:3:0). Prerequisites: CS 735 or equivalent. Investigation methods for scientific questions in the presence of teraops computation, gigabyte memory, and gigabit transmission. Mapping of mathematical models to parallel algorithm and architectures, associated data structures, languages, operating systems, networks, and global change will demonstrate important scientific accomplishments enables by computation. Working in teams including scientists and information technologists, students will learn the mathematical models, abstract algorithms, and concrete algorithms for these cases, and will conduct experiments and simulations with them.

815 Parallel Computation (3:3:0). Prerequisite: CS 635. Topics illustrate some of the contemporary thinking on the relationships between the architectural, algorithmic, and language requirements for parallel computers.

816 Parallel Architectures, Algorithms, and Applications (3:3:0). Prerequisite: CS 583 and computer architecture course. Familiarization for students in area of parallel architectures, algorithms, and parallel computers. Various algorithms and their applicability to certain architectures are discussed. Comparisons of these parallel algorithms with certain tools are studied, and applications to artificial intelligence, image processing, and database machines are explored.

817 Neural Networks (3:3:0). Prerequisite: CS 688. Discussion of the development of basic principles for neural networks. Certain analytical models, such as Hopfield, Anderson, Kohonen, Grossberg, etc., are discussed along with their advantages and disadvantages. Applications of neural networks are covered concerning problems in computer vision, memory organization, knowledge-based systems, and adaptive systems. Hardware for parallel and distributed systems are also discussed.

821 Software Engineering Seminar (3:3:0). Prerequisite: SWSE 621. This seminar studies the application of software engineering principles, design methods, and support tools through real-life problems extracted from faculty/industry projects. May be repeated with a change in topic.

822 Software Maintenance and Reuse (3:3:0). Prerequisites: CS/SWSE 621 (or equivalent), data structures, principles of modern programming, discrete mathematics, or permission of instructor. Perfective maintenance, reuse of software components and patterns, evolving software systems, principles of object-oriented analysis and development. Issues regarding technologies supporting perfective software maintenance and reuse.

823 Software for Critical Systems (3:3:0). Prerequisites: SWSE 620 and STAT 654. Study of software for systems in which failure can be catastrophic. Techniques to construct and analyze software for critical applications and examination of inherent limitations of such techniques. Also interaction between techniques used during development and behavior of software during operation. Topics include tolerance of software faults, design redundancy, data redundancy, software safety, formal methods, statistical testing, design for analyzability, and design for testability.

830 Detection and Estimation Theory (3:3:0). Prerequisite: ECE 528. Introduction to detection and estimation theory with communication applications. Topics include M-hypotheses, Bayes, minimax, Neyman-Pearson criterion, detection of signals in AWGN and ACGN, Bayes estimation, ML estimation of signal parameters in AWGN and ACGN, estimation of Gaussian waveforms in Gaussian noise, linear MSE estimation, and Kalman and Wiener filters.

832 Speech and Image Coding (3:3:0). Prerequisite: ECE 535, ECE 632. Study of waveform coding concepts and algorithms and their applications to the analysis and design of data compression systems. Specific schemes involving speech and image coding are discussed. Topics include statistical properties of speech and image signals, rate distortion theory, predictive and adaptive coding techniques, optimum quantization, and bit assignment algorithms.

833 Satellite Communication (3:3:0). Prerequisite: ECE 631. Introduction to the theory and applications of modern satellite communications. Topics include satellite channel characterization, channel impairment and transmission degradation, link calculations, modulation, coding, multiple access, broadcasting, random access schemes, demand assignment, synchronization, satellite switching and onboard processing, integrated service digital satellite networks, and satellite transponder, ground
stations, packet switching, optical satellite communications.

834 Telecommunications Networks (3:3:0). Prerequisite: ECE 542 and 528. Open Systems Interconnection Reference Model, analysis and modeling of layered network architectures including transport and higher layers, performance evaluation of System Network Architecture (SNA), DEC Network Architecture (DNA), and other telecommunication architectures; protocols and standards for local, metropolitan, and wide area networks. Topics include high speed packet switching, broadband multimedia protocols, and congestion control in broadband integrated networks.

835 Computational Vision (3:3:0). Prerequisite: CS 682 or equivalent. Study of recent advances in development of machine vision algorithms and knowledge-based vision systems. Topics include scalespace; Gabor and wavelet processing; distributed and hierarchical processing using neural networks; motion analysis; active, functional, and selective perception; object and target recognition; expert systems; data fusion; and machine learning. Emphasis is on system integration in terms of perception, control, action, and adaptation. Applications to robotics, intelligent highways, inspection, forensic, and grammatical inference. Emphasis on performance evaluation and learning.

836 Special Topics in Detection and Estimation Theory (3:3:0). Prerequisite: ECE 734. Advanced topics in detection, estimation, and signal processing in areas of current research interest. Topics may include spectral estimation, speech recognition, array processing, SAR, underwater acoustics, or higher order spectra.

838 Signal Processing Algorithms and Architectures (3:3:0). Prerequisite: ECE 535 or permission of instructor. Study of recent advances in development of fast signal processing algorithms and parallel architectures. Topics include fast transforms, multirate processing of digital signals, adaptive filtering, high resolution spectral analysis, parallel computational arrays, and mapping of signal processing algorithms into array processors.

840 Advanced Robotics (3:3:0). Prerequisite: ECE 650. Review of state-of-the-art in theoretical and software aspects of robotics. Topics include compliance, flexible manipulators, intelligent task planning, collision avoidance, grasping and pushing, dexterous manipulation with multifingered hands, coordination of multiple manipulators, legged locomotion, autonomous navigation, robot languages, intelligent control, integration of sensory information, visual servoing, robot learning.

841 State Estimation and Stochastic Control (3:3:0). Prerequisite: ECE 521 and 528. Detailed treatment of stochastic control theory and its applications. Topics include state space models with random inputs, optimum state estimation, Kalman filtering, Linear Quadratic Gaussian problem, minimum variance control, computational issues, and various applications.

842 Models of Probabilistic Reasoning (3:3:0). Prerequisite: STAT 644. Survey of alternative views about how incomplete, inconclusive, and possibly unreliable evidence might be evaluated and combined. Among the views discussed are the Bayesian, Baconian, Shafer-Dempster, and Fuzzy systems for probabilistic reasoning.

843 Computer-Aided Control System Design (3:3:0). Prerequisite: ECE 620 or 624. Investigation of available computer-aided design (CAD) methods and current research in application of artificial intelligence to the computer-aided design of dynamic systems. Applications in computer-aided control system design. Topics include control system design using existing CAD methods, representation of design knowledge, integration of algorithmic and heuristic approaches to system design, intelligent user interfaces for computer-aided design, and intelligent design tutors.

844 Pattern Recognition (3:3:0). Prerequisite: ECE 528, CS 580, CS 688, or equivalent. Study of recent advances in development of pattern recognition algorithms, approximation, and estimation techniques. Topics include statistical estimation theory, fuzzy logic, neural networks, and their relationships. Additional topics include Bayesian nets, Hidden Markov Models (HMM), evolutionary computation and complexity, and chaos, with applications to signal interpretation, time-series prediction, and grammatical inference. Emphasis on performance evaluation and learning.

845 High Frequency Electronics (3:3:0). Prerequisite: ECE 520. Study of devices and circuits used in high-speed communication systems. Topics include microwave bipolar transistors, GaAs MOSFETs, and high-speed integrated circuits; the design of linear and power amplifiers using S-parameter techniques and computer simulation.

846 Optical Signal Processing (3:3:0). Prerequisite: ECE 565. Study of optical systems for processing temporal signals and images. Topics include use of coherent optical systems for image processing and pattern recognition, principles of holography, acousto-optic systems for radar signal processing, and optical computers.

847 Topics in Photonics (3:3:0). Prerequisite: ECE 565 or permission of instructor. In-depth discussion of specific topics in photonics. Topics include optical storage (disks, holographic, 3-D), digital optical computing, integrated optics, photonic switching networks, optoelectronic devices. May be repeated when covering different topics.

848 Digital Video Communications (3:3:0). Prerequisite: ECE 535 and 642. Coding, transport, and modeling of digital video signals; digital coding of waveforms with emphasis on compression techniques for video signals, transform coding including DCT and rate distortion theory for images, subband/wavelet coding of images, treatment of video signals for different television formats, colorimetry and motion estimation/compensation, general characterization of video traffic, modeling of variable bit rate video coders, transport protocols for video and multimedia, network-delay compensation for video over ATM, VBR video flow control, discussion of applications ranging from HDTV/TV over ATM, digital HDTV for terrestrial broadcast, to videoconferencing/desktop multimedia over LAN/WAN.

850 Seminar: Topics in Systems Integration Engineering (3:3:0). Prerequisite: SYST 720 or equivalent. Analysis of the Systems Integration lifecycle and the tools, techniques, and methods that contribute to the design, development, application, and evaluation of approaches to systems integration. A review of the current technological advances that support systems integration methods including functional and nonfunctional SI requirements, risk assessment and risk management, internal protest avoidance mechanisms, and protest.
management. Course may be repeated with change of topic.

851 Seminar: Topics in Software Requirements
(3:3:0). Prerequisite: SWSE 620 or SWSE 624 or CS 624. Emphasizes the latest research ideas in the requirements engineering domain. Discusses the current state-of-the-art and state-of-the-practice in requirements engineering. Focuses on the most critical problems and discusses how their resolutions might (1) further the requirements research knowledge base and (2) enhance the quality and productivity of real software and system developments in industry. Course may be repeated with change in topic.

857 Automated Planning and Problem Solving
(3:3:0). Prerequisite: CS 580. Introduction to automated planning and problem solving in artificial intelligence. Students learn a broad set of techniques in automated planning and heuristic searching along with strategies for implementing automated problem-solving systems using these methods. Topics include heuristic search, predicate calculus, nonmonotonic logic, action planning, adversarial planning, multiagent planning, and logic models for reasoning about action and time.

858 Logic Models in Artificial Intelligence
(3:3:0). Prerequisite: CS 580. Examines the relevance of logic theory to artificial intelligence. Familiarization with a variety of formal logics that are used in artificial intelligence, as well as ongoing research in new logics. Topics include first-order predicate calculus, resolution and nonresolution theorem proving, nonmonotonic logic, assumption-based reasoning, the relationship between symbolic and quantitative theories of uncertainty, temporal logics and their application to planning and metareasoning.

860 Software Analysis and Design of Real Time
Systems (3:3:0). Prerequisite: SWSE 623. Provides background for students who want to conduct research in the software engineering of real time systems. Students gain an understanding of key real time software system analysis, design concepts and methods and how they are used in the development of large-scale, real-time software systems. Students also gain an understanding of potential impact of emerging technologies in this field. A term project in the design and analysis of a complex real-time software system is undertaken.

861 Distributed Database Management Systems
(3:3:0). Prerequisite: INFS 614 or equivalent. Topics in distributed database management including transaction management, concurrency control, deadlocks, replicated database management, query processing reliability, and surveys of commercial systems and research prototypes.

862 Formal Models for Computer Security
(3:3:0). Prerequisites: INFS 762. Study of formal mathematical models for computer security. Mathematical properties of these models are identified and analyzed. The models are compared with respect to formal and pragmatic criteria. The models include lattice-based models, noninterference models, models based on propagation of access rights, multilevel data models, integrity models, and miscellaneous models such as the n-tree model for group authorization.

863 Empirical Methods in Information Technology
(3:3:0). Prerequisites: STAT 654. Examines alternative paradigms of scientific research and their applicability to research in information technology. Topics include fundamental elements of scientific investigation, basic principles of experimental design and statistical induction, philosophy of science and its relation to the information technology sciences, and case studies of information technology research.

864 Scientific Databases
(3:3:0). Prerequisites: INFS 634. Study of database support for scientific data management. Requirements and properties of scientific databases, data models for statistical and scientific databases; semantic and object-oriented modeling of application domains; statistical database query languages and query optimization; advanced logic query languages; and case studies such as the human genome project and the earth orbiting satellite.

865 Networks and Distributed Systems

867 Intelligent Databases
(3:3:0). Prerequisites: INFS 760 or permission of instructor. Study of models and techniques that empower database systems with intelligent and cooperative behavior, with emphasis on three subjects: knowledge-rich databases: logic databases, epistemological queries, intentional answering, and knowledge discovery. User interfaces: cooperative query interfaces, interactive query constructors, graphical interfaces, browsers. Uncertainty: the representation, manipulation and retrieval of uncertain, imprecise or incomplete information, and the formulation and interpretation of vague or incomplete queries.

875 Scientific and Statistical Visualization
(3:3:0). Prerequisites: STAT 654 or CS 651. Visualization methods provide new insights and intuition concerning measurements of natural phenomena and scientific and mathematical models. Presents case study examples from a variety of disciplines to illustrate what can be done. Topics include human perception and cognition, an introduction to the graphics laboratory, elements of graphing data, representation of space-time and vector variables, representation of 3-D and higher dimensional data, dynamic graphical methods, and virtual reality. Students are required to work on a visualization project. Emphasizes software tools on the Silicon Graphics workstation but other workstations and software may be used for the project.

876/CSI 876 Measure and Linear Spaces II
(3:3:0). Prerequisite: INFT 776/CSI 778. Covers advanced topics in measure theory, linear spaces, and functional analysis such as reproducing kernels and adjoint operators, spectral theory for operators, special spaces such as Sobolev spaces, topics in wavelets, applications to stochastic processes, and nonparametric functional inference.

877 Geometric Methods in Statistics
(3:3:0). Prerequisites: STAT 751 or permission of instructor. Modern multivariate statistical methods including visualization of multivariate data rely on geometric insight and methods. Course develops the foundations of geometric meth-
ods for statistics. Topics include n-dimension Euclidean geometry, projective geometry, differential geometry including curves, surfaces, and n-dimensional differentiable manifolds, and computational geometry including computation of convex hulls, tessellations of 2-, 3-, and n-dimensional spaces and finite element grid generation. Examples include applications to scientific visualization.

878 Statistical Analysis of Signals (3:3:0). Prerequisite: STAT 644 and 658 or equivalent. Advanced course in the analysis of discrete- and continuous-time signals using methods of stochastic differential equations and time series. Familiarity with the methods of harmonic analysis and times series modeling is presumed. Topics include state-space modeling and eigen-value processing, nonlinear modeling of signals, non-Gaussian stochastic process structure, detection and estimation of vector-valued signals, robust signal detection, array processing, and target tracking. Relevant computational architectures such as systolic arrays are also discussed.

880 Queuing Modeling of Computer-Communication Networks (3:3:0). Prerequisite: OR 645, ECE 542, or equivalents. Study of analytical modeling of computer and communication networks and performance evaluations. Topics include Markovian systems, open networks, closed networks, approximations, decomposition, simulation, sensitivity analysis, and optimal operation of systems. Local area networks, manufacturing systems, and other applications.

881 Numerical Methods for Mathematical Optimization (3:3:0). Prerequisite: OR 641, 642, and CS 583 or 644. Study of computational issues related to the solution of linear, integer, and nonlinear programming problems. Topics include the use of list processing, AI, parallel processing, efficient inversion techniques, and numerical analysis procedures. Complexity analysis and the structure of algorithms. Recent results relating to the worst case and average case performance of algorithms. Survey of the leading software. Students use, alter, and develop software throughout the course.

882 Advanced Topics in Combinatorial Optimization (3:3:0). Prerequisite: OR 641 and 642. Study of recent advances in the solution of large integer programming problems using the polyhedral structure of the problem. Topics include the facial structure of a variety of real-world problems, methodology for developing cutting planes based on this polyhedral structure, reformulation procedures, group theoretic results, solving equations in integers, and the use of subadditive duality. Topics stress the most recent developments in the field.

883 Advanced Topics in Nonlinear Programming (3:3:0). Prerequisite: OR 644. Study of algorithms for solving nonlinear constrained and unconstrained problems. Study of current literature on methods for globally solving nonconvex problem and factorable programming techniques. Other possible topics are quasi-convexity, recent duality results, complementary pivot theory, quadratic and stochastic programming, max-min problems and some problems in optimal control.

910 Advanced Topics in Artificial Intelligence (3:3:0). Prerequisite: CS 680, 681, or 682. Special topics in artificial intelligence not occurring in the regular computer science sequence. Seminar format requires substantial student participation. Subject matter may include continuation of existing 600- or 700-level courses in artificial intelligence and/or other topics such as machine learning, intelligent tutoring systems, and mechanical theorem-proving. Course may be repeated for credit when subject matter differs.

915 Advanced Topics in Parallel Computation (3:3:0). Prerequisite: INFT 815. Seminar discusses current research topics in parallel computation. Topics vary according to student and faculty interest. Possible topics include formal models of concurrency, specification and design of parallel programming languages, logic programming in a parallel environment, and parallel distributed processing (neural networks).

921 Advanced Software Engineering Seminar (3:3:0). Prerequisite: INFT 821 or 851. Advanced software engineering topics currently in research laboratories, or which have received only empirical treatment. Topics may include special application areas (as opposed to nontraditional applications), such as artificial intelligence, as well as important industry-related software issues that have far-reaching consequences, like software configuration management.


925 Advanced Topics in C3 System Engineering (3:3:0). Prerequisite: SYST 680/ECE 670. Special topics in C3I, content varies in different terms. Representative areas include quantitative evaluation of C3 systems, applications of artificial intelligence in C3 systems, and military communications systems.

930 Multichannel Statistical Signal Processing (3:3:0). Prerequisite: INFT 830. Study of topics in multichannel estimation and detection theory, with emphasis on the multivariate gaussian noise model. Multivariate distribution theory, including the Wishart, matric-, and multivariate-beta distributions, considering radar and sonar signal processing applications. The general linear model and its application in adaptive and signal processing. Other topics include spectral analysis via principal components, tests for the dependence of several stochastic inputs, and analysis of covariance structures.

931 Secure Telecommunication Systems (3:3:0). Prerequisite: ECE 632 and 633. Introduction to secure data and voice communications. Topics include theoretic basis of cryptography, random cipher systems, practical security schemes, linear and nonlinear shift registers and encryption algorithms, block cipher and NBS data encryption standard (DES), public key cryptography, RSA, knapsack algorithms, digital signatures and authentication, security of computer networks, cryptographic protocols, key management, speech security, and voice scrambling.

932 Spread Spectrum Communications (3:3:0). Prerequisite: ECE 631. Fundamentals of spread spectrum communications. Major topics include pseudonoise spread spectrum systems, acquisition, synchronization, time-hopping, frequency hopping, and multiple-access communication.

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933 Modeling and Analysis of Integrated Services Digital Networks (3:3:0). Prerequisite: ECE 631 and 642. Study of integrated services digital networks. Topics include queueing, modeling, and analysis of digital circuit-switching systems; integrated data and voice multiple access schemes; ISDN layered architectures; ISDN protocols; transmission technologies and system implementations.

934 Advanced Topics in Detection and Estimation Theory (3:3:0). Prerequisite: INFT 830. Advanced topics in detection and estimation theory of current research interest. Areas may include adaptive array processing, direction finding techniques using eigenspace techniques (e.g., MUSIC, ESPRIT), spectral estimation, and underwater acoustics applications.

935 Knowledge-Based Systems for Text Translation (3:3:0). Prerequisite: INFT 835 or equivalent. Current topics for text processing, analysis, and translation. Topics include automatic text reading and reconstruction systems; computational linguistics; syntax analysis; semantic analysis and interpretation; discourse analysis and information structuring; text generation; text abstractions; strategies in machine translation and R & D; sublanguages for automatic translation, knowledge-based machine translation; basic theory and methodologies in EUROTRA and GMTP projects; machine translation as an expert task; human-machine interaction in translation; reflections on knowledge needed to process formed languages.

936 Advanced Computer Architecture Seminar (3:3:0). Prerequisite: ECE 641 or equivalent. Current topics of advanced research in computer architecture. Topics include data flow architecture; high-level language (HLL) architectures; multiprocessors: structure, algorithms, operating systems, RISC vs. CISC Architecture, distributed systems. Discussion of commercial advanced architecture systems.

940 Advanced Topics in Control and Robotics (3:3:0). Prerequisite: ECE 620, 621, 624, and 650. Advanced and newly developed topics in control and robotics. Content varies depending on current faculty interests and student demand. Topics such as knowledge-based control, intelligent control, hierarchical and distributed control, robust control, and reasoning under uncertainty.

941 System Identification and Adaptive Control (3:3:0). Prerequisite: ECE 624. Advanced treatment of identification and adaptive control. Topics include identification algorithms, their convergence and accuracy, computational aspects. Model reference and self-tuning adaptive control, transients, stability and robustness. Intelligent schemes to improve robustness. Students are also required to study the literature individually and to complete a computer project.

943 Models of Approximate Reasoning (3:3:0). Prerequisite: INFT 842. Survey of mathematical tools and algorithms for the modeling and utilization of uncertain knowledge in approximate reasoning. Topics include Bayesian theory, fuzzy logic, the Dempster-Shafer theory, evidential reasoning, probabilistic logic, multiattribute utility theory, confirmation theory, theory of endorsement, nonmonotonic reasoning, default reasoning, measures of information, knowledge fusion, propagation of beliefs in networks, and applications to knowledge support systems.

944 The Process of Discovery and Its Enhancement in Engineering Applications (3:3:0). Prerequisite: INFT 842 or permission of instructor. A study of ingredients of imaginative reasoning as it concerns the efficient discovery of new ideas and valid evidential test of them. Topics include different interpretations of Peirce's theory of abductive reasoning, other forms of reasoning, Hintikka's analysis of the process of inquiry, and current attempts to design systems that provide assistance in discovery-related or investigative activities.

945 Advanced Topics in Microelectronics (3:3:0). Prerequisite: INFT 845. Current topics of advanced research in microelectronics. Topics include Very High Speed Integrated Circuits (VHSICs), Monolithic Microwave Integrated Circuits (MMICs), Optoelectronic Integrated Circuits (OICs), novel device structures and advances in semiconductor device technology. May be repeated with a change in topic.

950 Design and Management Aspects of Information Systems (3:3:0). Prerequisite: INFS 790 or equivalent. Impact of organizations and management of information systems (IS) and vice versa. Problems of introducing IS; effect on organizational economic and political framework. Participative design and new techniques for specification, analysis, design, and implementation of IS. Rapid prototyping and expert systems; possible conflicts. Methods in life cycle management; economic analysis.

951 Software Productivity (3:3:0). Prerequisite: INFT 821 or 851. Analysis of technologies and methodologies of the systems approach to software engineering theory and application, decision support and knowledge-based systems for enhancing software productivity. Macro-enhancement approaches to increasing the effectiveness and efficiency of software development with particular emphasis on requirements specifications.

952 Knowledge-Based Systems Applications (3:3:0). Prerequisite: CS 580 or INFS 650. Analysis of frameworks of applications of knowledge-based systems within information technology. Study of impact of KSS on systems such as computer integrated manufacturing, planning support systems, and distributed information systems. Comparison of procedural and non-procedural computer languages in support of decision processes in large-scale systems.

958 Basic and Applied Decision Support Systems Technology (3:3:0). Prerequisite: SYST 642. Analysis of tools, techniques, and methods that contribute to the design, development, application, and evaluation of interactive computer-based decision support systems. Analysis of the state-of-the-art and state-of-the-expectation of basic and applied decision support systems technologies like requirements definition, software engineering, analytical methods assessment, and structured evaluation.

960 Expert Database Systems (3:3:0). Prerequisite: CS 580 and INFS 614. Study of the concepts, tools, techniques, and architectures of expert database systems, which support the specification, design, prototyping, production and maintenance of applications requiring knowledge-directed processing of shared information stored in large databases.

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961 Topics in Distributed Database Management (3:3:0). Prerequisite: INFT 861 or permission of instructor. Current topics of advanced research in distributed database management. Topics include transaction management, concurrency control, deadlocks, replicated data management, query processing, and reliability.

962 Advanced Topics in Computer Security (3:3:0). Prerequisites: INFT 862 or 865, or permission of instructor. Current topics of advanced research in computer security. Content varies depending on faculty interests, research developments, and student demand. Seminar format requires substantial student participation. Representative topics include formal models for computer security, multilevel data models, multilevel database management system architectures, secure concurrency control protocols, distributed secure system architectures, integrity models and mechanisms, security policy, and requirements analysis.

972/CSI 972 Mathematical Statistics I (3:3:0). Prerequisite: STAT 652 or equivalent. Focuses on the theory of estimation. The principles of estimation are explored including the method of moments, least squares, maximum likelihood, and maximum entropy methods. The methods of minimum variance unbiased estimation are covered in detail. Topics include sufficiency and completeness of statistics, Fisher information, Cramer-Rao bounds, Bhattacharyya bounds, asymptotic consistency and distributions, statistical decision theory, minimax and Bayesian decision rules, and applications to engineering and scientific problems.

973/CSI 973 Mathematical Statistics II (3:3:0). Prerequisite: INFT 972. Continuation of INFT 972. Concentrates on the theory of hypothesis testing. Topics include characterizing the decision process, simple versus simple hypothesis tests, Neyman-Pearson Lemma, uniformly most powerful tests, unbiasedness of tests, invariance of tests, randomized tests, and sequential tests. Applications of the testing principles will be made to situations in the normal distribution family and to other families of distributions.

976 Statistical Inference for Stochastic Processes (3:3:0). Prerequisite: STAT 646. Course covers the modern theory of parameter estimation and hypothesis testing for stochastic processes, counting processes with random intensities and solutions to stochastic differential equations driven by martingales. Applications to engineering, biology, and economics are considered.

979 Topics in Statistical Aspects of Information Technology (3:3:0). Prerequisite: STAT 652 or equivalent. Study of statistical science—the body of methods and techniques which convert raw data into information. Contents vary. Such topics as high interaction statistical graphics, stochastic methods for parallel computing, cryptography and covert communications, order-restricted inference, treatments of imprecision, and the foundations of inference are covered. Course may be repeated when topics are distinctly different.

984 Advanced Topics in Network Optimization (3:3:0). Prerequisite: OR 643. Covers recent developments in solving optimization problems on networks. It prepares doctoral students to perform advanced research on network-related problems. Topics include linear, discrete, non-linear, and stochastic problems. Several aspects of these problems are also studied. These include but are not limited to computational complexity, exact algorithms, heuristics, solvable special cases, and computer implementation issues.

990 Dissertation Topic Presentation (1:0:0). Provides the opportunity for Ph.D. students to present their research proposal for critique to interested faculty and students. Covers the presentation of the research topic for the Ph.D. in information technology, and is required of all Ph.D. students. At the end of the course, the student will have completed the dissertation research proposal. Course may be repeated with a change in topic. Degree credit is given once.

998 Doctoral Dissertation Proposal (1-12:0:0). Work on a research proposal that forms the basis for a doctoral dissertation. May be repeated. No more than 24 credit hours of INFT 998 and 999 may be applied to doctoral degree requirements.

999 Doctoral Dissertation (1-12). Prerequisite: Admission to candidacy. Formal record of commitment to doctoral dissertation research under the direction of a faculty member in information technology. May be repeated as needed.

Operations Research and Engineering

Faculty

Adelman, Leonard, Ph.D., University of Colorado, 1976; Professor
Friesz, Terry, Ph.D., The Johns Hopkins University, 1977; Professor
Greenberg, Irwin, Eng.Sc.D., New York University, 1964; Professor
Harris, Carl M., Ph.D., Polytechnic Institute of Brooklyn, 1966; Professor
Hoffman, Karla L., Sc.D., The George Washington University, 1975; Professor
Miller, Douglas R., Ph.D., Cornell University, 1971; Professor
Nash, Stephen, Ph.D., Stanford University, 1982; Associate Professor
Polyak, Roman, Ph.D., USSR Academy of Sciences, 1966; Research Professor
Schum, David A., Ph.D., Ohio State University, 1964; Professor
Soffer, Ariela, Sc.D., The George Washington University, 1984; Associate Professor

http://catalog.gmu.edu
Operations Research and Management Science, M.S.

The graduate program leading to a Master of Science in Operations Research and Management Science prepares students for research and professional practice associated with the formulation and analysis of mathematical models for decision making, and their computer implementation. Major components of the program include mathematical programming, queuing and network theories, computer simulation and modeling, applied and computational probability, and the application of these to realistic and relevant operational analysis problems. Students are expected to become proficient in these areas as well as in supporting areas of information technology necessary to implement OR/MS methods.

To achieve this objective, the program includes core courses and electives selected by the student with the aid of a faculty adviser. To obtain the master of science degree, students complete an approved plan of study that contains a minimum of 33 semester hours of graduate-level course work.

Students may take courses through the Cooperative Graduate Engineering Program, in affiliation with the University of Virginia and Virginia Tech. Appropriate courses may be transferred, with adviser approval, into this GMU degree program. Refer to section on Programs and Additional Graduate Courses in this catalog.

Admission Requirements

To be admitted to the program, a candidate must:

1. Fulfill all admission requirements for graduate study;
2. Hold a baccalaureate degree and have taken the following courses or their equivalents: MATH 113, 114, 213 Calculus, including calculus of several variables; STAT 344 Applied Probability for Engineers and Scientists; MATH 203 Matrix Algebra or 322 Linear Algebra;
3. Have a knowledge of at least one scientific computer programming language;
4. Have three letters of recommendation submitted by former professors or supervisors.

A student with deficiencies in preparation may be accepted conditionally pending removal of the deficiencies. Courses taken to remove admission deficiencies extend the minimum requirements for the degree. Students whose undergraduate training was in the quantitative social sciences or quantitatively oriented business administration may be allowed to complete the mathematics prerequisite requirement by taking INFT 500.

Degree Requirements

The program consists of 33 credits, divided as shown below. The core curriculum includes the following five courses (15 credits):

- OR 541 Operations Research: Deterministic Models
- OR 542 Operations Research: Stochastic Models
- OR 680 Applications Seminar
- STAT 644 Applied Probability
- STAT 654 Applied Statistics

(Higher numbered STAT courses may be substituted.)

Also, at least three 600-level or higher methodology courses must be taken, including at least one course in each of deterministic and stochastic OR.

Up to three additional elective courses may be chosen with the concurrence of the student's adviser. These courses should be taken in an area appropriate to the student's interests, such as statistics, business administration, computer science, information systems, systems engineering, electrical and computer engineering, economics, mathematics, and public administration.

With the permission of their advisers, qualified students may elect to write a thesis in place of 3 credits of course work from the methodological or applications area.

Students whose primary interest is in optimization may complete a special concentration by choosing three courses from OR 641, 642, 643, 644, 682, 741, 745, and 777. The remaining three courses are chosen with the written concurrence of the adviser and should be tailored to the student's interest and must include at least one stochastic OR course. These may be chosen from the department's offerings, from appropriate offerings in other departments within the School of Information Technology and Engineering, and from appropriate courses in other university departments. A sample of possible courses outside this department is available from the department.

Students concentrating in stochastic models must complete OR 635, one 600-level STAT course, and two courses from OR 647, 648, 671, 677, and 681. The remaining two courses are chosen with the concurrence of the student's adviser and must include at least one in deterministic OR.

A third option is available to students interested in operations engineering. For this, the three required OR methodology courses must be chosen.
from OR 635, 641, 643, 647, 648, 677, and 681. Two of the three additional electives must be selected with advisor's approval from the offerings of the other departments in the School of Information Technology and Engineering.

Particularly important to students planning a Ph.D. program in information technology are the core courses that satisfy the breadth requirement for the Ph.D. in Information Technology.

Operations Research Courses (OR)
540 Management Science (3:3:0). Prerequisite: MATH 108 and STAT 250 or DESC 200, or equivalent. Operations research techniques and their application to managerial decision making. Mathematical programming, Markov processes, queuing theory, inventory models, PERT and CPM, and simulation. Use of contemporary computer software for problem solving. OR/MS majors will not receive credit.


635 Discrete System Simulation (3:3:0). Prerequisite: STAT 344 and OR 542, or equivalents, and knowledge of both elementary statistical inference and a scientific programming language. Computer simulation as a scientific methodology in operations analysis, with emphasis on model development, implementation, and analysis of results. Discrete-event models, specialized languages, experimental design and output statistics. Extensive computational work.

641 Linear Programming (3:3:0). Prerequisite: OR 541 or permission of instructor. First, an in-depth look at the simplex method. Next, computational enhancements: the revised simplex method; sparse-matrix techniques; bounded variables and generalized upper bounds; and large-scale decomposition methods. Computational complexity of the simplex algorithm. The Khachian and Karmarkar algorithms.

642 Integer Programming (3:3:0). Prerequisite: OR 541 or permission of instructor. Cutting plane and enumeration algorithms for solution of integer linear programs; bounding strategies and reformulation techniques; knapsack problem, matching problem, set covering and partitioning problems; applications to problems in OR/MS, such as capital budgeting, facility location, political redistricting, engineering design, and scheduling.

643 Network Modeling (3:3:0). Prerequisite: OR 541 and 542 or permission of instructor. Introduction to network problems in operations research, computer science, electrical engineering, and systems engineering. Solution techniques for various classes of such problems are developed. Topics include minimal-cost network flow, maximal flow, shortest path, and generalized networks; plus stochastic networks, network reliability, and combinatorially based network problems. The complexity of each problem class is also analyzed.

644 Nonlinear Programming (3:3:0). Prerequisite: MATH 213 or equivalent and knowledge of a scientific programming language. Optimization theory and techniques applicable to problems in engineering, economics, operations research, and management science. Convex sets and functions, optimality criteria and duality. Algorithms for unconstrained minimization, including descent methods, conjugate directions, Newton-type and quasi-Newton methods. Algorithms for constrained optimization, including active set methods and penalty and barrier methods.

645/STAT 645 Stochastic Processes (3:3:0). Prerequisite: OR 542, STAT 644, or permission of instructor. Selected applied probability models including Poisson processes, discrete- and continuous-time Markov chains, renewal and regenerative processes, semi-Markov processes, queuing and inventory systems, reliability theory, stochastic networks. Emphasis on applications in practice as well as analytical models.

647 Queuing Theory (3:3:0). Prerequisite: OR 542, STAT 644, or permission of instructor. A unified approach to queuing organized by type of model. Single and multiple channel exponential queues; Erlangian models, bulk and priority queues, networks of queues; general arrival and/or service times; statistical inference and simulation of queues.

648 Production and Inventory Systems (3:3:0). Prerequisite: OR 541 and OR 542 or permission of instructor. Analysis of production and inventory systems. Introduction to the use of mathematical modeling for solutions of production planning and inventory control problems. Stochastic inventory systems of lot sized-reorder type; periodic review and single period models. Application of dynamic programming theory to deterministic and stochastic cases. Static and dynamic production-planning models.

649 Topics in Operations Research (3:3:0). Prerequisite: Permission of instructor. Advanced topic chosen according to interests of students and instructor from dynamic programming, inventory theory, queuing theory, Markov and semi-Markov decision processes, reliability theory, decision theory, network flows, large-scale linear programming, nonlinear programming, combinatorics.

671/SYST 671 Judgment and Choice Processing and Decision Making (3:3:0). Prerequisite: STAT 610 or equivalent. Intuitive nature of human judgment and decision making, and some methods currently being used for improving individual and group decisions. The nature of judgment emphasizing limitations on human information processing abilities. The use of decision-analytic techniques to improve decision making.
676 Dynamic Programming (3:3:0). Prerequisite: OR 541 and 542. Introduction to the theory and computational aspects of dynamic programming. The course studies sequential decision processes, optimal resource allocations, continuous-time dynamic programming, network models, Markov decision processes, and production models. Special attention is directed toward applications.

677/STAT 677 Quality Assurance (3:3:0). Prerequisite: STAT 610, 654, or equivalent. See STAT 677.

680/DESC 743 Applications Seminar (3:3:0). Prerequisite: OR 541 and 542 or DESC 742. Model development and implementation involved in the practice of operations research and management science.

681/DESC 744 Contemporary Issues in Decision Analysis (3:3:0). Prerequisite: OR 542 or DESC 611. Application of analytic reasoning and skills to practical problems in decision making. Topics include problem structure, analysis and solution implementation, emphasizing contemporary approaches to decision analytic techniques.

682/STAT 682 Computational Methods in Engineering and Statistics (3:3:0). Prerequisite: MATH 213 and 303 or equivalent. Numerical methods have been developed to solve mathematical problems that lack explicit closed-form solutions or have solutions that are not amenable to computer calculations. Examples include solving differential equations or computing probabilities. This course discusses numerical methods for such problems as regression, analysis of variance, nonlinear equations, differential and difference equations, and nonlinear optimization. Applications in statistics and engineering are emphasized.

741 Advanced Linear Programming (3:3:0). Prerequisite: OR 541 and 641. Recent developments in linear programming. Highlighting advances in interior point methods and also addressing developments in the simplex method. Projective methods, including Karmarkar's original work, affine methods, and path-following methods. The relationships among these methods will be discussed, as well as their relationships to methods in nonlinear programming. Also discussed will be advances in data structures and other implementation issues. Students will have the opportunity to test software and solve large-scale linear programs.

757/STAT 757 Software Reliability (3:3:0). Prerequisite OR 542 or equivalent; OR 645 or STAT 644; and STAT 354. Statistical approach to software reliability engineering: probability models and statistical methods for understanding measuring, predicting, and controlling the reliability of software. Topics include reliability estimation, controlled experiments and case studies, reliability growth models, evaluation and limitations of reliability estimation techniques, and models for fault-tolerant software.

777/SYST 777 The Modeling of Nonlinear Dynamic Systems (3:3:0). Prerequisite: OR 441 or 541; ECE 521; OR/STAT 682; or equivalent. Introduction to the use of nonlinear ordinary differential, difference and integral equations in modeling dynamic phenomena in engineering, the natural sciences, and the social sciences. Emphasis on the art of constructing and solving very large-scale, complex dynamic models. Example drawn from operations research, environmental engineering, mathematical biology, economics, transportation, and other fields.

Statistics

Faculty

Bolstein, A. Richard, Ph.D., Purdue University, 1967; Associate Professor
Carr, Daniel B., Ph.D., University of Wisconsin, 1976; Professor
Gantz, Donald T., Ph.D., University of Rochester, 1974; Professor
Gentle, James E., Ph.D., Texas A&M University, 1974; University Professor
Habib, Muhammad K., Ph.D., University of North Carolina, Chapel Hill, 1979; Associate Professor
Miller, John J., Ph.D., Stanford University, 1974; Associate Professor
Sutton, Clifton, Ph.D., Stanford University, 1987; Associate Professor
Wegman, Edward J., Ph.D., University of Iowa, 1968; Dunn Professor

Certificate in Federal Statistics

The graduate certificate in Federal Statistics is a professional program targeted at upgrading the skills of practitioners. The federal statistical system is a complex data collection and analysis system that requires a wide variety of multidisciplinary skills for its maintenance. The Federal Statistics certificate is intended to respond to the need for broad training in statistics, survey research, data analysis including graphics and data visualization, data bases and data security, parallel computation and related technology, geographic information systems, economics, social sciences, and issues of statistics and public policy. The certificate program is extremely flexible and can be tailored to the needs of students within the federal statistical sector, but is also intended to be responsive to the needs of those in state and local governments and those in the private sector who support the statistical system.

Admission Requirements

Potential candidates should have a bachelor's degree, but need not have formal undergraduate degrees in statistics or mathematics and, indeed, may have backgrounds in diverse fields such as sociology, economics, engineering, and business.
Candidates from all backgrounds are welcome and should inquire with the certificate coordinator for details of program planning. Courses are offered in late afternoon and evening and are particularly suitable for part-time students.

Certificate Requirements
The certificate consists of 15 credit hours, five courses, which are selected from the certificate program courses and elective courses. The certificate courses are aimed at building the foundations of statistics and survey research and consist of the following:

- STAT 654 Applied Statistics
- STAT 663 Exploratory Data Analysis
- STAT 670 Survey Sampling
- STAT 672 Statistical Inference for Survey Sampling
- STAT 673 Statistical Methods for Longitudinal Data Analysis
- STAT 679 Topics in Survey Design and Analysis

Prior statistics experience is not mandated and all of the above courses may be taken with only one solid undergraduate course in statistics or probability. All of these courses may be used as credit towards the M.S. in Statistical Science with a specialization in the federal statistics.

For the certificate program, the student may choose any four of the certificate courses plus an elective course chosen with the consent of the certificate coordinator. The elective course is drawn from a wide variety of courses and is intended to provide a broad background supportive of the multidisciplinary needs of complex statistical systems. The electives may include an additional certificate course or, with the consent of the certificate coordinator, courses from statistics, operations research, and public administration. Some courses may have prerequisites for which the student must qualify or seek a waiver from the appropriate instructor.

Students may obtain more information by contacting the Federal Statistics Certificate coordinator in Room 157, Science and Technology II, (703) 993-1680 or 993-1698.

Statistical Science, M.S.
Statistical science is regarded as one of the oldest and most successful information technology subjects, focusing on the conversion of raw data into information. In this graduate program, students are trained in the theory and practice of statistical methodology, particularly as they impinge upon high technology applications.

The M.S. program can be thought of in matrix form, one dimension offering a choice of research or professional options and the other dimension offering a choice of subject emphases including federal statistics, computational statistics, statistical signal processing, applied statistics, and engineering statistics. The research option is intended for students planning to continue for the Ph.D. degree or to begin or continue careers in statistical methodology research. The professional option provides M.S. degree qualifications to those seeking an expanded knowledge base in modern statistical theory and practice, but not wishing to pursue a research career. Such students might plan to go on to professional schools, teach statistics at a secondary level, or pursue other careers in which advanced work in statistical methodology is necessary or advantageous but in which independent research is not involved.

Admission Requirements
In addition to satisfying the general admission requirements for graduate study, all applicants to this program must:

1. Hold a bachelor's degree from an accredited institution with an appropriate undergraduate major. Examples include, but are not limited to, mathematics, computer science, statistics, and electrical engineering. Applicants must have advanced preparation in mathematics, including calculus or real analysis, basic statistics and probability, and matrix theory or linear algebra.

2. Demonstrate basic computer literacy including knowledge of at least one basic operating system and knowledge of at least one scientific programming language.

Presently the GRE is not required. It is recommended particularly for those students wishing to compete for graduate teaching assistantships, graduate fellowships, or graduate research assistantships.

Degree Requirements
Students in both the research and professional options must complete the 12-credit-hour core requirements for the degree:

- STAT 644 Applied Probability
- STAT 652 Statistical Inference
- STAT 654 Applied Statistics
- STAT 656 Regression Analysis
The core course work covers the basic elements of statistics at the graduate level. Applied Probability (STAT 644) covers the major mathematical framework for statistical theory and practice. Statistical Inference (STAT 652) provides basic statistical theory. After completing this course, students have the theoretical basis from which statistical methods are derived.

Applied Statistics (STAT 654) is a survey of statistical methods that have become the backbone of statistical practice. Focus in this course is on techniques that quantify random behavior. The final core course is Regression Analysis (STAT 656), which focuses on determining the relationship among two or more random quantities, particularly with emphasis on broad scientific and technological applications. From these basic elements, the perspective M.S. student may choose one of five predefined tracks or may, with the concurrence of his or her adviser, design a customized curriculum. The predefined tracks are (a) Federal Statistics, (b) Computational Statistics, (c) Statistical Signal Processing, (d) Applied Statistics, and (e) Engineering Statistics.

Research Option
The research option requires 33 credit hours, of which 6 credit hours must be in independent research (thesis). Research is done under the guidance of a faculty member. Research may be carried out at the university or, if appropriate, at nearby facilities. For example, students may pursue research at their place of employment on topics of interest to the employer, provided the research meets the standards of the university. The remaining 27 credit hours must include the 12 core credit hours and elective courses taken from the approved list or added with the consent of the thesis adviser.

In addition to satisfying the general degree requirements for graduate study, candidates for the research option must:

1. Submit a thesis or report based on the research to the student's thesis committee, which must give preliminary approval. The composition and appointment of this committee follows graduate program policies.

2. Pass a final oral examination that concentrates on, but is not limited to, the area upon which the thesis or report is written. The examination is administered by the student's thesis committee, and all interested members of the graduate faculty are invited to attend and participate in the questioning. The thesis committee makes the final decision as to whether the candidate passes or fails.

Professional Option
The professional option focuses on the completion of course work in modern statistical theory and practice. The basic course work requirements include 33 credit hours. Twelve hours must be the core courses taken by all M.S. students, with 18 additional credit hours taken from the approved list or with the approval of the student's adviser. Students in this program are encouraged to pursue a broad background in statistical science and may elect to concentrate on applications of statistical methodology to other disciplinary areas. In addition to satisfying the general degree requirements for graduate study, students in the professional option may:

1. Write a master's essay that is not an original research report but a scholarly essay on a topic of current interest in the statistical science discipline. The essay is usually about 20 to 25 pages long and demonstrates the student's ability to read and synthesize the current technical literature into a scholarly essay. The essay is evaluated by the student's adviser, taking into account the comprehensiveness of the coverage of the scientific literature, the accuracy of presentation and interpretation, and the literary style. Students are notified of their evaluations and may be required to revise their essays to develop their skills in preparing reports on technical subjects. The essay is normally written in the context of STAT 798, the Master's Essay.

2. Pass a final oral examination that covers both the areas of course work undertaken by the student and the subject matter of the student's essay. The examination is administered by the department's Graduate Committee during the student's final semester after the essay has been approved. All interested members of the graduate faculty are invited to participate.

The final decision as to whether the candidate passes or fails is made by the Graduate Committee.

Students who complete the essay will take 30 credits of in-class work and three credits of STAT 798, Master's Essay. Students opting not to write an essay must take 33 credits of in-class work.

Ph.D. Study in Statistics
Graduate study for the Ph.D. in statistics is available through two of the university's Ph.D. programs. The Ph.D. in Information Technology has a specialization in statistical science with an engineering emphasis. The Ph.D. in Computational Sciences and Informatics has a specialization in computational statistics with a basic science emphasis. Both degrees are interdisciplinary and
allow the student a broad range of course and research options. These programs are described elsewhere in this catalog. Advanced courses in statistics at the Ph.D. level are also listed under the respective Ph.D. program descriptions.

Statistics Courses (STAT)

610 Statistical Foundations for Tech. Decision Making (3:3:0). Prerequisite: MATH 108 or equivalent or permission of instructor. The use of statistical methods as scientific tools in the analysis of practical problems. Topics include descriptive statistics, probability theory; distributions; sampling, inference: estimation and hypothesis testing; elementary decision theory; time series analysis; linear regression and correlation; the analysis of variance. Credits not applicable toward M.S. in Operations Research or in Statistical Science.

612/CS 612 The Use of Computer Statistical Packages (3:3:0). Prerequisite: CS 103 or equivalent and a course in statistics or permission of instructor. Introduction to use of computer packages in the statistical analysis of data. Emphasizes techniques common to use of all statistical packages, including data checking, cleaning, manipulation, and transformation. Both simple and complex statistical analyses are covered. Techniques are illustrated by concentrating on one of the major statistical packages such as SAS or SPSS. Other packages are discussed and compared. Students are expected to perform computer statistical analyses of data relevant to their respective fields of study.

Credits are not applicable toward the credit requirements for the M.S. in Mathematics, Computer Science, M.S. in Operations Research or Statistical Science, but may be applicable toward a degree in some other fields.

644 Applied Probability (3:3:0). Prerequisite: STAT 344 or MATH 351 or equivalent or permission of instructor. A course in probability with applications in computer science, engineering, operations research, and systems engineering. Random variables and expectation, conditional expectation, random vectors, special distributions, parameter estimation, limit theorems, stochastic processes. Applications in engineering, operations research, and computer systems.

652 Statistical Inference (3:3:0). Prerequisite: STAT 644 or ECE 528 or equivalent. Critical aspects of probability, random variables and distributions, characteristic functions, and stochastic convergence. Optimal estimation, maximum-likelihood estimation, asymptotic theory, Bayesian methods, likelihood-ratio tests, statistical decision theory, sequential methods.

654 Applied Statistics (3:3:0). Prerequisite: STAT 344 or MATH 351 or equivalent or permission of instructor. Application of basic statistical techniques. Focus is on the problem (data analysis) rather than on the theory. Topics include one and two sample tests and confidence intervals for means and medians, descriptive statistics, goodness-of-fit tests, one- and two-way ANOVA, simultaneous inference, testing variances, regression analysis, and categorical data analysis. Normal theory is introduced first with discussion of what happens when assumptions break down. Alternative robust and nonparametric techniques are presented.

655 Analysis of Variance (3:3:0). Prerequisite: STAT 654 or permission of instructor. Single and multifactor analysis of variance, planning sample sizes, introduction to the design of experiments, random block and Latin square designs, analysis of covariance.

656 Regression Analysis (3:3:0). Prerequisite: STAT 652 or STAT 654 or equivalent. Simple and multiple linear regression, polynomial regression, general linear models, subset selection, step-wise regression, model selection. Multicollinearity, diagnostics. Model building. Both the theory and practice of regression analysis are covered in this course.

657 Nonparametric Statistics (3:3:0). Prerequisite: STAT 652 or STAT 654 or equivalent. Nonparametric procedures for two or more samples (independent as well as correlated), tests of significance and estimation methods, independence problems with nominal and rank data, comparison of parametric versus nonparametric methods. Emphasis is on application of nonparametric techniques to data.

658 Time Series Analysis and Forecasting (3:3:0). Prerequisite: STAT 652 or STAT 654 or equivalent. Modeling stationary and nonstationary processes, autoregressive, moving average and mixed model processes, hidden periodicity models, properties of models, autocorrelation functions, functions, partial autocorrelation functions, spectral density functions, identification of models, estimation of model parameters, and forecasting techniques.

659 Advanced Topics in Statistics (3:3:0). Prerequisite: Permission of instructor. Topics in statistics not covered in the regular statistics sequence. May be repeated for credit.

662 Multivariate Statistical Methods (3:3:0). Prerequisite: STAT 652 or STAT 654, or equivalent, and a course in matrix algebra or permission of instructor. Covers the standard techniques of applied multivariate analysis. Topics include review of matrices, T-square tests, principle components, multiple regression and general linear models, analysis of variance and covariance, multivariate ANOVA, canonical correlation, discriminant analysis, classification, factor analysis, clustering, multidimensional scaling. Computer implementation via a statistical package is an integral part of the course.

663/CSI 773 Exploratory Data Analysis (3:3:0). Prerequisite: A 300-level course in statistics. Exploratory data analysis provides a reliable alternative to classical statistical techniques which are designed to be the best possible when stringent assumptions apply. Topics covered include graphical techniques such as scatter plots, box plots, parallel coordinate plots and other graphical devices, re-expression and transformation of data, order statistics, influence and leverage, dimensionality reduction methods such as projection pursuit.

664/SYST 664 Bayesian Analysis and Decision Theory (3:3:0). Prerequisite: STAT 644 or STAT 654 or equivalent or permission of instructor. Covers the fundamentals of Bayesian decision theory and its application in statistical inference and decision analysis. Topics include prior distributions and Bayes theorem, proper scoring rules, conjugate priors, approximate posterior distributions, multi-attribute utility theory, influence diagrams and Bayesian networks, measuring utilities, and probability distributions.

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665 Categorical Data Analysis (3:3:0). Prerequisite: STAT 654 or equivalent or permission of instructor; STAT 655 is recommended. Analysis of cross-classified categorical (qualitative) data in three or more dimensions. A familiarity with the basic test for two-way contingency tables and elementary analysis of variance as presented in STAT 654 is presumed. Topics include the general log-linear model, hierarchical models, logic models and causal analysis, linear logistic response models, methods of model selection, analysis of incomplete tables, and application to the capture-recapture problem. A computer statistical package such as SAS or SPSS will be used extensively for data analysis.

670 Survey Sampling (3:3:0). Prerequisite: A 300-level course in statistics or permission of instructor. Review of probability and statistics, basic definitions of sampling, simple random sampling, stratified sampling, systematic sampling, cluster sampling, estimation problems. Emphasizes practical problems encountered in conducting a survey as well as the theoretical background. Class project involving the design of an actual survey and analysis using a statistical package.

672 Statistical Inference in Survey Sampling (3:3:0). Prerequisite: STAT 654 or equivalent and STAT 670. A unified theory of probability sample designs and inference in finite populations, this course presents a new look at the main results of STAT 670 and beyond. Design-based inference, the Horvitz-Thompson estimator, ratio and regression estimators, superpopulation model-based inference, optimal design-unbiased sampling strategies, optimal model-unbiased strategies using the prediction approach, Bayesian methods.

673 Statistical Methods for Longitudinal Data Analysis (3:3:0). Prerequisite: STAT 670. Principles of the design and analysis of longitudinal studies. Retrospective and prospective studies, repeated periodic and continuous surveys, rotating panel surveys, managing a longitudinal database, estimation of the level and change of population means, proportions and totals over time. Techniques include the classical minimum variance unbiased estimators, time series analysis, and model-based multivariate analysis. Case studies such as the Current Population Survey and the National Crime Survey.

677/OR 677 Quality Assurance (3:3:0). Prerequisite: STAT 610 or STAT 654 or equivalent or permission of instructor. Introduction to the concepts of quality control and reliability. Acceptance sampling, control charts, and economic design of quality control systems are discussed, as are system reliability, fault-tree analysis, life testing, repairable systems, and the role of reliability, quality control, and maintainability in lifecycle costing. The role of MIL and ANSI standards in reliability and quality programs is also considered.

679 Topics in Survey Design and Analysis (3:3:0). Prerequisite: STAT 670 or permission of instructor. Topics are presented in a seminar format according to the interests of students and instructors. Topics include composite sampling, use of administrative records in analysis of survey data, capture-recapture sampling to estimate population size, telephone survey methods, panel surveys, survey errors and costs, weighting survey data, imputation methods for item nonresponse, small area estimation, technique of interpenetrating samples, variance estimation, model versus design-based inference, inference for percentiles, randomized response for sensitive questions, multivariate analysis of survey data.

682/OR 682 Computational Methods in Engineering and Statistics (3:3:0). Prerequisite: MATH 203 and MATH 213 or equivalent or permission of instructor. Numerical methods have been developed to solve mathematical problems that lack explicit closed-form solutions or have solutions that are not amenable to computer calculations. Examples include solving differential equations or computing probabilities. Discusses numerical methods for such problems as regression, analysis of variance, nonlinear equations, differential and difference equations, and nonlinear optimization. Applications in statistics and engineering are emphasized.

751/CSI 771 Computational Statistics (3:3:0). Prerequisite: STAT 644 and STAT 652. Covers the basic computational intensive statistical methods and related methods that would not be feasible without modern computational resources. Covers nonparametric density estimation including kernel methods, orthogonal series methods and multivariate methods, recursive methods, cross-validation, nonparametric regression, penalized smoothing splines, the jackknife and bootstrapping, computational aspects of exploratory methods including the grand tour, projection pursuit, alternating conditional expectations, and inverse regression methods.

757/OR 757 Software Reliability (3:3:0). Prerequisite: OR 542 or equivalent; OR 645 or STAT 644; and STAT 354. Statistical approach to software reliability engineering: probability models and statistical methods for understanding, measuring, predicting, and controlling the reliability of software. Topics include reliability estimation, controlled experiments and case studies, reliability growth models, evaluation and limitations of reliability estimation techniques, models for fault-tolerant software.

798 Master's Essay (3:0:0). Prerequisite: Nine hours of graduate-level course work and permission of instructor. Project chosen and completed under the guidance of a graduate faculty member, which results in an acceptable technical report.

799 Master's Thesis (1-6:0:0). Prerequisite: Nine hours of graduate-level course work and permission of instructor. Project chosen and completed under the guidance of a graduate faculty member, which results in an acceptable technical report and oral defense.

Systems Engineering

Faculty
Arciszewski, Tomasz, Ph.D., Warsaw Technology University, 1975; Associate Professor
Brown, Rex, Ph.D., Harvard University, 1968; Research Professor
Bude, Dennis M., Ph.D., Stanford University, 1977; Associate Professor; Associate Director, Center of Excellence in Command, Control, Communications, and Intelligence (C3I)
Chang, Kuo-Chu, Ph.D., University of Connecticut, 1986; Associate Professor

deMonsabert, Sharon, Ph.D., Purdue University, 1982; Associate Professor

Fields, N. Ann, Ph.D., George Mason University, 1991; Research Assistant Professor

Friesz, Terry L., Ph.D., Johns Hopkins University, 1977; Professor

Houck, Mark H., Ph.D., Johns Hopkins University, 1976; Professor

Laskey, Kathryn B., Ph.D., Carnegie-Mellon University, 1985; Associate Professor

Lehner, Paul, Ph.D., University of Michigan, 1981; Associate Professor

Levis, Alexander H., Sc.D., Massachusetts Institute of Technology, 1968; Professor (Chair)

Michalski, Ryszard, Ph.D., Polytechnical University of Silesia, Poland, 1969; PRC Professor

Pachowicz, Peter, Ph.D., Stanislaw Staszic University, Poland, 1984; Assistant Professor

Palmer, James D., Ph.D., University of Oklahoma, 1963; BDM International Professor of Information Technology

Rathbone, Daniel B., Ph.D., Texas A&M University, 1979; Associate Professor

Rossini, Frederick A., Ph.D., University of California, Berkeley, 1968; Professor; Provost and Vice President for Academic Affairs

Ryan, Terrance C., Ph.D., University of Illinois, 1974; Professor and Assistant Dean

Sage, Andrew, Ph.D., Purdue University, 1960; D.Engr., University of Waterloo, 1987; First American Bank Professor, Dean of School of Information Technology and Engineering

Van Trees, Harry, Sc.D.E.E., Massachusetts Institute of Technology, 1961; Distinguished Professor of Information Technology, Electrical and Systems Engineering; Director, Center of Excellence in Command, Control, Communications, and Intelligence (C3I)

White, Bernard E., Ph.D., University of Virginia, 1984; Associate Professor, Assistant Dean for Undergraduate Affairs

**Systems Engineering, M.S.**

The graduate program leading to the Master of Science in Systems Engineering prepares students for (a) professional practice associated with problem formulation, issue analysis, and the evaluation of alternative courses of action as they pertain to the design and development of systems of all kinds, and (b) research and further advanced studies. The program emphasizes both analytical and practical aspects of engineering complex systems. Students are expected to demonstrate proficiency in several quantitative modeling disciplines. Students are also expected to master issues relevant to practical aspects of systems design, engineering, and management.

**Admission Requirements**

In addition to the general admission requirements of the university, the academic background requirements for entrance into the program include an undergraduate degree in engineering, mathematics, physical sciences, or a related field in which the applicant has successfully completed foundation courses in calculus through differential equations, applied probability and statistics, and a scientific programming language.

Acceptance to the degree program is based on an assessment of the applicant's capacity to successfully pursue the graduate program, and on factors such as the undergraduate record, Graduate Record Examination (GRE) scores (recommended but not required), and professional work experience. Well-qualified students who present minor admissions deficiencies may be admitted subject to completing an articulation program. To this end, students applying to the program are asked to complete a self-assessment form. The articulation program, when required, will consist of undergraduate math courses and up to three graduate courses that provide preparation for further graduate study. These foundation courses are listed below.

- SYST 500 Quantitative Foundations for Systems Engineering
- STAT 610 Statistical Foundations for Technical Decision Making
- A basic course in Computer Systems and Software

The use of analytical modeling software such as spreadsheets or math packages will also be very helpful. Students should acquaint themselves with analytical modeling software packages prior to beginning classes.
Upon acceptance, students will be informed as to the foundation courses that they must take. Graduate-level foundation courses generally do earn credit toward the M.S. degree but are taken in addition to the minimum 30-semester-hour requirement for the degree.

**Advising**

All entering systems engineering students must attend an orientation meeting that will culminate in the completion of a plan of study for the M.S. degree. Each student will then be assigned a faculty adviser; students are encouraged to seek out their adviser when questions arise and when their plan of study needs to be revised. The assigned adviser can also help each student identify the appropriate faculty member for supervising her or his project or thesis.

**Degree Requirements**

To obtain a Master of Science degree in Systems Engineering, students must complete a plan of study with a minimum of 30 semester hours of graduate level courses. The plan of study must be approved, in writing, by the student's faculty adviser before the student begins course work. Articulation requirements for candidates needing additional work in mathematics or engineering will also be included in the plan of study.

There are two options.

**Project Option.** The student completes the three core courses, two basic methods courses, four electives in a concentration area, and a three-semester-hour project (SYST 798). A project objective is selected with the approval of the faculty project adviser. Although a student may register for more than three semester hours of project work, only three hours will be applied toward the degree.

**Thesis Option.** The student completes the three core courses, two basic methods courses, three electives in a concentration area, and a six-semester-hour Master's Thesis (SYST 799). The master's thesis should reflect a significant independent research effort. The work is conducted under the guidance of a faculty thesis adviser, and the final written thesis and oral defense are approved by a three-member faculty committee and submitted to the School of Information Technology and Engineering for approval. The thesis work is expected to be completed while taking six semester hours of SYST 799. Although a student may register for more than six semester hours, only six hours will be applied toward the degree.

**Commonwealth Graduate Engineering**

Students may take courses through the Commonwealth Graduate Engineering Program in affiliation with the University of Virginia and Virginia Tech. With department approval, appropriate courses may be transferred to the Systems Engineering degree programs.

**Curriculum**

**Core Courses**

Students must complete the following three courses:

- SYST 611 Systems Engineering I — System Methodology and Modeling
- SYST 612 Systems Engineering II — System Design and Integration
- SYST 613 Systems Engineering III — System Management and Evaluation

**Specializations**

Four major areas of specialization are available for students to choose within the M.S. program in Systems Engineering: Systems Methodologies and Engineering (SME), Command, Control, Communications, and Intelligence (C3I), Software Systems Engineering (SSE), and Urban Systems Engineering (USE). The recommended methods and electives courses for each discipline are listed below:

**Systems Methodologies and Engineering (SME)**

Systems Methodologies and Engineering is the major specialization area under the Systems Engineering M.S. program. Systems Engineering activities extend over the entire "life cycle" of a system, from requirements specification to conceptual and functional design, through development integration, testing, production, employment, and maintenance.

In dealing with the various phases of the system life cycle, the system engineer's perspective is different from that of a product engineer or technology developer. Whereas the product engineer deals with details, the system engineer take a "top down" perspective dealing with details only as needed to guarantee successful implementation. Where the product engineer deals with system internals, the systems engineer also addresses the external view of the system through the system's interface to other systems, users, and managers. Our educational program reflects the systems engineer's unique perspective on the system life cycle.

Research in Systems Engineering addresses a broad range of issues relevant to the design, im-

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implementation, analysis, and management of systems. Research areas include decision support systems, distributed intelligence systems, knowledge-based planning systems, network systems, probabilistic reasoning systems, sensor fusion systems, and a variety of others. Research activities include both fundamental and applied research. The graduate program in Systems Engineering recognizes the importance of balancing an education in quantitative models and engineering tools with a proper understanding of the systems "perspective."

**Basic Methods Courses for SME**—Students must complete two of the following:

- SYST 555 Introduction to Intelligent Systems Engineering
- SYST 664 Bayesian Inference and Decision Analysis
- SYST 695 Petri Nets
- ECE 521 Modern Systems Theory
- OR 541 Deterministic Models in Operations Research
- OR 542 Stochastic Models in Operations Research
- STAT 644 Applied Probability or ECE 528 Random Processes in Electrical and Computer Engineering

**Electives Courses for SME**—A sample set of approved elective courses is:

- SYST 540, SYST 542, SYST 555, SYST 664, SYST 671, SYST 672, SYST 677, SYST 684, SYST 685, SYST 695, SYST 720, SYST 758, SYST 777, SYST 785, SYST 788, CS 580, CS 681, CS 688, CS 782, CS 785, OR 641, OR 642, OR 643, OR 644, OR 645, OR 681, and STAT 652.

**Concentration Areas for SME**—Each student must select three or four electives that together constitute a clearly defined concentration area. With the prior approval of the faculty adviser, a student may design his or her own concentration area with appropriate courses not necessary in the above sample list, or may select from one of several standard concentration areas, including:

- Decision Support Systems
- Engineering of Intelligent Systems
- Methods in Systems Engineering
- Systems Management

A description of each of these concentration areas is available from the Systems Engineering Department; each of the concentration areas specifies the basic methods courses to be taken. Therefore, the student should have approval of the concentration area prior to taking methods courses.

**Command, Control, Communications, and Intelligence**

Command, Control, Communications, and Intelligence (C^3I) Systems Engineering is a specialization area within the systems engineering degree program. C^3I systems are pervasive throughout the civilian and military world, allowing responsible authorities such as commanders or chief executive officers to control resources such as personnel, equipment, and money.

Civillian government examples include the air traffic control systems, the drug enforcement C^3I system, law enforcement agency systems, and various emergency preparedness systems. Military systems include national-level crisis management systems, nuclear C^3I systems, the NATO command and control system, and various tactical C^3I systems of the military services. Private industry examples include the corporate management systems of large national and multinational firms.

These systems include the equipment, people, and procedures necessary to accomplish the mission. The equipment may include a variety of sensors, communications systems, and information processing and decision-support systems. The program stresses the multidisciplinary approach necessary to understand the field.

The specialization focuses on theory and practice of C^3I and prepares students for careers in research, design, and development of C^3I systems, or in the use and management of C^3I systems. The courses offered emphasize the analytical and behavioral aspects of engineering complex C^3I systems.

**Basic Methods Courses for C^3I**—Students must complete the following two courses:

- SYST 680/ECE 670 Principles of C^3I Part I
- SYST 681/ECE 671 Principles of C^3I Part II

**Elective Courses for C^3I**—A sample set of approved elective courses is:

- ECE 528, SYST 542, SYST 664, SYST 671, SYST 683, SYST 684, SYST 685, SYST 687, SYST 760, SYST 761, SYST 785, SYST 788, ECE 630, ECE 631, ECE 634, ECE 637, ECE, 639, and ECE 642.

**Concentration area for C^3I**—Each student must select three or four electives that together constitute a clearly defined concentration area. With the prior approval of the faculty adviser, a student may design his or her own concentration area with appropriate courses not necessary in the above sample list, or may select from one of several standard concentration areas, including:

- C^3I Architecture
- C^3I Software

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Communications
Decision Support
Modeling and Simulation
Sensing and Fusion

Certificate in C²I Systems Engineering—A certificate program in C²I Systems Engineering is available to students who hold master's degrees in engineering and scientific disciplines, or who are currently in graduate status in such programs. Students who complete the two C²I basic method courses, ECE 528 or OR 542, as well as at least two of the following three courses: SYST 682, SYST 683, and SYST 684, will be eligible for a certificate.

Software Systems Engineering (SSE)
The Software Systems Engineering specialization provides specialized knowledge and experience in developing and modifying large, complex software systems. It emphasizes technical and management aspects of the software engineering process. Software systems engineers are concerned with the theoretical and practical aspects of technology, cost, and social impact of software systems that are both effective and efficient.

Basic Methods Courses for SSE—Students must complete two of the following courses:

OR 541 Deterministic Models in Operations Research
OR 542 Stochastic Models in Operations Research
STAT 644 Applied Probability
SYST 555 Introduction to Intelligent Systems Engineering
SYST 664 Bayesian Inference and Decision Analysis
SYST 695 Petri Nets

Elective Courses for SSE—A sample set of approved elective courses is:

SWSE 619, SWSE 620, SWSE 621, SWSE 623, SWSE 625, SWSE 630, SWSE 631, SWSE 632, SWSE 635, SWSE 699, SWSE 720, and SWSE 721.

Certificate in Software Systems Engineering—A certificate program in Software Systems Engineering is available to students who hold master's degrees in engineering and scientific disciplines, or who are currently in graduate status in such programs. Students who complete all of the following courses, SWSE 619, SWSE 620, SWSE 621, SWSE 623, and SWSE 625, are eligible for a certificate.

Urban Systems Engineering (USE)
The Urban Systems Engineering specialization under the M.S. in Systems Engineering degree is designed for those systems engineering students who are interested in the analysis and solution of engineering problems in the urban environment. Students interested in a fuller, more focused program should consider the Master of Science degree in Urban Systems Engineering.

Basic Methods Courses for USE—Students must complete two of the following:

USE 585 Automated Support Tools for Urban Systems Engineering
USE 670 Urban Systems Decision Methods and Tools
USE 680 Spatial Decision Support Systems
USE 685 Urban Systems Engineering Information Management

Elective Courses for USE—A sample set of approved elective courses is:

USE 530, USE 550, USE 560, USE 601, USE 602, USE 610, USE 632, USE 650, USE 660

Concentration Areas for USE—Each student must select three or four electives that together constitute a clearly defined concentration area. With the prior approval of the faculty adviser, a student may design his or her own concentration area with appropriate courses not necessarily in the sample list, or may select from one of several standard concentration areas (see the following section).

Urban Systems Engineering, M.S.

Urban Systems Engineering is the study of land, transportation, water, energy, and telecommunications systems from a civil engineering systems perspective, within a complex social, political, economic, and environmental context. Examples of urban systems include water supply and distribution systems; solid waste management systems; street, road, and highway systems; wastewater treatment and management systems; stormwater management systems; mass transit systems; other public utility systems; energy supply and distribution systems; telecommunication systems; constructed facility systems, etc. The focus of the program is on how these systems are successfully conceived, developed, designed, built, operated, maintained, and renewed in the built environment such as the Washington metropolitan area.

An urban society thrives and prospers when adequate, appropriate, reliable, robust, and cost-effective systems to support the functioning of the society are provided. The investment in existing infrastructure and other urban systems in the United States is enormous. The investment required to maintain, operate, renew, and manage the evolution of these urban systems in the future...
is even greater. The need for highly trained specialists to confront and solve these continuing, vital problems is pressing.

The program educates students in the theory and practice of urban systems engineering. Information technology and automated tools for analyzing and solving these problems are important components of the program. The urban systems engineer can look forward to pursuing a career focused on these problems in the public and private sectors.

The M.S.-U.S.E. program includes four required courses, electives selected by the student with the aid of a faculty adviser, and a thesis or urban systems engineering project. Students must complete a faculty approved plan of study with a minimum of 30 credit hours of graduate-level work, including the thesis (6 credits) or research project (3 credits).

Students may take courses through the Cooperative Graduate Engineering Program, in affiliation with the University of Virginia and Virginia Tech. Appropriate courses may be transferred, with adviser approval, into the M.S.-U.S.E. degree program. Refer to the catalog section on Programs and Additional Graduate Courses.

Admission Requirements
To apply for admission to the program, an applicant must:

1. Fulfill all admission requirements for graduate study;
2. Have completed a baccalaureate degree in engineering, physical sciences, economics, or other urban systems engineering-related field; and
3. Have three letters of reference submitted by former professors or supervisors.

Acceptance to the degree program is based on an assessment of the applicant’s capacity to successfully pursue the graduate program. Consideration is given to the applicant’s undergraduate record, any previous graduate work, professional work experience, the letters of reference, and any recent Graduate Record Examination (GRE) scores.

Well-qualified students who present minor admissions deficiencies may be admitted subject to completing an articulation program. Courses taken in the articulation program extend the minimum requirements for the degree.

Curriculum
Core Courses
Students must complete the following three core courses. These courses provide a common background for understanding the breadth and complexity of urban systems engineering and for introducing the application of information technology and the systems approach to analyzing and solving problems in urban systems engineering.

- USE 601 Urban Systems Engineering I—Modeling and Problem Solving
- USE 602 Urban Systems Engineering II—Infrastructure Planning and Management
- SYST 613 Systems Engineering III—System Evaluation and Management

Methods Courses
Students must complete at least one of these courses:

- USE 585 Automated Support Tools for Urban Systems Engineers
- USE 670 Urban Systems Decision Methods and Tools
- USE 680 Spatial Decision Support Systems
- USE 685 Urban Systems Engineering Information Management
- Or other appropriate methods courses such as SYST 611, SYST 612, OR 541, OR 542, STAT 644, STAT 670

Concentration Area
Each student must select an additional four or five electives that together constitute a concentration area. With the prior approval of the faculty adviser, a student may design his or her own concentration area, or may select from one of several standard concentration areas including:

- Transportation Systems Engineering
- Construction Management
- Environmental Systems Engineering
- Engineering Management
- Water Resource Systems Engineering
- Facilities Management

Systems Engineering Courses (SYST)

500 Quantitative Foundations for Systems Engineering (3:3:0). Prerequisite: MATH 213, 214. Provides the quantitative foundations necessary for core courses in the Systems Engineering master's program and the certificate program in C³. Topics include vectors and matrices, differential and difference equations; linear systems; Fourier, Laplace and Z-transforms, and probability theory. Engineering applications of the topics will be emphasized. Students will receive graduate credit for this course, which will, when used on a plan of study, extend the minimum credit hour requirements for the degree.

542 Decision Support Systems Engineering (3:3:0). Prerequisite: SYST 302 or graduate standing. Course studies the design of computerized systems to support individual or organizational decisions. Teaches a systems engineering approach to decision support system (DSS) development. A DSS is the end product of a development process, and it is this process that is key to success.
ful integration of a DSS into an organization. Any DSS is built on a *theory* (usually implicit) of what makes for successful decision support in the given context. Empirical evaluation of the specific DSS and underlying theory should be carried on throughout the development process. Examines some prevailing theories of decision support, considers the issues involved in obtaining empirical validation for a theory, and discusses what if any empirical support exists for the theories considered. Students design a DSS as a semester project.

555 Introduction to Intelligent Systems Engineering (3:3:0). Prerequisite: SYST 500 or equivalent. Introduction to intelligent systems engineering for students planning to study systems engineering. Covers the principles and interrelationships among basic methods in the field, including symbolic and subsymbolic reasoning, imprecise and approximate reasoning (e.g., fuzzy logic), and neural networks, and emphasizes engineering analysis and systems design and implementation. Basic intelligent system principles as well as various engineering applications are covered. Includes hands-on experience and the design of an experimental intelligent system with state-of-the-art tools.

611 Systems Engineering I—System Methodology and Modeling (3:3:0). Prerequisite: SYST 500 or equivalent. This course provides a broad, yet rigorous, introduction to methodologies for systems engineering. Emphasis is on systems modeling and performance. These methodologies address system performance issues and assist in the evaluation of alternative system designs. Resource allocation for planning and control is introduced.

612 Systems Engineering II—System Design and Integration (3:3:0). Prerequisite: SYST 500 or equivalent. Introduction to functional analysis including the process of designing the system-level architecture (requirements, functions, and subsystems/components). Techniques for system requirements identification are discussed. Open systems architectures and concurrency of design are addressed. Numerical graphical techniques for functional decomposition are introduced and compared. Software tools for systems engineering are introduced and evaluated.

613 Systems Engineering III—System Management and Evaluation (3:3:0). Prerequisite: SYST 500 or equivalent. Provides the necessary techniques for evaluating the cost and operational effectiveness of system designs and systems management strategies. Decision analysis, cognitive engineering and ergonomics, performance measurement, work breakdown structures, cost estimating, and quality management are discussed. Configuration management and standards are discussed. Case studies from the information systems industry systems are presented.

659/STAT 664 Topics in Systems Engineering (3:3:0). Prerequisite: Permission of instructor. Topics not covered in the department's regular systems engineering offerings. Course content may vary each semester depending on instructor and the perception of students' needs. Course may be repeated once for credit.


671/OR 671 Judgment and Choice Processing and Decision Making (3:3:0). Prerequisite: STAT 610. Intuitive nature of human judgment and decision making, and some methods currently being used for improving individual and group decisions. The nature of judgment emphasizing limitations on human information processing abilities. The use of decision-analytic techniques to improve decision making.

672/ECE 651/CS 685 Intelligent Systems for Robots (3:3:0). Prerequisite: SYST 611, ECE 650, CS 580, or SYST 555. Review of recent developments in the area of intelligent autonomous systems. Study of the applications of artificial intelligence, control theory, operations research, decision sciences, computer vision, and machine learning to robotics. Correspondences between various fields are studied. Topics include analysis and design of methods, algorithms and architectures for planning, navigation, sensory data understanding, visual inspection, spatial reasoning, motion control, learning, self-organization, and adaptation to the environment.

677/STAT 677/OR 677 Quality Assurance (3:3:0). Prerequisite: STAT 610, 654, or equivalent. Introduction to the concepts of quality control and reliability. Acceptance sampling, control charts, and economic design of quality control systems are discussed, as are system reliability, fault-tree analysis, life testing, repairable systems, and the role of reliability, quality control and maintainability in life-cycle costing. The role of MIL and ANSI standards in reliability and quality programs are also considered.

680/ECE 670 Principles of Command, Control, Communications, and Intelligence (C³l)—Part I (3:3:0). Prerequisite: ECE 528 and OR 542 or equivalent. Fundamentals of C³l are developed from a descriptive, theoretical, and quantitative perspective. Topics include C² process; quantitative models for combat, sensing, data fusion; individual and team decision making; organizational theory; tools for modeling C³ systems; and evaluations of C³ systems.

681/ECE 671 Principles of Command, Control, Communications, and Intelligence (C³l)—Part II (3:3:0). Prerequisite: SYST 680/ECE 670. Technology required for C³ systems is developed. Technology areas include sensors, communications, and computer-based systems. The C³I required for mission areas such as strategic, theater, and tactical are developed and analyzed. Electronic warfare and counter-C³I is discussed.

682 Command, Control, Communications, and Intelligence (C³I) Systems Engineering (3:3:0). Prerequisite: SYST 680/ECE 670 or equivalent. Multidisciplinary systems engineering synthesizes design methods, tools, and approaches from the behavioral, computer, engineering, mathematical, and managerial sciences. Focus on C³I requirements analysis and modeling, prototyping, tradeoff analysis, and evaluation methodology.

683 Modeling, Simulation, and Gaming (3:3:0). Prerequisite: SYST 680. Methods for designing combat models and games are developed. Existing combat mod-

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els are critical to the C^3 process. Exercises and games are used to demonstrate the value of properly developed C^3 modules in a combat simulation.

684 Sensor Data Fusion (3:3:0). Prerequisite: SYST 680 and ECE 528. Examine design issues in multisensor fusion systems. Study the use of probability, evidence, and possibility theories for object identification. Study Bayes networks, blackboard architectures, spatial and temporal reasoning for situation assessment.


695/ECE 695 Petri Nets (3:3:0). Prerequisite: ECE 521 or SYST 611. An introduction to Petri Nets and their application to the modeling and analysis of discrete event dynamical systems. Elements of discrete mathematics including sets and lattices and graph theory. Petri Nets and their properties. Concurrent and asynchronous processes. Stochastic Timed Petri Nets and performance modeling. Accuracy and timeliness. Applications from several domains: command and control, air traffic control, flexible manufacturing systems, robotics, decision making organizations, and decision support systems.

698 Independent Study and Research (3:3:0). Prerequisite: Graduate standing, completion of at least two core courses, permission of instructor. Study of a selected area in systems engineering or C^3I under the supervision of a faculty member. Written report required.

720 Introduction to System Integration (3:3:0). Prerequisite: SYST 611 and 613. Definition of a system integration strategy, life cycle and tools, techniques and methods for management of the systems integration process. Identification of key issues for integrating and validating the system. Planning and scheduling system deliverables including documentation, operations, and maintenance and training plans. Considerations of risk management and risk avoidance.

758 Computational Models for Probabilistic Inference (3:3:0). Prerequisite: SYST 659 or STAT 662. Graphical models for encoding conditional independence assumptions in a multivariate discrete probability distribution. Computational methods for updating probabilities when evidence is observed on some variables in the model. Algorithms for finding the most probable instantiation of the network. Applications in expert systems and decision analysis.

760 Special Topics in Command, Control, Communications, and Intelligence Systems Engineering (3:3:0). Prerequisite: SYST 680. Special topics in the C^3I area with different content in different terms. Representative areas include quantitative evaluation of C^3 systems, applications of artificial intelligence in C^3 systems, and military communications systems.

761 Advanced Topics in Command, Control, Communications, and Intelligence Systems Engineering (3:3:0). Prerequisite: SYST 681 and 683. Advanced topics in the C^3I. Representative areas include advanced modeling and analysis techniques, case studies of C^3 architectures, and applications of detection and estimation techniques in ASW.

777/OR 777 The Modeling of Nonlinear Dynamic Systems (3:3:0). Prerequisites: OR 541 or ECE 521, OR 682/STAT 682 or equivalent. Introduction to the use of nonlinear ordinary differential, difference, and integral equations in modeling dynamic phenomena in engineering, the natural sciences, and the social sciences. Emphasis on the art of constructing and solving very large-scale complex dynamic models. Examples drawn from operations research, environmental engineering, mathematical biology, economics, transportation, and other fields.


788 Multisensor Multitarget Tracking: Advanced Applications (3:3:0). Prerequisites: SYST 685 or ECE 734 or equivalent. Tracking single target in clutter, Probabilistic Data Association Filter (PDAF); tracking multiple targets in clutter, joint PDAF, multiple hypothesis tracker (MHT); multisensor track-to-track association and fusion, hierarchical estimation, distributed tracking in distributed sensor networks, performance evaluation for tracking algorithms.

798 Research Project (3:0:0). Prerequisite: 9 hours of graduate-level course work. Research project is chosen and completed under the guidance of a graduate faculty member, resulting in an acceptable technical report.

799 Master's Thesis (1-6:0:0). Prerequisite: 9 hours of graduate-level course work and permission of instructor. Research project is chosen and completed under the guidance of a graduate faculty member, which results in a technical report acceptable to a three-faculty-member committee, and an oral defense.

Urban Systems Engineering Courses (USE)

530 Water Resource Systems Analysis (3:3:0). Prerequisite: OR 541 or equivalent. Introduces the concepts, applications, and tools of systems analysis for the problems of water resources planning, management, and design. A variety of problems including river basin planning, real-time hydrosystem operations, water quality management, capacity expansion, urban drainage network design, and sanitary sewer design are used to illustrate the applications of systems analysis. Tools include linear and dynamic programming and knowledge-based systems.

550 Environmental Engineering Systems (3:3:0). Prerequisite: USE 451 or equivalent. Introduction to systems analysis in environmental engineering. Applications of optimization and simulation modeling, knowledge-based systems, and systems analysis and engineering to the solution of environmental engineering problems, related to air, soil, water, and noise pollution. Planning, management, design issues. Review of experi-

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mental design approaches for the characterization of environmental sites.

560 Public Transportation Systems (3:3:0). Prerequisite: USE 465 or equivalent. Analysis of public transportation systems in terms of their role in urban transportation. Topics covered are the history of public transportation in the United States; quantitative performance attributes of different modes; analytical techniques for planning and operation; management and administrative concepts.

585 Automated Support Tools for Urban Systems Engineers (3:3:0). Prerequisite: ENGR 355 or equivalent. The study of information technology support functions such as computer-aided design (CAD), geographic information systems (GIS), computer-aided engineering (CAE), computer-aided cost engineering (CACE), computer-aided facilities management (CAFAM), and their application in engineering practice. Study of strategies and techniques for automating the engineering operation including software and hardware requirements determination, specifications, selection, and purchasing; principles and strategies for computer networks; training; and productivity assessment. Exploration of unique automated system support opportunities such as scanning, automated raster to vector conversion, file format conversion, file compression, computer-aided presentation and projection, telecommuting, teleconferencing, etc.

601 Urban Systems Engineering—Modeling and Problem Solving (3:3:0). Prerequisite: MATH 213 and CS 112, or USE 300, or equivalent. Concepts of modeling, systems analysis, and engineering for problem solving in the urban environment. Modeling, simulation, optimization, limitations of modeling approaches. Decision support tools. Multiple objective, multiple decision-maker problems in the public and private sectors. Multiple case studies in urban systems engineering design, planning, and management in areas such as transportation; water resources; environment; solid, liquid, and gaseous waste; energy; telecommunications; and construction.

602 Urban Systems Engineering—Infrastructure Planning and Management (3:3:0). Corequisite: SYST 613. The study of planning and management practices applicable to the life cycle of the physical urban infrastructure (e.g., roads, sewers, water distribution and other pipelines, telecommunications and energy distribution systems). Course includes the study of the relationship of urban growth and infrastructure reinvestment; mechanisms of deterioration; direct and indirect methods of assessment, and degradation models; capital finance, budgeting, and programming; planning integration and coordination; quantitative applications in planning; uncertainty and reliability; public-private partnerships; operation and maintenance strategies; and future issues.

610 Construction Systems and Management (3:3:0). Prerequisite: Permission of instructor. Study of applications of construction management concepts and techniques to the production of the constructed system. Exploration of the construction industry and environment through study of the project cycle design and construction phases with emphasis on estimating, planning, scheduling, and controlling of men, money, materials, machines, time, and information. Popular scheduling software is used with class projects and a case study.


650 Environmental Law (3:3:0). Prerequisite: USE 550 or equivalent. Advanced course in the study of environmental laws as they pertain to urban systems infrastructure management. Review of the National Environmental Policy Act (NEPA), Endangered Species Act, Coastal Zone Management Act (CZMA), Clean Air Act (CAA), Clean Water Act (CWA), Safe Drinking Water Act (SDWA), Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and other environmentally related legislation. Course also covers a review of laws for allocation of surface and groundwater supplies and a review of environmental law data bases.

660 Urban Transportation Planning (3:3:0). Prerequisite: USE 601. Quantitative and qualitative techniques in urban transportation planning. Different levels of urban transportation planning; the technical transportation planning process, including travel demand estimation, establishment of transportation strategies, and utility analysis; activity center planning including on-site vehicle and pedestrian circulation, transportation interface, environmental planning, and planning administration.

670 Urban Systems Decision Methods and Tools (3:3:0). Prerequisite: STAT 644 or equivalent. Principles of decision making and of knowledge acquisition in the context of building knowledge-based decision support tools for urban systems engineering. Solving complex problems from several areas of urban systems engineering, including construction, environmental, and transportation engineering; using various decision support tools, based on the Bayesian decision theory and on the principles of artificial intelligence, including knowledge-based systems and learning systems.

680 Spatial Decision Support Systems (3:3:0). Prerequisite: SYST 642 or equivalent. Fundamentals of traditional decision support systems and their application to spatially or geometrically related decision environments. Survey of decision analysis models; exploration of spatial data base methodologies; review of engineering models including CAD, GIS, computer-aided engineering, AM/FM, expert systems, etc.; survey of man-machine interface techniques. Study of the application of decision support systems in construction, engineering design, facilities management, transportation, public service, etc.

685 Urban Systems Engineering Information Management (3:3:0). Prerequisite: USE 585. Advanced course in information resources management as applied to urban engineering problems and microcomputer data management. Covers all phases of the information management life cycle from the conceptual design and data collection phases, through systems development, archiving and disposal. Software engineering (structured analysis, rapid prototyping, object-oriented analysis, etc.) as applied to urban systems infrastructure problem solving is also covered. Reviews civil engineering applications of
data base technology, spreadsheets, communications software, customized applications software, groupware, and graphics software (including CADD and GIS). Covers the selection and use of appropriate software to match specific urban systems engineering problems related to the design, construction, and management of civil engineering infrastructure (transportation, water resources, environment, facilities, etc.). Includes the design and development of a system for an urban systems engineering application.

690 Topics in Urban Systems Engineering (3:3:0). Prerequisite: Determined by topic. Topics not covered in the regular urban systems engineering offering. Course content may vary each semester depending on instructor and the perception of students' needs. Course may be repeated with change in topic.

798 Directed Readings in Urban Systems Engineering (3:3:0). Prerequisite: Permission of instructor. Analysis and investigation of a contemporary problem in urban systems engineering. Prior approval by a faculty member who supervises the student's work is required. Written report.

799 Master's Thesis (1-6:0:0). Prerequisite: 18 hours of graduate-level course work and permission of instructor. Research project is chosen and completed under the guidance of a graduate faculty member, which results in a technical report acceptable to a three-faculty-member committee, and an oral defense.
College of Nursing and Health Science
College of Nursing and Health Science

Exercise Science and Health

Faculty
Bever, David L., Ph.D., Purdue University, 1978; Associate Professor
DuCharme, Kimberly, Ph.D., University of Waterloo (Ontario, Canada), 1993; Assistant Professor
Goodale, Thomas L., Ph.D., University of Illinois, 1965; Professor and Program Director
Metcalf, James A., Ph.D., University of Maryland, 1970; Associate Professor
Miller, Richard E., Ed.D., State University of New York at Buffalo, 1981; Associate Professor
Ruhling, Robert O., Ph.D., Michigan State University, 1976; Associate Professor
Schack, Frederick K., Ph.D., The Ohio State University, 1976; Associate Professor
Wiggins, David K., Ph.D., University of Maryland, 1979; Professor
Wright, Brett A., Ph.D., Texas A&M University, 1985; Associate Professor

Exercise Science and Health, M.S.

This program is offered through Academic Programs for Health Science, College of Nursing and Health Science, and serves professionals working in the fields of education, community health, health care, and business and industry. This degree may be individualized to prepare students for either advanced graduate study (doctoral program), becoming a “master” school teacher, or being prepared for health and fitness promotion, education, and program design and assessment.

Admission Requirements
In addition to fulfilling Graduate Council admission requirements, the applicant must:
1. submit three letters of recommendation;
2. provide transcripts of all college course work;
3. forward Graduate Record Examination (GRE) or Miller Analogy Test (MAT) scores to George Mason University;
4. submit a written goals statement (500-1,000 words) explaining how study in the M.S. in Exercise Science and Health program relates to the applicant’s educational and career plans; and
5. have completed undergraduate courses in human anatomy, physiology, nutrition, exercise physiology, and kinesiology.

Applicants who do not meet the above requirements may be offered provisional or nondegree status in accordance with general regulations of the Graduate Council.

Admission decisions are made whenever applicants’ files are complete. Candidates may enroll in any term during the following year, although fall enrollment is recommended given the course sequence.

Degree Requirements
In addition to fulfilling the graduate degree requirements, students must complete the following courses totalling 30 credit hours:

Core (18 credit hours)

EXSH 605 History of American Sport, Exercise, and Physical Culture (3)
EXSH 610 Advanced Exercise Physiology (3)
EXSH 615 Epidemiology in the Health Sciences (3)
EXSH 620 Research Design for Exercise Science and Health (3)
EXSH 621 Elements of Statistical Reasoning (3)
EXSH 680 Ethical Issues in Exercise Science, Health, and Leisure (3)
Cognate (6 credit hours)

Students complete 6 credit hours of graduate courses in the parent discipline supporting their area of emphasis (e.g., biology, history, psychology, sociology, etc.).

One of these Options (6 credit hours)

EXSH 799 Thesis (6)

or

Electives in Cognate or EXSH Major (6)

Thesis

Students choosing to do a thesis must recruit an adviser to supervise thesis work and chair the thesis committee. The adviser must be a member of the Health Science Programs graduate faculty. Students may not register for thesis credit until a proposal has been approved by the graduate program director after consulting with the thesis adviser. The graduate program director will appoint two members to the thesis committee, one of whom may be outside the Health Science Programs, based on recommendation from the student and thesis adviser.

Comprehensive Examination

Students who choose the Electives in Cognate or EXSH Major option rather than complete a thesis will take a comprehensive exam during the semester or summer at the conclusion of which they expect all course requirements for the degree to be completed.

Exercise Science and Health Courses (EXSH)

Prerequisite for all courses: graduate standing and/or permission of instructor.

500 Workshop in Exercise Science and Health (1-3:0:0). Concentrated full-time workshops, weekend seminars, and workshops dealing with selected topics in exercise science and health. May be repeated. No more than 6 semester hours may be applied for degree credit.

599 Independent Study in Exercise Science and Health (1-3:0:0). Study of a problem area in exercise science and health research, theory, or practice under the direction of faculty. May be repeated. No more than 3 semester hours may be earned. f,s, su

605 History of American Sport, Exercise, and Physical Culture (3:3:0). Examination of the American sport, exercise, and physical culture from the Colonial period to present. Emphasis on development of the sport and physical culture industry and its interconnection with physical education, health, and medical professions. f

610 Advanced Exercise Physiology (3:3:0). Lecture, demonstration, and seminar experiences in the application of research findings to the understanding of physiological function and the effects of exercise on people.

615 Epidemiology in the Health Sciences (3:3:0). Principles, methods, and application of epidemiology. Reviews the behavioral, psychological, social, and environmental risks to disease distribution. Focuses on lifestyle, exercise patterns, and environmental factors to health and disease conditions.

620 Research Design for Exercise Science and Health (3:3:0). Introduction to the techniques of research generally employed in the fields of exercise science and health.

621 Elements of Statistical Reasoning (3:3:0). Introduction to practical and applied aspects of both descriptive and inferential statistics in exercise science and health.

630 Exercise, Health and Fitness Program Development (3:3:0). Exercise and health program development related to fitness and health of adult populations. Three to six hours of field experience.

660 Management of Exercise and Health Organizations (3:3:0). Advanced study in management and administration of organizations dedicated to human development and improvement of quality of life. Application of theories and practices of management and behavioral sciences, fiscal management, marketing, and evaluation research.

680 Ethical Issues in Exercise Science, Health, and Leisure (3:3:0). Formulation of a coherent framework for ascertaining the good, right, and just, and for assessing evidence and reason underlying positions and arguments. Examination of current ethical issues in exercise science, health, and leisure.

799 Thesis (1-6:0:0). Exploration of an exercise science and health problem using appropriate research methodology under supervision of graduate faculty member(s). f,s, su

802 Readings for the Doctor of Arts in Community College Education (3:9:0:0). Prerequisite: Admission to the Doctor of Arts program in The National Center for Community College Education with a physical education specialty. Involves intensive reading in recent scholarship in physical education and related fields. Students must propose a readings list, which must be approved by their faculty advisor, and use the list to prepare a literature review. This is potentially publishable. f,s, su

Nursing

Faculty

Ailinger, Rita L., Ph.D., The Catholic University of America, 1974; Professor

Butler, Frieda R., Ph.D., University of Maryland, Baltimore, 1980; Commonwealth Professor

Carty, Rita M., D.N.Sc., The Catholic University of America, 1977; Professor and Dean
Connelly, Catherine E., D.N.Sc., The Catholic University of America, 1979; Professor and Director, Doctoral Program

Conti, Roberta M., Ph.D., George Mason University, 1993; Assistant Professor

Dear, Margaret, Ph.D., The Catholic University of America, 1979; Professor

Fisher, Myra H., D.N.Sc., The Catholic University of America, 1978; Assistant Professor and Assistant Dean for Administration

Gaffney, Kathleen, Ph.D., University of Maryland, 1984; Associate Professor

Harper, Doreen C., Ph.D., University of Maryland, 1980; Associate Professor

Jenkins, Helen, Ph.D., University of Maryland, 1983; Associate Professor

Johnson-Brown, Hazel J., Ph.D., The Catholic University of America, 1978; Professor

Kaseman, Dianne F., Ph.D., Florida State University, 1978; Associate Professor

Liu, Yuen Chou, Ph.D., New York University, School of Education, 1972; Professor

Malloy, Catherine, Dr.P.H., University of Pittsburgh, 1980; Professor and Associate Dean for Academic Programs

Noble, Mary Ann, D.N.Sc., Boston University 1968; Associate Professor

Redmond, Georgine, Ed.D., Virginia Polytechnic Institute and State University, 1987; Associate Professor and Assistant Dean for Student Affairs

Silva, Mary E., Ph.D., University of Maryland, 1976; Professor

Sorrell, Jeanne L., D.A.Ed., George Mason University, 1987; Associate Professor

Vail, James D., D.N.Sc., The Catholic University of America, 1980; Associate Professor

Walker, Dorothy J., J.D., Boston College Law School, 1979; Professor

Wu, Chien-Yun, Ph.D., George Mason University, 1990; Assistant Professor

Nursing, M.S.N.

The Master of Science in Nursing program is accredited by the Virginia State Board of Nursing and the National League for Nursing. The program prepares nurses for a variety of leadership roles in the health care delivery system. The Adult or Gerontological Nurse Practitioner and the Family Nurse Practitioner majors have been approved by the state boards of nursing and medicine in Virginia. The major in Advanced Clinical Nursing prepares nurses to provide and manage care of individuals, families, and groups, including the chronically ill, the elderly, and others with self-care limitations. The major in Nursing Administration prepares nurses to function in management positions in hospitals, nursing homes, community health agencies, and other health-related facilities. The M.S.N./M.B.A. program, offered jointly with the School of Business Administration, prepares nurses for mid- and top-level administrative, leadership, and health policy roles in health and health-related organizations. A variety of health care and health-related settings are used for clinical practice experiences.

Admission Requirements

In addition to meeting the graduate admission requirements, an applicant to this program must have a cumulative grade point average of 3.0 (on a 4.0 scale) for the last 60 hours of undergraduate work, hold an active license as a registered nurse, and submit three letters of recommendation. Although the GRE is not formally required, applicants may be asked to submit GRE scores at the discretion of the school when it believes those scores will lead to a clearer presentation of the applicant's qualifications. Applicants must have successfully completed undergraduate statistics and research courses.

Students applying to the majors in Advanced Clinical Nursing and the Nurse Practitioner in Primary Care must have a health-assessment course with a skills component within 18 months of their clinical practicum in the master's program.

In addition, applicants to the Nursing Administration major are required to have the equivalent of one year's experience in direct patient care as a registered nurse. Applicants to the M.S.N./M.B.A. program must have GMAT scores sent directly to George Mason University. It is recommended that students applying to the Advanced Clinical Nursing and the Nurse Practitioner in Primary Care majors have the equivalent of one year's experience in direct patient care as a registered nurse.

Special Requirements

Graduate students are required to have annual health examinations and immunizations before enrolling in practicum courses. Students enrolled in the Advanced Clinical Nursing and the Nurse
Practitioner in Primary Care majors must be in the process of completing a Hepatitis B immunization series when they enroll for their first practicum course. Nursing Administration students who have practicum placements in health care agencies must also be in the process of completing a Hepatitis B immunization series when they enroll for their first practicum course.

Degree Requirements
The master's program in nursing requires 36 semester hours of graduate credit. Of these, a 12-hour core consists of course work in the theoretical foundations of nursing, approaches to data analysis in nursing research, a seminar in concepts of nursing research, and completion of a research project. Twelve hours must be completed in the concentration areas of Adult or Gerontological Nurse Practitioner in Primary Care, Advanced Clinical Nursing, or Nursing Administration. The Family Nurse Practitioner in Primary Care major is a 42-credit curriculum with 18 hours in the concentration area. The M.S.N./M.B.A. program requires 72 semester hours of graduate credit. These hours include graduate nursing, business, decision sciences, and elective courses.

Core Courses—Required of all students:
NURS 755 Theoretical Foundations Related to Nursing (3)
NURS 759 Approaches to Data Analysis in Nursing Research (3) [not required for M.S.N./M.B.A. students]
NURS 790 Seminar in Concepts of Nursing Research (3)
NURS 791 Projects in Nursing Research (3)

Nursing Majors—Select one major
Major in Adult or Gerontological Nurse Practitioner in Primary Care
NURS 623 Clinical Concepts in Primary Care Nursing (3)
NURS 746 Practicum in Primary Care Nursing I (3)
NURS 748 Practicum in Primary Care Nursing II (6)

Nursing Support Courses:
* NURS 552/HCS 205 Clinical Diagnosis and Management of Health Deviations (5)
* NURS 554/HCS 207 Advanced Health Assessment (1)

Related Discipline Support Courses:
HCS 206 Clinical Decision Making (2)
PHARM 207 Pharmacology (4)

*Collected with George Washington University School of Medicine and Health Sciences. All courses offered at George Washington University are charged at George Washington University tuition.

Major in Advanced Clinical Nursing
NURS 773 Advanced Clinical Nursing I (3)
NURS 775 Advanced Specialty Practice I (3)
NURS 776 Advanced Clinical Nursing II (3)
NURS 778 Advanced Specialty Practice II (3)

Nursing Support Courses:
NURS 550 Pathophysiological Bases of Health Deviations (3)
Nursing Elective in specialty area [chronic care, gerontology, or oncology] (3)
Related Discipline Support Courses (6)

Major in Nursing Administration
NURS 763 Administrative Theory in Nursing (3)
NURS 765 Practicum in Nursing Administration I (3)
NURS 766 Administrative Strategies in Nursing (3)
NURS 768 Practicum in Nursing Administration II (3)

Nursing Support Courses:
NURS 654 Nursing Administration Financial Management (3) or NURS 760 Health Care Finance (3)
NURS Support Course (3)

Related Discipline Support Courses:
Management/Organizational Theory (3)
Recommended courses include SOCI 602, PUAD 620, PSYC 632, or MGMT 600
Related Discipline Support Course (3)

M.S.N./M.B.A. Program
(for full-time students)

First Year
Fall
NURS 755
FNAN/DESC 601
ACCT 600
DESC 600

Spring
MGMT 600
MIS 600
ACCT 650
NURS elective

Second Year
Fall
MKTG 650
NURS 763
NURS 765
DESC 650

Spring
FNAN 650
NURS 766
NURS 768
Business elective

Third Year
Fall
FNAN/DESC 700
BULE 700
NURS 790

Spring
MGMT 750
NURS 791
Business elective

Business elective

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Nursing, Ph.D.

The Ph.D. program at George Mason University builds on the M.S.N. degree and requires 60 semester hours beyond the master's degree. The objective of the Ph.D. in Nursing program is to prepare nurses for executive roles in selected areas of nursing. The graduate of the Ph.D. in Nursing program will:

1. Demonstrate administrative leadership skills that enable effective executive function in the chosen area of concentration;
2. Advance nursing knowledge through research in nursing, health-care ethics, health-care administration, and health policy; and
3. Analyze societal and governmental functioning to enable the exercise of leadership in the formulation and implementation of public policy in health care.

Admission Requirements

In addition to fulfilling the admission requirements for graduate study degree status, the applicant must have earned a master's degree from an accredited program and have a minimum grade point average of 3.25 on a 4.0 scale in the master's program. The applicant must submit evidence of at least one year of professional nursing experience, Miller Analogy Test (MAT) scores must be submitted, along with evidence of current licensure to practice professional nursing. (Students on a foreign student visa must present evidence of professional standing in their respective countries.) Three letters of recommendation will be required from professional or academic sources. At least two of the references must be from persons with contact with the applicant within the last two years. An interview with one or more persons on the Graduate Admissions Committee and a short essay describing the applicant's doctoral study goals are also required.

The Graduate Admissions Committee may offer provisional admission to a degree-seeking applicant even though all admission requirements for degree status have not been met if there is sufficient evidence to suggest capacity to pursue graduate work. Students admitted provisionally must resolve all deficits and be moved to degree status by completion of 12 semester hours of doctoral-level study.

Degree Requirements

In addition to meeting graduate admission requirements, students must satisfy the specific Ph.D. degree requirements. To earn the Ph.D. degree at George Mason University, the doctoral candidate must have earned a minimum of 90 graduate-level semester credits beyond the baccalaureate degree and a minimum of 60 graduate-level semester credits beyond the master's degree. A minimum of 48 graduate-level semester credits after admission to degree status in the Ph.D. program at George Mason University are required, 36 of which must have been earned at George Mason University. The candidate may apply a maximum of 12 graduate-level credit hours toward the Ph.D. degree, but may present only graduate-level credits in which satisfactory grades have been earned and which meet the requirements of the Ph.D. curriculum.

A written qualifying examination must be successfully completed in addition to the program of studies outlined in the curriculum of the Ph.D. program in Nursing. Successful completion of a dissertation for which 9 credits are awarded but to which no grade is assigned and the final oral doctoral examination are required.

Program of Study

The curriculum of the Ph.D. program in Nursing includes the nursing core (21 semester hours), research core (24 semester hours), and nursing and related discipline electives (15 semester hours). Prior to advancement to candidacy and enrollment for dissertation credit, the student's program of study must be approved within the College of Nursing and Health Science and by the director, Doctoral Program, College of Nursing and Health Science.

Internship in Health-Care Administration

Students are required to enroll in a one-semester internship, NURS 865 Internship in Health-Care Administration (6), for experiential learning in health-care administration, which includes planned seminars. For the internship, students are assigned to a doctorally prepared executive who serves as the preceptor in the student's area of concentration.

Advancement to Candidacy

After successful completion of the qualifying examinations and all required course work, the Doctoral Program director of the College of Nursing and Health Science approves advancement to candidacy.

Doctoral Supervisory Committee

The Doctoral Supervisory Committee is composed of at least three GMU graduate faculty: the director and reader in nursing and a reader from outside nursing. The Doctoral Supervisory Committee must be approved by the dean of the College of Nursing and Health Science. Additional
members who hold membership in the GMU graduate faculty or individuals from outside the university who present credentials equivalent to criteria for graduate faculty may join the committee at the discretion of the committee and with the approval of the dean of the College of Nursing and Health Science.

**Doctoral Dissertation Proposal**
The proposal must focus on a topic in nursing and must be approved by the Doctoral Supervisory Committee, Doctoral Program director, and College of Nursing and Health Science dean. The dissertation proposal and written dissertation must be consistent with the guidelines of the university outlined in *Guide for Preparing Graduate Theses, Dissertations, and Projects*.

**Doctoral Dissertation**
Prior to enrolling for dissertation credit, the student must have been advanced to candidacy. The student must also have an approved program of study and an approved doctoral dissertation proposal. The student's completed dissertation must be approved by the Doctoral Supervisory Committee, Doctoral Program director, and College of Nursing and Health Science dean.

**Final Oral Doctoral Examination**
The chair of the Doctoral Supervisory Committee, upon preliminary approval of the doctoral dissertation by the committee, petitions the Doctoral Program director, College of Nursing and Health Science, to schedule the final oral doctoral examination, which includes a defense of the doctoral dissertation. The final oral doctoral examination also demonstrates the Ph.D. candidate's intellectual command and maturity of judgment in the area of concentration chosen by the candidate and approved by the Doctoral Supervisory Committee. At the close of the final oral doctoral examination, the Doctoral Supervisory Committee makes a final judgment regarding approval of the doctoral dissertation and successful completion of the Ph.D. degree requirements. The original and two copies of the approved doctoral dissertation must be submitted to the university doctoral coordinator, College Hall.

**Time Requirements**
The student must complete all planned course work, excluding electives, and must advance to candidacy within five years of admission to degree or provisional status in the Ph.D. program. The student must successfully complete the doctoral dissertation, final oral doctoral examination, and all Ph.D. degree requirements within five years following the semester of advancement to candidacy.

**Continuing Nursing Education**
Continuing nursing education is a commitment of the College of Nursing and Health Science and the university. Activities are planned to meet the special needs of individuals and groups in the community. The College of Nursing and Health Science offers opportunities for credit and noncredit courses. Contract courses are offered in a variety of health-care agencies in the Northern Virginia area. These credits can be applied to a program of study in nursing.

**Graduate Certificate in International Nursing**
The graduate certificate in international nursing provides an opportunity for students to enrich their understanding of international health through a sequence of courses including, but not limited to, international nursing, anthropology, international relations, and economics.

**Program Requirements**
A student applying to the certificate program must be in degree status in the graduate nursing program or hold a master's degree from an National League of Nursing-accredited program. Application is made through the Graduate School of the university.

- **Required Courses**: 6 credits
  - NURS 698 International Nursing (3)
  - NURS 699 Practicum in International Nursing (3)
- **Elective Courses**: 9 credits
  - Graduate courses related to international nursing as approved by the student's adviser.

**Total**: 15 credits
Students must complete all courses with a 3.0 GPA to earn the certificate.

**Graduate Certificate in Nursing Administration**
The certificate program offers formal study in theory and practice in nursing administration in the health-care delivery system for the nurse with a master's degree in nursing or a bachelor's degree in nursing and a master's degree in another discipline from an accredited institution.

**Program Requirements**
Applicants to the certificate program must have either a master's degree in nursing or a bachelor's degree in nursing and a master's degree in another discipline from an accredited institution. Application is made through the Office of Admis-
Program Content

Required Courses: 6 credits

NURS 763 Administrative Theory in Nursing (3)
NURS 765 Practicum in Nursing Administration I (3) or NURS 768 Practicum in Nursing Administration II (3)

Elective Courses: 9 credits

Graduate courses related to nursing administration as approved by the student's advisor.

Total: 15 credits

Graduate Certificate in Nursing Education

The graduate certificate in nursing education combines foundation courses in education with courses in the principles and practices of nursing education. The program prepares students to function in nursing educational roles in both academic and nonacademic settings.

Program Requirements

Individuals applying to the graduate certificate in nursing education must be in degree status in the graduate nursing program or hold a master's degree in nursing from an NLN-accredited program. Application is made through the Office of Admissions of the university.

Program Content

NURS 657 Perspectives in Nursing Education (3)
NURS 658 Practicum in Nursing Education (3-6). (Those who qualify for a 3-credit practicum because of their educational experiences may choose the remaining 3 credits from courses designated by the graduate nursing program.)
EDRS 531 Educational and Psychological Measurement (3)
EDCI 701 Educational Program Development (3) or NURS 610 Curriculum Development (3)

Students must complete 15 credits with a 3.0 GPA.

NURSING COURSES (NURS)

505 Case Management (3:3:0). Prerequisite: B.A., B.S., or permission of instructor. Open to seniors. A course for health and human service professionals on case management program development and delivery. Study and application of the role of the case manager in identifying and coordinating cost-effective services. Topics include information management, socio-legal issues, funding, communication, and self-care/independent living.

530 Nurses as Writers (3:3:0). Seminar focused on the theories and practices related to writing in nursing. Researching, composing, revising, and editing are practiced in a variety of writing styles. (Lecture, seminar.)

531 Infant/Family Assessment (3:3:0). Designed to present infant (birth to two years) family assessment techniques and tools, which will prepare professionals to adapt and utilize results of recent research findings on child/caregiver assessment in early intervention practice. The course offers the opportunity to learn assessment scales that examine the infant's sleep patterns, behaviors, and interactions with caregiver and the environment, including family functioning and social support. Clinical practice focuses on obtaining interobserver reliability in the use of scales. A minimum of ten home visits with a partner required.

543 Global Health: Trends and Policy (3:3:0). Survey of health challenges in the world today; their social, economic, and epidemiological causes; and the role and likely success of high-tech medicine, primary preventive health care, social manipulation, and aid, in alleviating the problems. (Lecture, seminar.)

550 Pathophysiologic Bases for Major Health Deviations of Individuals (3:3:0). Health deviations in individuals occurring in the U.S. that require long-term and/or terminal health-care interventions. Present within developmental framework, as they influence physiologic integrity at the cellular level. Focus on the human being as a whole open system. Complex health programs from the perspective of maintaining homeodynamics.

552 Diagnosis and Management of Health Deviations (5:3:6). Corequisite: HCS 206. Students must be admitted to the primary care major. Common health deviations are analyzed in the physiologic and pathophysiologic aspects of system functioning across the life span. Systematic assessment and management of health deviations foundational to clinical decision-making for nurse practitioners in primary care are presented. Lecture and clinical laboratory.

*554/HCS 207 Practicum in Advanced Health Assessment (1:0:3). Application of advanced health assessment skills and clinical decision making with adults of all ages in primary care settings. The performance of skills and techniques needed to collect data for comprehensive health assessment is emphasized in this supervised practicum by nurse practitioner faculty preceptors.

*Collected with George Washington University School of Medicine and Health Sciences.

570 Cultural Dimension of Aging (3:3:0). Impact of cultural definitions of aging, research methodologies, and findings of cross-cultural studies. Implications for health care and nursing.
594 Special Topics in Nursing (3:3:0). Selected topics analyzing specialized areas in nursing. Content varies. Lecture, seminar, laboratory/workshop.

610 Curriculum Development (3:3:0). Uses seminar/discussion forums to analyze and apply theory and principles for planning, developing, and evaluating curriculum. Examines curriculum as a creative process, a planning process, and a social process.

611 Anthropology of Health (3:3:0). Cross-cultural issues of health and illness are explored from the standpoint of medical anthropology theory. Cultural dimensions of the developmental cycle and health care systems.

621 Components of Health Appraisal (3:2:3). Principles, skills, and techniques in health appraisal of clients of all ages. Methods of recording, interpreting, and auditing problem-oriented profiles provide a framework for development of a health appraisal data base.

623 Clinical Concepts in Family Primary Care (3:3:0). Core Course. Pre- or corequisite: NURS 755. Analysis of the scope of the nurse practitioner role in the management of common family primary health-care problems across the lifecycle through advanced biopsychosocial assessment for health maintenance and promotion. (Lecture, seminar.)

625 Entrepreneurial Nursing Practice (3:3:0). Overview of designs for independent practice and their conceptual frameworks. Problems inherent in pioneering a private nursing practice are delineated with opportunities to explore innovative approaches and alternatives for independent nursing practice.

626 Nursing Informatics and Computer Systems (3:3:0). Study of information and data management in nursing and the application of computer systems to solve problems of nursing practice, education, administration, and research. Course focuses on generic concepts of information science and the use of computers to manage nursing health-care data, incorporating computing skills for using specific software packages.

631 Health Assessment of the Developing Family (3:2:7). Students must be admitted to the family nurse practitioner major. Prerequisite courses: NURS 552, NURS 554. Theoretical and clinical application of health assessment and clinical decision-making skills for neonates, infants, children, adolescents, childbearing women and fathers, and parent-child interactions in primary care settings. (Seminar, clinical practicum.)

637 Gerontological Nursing: Normal Aging and Health Deviations (3:3:0). Examines the biopsychosocial aspects of aging. Emphasis is placed on examining the effects of age changes and health deviations on the functional capacity of older persons. The focus on interventions and promotion of the elderly's capacity for self-care.

640 Interpersonal Dimensions in Nursing (3:3:0). Examination of interpersonal relationships in which nurses are involved in various aspects of nursing leadership and advanced professional practice. Relates theoretical foundations to the effective development of relationships within the framework of the nursing process.

650 Health Care and Law (3:3:0). Survey course designed to introduce students to the impact of courts and legislatures on rights and responsibilities of health-care consumers and health-care providers. Focus is on definitions of standards of care, legal theories of liability, and legally effectual consent.

654 Nursing Administration Financial Management (3:3:0). Investigation of managerial technologies related to the financial planning and control functions of mid-level nurse administrators. Content develops knowledge and skills prerequisite to effective participation in financial management as related to business plan development program budget planning, and control.

657 Perspectives in Nursing Education (3:3:0). Prerequisite: Admission to the graduate nursing program or post-master's studies. Uses seminar discussion approach to focus on philosophy and history of nursing education, principles of teaching and learning used in nursing, and current issues, trends, and research in nursing education.

658 Practicum and Seminar in Nursing Education (3:6:2:7). Prerequisite: Admission to the graduate nursing program or post-master's status; NURS 657, NURS 610, or EDCI 701. Uses seminar/discussion approach and practicum experience to analyze the role and functions of the nurse educator. Emphasis on the application of teaching strategies, legal, and ethical issues in nursing education.

659 Nursing and Health Care of Aging Persons and Persons with Chronic Illness (3:3:0). Prerequisite or corequisite to courses in majors for CHANGE students. Seminar and discussion focus on the biological, psychological, and sociocultural aspects of aging and chronic illness. Emphasis on examining the functional capacity of persons and capacity for self-care. (Lecture.)


662 Oncology Nursing: Clinical Concepts in Advanced Practice (3:3:0). Prerequisite or corequisite to courses in majors for CHANGE students. Seminar and discussion focus on advanced nursing practice for individuals diagnosed with cancer and their families. Emphasis on physical symptoms, functional capacities, psychosocial disruptions, and knowledge deficits. (Lecture.)

670 Quality Management in Health Care (3:3:0). Issues, trends, and methodologies in health care quality management as explored within a systems framework with emphasis on law, ethics, principles, tools and techniques, cost, strategic directions, and evaluation. Roles and responsibilities of the various levels of health care managers will be addressed. (Lecture, discussion.)

675 Practicum in the Primary Care of the Developing Family (3:2:7). Prerequisite courses: NURS 552, 554; HCS 206. Prerequisite or corequisite: NURS 631. Required course for Family Nurse Practitioner Major. Students will function in delivering primary care through assessment, clinical decision making, health maintenance and promotion for neonates, infants, children, adolescents, childbearing women, and fathers. (Seminar, clinical practicum.)
690 Independent Study in Nursing (1-3:0:0). Prerequisite: Admission to graduate nursing program and permission of associate dean for academic programs. In-depth study of a selected area of nursing theory, research, or practice under the direction of faculty. May be repeated but the total credit hours earned may not exceed three.

698 International Nursing: Theoretical and Practical Dimensions (3-3:0). International nursing organizations, programs, and projects in relation to comparative health care systems. Theoretical conceptualization, research approaches, and methodological issues in the development of international nursing.

699 Practicum in International Nursing (3:1:8). Prerequisite: NURS 698. Practicum in a selected international health agency. The nursing programs are analyzed using a health-care systems framework.

720 Practicum in Family Primary Care Nursing I (3:2:7). Required course in major. Prerequisite or corequisite: NURS 623. Performance of advanced clinical decision-making skills in assessment and the management of families and individuals across the life span with emphasis on health maintenance and health promotion. (Seminar, clinical practicum.)

722 Practicum in Family Primary Care Nursing II (6:2:16). Required course in family nurse practitioner major. Prerequisite NURS 720. Perform advanced clinical decision making in the role of the family nurse practitioner. Family primary care problems throughout the life span are assessed and managed particularly with elderly, and medically underserved members. (Seminar, clinical practicum.)

746 Practicum in Primary Care Nursing I (3:2:7). Prerequisite or corequisite: NURS 622 and 755. Analysis of the scope of the nurse practitioner role in the management of adult primary care. An integrated approach to the assessment and management of common physical and psychosocial health-care problems. Advanced skills in biopsychosocial assessment and development of plans for health maintenance. Clinical specialty track option for primary care of adults or the elderly.

748 Practicum in Primary Care Nursing II (6:2:16). Prerequisite: NURS 746. The nurse practitioner student progressively assumes increased responsibility in the delivery of primary care (to the elderly and other adult medically underserved groups). Clinical specialty track option for primary care of adults or the elderly in a one-semester practicum.

750 Legal Issues Relevant to Health Care Administration (3:3:0). An examination of federal, state, and local statutes and regulations that impinge upon the operation of health-care agencies and health-care education enterprises.

755 Theoretical Foundations Related to Nursing (3:3:0). Prerequisite: Admission to graduate nursing program. Assumptions, concepts, and propositions inherent in selected nursing and related discipline theories.

759 Approaches to Data Analysis in Nursing Research (3:3:0). Prerequisite: Admission to graduate nursing program. Examination of univariate and bivariate procedures appropriate for analyzing nursing research data. Emphasis on selection, application, and computerization of procedures in relation to level of data and type and size of sample in nursing research. Course includes lecture and computer lab.

760 Health Care Financial Management (3:3:0). Prerequisite: Admission to the graduate nursing program or master's degree. Investigation of selected theory and techniques of accounting and financial management in health care administration. Develops the knowledge and skills prerequisite to effective participation in a health institution's financial planning and analysis. Course includes lecture, seminar, case study, and microcomputing experience.

763 Administrative Theory in Nursing (3:3:0). Prerequisite: Admission to graduate nursing program. NURS 755 and Management/Organizational Theory are pre- or corequisites. Utilization of administrative theory and management principles and processes as related to roles and functions of the nurse in management in health-related agencies.

765 Practicum in Nursing Administration I (3:1:8). Prerequisite: Admission to graduate nursing program; NURS 755. Pre- or corequisite: NURS 763. Application of administrative theory and management principles and processes in a selected health-related agency. Roles and functions of the nurse in management. Lab arranged.

766 Administrative Strategies in Nursing (3:3:0). Prerequisite: NURS 763. Roles and functions of the nurse in management as the nurse manager develops patterns of nursing care, articulating nursing education and nursing service.

768 Practicum in Nursing Administration II (3:1:8). Prerequisite: NURS 763, 765. NURS 766 is pre- or corequisite. Implementation and integration of the roles and functions of the nurse in management. Emphasis on using appropriate management principles and processes in a selected health-related agency. Lab arranged.

773 Advanced Clinical Nursing I (3:3:0). Prerequisite: Admission to graduate nursing program. Pre- or corequisite: NURS 550, 755. Foundation theory relevant to the practice of specialized advanced clinical nursing in a variety of health care settings. Focus on nursing practice issues and concepts influencing care of adults and their families with existing or potential health problems.

775 Advanced Specialty Practice I (3:2:7). Prerequisite: Admission to graduate nursing program and NURS 755. Pre- or corequisite: NURS 773. Opportunity to apply the nursing process as it relates to the care of individuals and families with existing or potential long-term health problems in a selected clinical setting. Lab arranged. Students in the Medicare Bridge Program have concentrated clinical experience.

776 Advanced Clinical Nursing II (3:3:0). Prerequisite: NURS 773. Expansion of selected content in long-term care as it relates to advanced clinical nursing practice. Collaboration with other health-care providers in groups and communities is examined. Emphasis on evaluation of nursing care and advanced standards of practice.

778 Advanced Specialty Practice II (3:2:7). Prerequisite: NURS 773, 775; NURS 776 is pre- or corequisite. Opportunity to apply roles of advanced nurse clinician in a selected clinical setting. Lab arranged. Students in the Medicare Bridge Program have concentrated clinical experience.
790 Principles and Methods of Nursing Research (3:3:0). Prerequisite: Admission to graduate nursing program. Pre- or corequisite: NURS 755. Principles and methods of nursing research applied to problem identification, research design, and data collection and measurement.

791 Projects in Nursing Research (3:0:0). Prerequisite: NURS 790. Pre- or corequisite: NURS 739. Research projects by students, individually or in groups, under direction of faculty.

865 Internship in Health Care Administration (6:1:17). Experiential learning in nursing administration in an educational or service enterprise (depending on concentration chosen). The internship spans two consecutive semesters and includes planned seminars.

866 Health Care Public Policy (3:3:0). Focus on the process of formulating health-care policy and analyzing its implications for nursing administration in nursing education and nursing service. Current and impending health issues, the legislative process, and program implementation evaluation will be examined.

870 Seminar in Health Care Administration I (3:3:0). Examination of forces influencing the roles of executives in health care education and health care delivery. Topics include governance, ideologies, theories of management and leadership, intergovernmental relations, decision making, and ethics.

871 Seminar in Health Care Administration II (3:3:0). Prerequisite: NURS 870. Continuation of NURS 870. Topics include human resource management, health economics, strategic management, research utilization, professional issues, and ethics.

955 Nursing Science (3:3:0). Prerequisite: Admission to Ph.D. program. A critical assessment and synthesis of the process of development and testing of theoretical foundation of nursing science.

992 Design in Nursing Research (3:3:0). Prerequisite: NURS 955. Pre- or corequisite: Intermediate statistics. Comprehensive examination of experimental and nonexperimental research designs and their use in nursing studies. (Lecture, discussion.)

993 Advanced Methods in Nursing Research (3:3:0). Prerequisite: NURS 992, and Intermediate statistics. Examination of advanced principles and special problems in research methodology from the formulation of the research question through the analysis of data and interpretation of findings. Emphasis on measurement as it relates to nursing research and health policy research. (Lecture, discussion.)

994 Nursing Research Seminar (3:3:0). Prerequisite: NURS 993. Seminar for doctoral students to accompany the development of a research proposal. Discussion of the development of the research problem with analysis and critique of methodology.

999 Doctoral Dissertation (9:0:0). Prerequisite: NURS 994. This course provides continued faculty assistance on an individual basis toward the completion of the approved dissertation.

George Washington University Courses:

PHARM 207 Pharmacology (4:4:0). Drugs and their actions. Principles of pharmacology and drugs, including their therapeutic and toxic action and their fate in the body. Admission by permission of instructor.

HCS 206 Clinical Decision Making (2:2:0). Corequisite: NURS 552. Analysis of varied cases using student participation in decision-making formulation. Students learn to correlate pathophysiology with symptom manifestation. Emphasis on interpretation of historical and physical examination data, laboratory data and radiographic studies relevant to the health problems discussed. Appropriate pharmacologic and nonpharmacologic therapies are discussed, in conjunction with the theoretical basis for selection of specific therapies.

Graduate Certificate in Gerontology

Committee: Rita Ailinger, Frieda Butler (Chair), Molly Davis, Eileen Fuerbach, Douglas Hershey, Aliza Kolker, Robert Ruhling, B. J. Schuchman, James Willett

Programs of Study

The Graduate Certificate in Gerontology is housed in the College of Nursing and Health Science. The certificate program combines theoretical and applied course work in aging with the student’s graduate curriculum in one of several departments. Since gerontology is by definition multidisciplinary, students in the program are required to take course work outside their major field. Various academic units participate in the program: College of Nursing and Health Science, Psychology, and Sociology and Anthropology. The program is administered by the college and supervised by a committee with representatives from the participating academic units.

Program Requirements

Students applying to the certificate program must be enrolled in graduate degree status or hold a master's degree in a related discipline. Students who already hold master's degrees must choose an area of specialization and should be enrolled in nondegree status for graduate study. The certificate requires 18 credit hours of graduate course work: 6 credit hours in the major or area of specialization, 6 credit hours outside the major, and 6 credits of practicum. A maximum of 3 credit hours may be transferred from outside the university. For more information, call (703) 993-1911/1912.
Centers and Institutes
Centers and Institutes

Computational Sciences and Informatics

Associate Faculty

Anderson, Evan, Ph.D., Cornell University, 1970; Distinguished Professor. Decision Sciences.

Andrykovitch, George E., Ph.D., University of Maryland, 1968; Associate Professor. Biology.

Ashany, Ron, Ph.D., Polytechnical Institute of Brooklyn, 1976; Research Professor. Computer Science.

Beall, Jim, Ph.D., University of Maryland, 1979; Senior Contract Professor. Astrophysics and Space Sciences.

Becker, Peter, Ph.D., University of Colorado, 1987; Assistant Professor. Astrophysics.

Black, W. Murray, Ph.D., Pennsylvania State University, 1971; Associate Professor. Electrical Engineering Materials Science.

Blaisen-Barojas, Estela, Ph.D., Universite de Paris VI, 1974; Professor. Computational Physical Chemistry and Condensed Matter.

Bolstein, Richard A., Ph.D., Purdue University, 1967; Associate Professor. Statistics.

Botkin, Daniel, Ph.D. Rutgers University, 1968; Professor. Global Change.

Carr, Daniel, Ph.D., University of Wisconsin, 1976; Associate Professor. Computational Statistics.

Cepperly, Peter H., Ph.D., Stanford University, 1973; Associate Professor. Physics.

Chandhoke, Vikas, Ph.D., University of Mains, 1991; Supervisor, SRIF. Biology.

Davis, Stephen, Ph.D., Yale University, 1976; Associate Professor. Quantum Chemistry and Spectroscopy.

Denning, Peter J., Ph.D., Massachusetts Institute of Technology, 1968; Professor. Computer Science.

Drukier, Andrzej, Ph.D., Niels Bohr University, 1972; Research Professor. Experimental Physics.

Dworzecka, Maria, Ph.D., Warsaw University, 1969; Professor. Nuclear and Computational Physics.

Ehrlich, Robert, Ph.D., Columbia Univ., 1964; Professor. Physics.

Ellsworth, Robert, Ph.D., University of Rochester, 1965; Professor. High Energy Particle Physics.

Evans, John C., Ph.D., University of Michigan, 1966; Associate Professor. Physics.

Foster, Gregory D., Ph.D., Univ. of California, 1985; Associate Professor. Environmental Chemistry.

Geldzhaler, Barry, Ph.D., University of Pennsylvania, 1980; Research Associate Professor. Astrophysics and Space Sciences.

Gentle, James E., Ph.D., Texas A&M, 1973; Professor. Computational Statistics.

George David G., Ph.D., Temple University, 1984; Affiliate Associate Professor. Computational Sciences and Bioinformatics.

Gilleveit, Patrick M., University of Manitoba, 1982; Affiliate Associate Professor. Molecular Biology.


Guillory, John, Ph.D., University of California, 1970; Senior Contract Professor. Plasma Science.

Haack, Barry, Ph.D., University of Michigan, 1977; Associate Professor. Geography.

Hertz, Paul, Ph.D., Harvard University, 1983; Senior Associate Professor. Astrophysics, Statistical Astronomy.

Hunter, Lawrence, Ph.D., Yale University, 1989; Senior Contract Professor, Machine Learning and Molecular Biology.

Ioannou, Dimitris E., Ph.D., University of Manchester, 1978; Professor. Electrical Engineering.
Jensen, Craig, Ph.D., University of Utah, 1983; Research Associate Professor. Nuclear Engineering and Space Sciences.

Jones, R. Chris, Ph.D., University of Wisconsin, 1980; Associate Professor. Environmental Biology.

Kafatos, Menas, Ph.D., Massachusetts Institute of Technology, 1972; Professor. Astrophysics and Space Sciences.

Kan, Ittai, Ph.D., University of Illinois, 1984; Associate Professor. Dynamical Systems.

Kerschberg, Larry, Ph.D. Case Western, 1969; Professor. Software Engineering and Intelligent Data Bases.

Leib, B. Joseph, Ph.D., William and Mary, 1971; Professor. Experimental Nuclear Physics.

Lim, Tech-Cheong, Ph.D., Dalhousie Univ., 1974; Associate Professor. Mathematics and Functional Analysis.

Lin, Jeng-Eng, Ph.D., Brown University, 1976; Associate Professor. Partial Differential Equations and Neural Networks.

Lohner, Rainald, Ph.D., University College of Swansea, Wales, U.K., 1984; Professor. Computational Fluid Dynamics.

Loustauau, Philippe, Ph.D., Univ. of Wisconsin, 1988; Associate Professor. Computer Algebra.

Manitius, Andrzej Z., Ph.D., Polytechnical University, Warsaw, 1968; Professor. Control Theory and Dynamics.

Michaels, George, Ph.D., University of Florida, 1985; Associate Professor. Molecular Biology and Bioinformatics.

Michalski, Ryzard, Ph.D., Polytechnical University of Silesia, Poland, 1969; Professor. Artificial Intelligence.

Miller, John J., Ph.D., Stanford University, 1974; Associate Professor. Statistics.

Mones-Hattal, Barbara, M.F.A., Rhode Island School of Design, 1979; Associate Professor. Art.

Moore, John H., Ph.D., University of Virginia, 1966; Professor. Economics.

Morowitz, Harold, Ph.D., Yale University, 1951; Robinson Professor. Biology.

Mushrush, George W., Ph.D., George Washington University, 1968; Professor. Fuels Chemistry.

Nash, Stephen G., Ph.D., Stanford University, 1982; Associate Professor. Operations Research.

Nemiroff, Robert, Ph.D., University of Pennsylvania, 1987; Research Assistant Professor. Astrophysics.

Norris, Eugene, Ph.D., University of Florida, 1969; Associate Professor. Computer Science.

Ozernoy, Leonid, Ph.D., Sternberg Astronomical Institute, 1966; Senior Contract Professor. Astrophysics and Space Sciences.


Rine, David, Ph.D., University of Iowa, 1970; Professor. Computer Science.

Sachs, Robert L., Ph.D., Courant Institute, 1980; Associate Professor. Nonlinear Partial Differential Equations.

Saperstone, Stephen H., Ph.D., Univ. of Maryland, 1970; Professor. Ordinary Differential Equations.

Satija, Indubala, Ph.D., Columbia University, 1983; Associate Professor. Nonlinear Dynamics.

Sauer, Timothy D., Ph.D., University of California, 1982; Associate Professor. Chaos and Dynamical Systems.

Shipley, Scott, Ph.D., University of Wisconsin, 1978; Adjunct Associate Professor. Remote Sensing.

Shukla, Jagadish, Ph.D., Banaras Hindu University, 1971; Adjunct Professor. Earth Systems and Global Change.


Soyfer, Valery N., Ph.D., Byelorussia State University, 1974; Distinguished Professor. Molecular Biology.

Spikell, Mark A., Ed.D., Boston University, 1972; Professor, Education.

Struppa, Daniele C., Ph.D., University of Maryland, 1981; Professor. Complex Analysis.

Summers, Mike, Ph.D., California Institute of Technology, 1985; Adjunct Associate Professor. Atmospheric Physics.

Sutton, Clifton, Ph.D., Stanford University, 1987; Assistant Professor. Statistics.

Taub, Steven R., Ph.D., Indiana University, 1960; Professor. Biology.


Trefill, James, Ph.D., Stanford University, 1966; Robinson Professor of Physics. Physics.
Walbridge, Mark R., Ph.D., University of North Carolina, 1986; Assistant Professor. Biology.
Wallin, John, Ph.D., Iowa State University, 1989; Assistant Professor. Astronomy and Astrophysics.
Wang, Pearl, Ph.D., University of Wisconsin, 1980; Associate Professor. Computer Science.
Wechsler, Harry, Ph.D., University of California, 1975; Professor. Computer Vision.
Wegman, Edward J., Ph.D., University of Iowa, 1968; Dunn Professor. Computational Statistics.
Willett, James D., Ph.D., Massachusetts Institute of Technology, 1965; Professor. Biochemistry.
Wood, Joseph S., Ph.D. Pennsylvania State University, 1978; Associate Professor. Geography.
Wood, Kent, Ph.D., Massachusetts Institute of Technology, 1973; Senior Contract Professor. Astrophysics and Space Sciences.
Zoltek, Stanley M., Ph.D., State University of New York, 1976; Associate Professor. Differential Geometry.

Computational Sciences and Informatics, Ph.D.

The Institute for Computational Sciences and Informatics has been established to address today's role of computation in science, mathematics, and engineering. Computational sciences is defined as the systematic development and application of computing systems and computational solution techniques to models of scientific and engineering phenomena; informatics is defined as the systematic development and application of computing systems and computational solution techniques analyzing data obtained by experiments, modeling, database search, and instrumentation.

Computing is now part of a triad with theory and experiment as a means of investigation, and it provides insight and leads to understanding that, in many cases, theory or experiment cannot. The multidisciplinary activities of the Institute respond to this new role for computation, and the Institute seeks to integrate computation among the sciences, mathematics, and engineering to produce new knowledge and understanding about, and approaches to, the research and educational possibilities to be found in nature's complex systems.

Computation is recognized as a central feature of the instructional and research program of the Institute for Computational Science and Informatics. The Institute, therefore, seeks to establish world class computational facilities consistent with funding available through the university and through other sources in cooperation with the University Computing and Information Systems organization.

The CSI Graduate Instructional Computing Facility located in 228 Science and Technology Building I is intended for general usage by CSI students, faculty and staff, and for other students taking CSI courses. The Facility is available on an occasional basis to instructors but because there is a need to maintain access for students, general use of the facility for course instruction will be limited. The Facility will generally be available for use from 7:00 a.m. until midnight, seven days a week.

The Facility currently houses eleven NeXT stations (25 megahertz 68040 processors), nine Silicon Graphics Indigos (50 megahertz R4000 processors), two IBM RT workstations, one Hewlett Packard 9000 (68020 processor), a DOS machine (33 megahertz 486 processor), and a networked laser printer which supports postscript printing. The Institute has access to its own Intel Paragon massively parallel computer; currently, the Center for Computational Statistics makes its Intel iPSC/2 16-node vector machine available for research and instructional purposes. This machine supports both the FORTRAN and C languages, is equipped with a vectorizing pre-compiler for FORTRAN and is available over the network. Several research platforms are available to students in specialty tracks such as bioinformatics and Space Sciences.

All CSI students are issued accounts and access to the instructional facility upon enrolling in the Graduate Program.

Admission Requirements

Students interested in applying to the doctoral program in Computational Sciences and Informatics should have an academic background in material sciences, engineering, math, computer science, or nocturnal science. The undergraduate degree should be from an accredited institution, and applicants should have earned a GPA of at least 3.0 in their last 60 hours of study. Applicants should forward a completed George Mason University Graduate Application, two transcripts from each college and graduate institution attended, three letters of recommendation, and a Goals Statement to the Office of Admissions. It is recommended that applicants submit scores from the GRE-GEN and GRE-SUB if they earned their baccalaureate within the last five years. The GRE-SUB is recommended if it is given in the student's undergraduate major subject area. If the undergraduate degree was earned more than five years
 ago, students should submit a resume or statement of work experience. TOEFL Scores are required for all foreign applicants. Those who are also applying for fellowships must have complete applications submitted by March 1; all other applications are due by April 1.

**Degree Requirements**

The doctoral program provides interdisciplinary research opportunities spanning, but not limited to, such specialty areas as: computational astrophysics, computational material science, computational biology (bioinformatics), computational chemistry, computational fluid dynamics, computational mathematics, computational physics and computational materials science, space sciences, computational statistics, and earth systems and global change.

The program emphasizes three intellectual elements: common computational science topics; computationally intensive courses in specific areas of scientific interest; and doctoral research. Interested individuals should have a bachelor's degree in either science, mathematics, engineering, or computer science. The program requires 72 credit hours beyond the baccalaureate degree with the following minimum credit hours in the following:

1. 12 hours of common computational sciences and informatics courses;
2. 12 hours from required courses in one of the areas of interest;
3. 12 hours in electives from specialty courses in one of the areas;
4. 12 hours from either additional computational topics, specialty research, individualized study based on professional experience and research, transfer credit, or other electives; and
5. 24 hours in dissertation research.

For those holding a master's degree, the 72 hours required may be reduced by up to 24 hours depending on courses previously completed. Scheduled courses and sequences accommodate part-time students, with courses offered in the late afternoon or early evening four nights a week.

Applicants are encouraged to apply their knowledge to a broad range of natural science problems using extensive computational knowledge and techniques missing from the more traditional degree programs in science and mathematics. The close relationship of the doctoral program to the research and development activities in federal laboratories, scientific institutions, and high-technology firms affords students opportunities for continuing or new employment.

Specific program requirements are as follows:

1. Common computational sciences and informatics core of 12 credit hours that includes CSI 801, 803, and 810; the remaining 3 credit hours are chosen from the following as appropriate for the doctoral research direction.
2. Required scientific core of at least 12 credit hours from:
   - **Computational Biology**: BIOL 552, 657, 646, 650, 752, 753; CSI 650, 651, 717, 728, 771, 806.
   - **Computational Chemistry**: PHYS 502, 510, 513 or 722, CHEM 711, 732, 736, 737, CSI 735, 768.
   - **Earth Systems and Global Change**: PHYS 575, GECA 553; BIOL 650, CSI 750.
   - **Computational Mathematics**: CSI 718, MATH 677 or 678, 676 or 778, and one or more of the following: MATH 661, 676, 747, 778; CSI 741, 747, 748, 806, 842, 846, 847, 848.
   - **Computational Physics**: PHYS 510, 732, 722 or 513, and 736 or 888.

3. **Computational Statistics**: CSI 773, 876, 877, 972, 973.

   - **Space Sciences**: ASTR 530, PHYS 575; and one or more of the following: PHYS 510, 732 or 736, 513 or 722.

4. Electives, after consultation with advisor, from specialty courses. The list includes 12 credit hours from but not limited to the following:
   - **Computational Biology**: CSI 651, 739; BIOL 680, 692 or 694; PHYS 688, 702; FRLN 680; any CHEM 600 or above.
   - **Computational Chemistry**: Determined after consultation with advisor.
   - **Earth Systems and Global Change**: PHYS 676; GECA 579, 652; CHEM 551; BIOL 741, 865; PUAD 739, 610; INFT 833.
   - **Computational Mathematics**: Determined after consultation with advisor.
   - **Computational Physics**: PHYS 613, 701, 705, 711, 736, 780; CSI 741, 888.

5. **Computational Statistics**: STAT 655, 656, 657, 658, 662, 663; ASTR 532, 535; PHYS 676; CSI 721, 761, 764, 765, 766, 780, 781, 861, 865, 873.

6. After consultation with advisor, 12 credit hours from: additional computational core courses; specialty research; individualized study based on professional experience and research; transfer credit; or other electives.

7. Dissertation research of at least 24 credit hours (CSI 998, 999).
Computational Sciences and Informatics Courses (CSI)

650 Bioinformatics I (3:3:0). Prerequisites: General chemistry, general physics, organic chemistry, calculus. An intensive review of those aspects of organic chemistry and biochemistry necessary to begin research in bioinformatics and to enter graduate courses in biology. Covalent bonding, quantum mechanical basis of bond formation, three-dimensional structure of molecules, reaction mechanisms, catalysis, polymers, enzymes, thermodynamic and kinetic foundations, metabolic pathways, sequence and structure of macromolecules. This course will make extensive use of computer approaches to convey the essential computational and visual nature of the material to be covered.

651 Bioinformatics II (3:3:0). Prerequisites: Bioinformatics I, general chemistry, general physics, organic chemistry, calculus, or permission of instructor. An intensive review of those aspects of biochemistry, molecular biology and cell biology necessary to begin research in bioinformatics and to enter graduate courses in biology. The areas covered will include cell structure, intracellular sorting, cellular signalling (i.e., receptors), Cytoskeleton, cell cycle, DNA replication, transcription, translation. This course will make extensive use of computer approaches to convey the essential computational and visual nature of the material to be covered.

717 Numerical Methods (3:3:0). Prerequisites: Math 214, Math 303, and some programming experience. Computational techniques for the solution of problems arising in science and engineering. Algorithms are developed for the treatment of typical problems in applications with special emphasis on the type of data encountered in practice. This includes theoretical development as well as implementation, efficiency, and accuracy issues in using algorithms and interpreting the results. When applicable, computer graphical techniques are used to enhance interpretation of results through visualization.


721 Computational Fluid Dynamics I (3:3:0). Prerequisites: Course in Partial Differential Equations such as MATH 676 or equivalent, knowledge of Linear Algebra (i.e., MATH 603 or MATH 625), coding experience in FORTRAN or C, or permission of instructor. This course teaches the fundamentals of Computational Fluid Dynamics, covering: Spatial and Temporal Approximation Techniques for Partial Differential Equations, Solution of Large Systems of Equations, Data Structures, Solvers of the Laplace/Full Potential Equation, Euler and Navier-Stokes solvers, Grid Generation, Adaptive Mesh Refinement, Efficient Use of Supercomputer Hardware and Future Trends.

722 Computational Fluid Dynamics II (3:3:0). Prerequisites: CSI 721 or permission of instructor. This course teaches the fundamentals of Computational Fluid Dy-
749 Topics in Computational Mathematics (3:3:0). Prerequisites: CHEM 533, PHYS 510, or Permission of instructor. Selected topics in computational physical chemistry not covered in fixed-content courses in computational condensed matter, materials sciences, dynamical systems, molecular physics. May be repeated for credit as needed. Possible topics that might be considered under this offering: Models of disorder, chemical disorder, order-disorder transformations in spin systems, order parameters, formation of glasses, random sphere packing, vibrations in solids, Anderson localization, model Hamiltonians to represent phonons, bosons, magnons, excitons, fermions.

750 Earth Systems and Global Changes (3:3:0). Prerequisites: Course in ecology, environmental geology, atmospheric physics, or permission of instructor. This course provides an introduction to the global system interactions responsible for global environmental change. Emphasis will be on those concepts that provide a global description of the earth system and on the basic environmental processes that influence global change. The course will discuss the natural causes of past and present global changes, how human activities affect these global system changes, and the ecological and human consequences of these global changes. Topics to be discussed include climate and hydrological systems, ecological system dynamics, earth system history, human interactions, solid earth processes, and solar influences. An introduction to climate and global change monitoring, satellite instrumentation and calibration, and model predictions.

759 Topics in Earth Systems and Global Changes (3:3:0). Prerequisites: Permission of instructor. Selected topics in earth systems and global changes not covered in fixed-content earth systems/global changes courses. May be repeated for credit as needed.

761 N-Body Methods and Particle Simulations (3:3:0). Prerequisites: CSI 801 or permission of instructor. Study of particle methods as a tool in solving a variety of physical systems. Study and development of the numerical results and visualization of these results in complex physical systems will be emphasized. Applications and projects will include stellar and galaxy dynamics, smoothed particle hydrodynamics, plasma simulations, and semiconductor device theory. Algorithms on parallel and vectorized systems will be included.

764 Computational Astrophysics (3:3:0). Prerequisites: PHYS 530. Study of statistical mechanical concepts important in astrophysics. Presentation of unified approach to particle acceleration and inter-action theory based on analytical and numerical analysis of Boltzmann and Liouville equations. Discussion of computational methods relevant for particle transport problems, with emphasis on Fokker-Planck and Monte-Carlo solution techniques. Applications from space sciences will include studies of cosmic ray acceleration, photon Comptonization, particle transport in the near-Earth environment, energy transport in stellar atmospheres, and self-gravitating system dynamics.


768 Molecular Dynamics Modeling (3:3:0). Prerequisites: PHYS 510 or CHEM 533, or Permission of Instructor. An introduction to simulation methods used in the physical chemistry sciences. Computational approaches to model molecular and condensed matter systems including interatomic and molecular potentials, molecular dynamics, time averages, ensemble distributions, numerical sampling, thermodynamic functions, response theory, transport coefficients, dynamic structure. Stochastic simulations such as Brownian motion, Langevin dynamics, Monte Carlo methods and random walks, introduction to cellular automata is included.

769 Topics in Space Sciences (3:3:0). Prerequisites: Permission of instructor. Selected topics in space sciences not covered in fixed-content space sciences courses. May be repeated for credit as needed.

771 Computational Statistics (3:3:0). Prerequisites: STAT 644 and STAT 652. This course covers the basic computationally intensive statistical methods and related methods which would not be feasible without modern computational resources. This course covers nonparametric density estimation including kernel methods, orthogonal series methods and multivariate methods, recursive methods, cross-validation, nonparametric regression, penalized smoothing splines, the jackknife and boot-strapping, computational aspects of exploratory methods including the grand tour, projection pursuit, alternating conditional expectations and inverse regression methods.

773 Exploratory Data Analysis (3:3:0). Prerequisites: Undergraduate course in statistics. Specific topics in data analysis. Students learn a variety of techniques for better understanding data. Many of the techniques are descriptive. Exploratory data analysis provides a reliable alternative to classical statistical techniques designed to be the best possible when stringent assumptions apply.

776 Stochastic Calculus (3:3:0). Prerequisites: STAT 652 or OR 645 or ECE 630 or ECE 632 or permission of instructor. Introduction to modern theory of stochastic calculus such as stochastic integrals, martingales, counting processes, diffusion processes and Ito-type processes in general. Applications of these methods to engineering, biology, and economics are considered in some detail.

778 Measure and Linear Spaces I (3:3:0). Prerequisites: STAT 652 or ECE 620 or 621 or 630 or permission of instructor. Measure theory and the theory of linear spaces such as Banach spaces, Hilbert spaces and Sobolev spaces for their mathematical foundation. This course focuses on the elements of measure theory and integration including theory of measure spaces $\sigma$-fields, measures measurability, convergence theorems including Fatou's lemma and Radon-Nikodym derivatives. Also covered are the theory of linear spaces including basic axioms geometry of function spaces, Cauchy sequences and completeness, normed linear spaces, inner product spaces, bases, Banach and Hilbert spaces, null and dual spaces.

http://catalog.gmu.edu
779 Topics in Computational Statistics (3:3:0). Prerequisites: Permission of instructor. Selected topics in computational statistics not covered in fixed-content computational statistics courses. May be repeated for credit as needed.

781 Plasma Science (3:3:0). Prerequisites: PHYS 513 or PHYS 722, PHYS 711 or CHEM 711; or permission of instructor. Study of ionized matter, theory and some computation, with application to astrophysics, industrial plasma processing, magnetosphere and ionosphere problems. Vlasov and fluid equations are derived and applied in Plasma Science, which begins with the study of waves in plasmas, with and without magnetic fields.

789 Topics in Computational Physics (3:3:0). Prerequisites: Permission of instructor. Selected topics in computational physics not covered in fixed-content computational physics courses. May be repeated for credit as needed.

790 Topics in Computational Sciences and Informatics (3:3:0). Prerequisites: Admission to masters program and permission of instructor. Selected topics in computational sciences and informatics not covered in fixed-content computational sciences and informatics courses. May be repeated for credit as needed.

796 Directed Reading and Research (3:3:0). Prerequisites: Permission of instructor. Reading and research on a specific topic in computational sciences and informatics under the direction of a faculty member. May be repeated as necessary.

801 Foundations of Computational Science (3:3:0). Prerequisite: CS 735 or equivalent. Investigation methods for scientific questions in the presence of terasop computation, gigabyte memory, and gigabit transmission. Mapping of mathematical models to parallel algorithm and architectures, associated data structures, languages, operating systems, networks, and visualization methods. Case studies in bioinformatics, space science, physics, and global change will demonstrate important scientific accomplishments enabled by computation. Working in teams including scientists and information technologists, students will learn the mathematical models, abstract algorithms, and concrete algorithms for these cases, and will conduct experiments and simulations with them.

803 Scientific and Statistical Visualization (3:3:0). Prerequisites: STAT 654 or STAT 663 or STAT 751 or CS 651 or permission of instructor. Visualization methods provide new insights and intuition concerning measurements of natural phenomena and scientific and mathematical models. The course will present case study examples from a variety of disciplines to illustrate what can be done. Course topics include human perception and cognition, an introduction to the graphics laboratory, elements of graphing data, representation of space-time and vector variables, representation of 3-D and higher dimensional data, dynamic graphical methods, and virtual reality. Students are required to work on a visualization project. The course emphasizes software tools on the Silicon Graphics workstation but other workstations and software may be used for the project.

806 Symbolic Computation (3:3:0). Prerequisites: An undergraduate degree in a scientific discipline. The course will provide an introduction to the representation of integers, fractions, polynomials, algebraic and review some symbolic algorithms using modular and p-adic methods, and then cover formal integration and algebraic and asymptotic solutions of ordinary differential equations. Students will be expected to complete a project.

810 Scientific Databases (3:3:0). Prerequisites: INF S 714 or equivalent; or permission of instructor. Study of database support for scientific data management. Requirements and properties of scientific databases; data models for statistical and scientific databases; semantic and object-oriented modeling of application domains; statistical database query languages and query optimization; advanced logic query languages; and case studies such as the human genome project and earth orbiting satellite.

840 The Mathematics of the Finite Element Method (3:3:0). Prerequisites: MATH 675, 676. The finite element method is a commonly used technique for developing numerical approximations to problems involving ordinary and partial differential equations. This course will develop the underlying mathematical foundation for the method, examine several specific types of finite elements, analyze the convergence rates and approximation properties of the method, and use it to solve a number of important equations. Students will develop their own codes and are expected to complete independent projects.

842 Linear and Nonlinear Modeling in the Natural Sciences (3:3:0). Prerequisites: Permission of instructor. This course will develop the tools of mathematical modeling, while simultaneously carrying out numerical simulations of the models. Examples from across the sciences will be considered throughout the course. Topics include: basic issues (models, simplification, linearity and nonlinearity); dimensionless parameters, dimensional analysis; models involving differential equations; examples from population growth, chemical kinetics; models involving partial differential equations; diffusion; transport; nonlinearity and shocks; probabilistic modelling; perturbation methods; extrapolation; introduction to stability.

847 Wavelet Theory (3:3:0). Prerequisites: Knowledge of convolution and Fourier transforms of sequences; some familiarity with Hilbert space theory helpful but not required. Knowledge of a scientific programming language. Study of the theory and computational aspects of wavelets and the wavelet transform. The course will first emphasize computational aspects of wavelets, defining the Fast Wavelet Transform in one and two dimensions and developing the appropriate numerical algorithms. Then the course will develop the theory of wavelet bases on the real line, discussing Multiresolution Analysis, Splines, time-frequency localization, and wavelet packets.

848 Mathematical Tomography (3:3:0). Prerequisites: MATH 675. Physical principles of tomography; the Radon transform in Euclidean space, inversion formulas, the Radon transform on distributions; integral geometry and generalized Radon transforms, the Radon transform on symmetric spaces; applications to CAT, PET, radar imaging and synthetic aperture radar.

861 Accretion Astrophysics (3:3:0). Prerequisites: CSI 764 or CSI 765 or permission of instructor. This course examines the overall phenomenon of accretion in astrophysical sources and relevant topics of current observational and theoretical interest such as: accretion as a source of energy; gas dynamics and radiative processes including
inverse Compton, synchrotron, bremsstrahlung and line cooling; accretion in binary stars; accretion disk theory, X-ray and directed motion such as jets and beams; galactic compact sources and observations of X-ray emission from such objects; quasars and active galactic nuclei (AGN); accretion onto supermassive black holes; recent observations of gamma-ray emission from galactic compact sources and AGN using satellites; elements of general relativistic treatment of accretion onto black holes and theory of thin disks. Other low-energy accreting sources such as protoplanetary nebulae and bimodal flows will also be examined.

865 Visualization and Modeling of Earth Systems and Space Sciences Data (3:3:0). Prerequisites: CSI 803. Investigation of methods of analysis of large complex data bases and the models derived to explain such data using computer-aided visualization and analysis (CAVA). Discussion of gradient, divergence, and curl engines with respect to graphical analysis of data and development of system models using these same engines. Study of multidimensional rotation, projections, and slicing engines with respect to CAVA. Discussion of multidimensional presentations of data using rotation engines. Study of correlation function and time series analyses using multidimensional rotation engines. Multidimensional analysis of data using chi-squared and other statistical tests. Presentation of Fourier transforms, wavelet analysis, and Scargle deconvolution algorithm techniques. Multidimensional analysis of astronomical catalog data and remote sensing data applicable to earth systems and global changes.

873 Statistical Methods in Astronomy (3:3:0). Prerequisites: PHYS 530, or permission of instructor. Study of statistical methods applicable to problems in modern astronomy and astrophysics. Course will include time series analysis, parametric and non-parametric hypothesis testing, parameter estimating, spatial analysis, and image analysis. Emphasis will be placed on the imperfect nature of actual data sets and hypotheses. Examples will be drawn from areas of current astrophysical interest.

876 Measure and Linear Spaces II (3:3:0). Prerequisites: INFT 776/CSI 778 or permission of instructor. This course will cover advanced topics in measure theory, linear spaces and functional analysis such as reproducing kernels and adjoint operators, spectral theory for operators, special spaces such as Sobolev spaces, topics in wavelets, applications to stochastic processes and nonparametric functional inference.

877 Geometric Methods in Statistics (3:3:0). Prerequisites: STAT 751 or permission of instructor. Modern multivariate statistical methods including visualization of multivariable data rely on geometric insight and methods. This course develops the foundations of geometric methods for statistics. Topics include n-dimensional Euclidean geometry, projective geometry, differential geometry including curves, surfaces and n-dimensional differentiable manifolds, and computational geometry including computation of convex hulls, tessellations of 2-, 3- and n-dimensional spaces and finite element grid generation. Examples include applications to scientific visualization.

879 Advanced Topics in Plasma Science (3:3:0). Prerequisites: CSI 781 or permission of instructor. This is the second course in Plasma Science. Part I studies ionized matter, theory and some computation, with application to astrophysics, industrial plasma processing, magnetosphere and ionosphere problems. Vlasov and fluid equations are derived and applied in Plasma Science I, which begins the study of waves in plasmas, with and without magnetic fields. Advanced topics in Plasma Science continues the investigations in waves and instabilities in linearized and nonlinear plasmas with applications. Computational projects required.

880 Topics in Theoretical Physics (3:3:0). Prerequisites: PHYS 701 or permission of instructor. Selected topics in the computational aspects of theoretical physics not covered in fixed-content courses in theoretical physics. May be repeated for credit as needed. The following are possible topics that may be considered for offering under this course: canonical perturbation theory; discrete and continuous groups; computational considerations in mathematical treatment of linear and non-linear dynamical systems; physical considerations in the solution of partial differential equations; computational problems in general relativity and cosmology.

881 Topics in Dynamical Systems (3:3:0). Prerequisites: PHYS 705 or permission of instructor. Selected topics in the computational aspects of dynamical systems not covered in fixed-content courses in dynamical systems. May be repeated for credit as needed. The following are possible topics that may be considered for offering under this course: anharmonic oscillators, chaotic and non-chaotic orbits, chaos in the Solar System; Hamiltonian chaos and the KAM theorem; quantum chaos; strange attractors, their dimension and Lyapunov exponents; bifurcation theory; galaxy dynamics.

882 Topics in Continuum Systems (3:3:0). Prerequisites: PHYS 620 or permission of instructor. Selected topics in the computational aspects of continuum systems not covered in fixed-content courses in dynamical systems. May be repeated for credit as needed. The following are possible topics that may be considered for offering under this course: smooth-particle hydrodynamics; radiation hydrodynamics; algorithms for continuum systems; adaptive grids for continuum computations; spectral methods in CFD; algorithms for concurrent machines; formation of high-energy particle jets in astrophysical applications; application to Earth atmospheric problems; flow considerations in molten materials.

883 Topics in Complex Systems (3:3:0). Prerequisites: PHYS 701, 705, or permission of instructor. Selected topics in the computational aspects of complex systems not covered in fixed-content courses in complex systems. May be repeated for credit as needed. The following are possible topics that may be considered for offering under this course: mesoscopic systems, biomolecular dense modeling; ergodic theory; theory of phase transitions; renormalization group methods, superconductivity; quantum chaos; canonical perturbation theory; evaluation of the mechanical properties of solids.

884 Topics in Statistical Mechanics (3:3:0). Prerequisites: PHYS 711 or permission of instructor. Selected topics in the computational aspects of statistical mechanics not covered in fixed-content courses in statistical mechanics. May be repeated for credit as needed. The following are possible topics that may be considered for offering under this course: reaction dynamics; many-particle dynamics, spin systems and random walks; nonequilibrium systems; radiative processes in non-equilibrium systems; correlation theory; conforma-
885 Topics in Electrodynamics (3:3:0). Prerequisites: PHYS 722 or permission of instructor. Selected topics in the computational aspects of electrodynamics not covered in fixed-content courses in electrodynamics. May be repeated for credit as needed. The following are possible topics that may be considered for offering under this course: plasmas and plasma processes; advanced considerations in magnetism; magnetic fields in space; sensing electromagnetic fields; plasma radiation processes.

886 Topics in Imaging and Pattern Recognition (3:3:0). Prerequisites: PHYS 612 or permission of instructor. Selected topics in the computational aspects of imaging and pattern recognition not covered in fixed-content courses. May be repeated for credit as needed. Possible topics considered for offering under this course are: medical imaging; image reduction of Landsat photographs; STM and other atomic imaging methods; acoustical imaging applications; discrete and continuous source recognition in astronomical data; astronomical image reduction processes and software; radio astronomy and aperture synthesis techniques; large-scale digital sky surveys using automatic classification and detection schemes.

887 Topics in Condensed Matter (3:3:0). Prerequisites: PHYS 512 and 732 or 736, or permission of instructor. Selected topics in the computational aspects of condensed matter not covered in fixed-content courses in condensed matter. May be repeated for credit as needed. The following are possible topics that may be considered for offering under this course: methods of electronic structure calculations; surface science; molecular clusters; material science; superconductivity; quantum Hall effect; magnetism; Hubbard model; mesoscopic systems; liquid-membrane interactions.

888 Topics in Quantum Systems (3:3:0). Prerequisites: PHYS 732 or 736, or permission of instructor. Selected topics in quantum systems in physics and chemistry not covered in fixed-content courses in quantum mechanics. May be repeated for credit as needed. The following are possible topics that may be considered for offering under this course: methods and functional theory; energy transfer and fluorescence; nuclear magnetic resonance; Mossbauer spectroscopy; advanced computational considerations in atomic and/or molecular structure, nuclear scattering theory, quantum considerations in condensed matter problems, quantum gravity.

889 Topics in High-Energy Physics and Astrophysics (3:3:0). Prerequisites: PHYS 540 or 765, and PHYS 732 or 736, or permission of instructor. Selected topics in the computational aspects of high-energy physics and astrophysics not covered in fixed-content courses in high-energy physics and astrophysics. May be repeated for credit as needed. The following are possible topics that may be considered for offering under this course: cosmic-ray spectrum; solar neutrino problem; dark matter in the Universe problem; cosmic microwave background; the search for gravitational radiation; X-ray emission from clusters of galaxies.

890 Colloquium in Computational Sciences and Informatics (1:1:0). Prerequisites: Admission to doctoral candidacy or permission of instructor. Attendance of colloquium presentations in computational sciences and informatics by Institute faculty, staff, and professional visitors. May be repeated twice for credit.

903 Advanced Topics in Scientific Visualization (3:3:0). Prerequisites: Permission of instructor. Selected topics in scientific visualization not covered in fixed-content scientific visualization courses. May be repeated for credit as needed.

904 Seminar in Scientific Visualization (1:1:0). Prerequisites: Permission of instructor. Consideration of selected topics in scientific visualization either not covered in fixed-content scientific visualization courses or as an extension of fixed-content courses. The format for presentation of the course material is that of a seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

906 Advanced Topics in Symbolic and Numerical Computation (3:3:0). Prerequisites: Permission of instructor. Selected topics in symbolic and numerical computation not covered in fixed-content symbolic and numerical computation courses. May be repeated for credit as needed.

907 Seminar in Symbolic and Numerical Computation (1:1:0). Prerequisites: Permission of instructor. Consideration of selected topics in symbolic and numerical computation either not covered in fixed-content symbolic and numerical computation courses or as an extension of fixed-content courses. The format for presentation of the course material is that of a seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

910 Advanced Topics in Scientific Databases (3:3:0). Prerequisites: Permission of instructor. Selected topics in scientific databases not covered in fixed-content scientific databases courses. May be repeated for credit as needed.

911 Seminar in Scientific Databases (1:1:0). Prerequisites: Permission of instructor. Consideration of selected topics in scientific databases either not covered in fixed-content scientific databases courses or as an extension of fixed-content courses. The format for presentation of the course material is that of a seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

928 Advanced Topics in Large-Scale Physical Simulation (3:3:0). Prerequisites: Permission of instructor. Selected topics in large-scale physical simulation not covered in fixed-content large-scale physical simulation courses. May be repeated for credit as needed.

929 Seminar in Large-Scale Physical Simulation (1:1:0). Prerequisites: Permission of instructor. Consideration of selected topics in large-scale physical simulation either not covered in fixed-content large-scale physical simulation courses or as an extension of fixed-content courses. The format for presentation of the course material is that of a seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

931 Seminar in Bioinformatics (1:1:0). Prerequisites: Permission of instructor. Consideration of selected topics in bioinformatics either not covered in fixed-content bioinformatics courses or as an extension of fixed-con-
tent courses. The format for presentation of the course material is that of a seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

935 Advanced Topics in Computational Chemistry (3:3:0). Prerequisites: Permission of instructor. Selected topics in computational chemistry not covered in fixed-content computational chemistry courses. May be repeated for credit as needed.

936 Seminar in Computational Chemistry (1:1:0). Prerequisites: Permission of instructor. A consideration of selected topics in computational chemistry either not covered in fixed-content chemistry courses or as an extension of fixed-content courses. The format for presentation of the course material is that of a seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

939 Advanced Topics in Bioinformatics (3:3:0). Prerequisites: Permission of instructor. Selected topics in bioinformatics not covered in fixed-content bioinformatics courses. May be repeated for credit as needed.

941 Seminar in Computational Mathematics (1:1:0). Prerequisites: Permission of instructor. A consideration of selected topics in computational mathematics either not covered in fixed-content mathematics courses or as an extension of fixed-content courses. The format for presentation of the course material is that of a seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

949 Advanced Topics in Computational Mathematics (3:3:0). Prerequisites: Permission of instructor. Selected topics in computational mathematics not covered in fixed-content computational mathematics courses. May be repeated for credit as needed.

951 Seminar in Earth Systems and Global Changes (1:1:0). Prerequisites: Permission of instructor. A consideration of selected topics in earth systems and global changes either not covered in fixed-content courses or as an extension of fixed-content courses. The format for presentation of the course material is that of a seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

959 Advanced Topics in Earth Systems and Global Changes (3:3:0). Prerequisites: Permission of instructor. Selected topics in earth systems and global changes not covered in fixed-content earth systems and global changes courses. May be repeated for credit as needed.

961 Seminar in Space Sciences (1:1:0). Prerequisites: Permission of instructor. A consideration of selected topics in space sciences either not covered in fixed-content space sciences courses or as an extension of fixed-content courses. The format for presentation of the course material is that of a seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

969 Advanced Topics in Space Sciences (3:3:0). Prerequisites: Permission of instructor. Selected topics in space sciences not covered in fixed-content space sciences courses. May be repeated for credit as needed.

970 Seminar in Computational Statistics (1:1:0). Prerequisites: Permission of instructor. A consideration of selected topics in computational statistics either not covered in fixed-content statistics courses or as an extension of fixed-content courses. The format for presentation of the course material is that of a seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

972 Mathematical Statistics I (3:3:0). Prerequisites: STAT 652, CSI 778. This course focuses on the theory of estimation. The principles of estimation are explored including the method of moments, least squares, maximum likelihood and maximum entropy methods. The methods of minimum variance unbiased estimation are covered in detail. Other topics include sufficiency and completeness of statistics, Fisher information, Cramer-Rao bounds, Bhattacharyya bounds, asymptotic consistency and distributions, statistical decision theory, minimax and Bayesian decision rules, and applications to engineering and scientific problems.

973 Statistical Inference for Stochastic Processes (3:3:0). Prerequisites: STAT 646 or permission of instructor. Course covers the modern theory of parameter estimation and hypothesis testing for stochastic processes, counting processes with random intensities and solutions to stochastic differential equations driven by martingales. Applications to engineering, biology, and economics are considered.

976 Statistical Inference for Stochastic Processes (3:3:0). Prerequisites: STAT 646 or permission of instructor. Course covers the modern theory of parameter estimation and hypothesis testing for stochastic processes, counting processes with random intensities, and solutions to stochastic differential equations driven by martingales. Applications to engineering, biology, and economics are considered.

978 Statistical Analysis of Signals (3:3:0). Prerequisites: STAT 644 and 638 or equivalent. Advanced course in the analysis of discrete- and continuous-time signals using methods of stochastic differential equation and time series. Familiarity with the methods of harmonic analysis and times series modeling is presumed. Topics include state-space modeling and eigen-value processing, nonlinear modeling of signals, non-Gaussian stochastic process structure, detection and estimation of vector-valued signals, robust signal detection, array processing and target tracking. Relevant computational architectures such as systolic arrays are also discussed.

979 Advanced Topics in Computational Statistics (3:3:0). Prerequisites: Permission of instructor. Selected topics in computational statistics not covered in fixed-content computational statistics courses. May be repeated for credit as needed.

981 Seminar in Computational Physics (1:1:0). Prerequisites: Permission of instructor. A consideration of selected topics in computational physics either not covered in fixed-content physics courses or as an extension of fixed-content courses. The format for presentation of the course material is that of a seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.
989 Advanced Topics in Computational Physics (3:3:0). Prerequisites: Permission of instructor. Selected topics in computational physics not covered in fixed-content computational physics courses. May be repeated for credit as needed.

990 Advanced Topics in Computational Sciences and Informatics (3:3:0). Prerequisites: Permission of instructor. Selected topics in computational sciences and informatics not covered in fixed-content courses. May be repeated for credit as necessary.

992 Seminar in Computational Sciences and Informatics (1:1:0). Prerequisites: Permission of instructor. A consideration of selected topics in computational sciences and informatics either not covered in fixed-content courses or as an extension of fixed-content courses. The format for presentation of the course material is that of a seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

996 Doctoral Reading and Research (1-12:0:0). Prerequisites: Admission to doctoral program and permission of instructor. Reading and research on a specific topic in computational sciences and informatics under the direction of a faculty member. May be repeated as needed.

998 Doctoral Dissertation Proposal (1-6:0:0). Prerequisites: Admission to doctoral candidacy. Development of a research proposal under the guidance of a major professor and the doctoral supervisory committee which forms the basis for a doctoral dissertation. Maybe repeated as needed; however, no more than a total of 24 hours in CSI 998 and CSI 999 may be applied towards satisfying doctoral degree requirements.

999 Doctoral Dissertation (1-24:0:0). Prerequisites: Approval of the Graduate Committee. Research on a basic or applied topics in computational sciences or informatics under the direction of a graduate faculty member. May be repeated as needed; however, no more than a total of 24 hours may be applied towards satisfying doctoral degree requirements.

Conflict Analysis and Resolution

Faculty
Birkhoff, Juliana, M.S., George Mason University, 1986; Ph.D. Candidate ICAR; Clinical Faculty Conflict Analysis and Resolution; Theory Coordinator, Applied Practice and Theory Program

Blechman, Frank O., B.A., University of Virginia, 1969; Clinical Faculty Conflict Analysis and Resolution

Druckman, Daniel, Ph.D., Northwestern University, 1966; Permanent Adjunct Professor of Conflict Analysis and Resolution

Duryea, Michelle LeBaron, M.A., Simon Fraser University, 1990; L.L.B., University of British Columbia, 1980; Associate Professor of Conflict Analysis and Resolution

Mitchell, Christopher R., Ph.D., University of London (University College), 1972; Professor of Conflict Resolution and International Relations

Rubenstein, Richard E., M.A., Oxford, 1961; J.D., Harvard University, 1963; Professor of Conflict Resolution and Public Affairs

Sandole, Dennis J.D., Ph.D., University of Strathclyde, Scotland, 1979; Associate Professor of Conflict Resolution and International Relations

Warfield, Wallace, M.P.A., University of Southern California, 1986; Clinical Faculty Conflict Analysis and Resolution

Other Faculty
Avruch, Kevin A., Ph.D., University of California, San Diego, 1978; Associate Professor of Anthropology

Black, Peter W., Ph.D., University of California, San Diego, 1977; Associate Professor of Anthropology

Botes, Jannie, M.A., The American University, 1988; Adjunct Professor of Conflict Analysis and Resolution

Breggin, Peter, M.D., Case Western Reserve School of Medicine, 1962; Adjunct Professor of Conflict Analysis and Resolution

Broome, Benjamin J., Ph.D., University of Kansas, 1980; Associate Professor of Communication

Brown, Brack, Ph.D., Syracuse University, 1977; Associate Professor of Public Administration

McFerson, Hazel M., Ph.D., Brandeis University, 1976; Assistant Professor of Government and Politics and Conflict Analysis and Resolution

Paden, John N., Ph.D., Harvard University, 1968; Robinson Professor of International Studies

Price, James R., Ph.D., University of Chicago, 1980; Adjunct Professor of Conflict Analysis and Resolution

Scimecca, Joseph A., Ph.D., New York University, 1972; Professor of Sociology and Conflict Resolution

Stone, John, Ph.D., Oxford University, 1969; Professor of Sociology and Anthropology

Taylor, Anita M., M.G.B., Ph.D., University of Missouri, 1971; Professor of Communication

Tuso, Hamdesa, Ph.D., Michigan State University, 1981; Assistant Professor of Conflict Analysis and Resolution
Wilkins, Roger W., LL.B., University of Michigan, 1956; Robinson Professor of History and American Culture

Conflict Analysis and Resolution, M.S.

The Master of Science in Conflict Analysis and Resolution, offered by the Institute for Conflict Analysis and Resolution, is a two-year professional program that prepares students for practice through the integration of theory and such conflict resolution processes as negotiation, mediation, third-party consultation, and analytical problem solving. Students study the theory, methods, and ethical perspectives of the field and apply this knowledge in laboratory-simulation and workshop courses, and in field internships. The latter are contracted with agencies in the Washington area and elsewhere, including abroad. Graduates of the program work in a variety of settings where conflict resolution is useful—businesses, unions, government agencies, religious groups, court systems, educational institutions, community centers, and conflict resolution consulting firms.

In addition, students can take a two-semester, 6 credit course or “Practicum” (CONF 690 or CONF 890) in the Applied Practice and Theory (APT) program during which they become part of a continuing team applying analytical methods and intervention processes to a variety of local and regional conflict situations under the guidance of clinical faculty members. Doctoral students are required to take this course, but it is optional for master's students.

Admission Requirements

In addition to meeting all Graduate School requirements for admission, an applicant to the M.S. program must have a GPA of no less than 3.0 in all undergraduate work and must submit the following:

1. All undergraduate and graduate transcripts;
2. GRE verbal, quantitative, and analytic scores from within the past five years*;
3. Three letters of recommendation, one of which should be from a faculty member in the applicant's undergraduate or graduate major field;
4. A four to five-page essay stating the applicant’s goals and reasons for seeking admission to the program.

*Applicants who have earned an M.B.A. may substitute the GMAT for the GRE scores, and those who have earned a law degree may substitute LSAT scores. If they are five years beyond their last examination, applicants may retake any of the above or take the GRE or Miller Analogies test.

Background courses in the social sciences, as well as prior work experience are desirable. A personal interview may be required by the admissions committee. Prior graduate-level academic work is evaluated on an individual basis regarding transfer credit and fulfillment of program requirements; however, normally, the university does not permit any reduction in the total credits required for the degree. Although students may enroll on a full- or part-time basis, entry into the program is in the fall semester only.

Degree Requirements

Each student is required to successfully complete 48 credits, 33 of which are required: CONF 501, 601, 610, 613, 621, 623, 633, 636, 642, and 694. The remaining electives may be chosen from among other master’s level courses in conflict, or in related disciplines with adviser approval.

Masters' students may, in their final year, undertake a master's thesis consisting of original research related to the field working under the supervision of a thesis committee.

Conflict Analysis and Resolution, Ph.D.

The doctoral program, the first of its kind in the United States, provides advanced study for students in the fields of conflict and conflict resolution. Students are prepared to qualify as researchers, theoreticians, and teachers in higher education, and as policy administrators, analysts, and consultants in both the public and private sectors.

The program stresses a close linkage between knowledge of theory and of process in the resolution of conflict. For this, training in the methods of research and analysis is necessary and is emphasized, much of this taking place in the two-semester APT program (see M.S. program). In addition, students are expected to obtain a background in a substantive area of conflict, usually related to the topic of the dissertation.

Admission Requirements

In addition to the four requirements listed above for applicants to the M.S. program, applicants to the Ph.D. program are asked to submit a written sample of work that shows the applicant’s poten-
tial for completing dissertation research in a doctoral program.

Although students may enroll on a full- or part-time basis, entry into the program is in the fall semester only.

Degree Requirements

The Ph.D. in Conflict Analysis and Resolution is not granted automatically upon completion of a set of course requirements. It is granted only to candidates who have shown a thorough knowledge of conflict theory and processes of conflict resolution, and the ability to conduct sound independent research through completion of a doctoral-level thesis.

Total post-baccalaureate credit requirements are 89. Students with an M.S. in Conflict Analysis and Resolution will receive 41 credit hours toward this total, being required to take 8 core courses: CONF 802, 803, 810, 811, 812, 900, and 901 and 6 credits in the Applied Practice and Theory Program (CONF 890). An additional 9 credits of electives and 12 credits of doctoral dissertation proposal and doctoral dissertation research credits completes the total. Electives will be chosen in consultation with the student's academic adviser and approved by the graduate coordinator or director of the institute.

Those entering the doctoral program with a master's degree in a related field, in addition to the above courses, will be required to complete 17 credits from the M.S. in Conflict Analysis and Resolution program as follows: CONF 501, 601, 613, 636, and either 623 or 633. If such courses are waived because they overlap previously taken course work, then an equivalent number of units must be taken in substitution.

All students entering the doctoral program must demonstrate competence in social statistics. This will generally require having taken an intermediate course in statistics prior to or after entering the program. (Such courses will not be counted toward the total credits for the degree.) This course must be completed prior to enrollment in CONF 811.

Ph.D. candidates are required to prepare for and pass comprehensive examinations in the areas of theory, methods, process, and a substantive area of specialization prior to being advanced to candidacy. The comprehensive examinations will be given once a year.

Doctoral candidates are also required to demonstrate proficiency in one foreign language. It is recommended that this requirement be fulfilled prior to starting dissertation work, but in any case, it must be completed before the Ph.D. degree is awarded.

Conflict Analysis and Resolution Courses (CONF)

Unless otherwise noted, all non-departmental majors require permission of instructor to register for CONF classes.

501 Introduction to Conflict Analysis and Resolution (3:3:0). Prerequisite or corequisite for all M.S. CONF majors. Introduction to the field of conflict analysis and resolution. Examines definitions of conflict and diverse views of its "resolution." Explores thinking about human behavior and social systems as they relate to the origins of conflict and to the role of conflict in violent and peaceful social change. Considers appropriate responses to conflict at interpersonal, intergroup, industrial, communal, and international levels.

601 Theories of Conflict and Conflict Resolution (3:3:0). Prerequisite: CONF 501. Examines major social scientific theories of conflict. Emphasis is on the need for theories to inform our ability to resolve conflict. Weaves together ideas from conventional disciplines with new approaches especially to causes of deep-rooted conflict. Focus is on analysis as a tool.

609 War, Violence, and Conflict Resolution (3:3:0). Prerequisite: CONF 501. Considers various theories of violence, its causes, and conditions, and applies them to a variety of instances: family abuse; religious and ethnic violence; terrorism, revolution, and warfare. Insights gained from study of initiation, escalation, management, resolution, and prevention of violence are applied to theories about the resolution of deep-rooted conflicts.

610 Philosophy and Methods of Conflict Research (3:3:0). Prerequisite: CONF 501. Introduction to research design, including use of theory to define the problem; exploring research approaches; gathering, analyzing, and interpreting data. Latter includes field observation; field experiments; lab experiments (simulations); surveys and sampling techniques; and archival, documentary, and literature resources. Quantitative techniques include theories of measurement (numerical and ordinal scales); distributions; and analysis techniques (chi-square, correlations, factor analysis). Briefly introduces philosophies of science, and its limits.

613 Laboratory and Simulation I: Interpersonal and Inter-Group Conflict (4:3:1). Prerequisite or corequisite for all M.S. CONF majors: CONF 501. An introductory survey of the skills and processes useful for conflict resolution, including learning to be a good observer/listener, to develop "hearing" and empathy skills. Although skills suit all levels of conflict, cases for demonstration will mainly focus on interpersonal conflict. Provides opportunity for students to share past personal experiences in conflict resolution, and to begin to analyze these experiences.

617 Cross-cultural Analysis of Conflict (3:3:0). Prerequisite: CONF 501. Introduction to techniques of participant observation and anthropological research. Provides insights into cross-cultural fieldwork experience, an important skill for facilitators working with groups outside their own "worldview." This course is highly recommended for students interested not only in

http://catalog.gmu.edu

621 Ethnic and Cultural Factors in Conflict Resolution (3:3:0). Prerequisite: CONF 501. Examines the role culture plays in the genesis, structuring, and resolution of processes of conflict within and between groups. Special attention is given to ethnicity and other subcultural markers of identity in complex social systems as both the generators and outcomes of conflict. The relevance of these variables to the success or failure of conflict resolution is explored.

623 Laboratory and Simulation II: Organizational and Community Conflict (4:3:1). Prerequisite: CONF 501 and 613. Moves from conflicts that are simply described to those with multilevel components, such as community and organizational conflicts. This course expands the skills acquired in 613 by adding the following: recording chronology; identifying roles played by various participants; observing turning points in the resolution process; precisely stating the agreed-upon solution.

633 Laboratory and Simulation III: International and Intercommunal Conflict (4:3:1). Prerequisite: CONF 501, 613, and 623, or permission of instructor. A continuation of the study of resolution processes as applied to highly complex systems, especially where one party denies the legitimacy of existing political authority. Considers third-party options for intervention in revolutionary and international conflicts, and means for building communication and trust among parties, and implementing agreements.

635 Structural Sources of Conflict (3:3:0). Prerequisites: CONF 501 and 601. Examines how structures and institutions affect behavior and give rise to conflictual relationships at all social levels, from the interpersonal to the international. Explores the role of conflict resolution as a political process providing opportunities for non-violent system change.

636 Third Party Roles, Resources, and Ethics (3:3:0). Prerequisites: CONF 501, 613 and 623 or 633. Analysis and critique of the nature and roles of third parties in conflicts. Theoretical perspectives and case histories are used to understand the settings in which third parties may operate. Covers roles as mediator, conciliator, arbitrator, and facilitator, and types of intellectual and other resources third parties may bring to conflicts. Includes ethics course assessment of third-party interventions in a variety of conflict settings.

642 Integration of Theory and Practice (3:3:0). Taken in the last semester of master's student's course work. Course assists students in developing their own "generic" theory of conflict by reviewing and integrating their prior course work. Students are expected to demonstrate a holistic comprehension of the field by writing a major essay of publishable quality about the causes, events, and resolution of a particular conflict of their own choosing.

690 Practicum in Conflict Analysis & Resolution—two semesters (3:3:3). Prerequisite or corequisite: CONF 501, 613, 623, 633, and permission of instructor. A two-semester course that involves students in an in-depth field study of an ongoing conflict situation and in intervention processes undertaken to manage or resolve that conflict.

694 Internship (3:3:0). Prerequisite: 21 hours of prior course work, including 613 and 623. CONF 633 recommended. Under direction of the clinical coordinator, students will spend at least 160 hours working on a project involving the study and/or resolution of conflict. Students will be expected to mesh theory and practice through observation and experience. The course includes a comprehensive report analyzing the individual's experience.

695 Special Topics in Conflict Analysis and Resolution (3:3:0). Prerequisite: CONF 501 and permission of instructor. A number of such optional courses are conducted each semester. Course content varies depending upon interests of instructors and students.

697 Directed Reading (1-3:0:0). Independent reading at the master's level on a specific topic related to conflict analysis and resolution as agreed to by a student and a faculty member.

799 Thesis (3:0:0). Prerequisite: Approved proposal. Two semesters. Original research under the direction of a thesis committee.

802 Theories of the Person (3:3:0). Prerequisites: CONF 501, 601, and acceptance in the doctoral program, or permission of instructor. To understand "human nature" is the first task of the student of human conflict. This course reviews and critiques various theories about the nature of the person and the needs all humans have as social beings, thus building a framework for analyzing, and perhaps one day predicting, broad aspects of behavior.

803 Theories of Social Change (3:3:0). Prerequisites: CONF 501, 601, and acceptance in the doctoral program, or permission of instructor. Understanding social conflict and the potential for conflict resolution requires that both conflict and cooperations be perceived in relationship to patterns of social change. This course reviews and critiques significant theories of social change in order to establish a basis for creative conflict analysis and resolution.

810 Mind and Conflict (3:3:0). Prerequisites: CONF 501, 601, and acceptance in the doctoral program, or permission of instructor. A philosophical inquiry into the structure of worldviews and the building of testable scientific hypotheses. This course assumes that the ways we think, as human beings, and the ways we build and test our theories about the world are closely linked. Explores and critiques the thinking of major 20th century thinkers on this topic, thus forming an introduction to research methodology.

811 Advanced Quantitative Research Methods in Conflict Research (3:3:0). Prerequisites: CONF 501, 601, and acceptance in the doctoral program, or permission of instructor. (Note: A prior course in intermediate statistics is essential.) Review of the methods of quantitative analysis and application to the study of conflict and conflict resolution.
analysis commonly used in research on conflict and conflict resolution. Game theory, n-way analysis of variance, multiple regression, and other methods are covered in detail, including discussion of basic applications and special techniques to deal with practical problems. Multivariate analysis of variance, path analysis, and systems of equations incorporating measurement error are also considered.

812 Advanced Qualitative Research Methods in Conflict Analysis (3:3:1). Prerequisites: CONF 501, 601, and acceptance in the doctoral program, or permission of instructor. Review of research design and methodology, together with a review of such qualitative research methods as participant observation, case studies, and grounded theory, and how these research methods can be used in conflict situations where experimental design and traditional quantitative methods of research are not appropriate.

820 Crime and Conflict Resolution (3:3:0). Prerequisites: CONF 801, or permission of instructor. Explores the usefulness of conflict analysis and resolution perspectives in analyzing the causes, nature, and consequences of criminal behavior, and alternative approaches to the crime problem.


850 Conflict Termination: Dynamics of the Peace Process (3:3:0). Analytical study of the nature of the "peace process" in terminating international, transnational, and civil conflicts. Includes analysis of parties' decision-making procedures during processes of de-escalation, pre-bargaining, and negotiation. Examines impact of various third-party roles (mediator, conciliator, facilitator) on the overall process, including implementation and monitoring of agreements. Takes as exemplary case studies efforts to terminate such conflicts as the Iran-Iraq war, the Cyprus dispute, and the Eritrean conflict.

890 Practicum in Conflict Analysis and Resolution—two semesters (3:3:0). Prerequisites or corequisites: CONF 501, 613 and 623 or 633, and permission of instructor. A two-semester course that involves students in an in-depth field study of an ongoing conflict situation and in intervention processes undertaken to manage or resolve conflict. May be repeated for up to 6 hours total credit toward degree.

897 Directed Reading (1-3:0:0). Independent reading at the doctoral level on a specific topic related to conflict and conflict resolution as agreed to by a student and a faculty member.

900 Integrating Theory and Method in Conflict Analysis (3:3:0). Prerequisites: CONF 801, 802, and at least 9 further credits in the doctoral core program. Analysis of the theoretical basis undergirding the methods of research in conflict resolution. Exploration of how theory is built through the reciprocal influence of research and practice.

901 Theory Development (3:3:0). Prerequisites: CONF 801, 802, and 900, or permission of instructor. Examines recent developments in theory and research in conflict analysis, with particular emphasis on project and dissertation work recently undertaken and completed. Its purpose will be to link ongoing research in this and parallel fields to students' own plans for dissertation work, and examine methodological approaches currently being used as well as the direction and focus of current, substantive research.

998 Doctoral Dissertation Proposal (3:3:0). Prerequisites: Successful completion of all course work and doctoral qualifying examinations. Work on a research proposal that forms the basis for a doctoral dissertation. May be repeated for up to 6 hours total credit toward degree.

999 Doctoral Dissertation Research (Credits vary. At least 6 credits must be taken toward the degree). Research on an approved dissertation topic under the direction of a committee. (NOTE: At least 12 credits of 998 and 999 must be accumulated toward the degree.)

Dance

Faculty

Allen, Judith, M.F.A., University of North Carolina at Greensboro, 1972; Professor
Miller, Linda Garner, M.F.A., University of Hawaii, 1980; Associate Professor
Murphy, Claudia, M.A., George Washington University, 1972; Associate Professor
Studd, Karen, M.S., University of Oregon, 1983, C.M.A., Laban Institute of Movement, 1987; Associate Professor

Dance, M.F.A.

The M.F.A. in Dance is a 60-credit-hour plan of study grounded in the modern dance genre, which emphasizes performance, teaching, and choreography. It is expected that candidates enter the program with advanced technical proficiency in either ballet or modern technique, and that during their study they take advantage of the diverse and abundant cultural opportunities in the Washington, D.C., area. The curriculum allows for and encourages apprenticeships and internships in professional and resident companies, experimentation in academic pursuits, and the development of independent and interdisciplinary artistic projects.

Admission Requirements

In addition to fulfilling the admission requirements for graduate study, the applicant must submit directly to the Dance Division of the Institute of the Arts a resume and a ten-minute VHS video that illustrates the applicant's choreography. All candidates must also demonstrate advanced-level technical proficiency through a personal audition
or provide examples of their proficiency on VHS video. Applicants should call the Dance Division to schedule an on-site audition.

It is expected that applicants have some life experiences in the field; therefore, this would normally preclude a person who recently was awarded an undergraduate degree.

All candidates must satisfy the following prerequisites: advanced technical ability, improvisation, two semesters of dance composition, two semesters of dance history, rhythmic analysis or music for dance, anatomy/kinésiology, elementary Lab notation, and dance production. Prerequisite courses may be completed prior to or concurrent with graduate course work and are usually fulfilled if the applicant has earned a B.A. or B.F.A. in Dance.

Degree Requirements
All students are required to take:

- **DANC 501 Graduate Dance Seminar** (3)
- **DANC 525/545 Advanced Modern or Ballet Technique** (18)
- **DANC 560 Advanced Choreography** (6)
- **DANC 570 Advanced Dance Performance** (3)
- **DANC 580 Laban Movement Analysis** (3)
- **DANC 598 Philosophy and Aesthetics** (3)
- **DANC 615 Contemporary Trends** (3)
- **DANC 627 Advanced Teaching Seminar** (3)
- **DANC 680 Dance Management** (3)
- **DANC 790 Internship** (3)
- **DANC 799 Thesis** (6)
- **Electives** (6)

The university does not guarantee the availability of these courses every semester. Some will be offered in alternating years.

Dance Courses (DANC)

**501 Graduate Dance Seminar (3:0:3).** Presentation and discussion of current issues in dance specific to the areas of education, research, and professional development in the field.

520 Special Topics in Dance (3:0:3). **Prerequisite: 9 hours of dance courses or permission of instructor.** In-depth presentation and exploration of topical studies in dance and/or related study areas (e.g., dance as therapy, avant-garde dance, philosophical approach to twentieth century dance artists, cinedance). Topic depends on instructor. May be repeated for a total of 9 credits.

525 Advanced Modern Dance (3:0:6). **Prerequisite: Audition.** Course provides the advanced student the opportunity for continued training. Emphasis and importance is placed on the attainment of high technical quality and performing skills. May be repeated for a total of 18 credits.

545 Advanced Ballet (3:0:6). **Prerequisite: audition.** Course provides the advanced student with the opportunity for continued training. Emphasis is placed on the attainment of high technical quality, performance skills, and an in-depth knowledge of ballet vocabulary and styles. May be repeated for a total of 18 credits.

560 Advanced Choreography (3:3:0). **Prerequisite: DANC 351 or permission of instructor.** Intensive study and exploration of advanced choreographic forms culminating in a public performance of a complete dance work. May be repeated for a total of 12 credits.

570 Advanced Dance Performance (1-3:0:6). **Prerequisite: Audition.** Advanced exploration into performance, repertory, and/or production skills through participation in university dance productions, special guest artist programs, or professional dance companies. May be repeated for a total of 12 credits.

580 Laban Movement Analysis (3:3:0). Introduction to the components of Laban Movement Analysis: Body, Shape, Effort, and Space. The course also includes Motif Writing for recording and analyzing movement.

598 Philosophy and Aesthetics of Dance (3:3:0). **Prerequisite: DANC 390 and 391 or permission of instructor.** A study of the philosophical theories and aesthetic principles of dance as a performing art. What dancing is, what it expresses, what it creates, and how it is related to other arts and artists is explored.

599 Independent Study (1-3:0:0). Individual research or a creative project in close consultation with an instructor. Projects selected from performance, choreography, technical theatre as it applies to dance management, dance history, or criticism. May be repeated for a total of 6 credits.

615 Contemporary Trends (3:3:0). **Prerequisite: Graduate standing.** A study of contemporary art and artists and their current ideas and practices as they relate to the making of new work. The course includes the exploration of formal and conceptual ideas on which the making of art is based.

627 Advanced Teaching Seminar (3:3:0). **Prerequisite: DANC 454 or permission of instructor.** Discussion of advanced problems in teaching from both the scientific and creative points of view. New theories and philosophies provided through guest lectures and medical specialists.

680 Dance Management (3:3:0). **Prerequisite: Graduate standing.** Exploration into the technical, financial, and economic aspects of dance management. Students gain insights into the areas of marketing, fundraising, publicity, incorporation, booking, nonprofit vs. profit-making organizations, and issues relating to current practices in the performing arts industry. This course would be a prerequisite for internships at the NEA or in dance company management.

790 Internship (1-3:0:0). **Prerequisite: Graduate standing and permission of advisor.** Study that would involve intensive professional experience through sponsorship by a dance company, agency, or other arts organization in the areas of management, administration, performing, choreography, or teaching. May be repeated for total of 6 credits.
799 Thesis Project (6:0:0). Prerequisite: Graduate standing, permission of adviser, and approval of proposal. All thesis projects must be scheduled one year in advance. The thesis project involves both written documentation and public performance. Performance may be of a formal nature occurring in concert spaces or of a more experimental nature that could be site specific.

Interdisciplinary Studies

Faculty
Debra Bergoffen, Coordinator, Liberal Studies
Catherine McCormick, Coordinator, M.A.I.S. Program

Interdisciplinary Studies, M.A.I.S.
The Master of Arts in Interdisciplinary Studies (M.A.I.S.) is for students who seek master's degrees that integrate knowledge from several disciplines. The M.A.I.S. is nontraditional in that students design, with the help of faculty advisers, individualized programs of study that include courses from several academic departments. Therefore, student's programs are individualized, interdisciplinary, and unique.
The M.A.I.S. degree program is divided into two tracks: Individualized Studies and Liberal Studies.

Individualized Studies
The Individualized Studies (IS) track is for students who have specific professional or career interests in interdisciplinary areas not served by traditional graduate programs. Students in this track combine courses from various disciplines appropriate to their particular career needs. The program is intended to promote advanced scholarship that transcends traditional disciplinary boundaries. Students can select from a wide variety of clusters of interrelated courses designed by faculty. The clusters can be used to forge specific links among courses from various disciplines and creatively re-integrate them along specific thematic lines. With the help of a faculty adviser, students can tailor these course clusters to their particular interests and needs.

Students in the IS track may earn a maximum of 6 hours of credit for prior experiential learning related to their field of concentration. In all cases, a minimum of 18 hours of classroom course work at George Mason University must be completed with a minimum grade of B (excluding credit for experiential learning and IS project or thesis credits). No more than 12 hours of course work within a single discipline taken at George Mason University may be offered toward the M.A.I.S. degree in the IS track. The extent to which transfer credit and credit earned at George Mason in the same discipline may be offered toward the degree is determined on an individual basis. For additional information contact the office of Graduate Interdisciplinary Programs at (703) 993-8762.

Admission Requirements
Applicants to the IS track must first obtain counseling through the IS office. Application is completed after a student has applied to the Graduate School, submitted all undergraduate and graduate transcripts, submitted three letters of recommendation, and completed the application to the IS program. Unless specifically waived, one of the following standardized examinations: the GRE, LSAT, or Miller Analogy is required for the M.A.I.S. program.

Degree Requirements
The IS track requires that students complete at least 36 hours of course work. Up to 12 hours of transfer credit may be accepted, provided that each course has a minimum grade of B and that the course work relates to the proposed area of concentration.
The proposed course of study must be designed in collaboration with and approved by a full-time member of the George Mason University faculty. A 3-credit IS project integrating knowledge from the student's area of concentration is required. With the approval of the faculty adviser, the chair of the adviser's department, and the director of Individualized Study Programs, a 6-credit IS thesis may be substituted for the project.

Liberal Studies
The Liberal Studies (LS) track (Cultures, Ideas, Values) is a humanities master's program. It explores the ways in which our alternative perspectives determine what we know, how we know it, and who we think we are. The program is designed for students interested in examining the ideas and values of cultures from a multidisciplinary perspective. It is intended for students who wish to broaden their liberal arts background, for students whose professions already situate them within the humanities (e.g., teachers, librarians, ministers) and for students who wish to pursue graduate degrees in the humanities (e.g., philosophy, religious studies, women's studies, cultural studies). This degree is also valuable for business
and professional people who understand that grounding in the humanities provides insight into the complex issues posed by contemporary society. For additional information, contact the Philosophy and Religious Studies Department at (703) 993-1290.

The Culture, Ideas, Value M.A. can qualify students to apply for entrance into the university’s Cultural Studies Ph.D. program.

Admissions Requirements
Students must be admitted by the Graduate Admissions Office for the College of Arts and Sciences and must show a capacity for original thought and sustained work in the humanities and liberal arts. Transcripts of all colleges attended, with a minimum undergraduate grade point average of 3.0, and three letters of reference are required.

Before completing the application for admission, prospective students should contact the Liberal Studies coordinator at the Department of Philosophy and Religious Studies.

Unless specifically waived, one of the following standardized examinations—GRE, LSAT, or Miller Analogyl—is required for the program. The expanded goals statement (Part B of the Application for Graduate Admission) detailing the prospective student’s interest in the Liberal Studies track and their proposed course of study will be heavily weighted in the admissions decision.

Degree Requirements
In consultation with an adviser, students create a coherent package of multidisciplinary courses that includes 12 credits of core courses, 6 elective credits in philosophy and/or religious studies, and 18 elective credits in any discipline or disciplines. Students will be required to take a comprehensive exam. As part of their 18 elective credits, students may choose to do a project (3 credits) or write a thesis (6 credits). A total of 36 credits is required to complete the degree.

Liberal Studies Courses (LS)
500 Religious Worlds in Transition (3:3:0). This course examines a selection of non-Western and pre-Western cultures and religions, both ancient and modern, and examines their responses to an evolving world. Each culture is viewed from its own construction of values, its conceptions of the relationships of the sacred to the world, the human condition, and “success” in human life; second, for its responses to the inevitable crises of history and the forces of change. In this context, Western culture is seen to be but one of many such constructions in transition, one of many ways of being in the world, more or less successful according to culturally determined conceptions of success itself.

502 Religions in Conflict and Dialogue (3:3:0). This course examines the nature and patterns of religious conflict and explores ways of engaging in dialogue. The exploration of religious pluralism for dialogue is the main course theme.

511 Contemporary Values (3:3:0). In this course, the student identifies personal, social, political, and religious values operative in contemporary society; examines their foundations and interrelationships; and examines in depth at least one area of human life in which values are both important and contested.

513 Existence, Faith, and Doubt (3:3:0). A philosophical examination of the idea of religion, of the essential features and variations belonging to religious existence, of the challenges to religious self-understanding posed by contemporary interpretation of religious consciousness, and of the responses to those challenges through a hermeneutics of the religious symbol.

515 Time and the Human Condition (3:3:0). An exploration of Western culture’s changing interpretations of the meaning and value of time and an examination of the ways these changing interpretations reflect diverse understandings of the meaning of the human condition.

520 Science, Reason, and Reality (3:3:0). An advanced exploration of the interrelations between science, reason, and reality. In principle, what are the rational (objective) standards, if any, for scientific knowledge of physical reality and for the underlying causal forces of nature? Explores the following philosophical perspectives: the logical empiricist approach, the Popperian falsifiability orientation, Kuhn’s historicism, Newton-Smith’s rationalism, a modelling approach by Van Fraasen, and Hacking’s experimental realism.

Archaeology
The archaeology track is designed specifically as an interdisciplinary/multidisciplinary course of study, with a special emphasis on the sciences collaborative to archaeological research. The track provides training in the broadly based, integrated, multidisciplinary nature of archaeology. It requires that each student master certain research skills in archaeology, study a variety of collateral science disciplines, and develop a broad understanding of the ways in which diverse scientific disciplines contribute to and are integrated into contemporary archaeological research.

The curriculum consists of a minimum of 36 semester hours. Three core courses—ANTH 620, ANTH 625, and ANTH 710 (9 credit hours)—are required of each student. Each student is also required to take at least one analytical techniques course. Each student will declare at least one archaeological substantive area and complete at least 3 credit hours in that area. With the approval of the program adviser, each student then selects a minimum of 18 credit hours from the existing graduate-level courses offered by collateral disciplines (e.g., geology, geography, biology).
master's project (MAIS 798) or thesis (MAIS 799) is also required of each student.

For additional information contact Ann M. Pal-kovich, Associate Professor, Archaeology Programs, Department of Sociology and Anthropology, 993-1440.

Archaeology Courses (ANTH)

535 Anthropology and the Human Condition (3:3:0). Prerequisite: Graduate standing or permission of instructor. Examination of contemporary human problems from crosscultural and biocultural perspectives. Historical background and future implications of current cultural and biocultural issues will be discussed.

560 Human Osteology (4:3:3). Prerequisites: Course in human evolution or anatomy and senior status or graduate standing, or permission of instructor. Examination of the structure and function of the human skeletal system. Discussions include age criteria, pathology, epigenetic traits, biomechanics, and phylogenetic relationships.

568 Human Origins (3:3:0). Prerequisite: Graduate standing or permission of instructor. Detailed survey of the genetic, morphological, and behavioral origins of hominids. Current interpretations and debates are discussed.

580 Evolution and Human Ecology (3:3:0). Prerequisite: Graduate standing or permission of instructor. Examination of the complex relationships between human cultures, biocultural adaption, and the natural world from an evolutionary perspective.

620 Theory: Archaeology and Biological Anthropology (3:3:0). Prerequisite: Course in archaeology or permission of instructor. Examination of theoretical approaches in archaeology, paleoanthropology, and biological anthropology.

625 Research Design and Methods in Archaeology and Biological Anthropology (3:3:0). Prerequisite: Course in archaeology or permission of instructor. Examination of the research strategies and methods in archaeology, paleoanthropology, and biological anthropology.

670 Regional Studies in Archaeology (3:3:0). Prerequisite: Permission of instructor. Regional survey of specific culture area in archaeology to be chosen by student and instructor.

675 Laboratory Techniques (4:3:3). Prerequisite: Course in archaeology and permission of instructor. Techniques of data collection, analysis, and management in archaeology and biological anthropology.

680 Readings in Archaeology (3:3:0). Prerequisite: Permission of instructor. Directed readings and research on a specific topic in archaeology to be chosen by student and instructor. May be repeated for a maximum of 6 credit hours.

682 Readings in Biological Anthropology (3:3:0). Prerequisite: Permission of instructor. Directed readings and research on a specific topic in biological anthropology chosen by student and instructor. May be repeated for a maximum of 6 credit hours.

684 Readings in Cultural Anthropology (3:3:0). Prerequisite: Permission of instructor. Directed reading and research on a specific topic in cultural anthropology chosen by student and instructor. May be repeated for a maximum of 6 credit hours.

710 Contemporary Issues in Archaeology and Biological Anthropology (3:3:0). Prerequisites: ANTH 620, ANTH 625, completion of 24 hours of graduate work, and approval of graduate adviser. Course considers contemporary research developments and explores the ways in which various scientific disciplines and theoretical approaches are integrated in the study of biocultural evolution, adaption, and diversity.

Gerontology

There is a growing need for professionals who plan for the aging society and provide services to the elderly. For nonprofessionals, there is a need to increase understanding of our own aging and that of our loved ones. The gerontology track in the M.A.I.S. program is designed for students interested in doing research on aging, shaping public policy on the aging society, providing services to the elderly, or increasing their own awareness of human development in the later years. The program provides training in the basic physiological and social-scientific theories of aging, the impact of the physical and cultural environment on the aging process, and policy issues and ethical concerns pertaining to old age.

For additional information call the M.A.I.S. Office, 993-8762.

In addition to the M.A.I.S. degree, students may also pursue a certificate in gerontology. For information on the certificate program, contact the Department of Human Services (703) 993-2060.

Interdisciplinary Studies Courses (MAIS)

796 Individualized Studies Project (3:3:0). Prerequisite: Degree candidacy in Individualized Studies Track M.A.I.S., completion of 27 semester hours of graduate course work, approval of faculty adviser, and approval of assistant dean for Individualized Study Programs. Research project related to the student's individualized concentration taken under supervision of the faculty adviser.

International Transactions

Faculty
Malawer, Stuart S., J.D., Cornell Law School, 1967; Ph.D., University of Pennsylvania, 1976; Professor of Law and Director, MAIT Program
Dinan, Desmond, Ph.D., National University of Ireland, 1985; Associate Professor of History, Deputy Director, International Institute
Fitzpatrick, Peter J., J.D., University of Virginia, 1973; Professor of Law and Technology
Fontana, Joseph, J.D., University of Colorado, 1961; Professor of International Transactions
Gerson, Allan, J.S.D., Yale University, 1976; Professor, International Law and Transactions, International Institute
Moore, John H., Ph.D., University of Virginia, 1966; Professor of Economics, Director, International Institute
Ratchford, J. Thomas, Ph.D., University of Virginia, 1961; Professor of International Science and Technology Policy
Sekulic, Dusko, Ph.D., University of Zagreb, 1979; Professor of Sociology and International Relations

Associated Faculty
Ferri, Michael G., Ph.D., University of North Carolina, 1975; Professor of Finance
Gulledge, Thomas R., Ph.D., Clemson University, 1981; Associate Professor of Decision Sciences
Johnson, Manuel H., Ph.D., Florida State University, 1977; Koch Professor of International Economics
Paden, John, Ph.D., Harvard University, 1968; Robinson Professor of International Studies

International Transactions, M.A.I.T.
In addition to full-time faculty from the International Institute, the faculty for the program includes adjunct members with wide professional and educational backgrounds who bring to the classroom their pragmatic expertise. The program also utilizes full-time faculty members from other departments of George Mason University. Principally, they teach in the foundation courses and required core courses where the more traditional academic disciplines can contribute significantly to the overall professional education of students.

The M.A. in International Transactions (M.A.I.T.) is a professional degree in international affairs focusing on international trade. It is designed for individuals already involved in the world marketplace and those desiring to enter the international field. The degree provides a general and in-depth study of international relations. As an interdisciplinary degree, courses integrate relevant aspects of politics, history, law, economics, science, technology, and culture. This new degree adapts the international relations subfield of international political economy to the pragmatic needs of those working with issues concerning the global economy. Courses are offered in the evenings and on Saturdays. Special programs at overseas institutions are offered each summer. Sites include Oxford (St. Peter's College), Belgium, Hungary, and Russia. The M.A.I.T. program has a special arrangement with Oxford University (St. Catherine's College), which permits highly qualified students to study international relations and politics during the academic year.

Admission Requirements
To enter the M.A. in International Transactions program as a degree candidate, a student should comply with the following requirements: bachelor's degree from an accredited college or university; undergraduate GPA of 3.0 or higher in all undergraduate course work, the last 60 hours of undergraduate course work, or the undergraduate major; completed Graduate School application along with official transcripts from all colleges and universities attended, resume, expanded goals statement, and two letters of recommendation.

Degree Requirements
While the degree has a significant structure, it permits students to select from a broad range of electives. The program requires 36 credits for graduation. A degree candidate must complete two foundation courses (INTL 500 and 501), five core courses (INTL 610, 611, 612, 613, and 614), and five additional electives to be chosen from 700-level INTL courses listed in course offerings or those given by other university departments with the permission of the program director. While a thesis or foreign language competence is not required, a final project is required.

The International Transactions Program also offers three Specialization Certificates in International Trade, International Planning, and International Technology. These are available
only to graduates of the M.A.T. program. The certificate requires 12 additional credits.

Courses in economics and ethics are strongly recommended (INTL 762 and 755). The International Trade Clinic provides a unique clinical component to the program. For information, contact (703) 993-8200.

International Transactions Courses (INTL)

500 Approaches to International Transactions (3:3:0). Focuses on the multiple actors and actions in today's international system to develop an understanding of the relationships that characterize and condition international transactions. While there is no widely accepted definition or theory of international transactions, this course examines the existing field and explores its parameters and conceptual approaches from different disciplines, focusing primarily on economics, finance, and politics. Identifies important themes that have been postulated by different approaches to the study of international transactions. Specializes on different fields and assess one or more themes and highlight the characteristics features of their approach.

501 International Transactions and Culture (3:3:0). Prerequisite: INTL 500. Examines the major dimensions of cultural analysis as related to international transactions. Includes the flow of peoples, messages, goods, capital, and technology across national and cultural boundaries. Particular focus is placed on problems of the United States business community conducting business abroad. Examples from particular world culture zones are considered, including East Asia, Africa, the Moslem world, Latin America, and the Soviet Union.

610 International Trade and Technology (3:3:0). An overview of technology and trade policy in the U.S. and other countries. Focus is primarily on the high-technology-oriented regulatory systems of the U.S. (both state and federal), and the European Union, on the national and supranational levels. Emphasis is placed on different fact patterns involving combinations of issues drawn from the fields of international trade, technology, marketing, and commercialization.

611 International Financial Institutions and Globalization (3:3:0). Focuses on the activities and roles of international organizations, international and regional banks, and central banks in the international financial system. In addition, examines the mechanics of international finance, lending, and operational services in international banking. Also examined are recent international coordination and cooperation efforts and such current issues as the international debt crisis, operations of leading money center banks, activities of central banks in conducting monetary policies for purposes of economic growth and development, and proposals for regulating the growing globalization of financial markets.

612 Multinational Corporations in the International Political System (3:3:0). Examines the international business environment and focuses on the activities and relationships of multinational corporations (MNCs), both American and foreign. Focuses on the national business issues of management and organization, as well as on cooperation and conflict with home and host governments. Particular emphasis is on the changing American and foreign perspectives on the role of multinationals in the international environment and the impact on free trade and economic development. Issues of management and sovereignty are emphasized within the context of the political and economic consequences of such actions.

613 Regional and Supranational Organizations (3:3:0). The purpose of this course is to assess the role of international organizations in the international system today with a focus on a wide range of international and regional economic institutions. Emphasis is on the changing nature of these organizations in terms of exercising powers traditionally associated with those of nation states. Additional focus is on the current resurrection of the United Nations and on a wide variety of other international institutions in terms of powers, budgetary matters, and decision-making process. The economic and political relationship of international organizations to U.S. national security interests and the development of an interdependent international system are stressed.

614 International Trade Relations (3:3:0). Examines international trade relations. Emphasis on the role of the U.S. in the world economy and on the evolving nature of the international system. Focuses on a wide range of substantive trade issues, examines the relationships between domestic agencies, international institutions, and private sector parties in the context of free trade and international competitiveness. Assesses the competing approaches to international trade and the role of interest groups in the U.S. and abroad in formulating trade policy. Requires a research project focusing on particular trade issues or trade relations generally in the 1990s.

701 Special Topics in International Transactions (1-3:1-3:0). Course description varies from semester to semester in which course is offered.

702 Special Topics Abroad (1-6:1-3:0). Special topics abroad are organized by the International Transactions Program and by the university.

710 International Finance and Tax in the Global Economy (3:3:0). Focuses on the global integration of money and capital markets and examines management as well as tax implications from the perspective of the multinational firm and free trade. Assesses the interrelationship of international finance and tax policies from national and international perspectives on crucial public policy issues of the 1990s.


712 International and Foreign Regulation of International Transactions (3:3:0). Focuses on current issues concerning the international and regional regulation of trade.

713 U.S. Foreign and Economic Decision Making (3:3:0). Identifies and assesses approaches to foreign policy decision making within the United States and the offices involved with political and trade issues. Examines the congressional and executive processes and their interrelationship. Exercises involve both historical and simulated cases; particular attention is given to the conflicting interests of private and institutional entities. As-
sesses the tension between political and economic issues within the context of national security concerns.

714 Transborder Data Flows and Trade (3:3:0). Identifies types of transactions in telecomputer and satellite operations concerning transborder data flow and international communication and examines resulting political, legal, business, and cultural problems and prospects. Emphasis on problems confronted by the individual, multinational corporation, and the state as they relate in particular to international trade. Also considers national and international regulatory systems and institutional organizations in order to identify issues and possible solutions.

715 Global Environment and the World Economy (3:3:0). Examines the growing relationship between environmental interdependence and the developing world economy. The increased globalization of environmental and health issues is assessed with a focus on the impact of these issues on national transactions involving trade and development. Attempts to develop an understanding of the relationship of scientific knowledge to the global environment in the context of existing political and economic institutions. Emphasis on formulating and assessing policies and structures for corporations, nations, regions, and international organizations. The tensions among free trade, international competitiveness, and regulatory responses are central to the course. Particular attention is given to the practices of nations and international organizations, emerging forms of regional and international cooperation, and the growing use of multilateral agreements.

716 European Union and the International System (3:3:0). Examines current economic and political changes within Europe from an international perspective. Seeks to understand the impact of those changes on the international system and the U.S. Concentrates on the European Community's internal market program ("EC 1992"), new membership, international trade, trade agreements, treaty relations generally, and foreign policy ("external competence"). Other aspects of proposed European integration are assessed, such as monetary and political union. The transition to democratic regimes and capitalist economies in Eastern Europe and the former Soviet Union and the consequences of these changes for the European Community are also examined.

717 International Science and Technology (3:3:0). Examines U.S. science and technology policies (SandT) and structures, as well as those in Western Europe (including the European Union), Japan, and the former Soviet Union. Assesses the functional linkages between SandT and international transactions focusing on trade, national security, finance, and development assistance. Also considers the emergence of multilateralism and international institutional arrangements as alternatives to traditional bilateral patterns of cooperation.

718 Japan's International Trade and Technology (3:3:0). Examines the interrelationship of international trade and economic development in post-War Japan. Fo- cuses on the importance of technology in Japan's domes- tic and international trade policies. Emphasis on current business and political issues in the context of the global trading system. Focuses on particular policies and prac- tices which are at issue in the current GATT negotiations and in bilateral trade relations with the U.S. and the European Union. An assessment of these policies and prac- tices involves an examination of domestic, social, cultural, political and historical aspects of Japanese society.

750 Trade and Politics in Eastern Europe and The Former Soviet Union (2-3:2-3:0). Examines the background and recent developments concerning the political, business, and cultural environment confronting American firms seeking to do business in Eastern Europe and the former Soviet Union. Special emphasis on international trade patterns and relations between these states and the United States. Particular attention is given to the modes of doing business in these countries and to the unique problems American firms confront. Focus is on privatization, joint ventures, and countertrade.

751 Trade and Politics in South America (2-3:2-3:0). Examines the political and legal aspects of conducting business and trade with countries of South America. The principal objective is to create an understanding of the political, economic, and legal environment unique to this region. Examines trade relations, business transactions, regional and sub-regional efforts of economic integration, and current issues. Particular attention is given to bilateral and regional trade developments and proposals, as well as traditional concerns of political and economic sovereignty. Examines the trends toward democratization, privatization, and free-trade policies.

752 International Business Lobbying in the United States, Europe, and Japan (3:3:0). A comparative overview of the lobbying process and practices concerning the representation of foreign firms in the United States, the European Union, its member states and Japan. Examines contemporary problems relating to lobbying by multinational corporations in a foreign political and cultural setting. Specific case studies are undertaken relating to specific industries. Examines interest groups and political parties in different political systems.

753 State and Local Strategies for Trade Development (3:3:0). Examines the role of states in the international marketplace. Focuses on formulating specific export marketing plans for particular Virginia firms and industries. Specific attention is given to an examination of state economic development policies, structure of state agencies, services, and resources available to the domestic exporter and foreign investors contemplating direct investment and current issues. Staff members of the Virginia Department of Economic Development and members of other state agencies and departments participate in this course.

754 International Commercialization of Space (3:3:0). Identifies and analyzes problems and transactions concerning the privatization and commercialization of transnational space activities including launch and satellite operations. Emphasis on the interplay of new technologies with existing legal, political, and business structures in formulating viable commercial satellite and launch operations. Focuses on planning and implementing private space actions in conjunction with various public and private international organizations. Sessions focus on interdisciplinary aspects of space commercialization involving technology, finance, tax, insurance, joint venture and business matters, and international legal and national regulatory issues. Guest lecturers include leading business executives engaged in space and satellite operations.
755 Ethics in International Affairs (3:3:0). Examines ethics in a wide variety of international transactions, foreign policy, and international relations generally. Addresses the traditional and more recent concerns of ethics scholars, specifically with regard to international actors and actions in the 1990s. Examines reason and the notion of values, moral traditions, and religious beliefs. Assesses the distinction between morality on the international level and internal morality. Specific transactions are examined in legal, political, and ethical dimensions.

756 National Security and the Global Economy (3:3:0). Examines the impact of globalization and changing international economic relations on traditional notions of national security, emphasizing international trade and investment patterns in the post-Cold War era. While it generally assesses the growing significance of economic factors on national security policy, the course focuses on the impact of international trade and investment on current United States national security policies and practices. This is principally within an historical, legal, and international political context. A number of recent case studies concerning the defense industry are studied. Examines of U.S. legislation relating to national security and globalization.

757 Transnational Business Planning (3:3:0). A broad assessment of how U.S. business structures its entrance and conduct of business in international markets in both developing and developed countries. Various methods, such as licensing, joint ventures, acquisitions, and divestitures are assessed. Goes beyond theory to lead the student through the actual procedures in a step-by-step fashion, necessary to carry out the method adopted. Particular emphasis is given to a broad range of relevant factors not normally assessed. Case studies are used.

758 Global Market Planning (3:3:0). Provides students with an opportunity to develop an international market plan for a specific industry or service sector. Generally studies and implements the essentials of market planning. Students consult with industry experts in both the private and public sectors. Students also utilize key trade data bases. The final product is a strategic plan that recommends specific markets and market entry strategies as well as specific agents, buyers, and/or distributors. Students present the completed market plan to invited industry experts for their dissemination and use.

759 Export Licensing, Controls, and Documentation (1-3:1-3:0). Examines legislation and practices governing exports and reexporting of U.S. goods and technology. Considers the diverse rules of various U.S. agencies concerned with regulating U.S. exports. Examines the extensive documentation required for exporting that includes application for validated licenses and an assessment of extraterritorial controls generally.

760 International Environmental Politics (3:3:0). Focuses on the multiplicity of issues in reconciling human needs with global natural processes. Examines the larger political and structural aspects of various issues (conservation, pollution, global change, destruction of biological diversity, national accounting, anthropocentrism) and focuses on implementation strategies impacting on trade, investment, economic development, and environment.

761 European Political and Economic Union (3:3:0). Examines the political and institutional development of the European Union from the post-war movement for European integration to the latest efforts. Focuses on the impact of European Union on enhanced regional integration on the community's main trading and alliance partners. Analyzes changing nature of the community's relations with the United States, the European Free Trade Association, and the former Soviet bloc countries, in the post-Cold War and post-Maastricht world.

762 Economic Analysis of International Transactions (3:3:0). Assesses the contending approaches of economics as they concern international trade, finance, and international transactions. Focuses on particular subjects that are of direct importance to the international system. Concludes with evaluation of current economic theory and tools related to particular international transactions. Intended for those students who want a more detailed understanding of economics, from a pragmatic perspective — relates specifically to broad field of international transactions today.

764 East Asian Trade and Investment Transactions (3:3:0). Examines Korea, China, Taiwan, and Hong Kong with some attention to Japan. Focuses on trade and financial relations among these East Asian nations and the United States. Assesses domestic political and economic institutions within these states' sectoral policies, as well as their role within the international system. Gives attention to transactional flows, role of government, and regional institution development.

765 Cultural and International Transactions in Sub-Saharan Africa (3:3:0). Examines Sub-Saharan Africa and Southern Africa in the international trading system today. Assesses domestic, sub-regional, and regional factors influencing economic and trade relations among these states and with other countries. Emphasizes political, historical, cultural, and development factors. Focuses on perspective of U.S. firms as well as international institutions trading or investing in this region. Explores issues concerning negotiating particular transactions and international linkages.

766 Trade and Investment in the Middle East and North Africa (3:3:0). Examines major economic, political, and cultural, which influence trade and investment relations with Middle East and North Africa. Organized thematically, course covers issues of international cooperative efforts and a range of diverse transactions. Focuses on role of major international and regional institutions in economic development. Develops understanding of challenges facing region and of implications for formulating trade and investment strategies by U.S. firms.

767 Political Economy and Integration in Latin America (3:3:0). Introduction to Latin America that assesses broad political, economic, and cultural dynamics of Latin America and Caribbean regions. Emphasizes those issues that affect U.S.-Latin American political business and trade relations. Examines domestic interest groups and decision-making system within particular countries as well as the structure of regional arrangements. Focuses on political and economic developments within the international system.

768 Global Intellectual Property Rights and International Trade (3:3:0). Examines national and regional systems, international contractual relations (licensing), and the evolving global system for protecting intellectual property. Addresses current international treaty system
and the ongoing multilateral efforts to strengthen worldwide institutional property protection: the “TRIP’s” negotiations under the general agreement on tariffs and trade (GAATT) and the North American Free Trade Agreement (NAFTA). Introduces intellectual property regimes of the European economic community. Examines regional and bilateral challenges and opportunities including Eastern Europe, Latin America, and East Asia. Considers U.S. policy and law related to international intellectual property such as the “Special 301” provision of the 1988 Trade Act and Section 337 of the Trade Act of 1930.

769 International Entrepreneurship Planning (3:3:0). Provides overview of planning international transactions to potential entrepreneurs. Focuses on role playing and practice negotiations. Helps students learn about entrepreneurship as it relates to the international marketplace for both goods and services. Assists in utilizing and adapting information from various graduate courses and disciplines to situations found in global markets. Consolidates information into a coherent practical systems approach for small- and medium-business entrepreneurs. Discusses business and financial documents in relation to doing overseas transactions. Assesses communication factors such as language, technology, and information systems. Addresses role of entrepreneurs (in small and mid-size firms) as a principal vehicle in growth of business and industry in developing world and in expanding U.S. export sector.

770 International Arbitration and Negotiations (3:3:0). Assesses the growing role of arbitration in international transactions and examines the field of negotiations with a particular emphasis on different national, cultural, and psychological characteristics. Focuses on arbitration and negotiation in the private sector and with government agencies engaged in international commerce and trade.

771 South and Southeast Asian Trade and Investment (3:3:0). Focuses on issues of trade and finance in the most dynamic countries of South and Southeast Asia. Examines the trade and financial policies and structures of such countries as India, Indonesia, Thailand, Vietnam, Singapore, Hong Kong, and the Philippines. Assesses regional trade patterns and institutions with a focus on existing trends and implications for regional development and the United States.

772 International Satellite Telecommunications (3:3:0). Focuses on the developments in the field of international telecommunications and satellite regulation. Examines the regulatory environment and the business and financial aspects of the global telecommunications industry. There is an examination of the various commercial trends in structuring and in domestic and overseas expansion.

773 International Trade Clinic (3:3:0). Principal course in the International Transactions Program providing a clinical and professional component to the program. Students work with designated instructors in conducting various professional tasks such as preparing studies and memos on behalf of local governments, state agencies, legislative committees, private firms, trade associations concerning exporting, economic development, direct and foreign investment strategies. These involve both private commercial matters and public policy issues.

774 International Research and Writing (3:3:0). Focuses on developing skills needed for writing research proposals and papers at the graduate level and for producing policy proposals, position papers, memorandums, and strategic plans required in the professional world. This course is available to all students and required for those designated by instructors in the Foundation Courses.

780 Internship (1-3:0:0). Open to authorized graduate majors only. Departmental approval and adviser necessary prior to enrollment. Purpose is to integrate academic preparation into an applied substantive experience. Internships are available in state, federal, and international agencies and within the private sector. A particular emphasis has been on creating internships in the private sector. A written project is required.

790 Independent Study (1-3:0:0). Open to authorized graduate majors only. Departmental approval and research adviser necessary prior to enrollment. Gives student an opportunity to do a more detailed research project than is generally possible in a particular course. Research often involves areas and topics not currently covered by existing courses.

Note: Not all courses earn three hours of graduate credit. Exact format of some courses may vary in length of time offered and thus credits earned. Some course requirements are subject to change.

Public Policy

Faculty

Botkin, Daniel B., Ph.D., Rutgers University, 1968; Professor of Biology
Boneau, C. Allan, Ph.D., Duke University, 1957; Professor, Department of Psychology
Bowen, Larry S., Ph.D., Ohio State University, 1970; University Professor of Education and Public Policy
Conlan, Timothy, Ph.D., Harvard University, 1981; Associate Professor of Government and Politics
Connelly, Catherine E., D.N.Sc., The Catholic University of America, 1979; Associate Professor of Nursing
Dede, Christopher, Ed.D., University of Massachusetts, 1972; Professor of Education and Information Systems Engineering
Dietz, Thomas M., Ph.D., University of California, Davis, 1979; Professor of Sociology
Doyle, Elly, M.A., Virginia Polytechnic Institute and State University, 1968; Executive Director, Center for Transportation and Land Policy
Ellig, Jerome R., Ph.D., George Mason University, 1988; Assistant Professor of Economics and Social and Organizational Learning
Friesz, Terry L., Ph.D., Johns Hopkins University, 1977; Professor of Systems Engineering

Fuller, Stephen, Ph.D. Cornell University, 1969; Professor of Public Policy and Regional Development

Gifford, Jonathan, Ph.D., University of California, Berkeley, 1983; Assistant Professor of Government and Politics

Gortner, Harold F., Ph.D., Indiana University, 1971; Professor of Public Administration

Guagnano, Gregory A., Ph.D., University of California, Davis, 1986; Assistant Professor of Sociology and Survey Research

Gulledge, Jr., Thomas R., Ph.D., Clemson University, 1981; Associate Professor of Public Policy and Operations Research

Harrington, Jr., James W., Ph.D., University of Washington, 1983; Associate Professor of Public Policy and Geography; Director, Graduate Program

Haynes, Kingsley E., Ph.D., Johns Hopkins University, 1970; University Professor; Director, The Institute of Public Policy

Heck, Hugh, Ph.D., Yale University, 1970; Clarence J. Robinson Professor of Comparative Government

High, Jack C., Ph.D., University of California, 1980; Professor of Economics and Social and Organizational Learning

Hill, Christopher, Ph.D., University of Wisconsin–Madison, 1969; Professor of Public Policy and Technology

Johnson-Brown, Hazel J., Ph.D., The Catholic University of America, 1978; Professor of Nursing and Health Policy

Kash, Don E., Ph.D., University of Iowa, 1963; John T. Hazel, Sr., and Ruth D. Hazel Professor of Public Policy

Kafatos, Menas, Ph.D., Massachusetts Institute of Technology, 1972; Professor of Physics and Computational Science and Informatics

Lavine, Thelma Z., Ph.D., Harvard University, 1955; Robinson Professor of Philosophy and American Culture

Lavole, Donald J., Ph.D., New York University, 1981; Associate Professor of Economics and Social and Organizational Learning

Lipset, Seymour Martin, Ph.D., Columbia University, 1949; Virginia E. Hazel and John T. Hazel Jr., Professor of Public Policy

Mahler, Julianne G., Ph.D., State University of New York, Buffalo, 1976; Associate Professor, Department of Public and International Affairs

Moore, John H., Ph.D., University of Virginia, 1966; Professor of Economics and International Transactions

Perry, Wayne D., Ph.D., Carnegie Mellon University, 1975; Professor of Public Policy and Operations Research

Pfiffner, James P., Ph.D., University of Wisconsin, 1975; Professor of Government and Politics

Regan, Priscilla, Ph.D., Cornell University, 1981; Assistant Professor of Government and Politics

Rossini, Frederick A., Ph.D., University of California, Berkeley, 1968; Professor of Public Policy and Systems Engineering; Provost and Executive Vice President for Academic Affairs

Schick, Allen, Ph.D., Yale University; Professor of Public Policy and Public Affairs

Scimecca, Joseph A., Ph.D., New York University, 1972; Professor of Sociology

Sibley, Edgar H., Ph.D., Massachusetts Institute of Technology, 1967; University Professor

Stough, Roger R., Ph.D., Johns Hopkins University, 1978; Northern Virginia Professor of Public Policy; Associate Director, The Institute of Public Policy; Director, Center for Regional Analysis

Warfield, John N., Ph.D., Purdue University, 1952; University Professor; Director, Institute for Advanced Study in the Integrative Sciences

Wegman, Edward J., Ph.D., University of Iowa, 1968; Dunn Professor of Statistics

White, Louise G., Ph.D., The American University, 1974; Chairperson, Department of Public and International Affairs; Professor of Public Affairs

Young, April, Ph.D., St. Louis University, 1984; Research Faculty and Senior Fellow in Public Policy

**Public Policy Ph.D.**

The Ph.D. in Public Policy program is distinctive in its heavy emphasis on the combined influence of culture and values, technology, and institutions on public policy. Participants in the program investigate the increasing tension between rapidly changing technical capabilities driven by science and engineering and our less fluid elements of culture and institutions.

The Ph.D. program has five substantive tracks: science and technology policy; evolutionary systems and economic policy; regional development policy;...
society, values, and policy; and governance and public management policy. As a basis for investigating the policy issues associated with each of these substantive areas, students develop in-depth understanding of American institutions, values, and culture; competence in advanced analytical methodologies; and a comparative, international perspective. At the time of admission, each student is assigned a faculty mentor who will assist in the design and development of the student's program.

The Institute of Public Policy, within which the Ph.D. in Public Policy is housed, has the investigation of alternative approaches to policy as a primary interest. This interest results from a view that the rapid changes resulting from modern technology require modifications both in the substance of public policy and in the way public policy is made. A goal of the program is to contribute to conceptual developments that will allow policy modifications to occur while protecting the fundamental, pluralistic, democratic character of policy making in the United States.

Admission Requirements

The program is seeking students with exceptional potential for accumulating, sorting, analyzing, and communicating information and findings effectively. Public policy is inherently complex and value laden. In the end, high-quality policy analysis requires thoughtful and judicious handling of complex and incommensurate information. Some of this information will be quantitative and some will be qualitative. Thus, the program seeks entering students who can handle and integrate both kinds of information and produce convincing, well-organized, written syntheses. The institute will tailor each student’s program to assure that any deficiencies, whether quantitative or qualitative, are addressed. The ideal Ph.D. candidate would be full-time and have demonstrated research capabilities in writing, a floor of mathematical capabilities roughly equal to the first semester of calculus and a competence in statistics, some background in economics, and a theoretical and working knowledge of the public policy process. Prospective students who are deficient in any of these attributes may be admitted to the program and will receive assistance in making up deficiencies. Specific entrance requirements include:

1. Master's degree from an accredited institution;
2. Grade point average of 3.0;
3. Satisfactory scores on the Graduate Record Examination (verbal and quantitative sections) (GRE) or General Management Aptitude Test (GMAT).

Applicants must submit two letters of recommendation from faculty at the prospective student's previous institutions or those acquainted with policy-relevant work, a two-page written statement of the student's interest in public policy study, a resume or vita, and a writing sample (e.g., technical report, publication, term or seminar paper).

While prospective part-time students are invited to apply, they will be required to be in residence on a full-time basis for at least one academic year during their program.

The application deadline for students desiring financial aid is February 1. The deadline for all other students for fall semester is April 1.

Degree Requirements

Students are required to pass 82 hours of course work, of which no more than 24 hours may be dissertation credits. Students may transfer up to 30 semester hours of credit from a master's degree at the discretion of the graduate program director. Credit is not given for comprehensive examinations from other universities.

Students must pass the two 4-hour core courses (PUBP 800 and PUBP 801), pass two 4-hour concentration courses, and make up all deficiencies in the areas of policy analysis skills during the first year they are in the program. A course in the logic of policy inquiry is also required. The two 4-hour concentration courses are determined by the student's track: PUBP 810 and PUBP 811 for those concentrating in Regional Development Policy; PUBP 820 and PUBP 821 for those concentrating in Science and Technology Policy; PUBP 830 and PUBP 831 for those concentrating in Evolutionary Systems and Economic Policy; PUBP 840 and PUBP 841 for those concentrating in Governance and Public Management Policy; and PUBP 860 and PUBP 861 for those concentrating in Society, Values, and Policy.

Students must also pass a comprehensive examination that covers the core and concentration curricula. This examination is held in January and August of each year.

Students will also be required to complete the equivalent of a three-course, doctoral-level sequence in advanced methodology. While the program does not specify a specific sequence (this is determined in collaboration with the student's adviser), the following are offered as illustrations:

Decision Sciences

DESC 611 Quantitative Analysis in Operations Management
DESC 742 Management Science

http://catalog.gmu.edu
DESC 743 Seminar in Applications of Management Science
DESC 744 Contemporary Issues in Decision Analysis

Statistical Analysis
STAT 644 Applied Probability
STAT 652 Statistical Inference
STAT 654 Applied Statistics
STAT 656 Regression Analysis

Analytic Public Policy Analysis
PUAD 804 Conduct of Social Inquiry, Research Design
PUAD 805 Conduct of Social Inquiry II, Quantitative Analysis
PUAD 823 Decision Making Under Uncertainty
PUAD 824 Models of Policy Design and Implementation

Operations Research
OR 541 Operations Research: Deterministic Models
OR 542 Operations Research: Stochastic Models
OR 644 Applied Probability
OR 654 Applied Statistics

Experimental Design
PSYC 651 Quantitative Analysis of Experiments
PSYC 652 Quantitative Analysis II: Analysis of Variance
PSYC 653 Research Methods I: Experimental and Research Design

Final methodology concentrations are approved by the institute's graduate director and the student's adviser. Other methodological concentrations may be developed in areas such as mathematical modeling, psychometric measurement, survey research, and legal analysis, as appropriate.

Although the university does not guarantee the availability of these courses every semester, a typical first-year program of study would include PUBP 800, 810, 820, 830, 840, or 860 in the first semester and PUBP 801, 811, 821, 831, 841, or 861 in the second semester. Full-time students would add a methodology course each semester. Part-time students would make up any deficiencies and begin work on their methodology requirements during the summer before and after the first academic year of course work. Comprehensive examinations would be held in August or early September at the start of the student's second year in the program.

To be eligible for program continuance and for continuing financial aid, students must successfully complete the comprehensive examinations by the end of the first 18 months of their program. Part-time students will need to schedule courses in the first year so as to complete the core and concentration required courses, and take the comprehensive examination at the end of 18 months.

Public Policy Courses (PUBP)
550 Topics in Public Policy (1-3:3:0). Selected topics in public policy not covered in fixed-content public policy courses.
710 Topics in Public Management and Policy (1-3:3:0). Taught in workshop style. Most class meetings will involve an initial presentation by the professors or visiting speakers, followed by a one-hour forum exploring the implications of the presentation for leadership in contemporary society. Presentations range from disciplinary perspectives on leadership to the examination of different leadership style. The workshop explores diverse aspects of leadership, especially as it applies to regional economic development. The course is highly interactive and involves participation on a regular basis by several faculty and students.
740 Topics in Public Policy: Science and Technology (1-3:3:0). Selected topics in public policy not covered by fixed-content public policy courses. Selected topics relate to science and technology.
770 Topics in Regional and Urban Development Policy (1-3:3:0). Seminar involving participation by both faculty and students in an exploration of the concept of leadership and institutional development in regional economic development. The first part involves presentations by faculty members on conceptual, theoretical, and methodological traditions regarding leadership and institutional development. The last part focuses specifically on the issue of leadership in the context of regional economic development.
796 Directed Readings and Research (1-3:3:0). Independent reading and research at the doctoral level on a specific topic related to public policy as agreed to by a student and a faculty member.
800 Culture and Policy (2:2:0 to 4:3:1). Focuses on the comparative analysis of the United States and Canada. It seeks to illustrate the value of comparative analysis in the social sciences, of looking at the way two cultures, societies, and political values deal with the same needs and institutions. These two nations are highly similar, a fact that facilitates isolating the factors responsible for differences between them. A discussion seminar and laboratory is required in the four-credit version of this course.
801 Macro Policy (2:2:0 to 4:3:1). Demonstrates how macroeconomic, technological, demographic, and social forces impact upon the supply and demand for governmental services. Counterpart analysis of the impact of shifts in the patterns of international trade, the demographic composition of the population, and trends in the social structure are also examined. Intended to build an understanding of the need to factor alternative assumptions about the macro environment into policy planning; to show how macro events can affect both social welfare and policy performance indicators; and to suggest how national income accounting analysis and simple macroeco-
803 Topics in Culture and Policy (2:2:0 to 4:3:1). Selected topics in public policy not covered in fixed-content public policy courses. Selected topics relate specifically to culture and policy.

809 Education, Technology, and Public Policy (3:3:0). Attempts at educational improvement since Sputnik in 1957 have been largely without remedial effect. This course considers the strategic role of technology in a search for new solutions. The student will acquire an understanding of the nation’s recent attempts at educational improvement and of the underlying policy considerations; the shifting roles of state, local, and federal governments; and the technological opportunity for reaching all Americans with education and training by means of the nation’s emerging digital communications and information infrastructure. Working in teams, students will prepare a policy paper on some aspect of this issue using the Internet digital data network.

810 Theory and Methods in Regional Policy I (2:2:0 to 4:3:1). The theory and methods used in regional policy analysis are introduced and critiqued. Students learn about Central Place Theory, Growth Pole Theory, Economic Base Theory, as well as other theoretical constructs utilized in regional policy analysis. Further, methodological tools such as regional econometric modelling, multi-objective programming, shift-share analysis, economic base analysis, location quotient analysis, and Input-Output analysis are also introduced and examined. Finally, selected current regional public issues are examined using the theoretical and methodological constructs introduced in the first part of this course.

811 Theory and Methods in Regional Policy II (2:2:0 to 4:3:1). Second of two semesters of required concentration seminar sequence in Regional Policy. Only students who have participated in the first semester of this sequence (i.e., PUBP 810) will be admitted. Develops research papers that investigate some element or aspect of regional policy. Identifies and develops topics with the goal of producing publishable papers. The students will have developed the focus of this paper based upon work carried out in the first semester. The students will be expected to prepare an initial two-page proposal that will be followed by a detailed proposal that will be followed by the completed paper. Each of these will be critiqued in the seminar. The sessions of the seminar will be organized to conform to this process of review and critique. The instructor will work with each of the students individually, as well as in the seminar sessions.

814 International Trade Policy (2:2:0 to 4:3:1). The primary foci are on institutions of international-trade management, and the trade-management choices facing the United States. After a review of international trade theories, explores some recent writing on these institutions and choices. Then, students become involved in individual research into international economic issues, sharing methodologies and funding, and developing conclusions with the class. The four-credit version of this course requires a discussion section and research laboratory.

815 International Competitiveness and Regional Development (2:2:0 to 4:3:1). Explores the meanings, trends, and sources of international economic competitiveness. The must be sought in nation’s economic and industrial structures, macroeconomic conditions, the actions of corporate stakeholder (management, employees, owners), and the microeconomic markets for labor, capital, and technology. Public-policy choices to increase competitiveness will be compared for their context-dependence and likely effects. An additional concern will be the subnational, regional sources of competitiveness, and the regional manifestations of international competition. The United States will be the case at the course’s core, but international comparisons will be drawn from Europe and East Asia. The course is designed for master’s or doctoral-level students who have either practical or academic background in public institutions and international issues.

816 The Rise of World Regional Economies in Competition (2:2:0 to 4:3:1). The role of government policy and federal laboratories in innovation and development is examined. The concept of such developments for specific regional economies world wide is outlined. Exploration of the central role of time in bringing innovations to market and the role of organizations in stimulating, directing, and maintaining the continued process of technological innovation.

817 Policy Research Topics: Transportation Policy (2:2:0 to 4:3:1). Research workshop examines the development of policy research and relevant methodologies linked directly to faculty and student interest. In-depth review of the interactive, identification of cutting-edge policy concerns and execution of a research program. The four-credit version of this course requires a discussion section and a research laboratory.

818 Statistical Methods of Policy Analysis and Research (2:2:0 to 4:3:1). Introduces some of the most popular quantitative approaches to management with a focus on economic analysis and decision making. Examines the principles and applications of several quantitative techniques, noting especially the opportunities for their use in public policy analysis. The four-credit course requires a discussion seminar and/or research laboratory.

819 Managerial Economics and Policy Analysis (3:3:0). This course focuses on the application of microeconomics theory in analyzing public policy issues. It is intended to provide the student with the capability to understand the economic literature and successfully complete a graduate course in microeconomic theory in the Economics Department.

820 Technology, Science, and Public Policy I (2:2:0 to 4:3:1). The first of a two-semester core sequence required for Ph.D. Public Policy students in the Science and Technology Policy Track. Provides a broad coverage of the literature relevant to science and technology policy. This core sequence begins with postulate that technology has become a major casual force in the contemporary world. This seminar looks at the key formulations of the relationship of science, technology and public policy and prepares the students for that second component. A research laboratory and special colloquia attendance are required of the four-credit version of this course.
821 Technology, Science, and Public Policy II  
(2:2:0 to 4:3:1). The second of a two-semester core seminar sequence in the Science and Technology Policy Track. The seminar develops research papers that investigate some element or aspect of science and technology policy. Identifies and develops topics with the goal of producing publishable papers. A set of discussion meetings, research laboratory, and colloquium attendance is required of the four-credit version of this course.

833 Topics in Public Policy (1-4:3:0). Selected topics in public policy not covered in fixed-content public policy courses.

840 Research Seminar in Policy Governance I  
(2:2:0 to 4:3:1). An in-depth survey of the major institutions that formulate and implement public policy in the United States. Examines linkages between translation of public preferences into public policy and decisions about which societal and economic functions are most appropriately carried out by governments and which are best accomplished by private institutions and individuals. The four-credit course requires a discussion seminar and research laboratory.

841 Research Seminar in Policy Governance II  
(2:2:0 to 4:3:1). The second of a two-semester sequence (PUBP 840, PUBP 841) in the Governance and Management Policy Track. Deals with the division of responsibilities among the several levels of government and between the public and private sectors. Focuses upon the impact of these divisions on the development of public policy in several policy areas, such as urban governance, environmental policy, and health care.

850 Seminar in Public Policy (1:1:0). A weekly colloquium series, required of Public Policy Ph.D. students. Features a variety of speakers from universities, government, and nonprofit sectors. Topics include policy formulation and analysis, as well as theoretical and methodological foundation.

852 Systematic Thinking for Social Action  
(2:2:0 to 4:3:1). During the 1960s and 1970s Americans devoted a growing share of their national resources to public programs for meeting social needs. Throughout this period funding for these programs expanded while dissatisfaction grew. In the 1980s expectations decreased and funding decelerated while concerns with efficiency and funding decelerated while concerns with efficiency and effectiveness grew even more important than in earlier decades. This course focuses on measuring social needs, evaluating the effectiveness of government programs to meet them, and estimating the costs and benefits of alternative programs. The context will be the past several decades of experience in the United States.

853 Ethics and Legal Issues of Social Experimentation  
(2:2:0 to 4:3:1). In this course the moral and ethical dilemmas and issues raised by large scale social experimentation are examined. Issues such as balancing of benefits and harm, informed consent, protecting others rights, and privacy are explored. While cases from the period of large-scale social experimentation in the U.S. will be treated, additional focus will be on the problems posed by the reconfiguration of these experiments over the past decade.

860 Social Theory and Public Policy  
(2:2:0 to 4:3:1). An introduction to social theory and how it impacts upon public policy. Major theoretical frameworks in the social sciences will be analyzed in relation to the role they can play in the formulation of public policies in such selected areas as: poverty and inequality; the family; education; crime and drugs; and race and ethnicity.

861 Research Seminar in Culture and Policy  
(2:2:0 to 4:3:1). The seminar emphasizes the integration of theory and method into empirical research projects. Among the issues covered are the linkage between theoretical constructs and empirical literature, the derivation of research questions from an existing body of literature and the selection of methods appropriate to answer those questions. The seminar requires both the development of concrete proposals for empirical research and the criticism of such proposals.

998 Research/Proposal for Dissertation  
(1-9:0:0). Work on a research proposal that forms the basis for a doctoral dissertation. May be repeated. No more than 24 credit hours of PUBP 998 and 999 may be applied to doctoral degree requirements.

999 Dissertation  
(1-9:0:0). Research on an approved dissertation topic under the director on dissertation committee. May be repeated. No more than 24 credit hours of PUBP 998 and 999 may be applied to doctoral degree requirements.
Programs and Additional Graduate Courses
Northern Virginia Commonwealth Graduate Engineering Program

Graduate programs in engineering and information technology are offered under the auspices of a Commonwealth Network in Northern Virginia. This network includes George Mason University (the regional office), Virginia Polytechnic Institute and State University (VPI&SU), Old Dominion University (ODU), the University of Virginia (UVA), and Virginia Commonwealth University (VCU) and employs a mix of direct classroom laboratory instruction from GMU and live interactive televised lectures from other universities. Afternoon and evening instruction is provided at several classroom sites, including the GMU Fairfax Campus, the UVA/VPI&SU Northern Virginia Center, and additional off-campus corporate televised receive sites.

Master's degrees are offered by either UVA, VPI&SU, ODU, or GMU following successful completion of the appropriate program of study. Discipline areas of the degree programs from UVA include Master of Materials Science, the Master of Engineering in Nuclear Engineering, Chemical Engineering, Mechanical and Aerospace Engineering (Manufacturing Systems Engineering), Electrical Engineering, Systems Engineering, or Civil Engineering (Structural Focus). From VPI&SU, the following degree programs are offered: Master of Engineering Administration; Master of Science or Master of Engineering in Electrical Engineering, Aerospace and Ocean Engineering, Civil (Environmental) Engineering, and Systems Engineering; and Master in Mechanical Engineering. ODU offers the Master of Engineering Management. GMU offers Master of Science degree programs (described within this catalog) in Computer Science, Electrical Engineering, Information Systems, Operations Research, Software Systems Engineering, Statistical Science, and Systems Engineering. Also offered from GMU is the Doctor of Philosophy in Information Technology, and Certificates in Software Systems Engineering and C^3T in Systems Engineering.

Students apply to a degree program at one of these four institutions based upon course offerings and programs sponsored by an institution and the individual direction a student wishes to follow. Program requirements are the responsibility of the degree-granting institution and, subject to these requirements, courses may be taken from any of the five universities. Within the framework of departmental and graduate school approval, the majority of courses must be taken through the student's home institution; and additional courses approved by the home institution may be transferred among the four cooperating institutions (VCU offers only one course per semester and is not a degree program). UVA, ODU, and VPI&SU degree programs are composed primarily of televised courses and are supported by additional courses from GMU. These degree programs do not generally have a thesis or research component. GMU degree programs do require a research project or thesis component and are composed primarily of live classroom instruction with the possibility of transferring televised courses into these degree programs.

Course registration is contingent upon admission to a degree program or acceptance for non-degree studies. Students are responsible for learning about program requirements and obtaining course approval. Students may register while application materials are being processed as space permits and with permission from their program advisor and instructor. In addition, courses may be transferred among institutions with written approval of the home institution before registering.

The Northern Virginia Commonwealth Graduate Engineering Program is one of three cooperative efforts in the commonwealth; the others are hosted by Virginia Commonwealth University in Richmond and Old Dominion University in Tidewater. This statewide network is also supported by the Virginia Department of Information Technology and State Council of Higher Education in Virginia and provides expanded academic resources.
Additional Graduate Courses

Art History Courses (ARTH)

593 Art Internships (3-6:0:0). Prerequisite: B.A. or equivalent or permission of instructor. Internship with a professional arts institution, organization, or individual in the D.C. area. Project to be arranged by the student, in consultation with faculty instructor and field supervisor. Recommended for advanced Art History students seeking exposure to professional work in the visual arts. May be taken for three to six hours, or repeated for up to six hours of credit.

594 The Museum (3-3:0). Prerequisite: B.A. or equivalent or permission of instructor. Examination of the history, theory, practice, ethics, and current problems of collecting and displaying art and artifacts to the public. Emphasis on issues central to the D.C. museums or museums in other locations; specific focus may vary with instructor.

596 Independent Study (3-3:0). Prerequisite: B.A. or equivalent or permission of instructor. Independent reading and research on a specific project under the direction of a department faculty member. A written report is required. May be repeated for credit.

599 Special Topics in the History of Art (3-3:0). Prerequisite: B.A. or equivalent or permission of instructor. Topics vary and include women in art, art patronage, art criticism, and others.

600 VIT Research Methodologies (3-3:3). Prerequisite: Admission to the Visual Information Technologies program or permission of instructor. Explores methods of examining and interpreting works of art developed by art historians since the 19th century, as well as new ways of looking at art by using such computer tools as expert systems, computer analysis of pigments and other materials, and electronic search and retrieval of archival documents. The various lines of inquiry are examined through analytical and critical readings of both model texts and articles.

620/PHIL 356 Philosophy, Theory, and Criticism (3:3:0). Prerequisite: Admission to Visual Information Technologies program or permission of instructor. Basic problems that arise from an inquiry into the meaning and value of art and our response to it. Students in the VIT program write a supplemental paper and design an individualized project.

696/COMM 431/GOVT 431 Special Topics in Visual Information Technologies (3:3:0). Prerequisite: Admission to Visual Information Technologies program or permission of instructor. Study of the impact of the information network of wire and airless communications and computers on the political process in advanced industrial countries.

800 Studies for the Doctor of Arts in Education (variable credit). Prerequisite: D.A.Ed. student admission to study in art. Program of studies designed by student's discipline director and approved by student's doctoral committee. Course work allows the student to participate in the research activity of the discipline director and results in a paper reporting the original contributions of the student. The paper is presented in a subsequent D.A.Ed. summer seminar. Enrollment may be repeated.

Communication Courses (COMM)

Communication courses at the 500 level are open to postbaccalaureate students or communication majors with advanced undergraduate standing and other seniors with permission of department.

501 Communication in Professional Relationships (3:3:0). Theoretical perspectives and relevant research related to communication techniques useful in various professional roles and situations. Relates theoretical foundations to practice, allowing individual students to assess theories of communication and their applications in individual professional fields.

502 Theories of Mass Communication (3:3:0). Investigates into the various theories of mass communication that have guided the development of mass communication (broadcast, cablecast, telecommunications, etc.). Emphasis is placed upon the major scientific, humanist, and critical approaches to the question of mass media impact and effects.

504 Communication and Interpersonal Conflict (3:3:0). Prerequisite: Admission to Graduate School or senior standing and permission of instructor. This course provides a theoretical introduction and experiential learning in the role of communication in conflict and conflict management. The focus is upon interpersonal interactions, including dyadic and small group levels in various settings such as friendships, marriage, family, and the workplace. The course examines the factors that generate conflicts and the communication strategies and skills that help shape conflict interaction toward productive ends. Class activities include lectures, guided discussions, case analyses exercises, and simulations.

505 Intercultural Communication (3:3:0). Analysis of communication variables as they relate to communication across cultures. Topics include nonverbal communication, time conceptualizations, perceptual and attitudinal foci, values, social organization patterns, cultural norms, language ethics, conflict across cultures, and research in intercultural communication.

506 Communication in International Organizations (3:3:0). Analysis of communication variables as they relate to organizational and managerial functions within international organizations. Focus on interpersonal aspects of government and business relations both outside the U.S. and with foreign visitors in the U.S., with extensions being made to management of subcultural differences within U.S. national organizations. Emphasis on developing an understanding of how cultural differ-

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ences influence managerial activities, and upon learning to deal effectively with these cultural differences.

510 Studies in Oral Interpretation (3:3:0). A comprehensive examination of the role of the oral communicator in the selection, adaptation, and performance of literature. Seminar course topics vary depending upon genre being considered. May be repeated three times for credit if each course is devoted to a different genre.

530 Theories of Small Group Communication (3:3:0). Advanced levels of theory and practice of small group interaction. Examination of current research in small group communication; a focus on learning the theory and application of the theory to relevant setting.

531 Approaches to Group Facilitation (3:3:0). Introduces various theoretical and practical approaches to group facilitation with in-depth focus and practice with one approach. Students participate in group sessions, analyze videotapes of decision-making groups, and practice different methodologies for facilitating group interaction.

534 Theories of Interpersonal Communication (3:3:0). Prerequisite: COMM 301 or permission of instructor. Contemporary theories of interpersonal communication. Analysis of theories, concepts, and approaches to the improvement of interpersonal communication. Extensive examination of interpersonal communication research is included.

535 Organizational Communication (3:3:0). An analysis of communication systems and processes within organizations, both public and private. Specific topics include conflict management, group decision making, interviewing, technical presentations, and use of various channels to improve internal and external communication for the organization.

536 Communication Consulting (3:3:0). Prerequisite: COMM 335. Investigation of theories that serve as the foundation for communication consulting. Designed to provide both the theoretical information and mechanisms for application necessary to modify communicative behavior within organizations.

540 Directing Forensics Programs in Individual Events (3:3:0). An investigation of the role of the individual events forensics educator in developing a high school or college program, coaching and judging competitive original speaking and oral interpretation events, and tournament management.

542 Directing Debate Activities (3:3:0). Theory and practice of competitive debate. Emphasis on traditional and contemporary theories of debate, administrative activities related to the direction of a debate program, and methods of instruction in debate, including analysis of current debate topic. For both novice and experienced debate coaches.

543 Advanced Debate Theory (3:3:0). Prerequisite: Prior debate and/or debate coaching experience or permission of instructor. Theoretical issues involved in the practice of debate. Critical examination of new issues in theory and discussion of revisions in theories designed to enhance academic debate.

550 Communication in the Classroom (3:3:0). Prerequisite: 84 hours. Examination of both verbal and nonverbal elements in the classroom that produce meaning among teachers and students. Communication theories and skills needed to manage the communication environ-

551 Developing Students' Speaking and Listening Skills (3:3:0). Prerequisite: 84 hours. Speaking and listening skills that develop the oral communication competency of children and adolescents. Emphasis on development of assignments that both directly and indirectly develop communication competence. The five functions of communication and steps in developing them are developed in the context of integrating the basic skills at the elementary level and direct teaching at the secondary level. Issues of definition in terms of philosophies of communication education and curriculum development, as well as competency assessment are covered.

554 Telecommunications Policy and Regulation (3:3:0). A review of the history and principles of telecommunications regulation. A study of the relevant policy-making and regulatory institutions and their roles in charting the course of telecommunications in the United States. Examination of the role of citizens and lobby groups in the regulatory process.

555 Theories of Telecommunications Production (3:3:0). Prerequisite: Approval of M.A.I.S. or permission of instructor. Telecommunications production theories involving computers, computer graphics, television cameras, computerized editing, audio mixing, and other production tools available for electronic communication. Explores problems of fitting messages to various media, including aesthetic demands on product imposed by new technologies.

556 Global Communication (3:3:0). The study of global telecommunication channels and artifacts of international mass communication, with focus on discussion of problems of free flow of information, the roles of national and international organizations in fostering global communication, and the roles of the old and new mass communication and other telecommunications technologies in worldwide social, political, educational, and economic development.

590 Seminar in Communication (3:3:0). Intensive study of specific topics in interpersonal, public, and mass communication. Specific content varies. May be repeated for credit with permission of department.

596 Directed Readings and Research (1-3:0:1-3). Prerequisite: Graduate standing and permission of department. Reading and research on a specific topic, under the direction of a faculty member. A written report is required; an oral or written examination over the material may be required. Course may be repeated for a maximum of 6 credits.

597 Independent Production (1-3:0:1-3). Prerequisite: Graduate standing and permission of department. Media or creative production activities, under the direction of a faculty member. A completed production is required; a written report and an oral examination may be required. Course may be repeated for a maximum of 6 credits.
694 Communication Internship (3-6:1-2:0). Prerequisite: Graduate standing and permission of department. Students will work in an approved, professional-level communication position, meeting regularly with an internship supervisor from the department. A paper and a journal are required, as well as a minimum of 60 hours work for each credit hour of enrollment. Normally, students will enroll in internships at the end of their program of study.

800 Studies for the Doctor of Philosophy in Education (variable credit). Prerequisite: Admission to the Ph.D. in Education program to study in communication. A program of studies designed by student's discipline director and approved by student's doctoral committee. Course work allows the student to participate in the research activity of discipline director and results in a paper reporting original contributions of the student. Enrollment may be repeated.

806 Seminar in Communication Skills for Teaching (3:3:0). Prerequisite: Admission to doctoral program or permission of the instructor. Study of principles and practices underlying effective lecturing and in leading instructional discussion. Application to the student's field of study is encouraged as a way of establishing the teaching environment. Same as EDCC 806.

Geology Courses (GEOL)

500, 501 Selected Topics in Modern Geology (1-3:1-3:0), (1-3:1-3:0). Prerequisite: Baccalaureate degree in geology or permission of instructor. Lecture/lab/field trip. Topic is designated in the class schedule.

503 Special Topics in Earth Science (1-6:1-6:0). Prerequisite: Employment or anticipation of employment as an Earth Science teacher. An inservice course designed to strengthen and update a teacher's knowledge of Earth Science.

800 Studies for the Doctor of Philosophy in Education (variable credit). Prerequisite: Admission to the Ph.D. in Education program to study in geology. Program of studies designed by student's discipline director and approved by student's doctoral committee, which brings the student to participate in the current research of the discipline director and results in a paper reporting the original contributions of the students. Enrollment may be repeated.

Philosophy and Religious Studies Courses (PHIL)

505 Professional Ethics (3:3:0). Advanced study of ethical theory as it applies to moral problems that arise in business and professional contexts.

510 Seminar in the Ethics of Health Care (3:3:0). Prerequisite: Junior, senior, or graduate standing or permission of instructor. An examination of moral dilemmas within the health-care profession based on ethical theories and principles. Special emphasis on patients' rights, social justice of health care, and evolving health-care technologies.

512 Issues in Philosophy and Literature (4:3:0). Prerequisite: Senior standing, 6 hours of 300-level English, and 6 hours of 300-level philosophy or permission of instructor. The topic of the seminar varies from term to term; possible topics include structuralism, technology, form and matter, conceptions of the future. The course is cross­listed and team taught.

531 Freud and Philosophy (3:3:0). Prerequisite: 6 hours in philosophy or a course in personality theory, or permission of instructor. Exploration of philosophical aspects of Freud's thought, focusing on Freud's philosophy of human nature and culture and its influence on contemporary thought.

555 Environmental Ethics (3:3:0). Prerequisite: Junior, senior, or graduate standing, and 3 credits in philosophy plus a combined total of 9 additional credits in philosophy and science or permission of instructor. Examination of ethical principles affecting environmental issues with special emphasis on the problems encountered by environmental biologists.

574 Current Issues in Philosophy of Psychology (3:3:0). Prerequisite: A combined total of at least 12 credits in philosophy or psychology, at least 3 of which must be in philosophy and at least 3 of which must be at 300 level or above, or permission of instructor. A careful examination of some issue or issues of current interest to both philosophers and psychologists. Typical of issues examined are the mind-body problem, philosophical and psychological implications of work in artificial intelligence, and philosophical issues in psycholinguistics.

591 Special Topics in Philosophy (3:3:0). Prerequisite: Graduate standing and permission of instructor. Examination of specific topics in philosophy that are of central interest in that field and of interdisciplinary interest as well. Topics will be selected with special reference to the areas of philosophy of technology, aesthetics, philosophy of religion, and ethics and social and political philosophy. Course may be repeated for credit up to three times (when the course content differs) with permission of the instructor and the student's adviser.

800 Studies for the Doctor of Philosophy in Education (variable credit). Prerequisite: Admission to the Ph.D. in Education program to study in philosophy. Program of studies designed by student's discipline director and approved by student's doctoral committee that brings the student to participate in the current research of the discipline director and results in a paper reporting the original contributions of the student. Enrollment may be repeated.

Study of the Americas Courses (STAM)

502 Problems in American Culture (3:3:0). Prerequisite: Graduate standing. Interdisciplinary study of a particular aspect of a culture or cultures of the Western Hemisphere. Limited to 15 students. Specific content varies and is announced before registration. May be repeated with permission of chair.

690 Internship (2-6:0:0). Prerequisite: Permission of chair. Internships are nonpaying, work-study positions established by the STAM program with employers involved in interdisciplinary STAM issues. Qualified students are placed with area schools, interest groups, agencies, museums, parks or corporations. Placement depends upon availability of positions.
Statement on Equal Opportunity and Affirmative Action

George Mason University is an equal opportunity and affirmative action institution committed to the principle that access to study or employment opportunities afforded by the university, including all benefits and privileges, be accorded to each person—student, faculty, or staff member—on the basis of individual merit and without regard to race, color, religion, national origin, veteran status, disability, sexual orientation, sex, or age (except where sex or age is a bona fide occupational qualification).

George Mason shall maintain a continuing affirmative program to promote equal opportunity and to identify and eliminate discriminatory practices in every phase of university operations. Furthermore, affirmative action will be taken to ensure that opportunities afforded by the university are fully available to persons with disabilities, women, disabled and Vietnam veterans, and minorities. The university will make every reasonable accommodation to enable students or employees with disabilities to undertake work or study for which they qualify.

As required by the Civil Rights Act of 1964, as amended, the university is committed to the broad application of Title IX of the Education Amendments of 1972, Title VI of the Civil Rights Act of 1964, the American Disabilities Act of 1990, Section 504 of the Rehabilitation Act of 1973, and the Age Discrimination Act of 1975.

Students and employees should bring problems or questions regarding EO/AA/Sexual Harassment policies to the attention of the supervisor, department chair, the dean of Student Services, an academic dean, the director of Human Resources, the university ombudsman, a trusted faculty or staff member, the Women's Studies Research and Resource Center, or the vice president and university equity officer, Mason Hall, Suite D105, 993-8750. Students with disabilities can contact Disability Support Services at Finley Building, Room 119, 993-2474.

Conduct

The university respects and protects the individual dignity, integrity, and reputation of its students. Students must comply with the conventions and regulations of university life that are necessary to maintain order, protect individuals and property, and fulfill the purposes and responsibilities of a university.

Students enrolling in the university assume an obligation to conduct themselves in a manner compatible with the university's function as an educational institution. The Code of Virginia (Section 23-9.2:3) confers upon the university the responsibility for maintaining order within the university and the right to exclude those who are disruptive.

The Office of the Judicial Administrator is administratively responsible for supervising student conduct on campus. A system of courts administers nonacademic discipline. In addition to these courts, the student Honor Committee, described under Academic Policies, is responsible for adjudicating violations of the Honor Code that relate to academic matters. Questions regarding student conduct should be directed to the Judicial Affairs office, Room 302, Student Union I (993-2884).

Privacy of Student Records

Annually, George Mason University informs students of the Family Educational Rights and Privacy Act (FERPA) of 1974. This act, with which the institution intends to comply fully, protects the privacy of education records, establishes the right of students to inspect and review their education records, and provides guidelines for the correction of inaccurate or misleading data through informal and formal hearings. Students also have the right to file complaints with the Family Educational Rights and Privacy Act office concerning alleged failures by the institution to comply with the act.

Local policy explains in detail the procedures to be used by the institution for compliance with the provisions of the act. The Office of the Registrar keeps a copy of the policy and also maintains a Di-
rectory of Records listing all education records maintained on students by this institution.

George Mason routinely complies with requests from the State Council of Higher Education for Virginia (SCHEV) for personally identifiable information on enrolled students. This information is for research purposes, and as a condition of accepting the data, SCHEV has agreed to protect it from further disclosure, except as aggregate data.

Questions concerning the Family Education Rights and Privacy Act may be referred to the Office of the Registrar.

Drugs and Alcohol Policy
(Adopted by the Board of Visitors, May 1990)

The abuse of drugs and alcohol by members of the George Mason University community is incompatible with the goals of the university. By defining standards of behavior and by providing educational programs to create an awareness of drug and alcohol-related problems, the university attempts to prepare individuals to act responsibly. Those in need of assistance in dealing with such problems are encouraged to seek the confidential services of the university's Counseling Center, the Student Health Center, or the Drug Education Center.

Drugs

The university prohibits the possession and use of illegal drugs. Possession, sale, use, or distribution of controlled substances, including marijuana, is a violation of both federal and state laws, and university regulations.

Alcohol

The use of alcoholic beverages on campus is at the discretion of the university and subject to state alcoholic beverage regulations. Unless the university has specifically sanctioned the location and condition of alcohol use, the possession and consumption of alcohol on campus is prohibited.

Individuals involved in the sale, use, or distribution of controlled substances (drugs and alcohol) are subject to arrest and university disciplinary action. The university imposes a variety of sanctions, which may include eviction from university housing and suspension or dismissal from the university.

The regulations outlined in this policy also apply to officially sponsored university activities held off campus.

Notice to All State Employees

The federal Drug-Free Workplace Act requires that we inform you that the unlawful manufacture, distribution, possession, or use of a controlled substance is prohibited in the workplace. The workplace consists of any state-owned, controlled, or leased property, or the site where state work is performed. Any employee who violates this prohibition will be subject to disciplinary action up to and including discharge and/or will be required to satisfactorily participate in a drug abuse assistance or rehabilitation program at the discretion of management. As a condition of employment, each employee must abide by the terms of this prohibition and notify his/her supervisor of any criminal drug statute conviction occurring in the workplace no later than five days after such conviction.

I. General Laws & Regulations

A. Those who choose to purchase, possess, and consume alcoholic beverages on campus must do so responsibly and be of legal age (21). All members of the university community, to include students, faculty, staff, alumni, and their guests, are expected to comply with federal and state laws regarding the use of alcohol and university-related regulations contained in this policy. This compliance also extends to university-sponsored activities held off campus. Students and employees are expected to take personal responsibility for their own conduct when making decisions regarding the use of alcohol.

B. Virginia state law prohibits the purchase, possession or consumption of beer, 3.2 beverages, wine or distilled spirits by persons under the age of 21. It is also prohibited to purchase for, or to serve such beverages to, a person under 21. Underaged persons who use or attempt to use a driver's license which has been altered, forged, borrowed from another, or is in any way deceptive in an attempt to obtain beverages prohibited to them shall have their driver's license revoked for not less than thirty days but not more than one year. Consuming alcohol in non-licensed public places or offering a drink to another in a non-licensed public place is also a violation of Virginia law. The sale of alcoholic beverages to an intoxicated person is prohibited. It is also unlawful for an intoxicated person to purchase or possess alcoholic beverages. While this purchase or possession is a misdemeanor, violators are also subject to having their driver's license revoked for a year. It is illegal to operate a motor vehicle—including mopeds—while a person has a blood alcohol concentration (BAC) of .08 percent or higher. Sobriety spot-checks to detect drunken drivers are legal.
C. It is illegal to serve alcohol from an unregistered keg (common container holding four gallons or more). Only University Dining Services or authorized entity may serve alcohol from kegs. Possession, use, sale or distribution of controlled substances, including marijuana, is a violation of both federal and state laws and university regulations. The 1988 federal Drug-Free Workplace Act also prohibits the unlawful manufacture, distribution, possession, or use of a controlled substance in the workplace.

D. Students, faculty, staff, and sponsoring organizations found in violation of state and/or university regulations may be subject to disciplinary action, civil action, and/or loss of the privilege to reserve or use university facilities. Disciplinary action for students or student organizations will be conducted in accordance with the George Mason University Judicial System for Student Conduct; civil proceedings may occur in certain situations. University sanctions are intended not to punish individuals but to provide education and rehabilitation services. Sanctions vary with severity of violation and range from written warnings to expulsion from the university. Included in most sanctions for students is an evaluation by the director of the Drug Education Center to ascertain severity of alcohol and other drug problems and a referral to arrange community service hours. Employees found in violation may be subject to action by their appropriate administrative office.

II. Health Risks

For most people in our society the use of chemicals is a daily reality. These chemicals include over-the-counter medications, prescription drugs, and illegal drugs such as marijuana, cocaine, and LSD. They also include legal chemicals such as alcohol, nicotine, and caffeine. Many chemicals have the potential to improve our health and enrich our lives. Yet many of these chemicals also have the potential to cause serious health problems.

Alcohol is a depressant that slows down brain activity. Like any drug that affects the mind, alcohol has the potential to be abused. Decision-making abilities can be impaired by alcohol use, which can cause negative consequences such as risky sexual behavior. It is expected that all students and employees respect those who choose not to drink. Drinking alcohol should be avoided particularly by pregnant women and anyone taking prescribed medications or operating a motor vehicle. Long term or heavy use of alcohol is linked to cancer, heart and liver damage, and other serious illnesses. Tolerance, physical and psychological dependence can develop. The potential for health problems can also develop from the use of nicotine or caffeine products.

Illicit drugs have more than legal consequences; they have specific health and ethical risks which can cause dangerous consequences and/or unhealthy dependent behavior. Use of alcohol or any other drug in a manner that leads to impairment or intoxication is unhealthy, risky, and should be avoided and discouraged.

Those in need of assistance in dealing with alcohol and other drug problems are encouraged to seek the confidential services of campus departments listed in Section IV.

III. General Regulations for Individuals and Organizations Serving Alcoholic Beverages

A. University regulations prohibit the possession or consumption of any alcoholic beverage on university grounds unless the university has sanctioned the location and/or conditions for possession or consumption (e.g., Rathskeller). For further information regarding service of alcohol at public and private events, as well as at the Patriot Center and Arlington Campus, please review the comprehensive guidelines for alcohol service available in the Drug Education Center.

IV. Campus and Community Resources

A. Individual assessments and training programs
B. Educational materials—print and video
C. GMU Alcohol and other Drug Policy handouts
D. CAMPUS NETWORKS—peer educator program
E. Community resource liaison/referral

The Counseling Center—Charlotte Stannard, M.Ed., LPC, 993-2380
A. Personal and group counseling
B. ACOA and recovery support groups

Human Resources—993-2600
A. Information and referral services for employees

The State Employee Assistance Service (SEAS) 804-786-6741
A. Call to make an appointment

Alcoholics Anonymous—for campus meetings call 993-3686; or in VA, 824-0071; in MD and DC, 966-9155

Narcotics Anonymous—in VA, call 281-8638; in MD, 731-7221

Northern Virginia Hotline 536-4077
A. 24 hour information help-line

Fairfax County - Falls Church Programs 359-7040
A. Programs funded by the county and based on a sliding fee scale.
The Alcohol and Other Drug Policy, composed of these four sections, outlines subject matter pertaining to university regulations on substance use and abuse. This policy is annually distributed to all employees and students as a means of informing the campus community of alcohol and other drug laws, health risks, and campus and community resources. University regulations regarding the Alcohol and Other Drug Policy have been developed by a committee of faculty, staff, and students. This policy statement is available in the Drug Education Center in Student Union I, Room 352. This policy is also distributed through the university catalogs, student and faculty/staff handbooks, and the university’s two newspapers: Broadside and The Mason Gazette.

Computer Use Policy
George Mason University has established regulations regarding computer resources. These regulations define computer violations and actions that are taken when a violation is confirmed. University computer resources are restricted to use for research, instructional support, and administrative purposes. Unauthorized access, including illegal use of passwords on mainframe systems, is prohibited. Also prohibited is use of legal access for unauthorized purposes, such as tampering with or destroying files, soliciting, or harassing. Illegal use or copying of licensed software or student files is also an offense.

In all cases where a violation is reported, the user’s access to hardware and/or software is terminated until a final decision is made. Depending on the status of the person involved and the nature of the violation, referral may be made to Student Services, Human Resources, or University Police. Section II of the Honor Code also applies to computer programs. A complete copy of the policy may be obtained from the Office of the Associate Vice President for Student Services or from University Computing and Information Systems.

Policy for Acceptable Use of Computing
This policy applies to all of the George Mason University community including students, faculty, administrators, staff, contract employees, and those who may be granted a guest computer account on a request basis by a system administrator. For purposes of this policy, computer systems include all computers and software owned by the university, any communications hardware and software provided by the university for the purpose of accessing its computers, and any computer network governed in part or whole by the university.

Computer systems at GMU support students, faculty, and staff as they carry out the educational mission of the university. The institution encourages and promotes uses of computing and network resources by the university community that are in keeping with this mission. Computing activities that do not support instruction, research, or administration are subject to regulation and restriction to ensure that they do not interfere with this legitimate work.

Access to any university computer system is provided with the understanding that the recipient is personally responsible for proper use of the resources, thereby respecting the work of others. The only way to ensure that limited resources are utilized fairly and that privacy is protected is to rely on the integrity of each computer user. Improper use of computer or network resources is not acceptable.

Examples of improper computer use include (but are not limited to):

Accessing, modifying, or attempting to access or modify any computer system, network, or program you are not authorized to use. (Authorization must be provided by the system administrator.) This includes using anyone else’s user ID.

Attempting to provide or providing computer or network resources to unauthorized users inside or outside the university community. (Authorization must be provided by the system administrator.) This includes allowing/enabling anyone else to use your user ID.

Using or attempting to use the computer to harass, threaten, or abuse others or to transmit obscene or fraudulent messages.

Attempting to access or accessing data without explicit permission from the owner.

Attempting to use or using university computer or network resources for personal or commercial profit, except as provided under the university’s research policy.

Tampering with, stealing, disabling, or destroying university hardware or software, or attempting to do any of these.

Violating software license agreements, copyrights, or intellectual property rights. This includes copying software without permission from the copyright holder or continuing to operate software for which the license has expired.

Each computer system administrator (in the case of the central academic and administrative computer systems and the campuswide network, the designated staff of University Computing and Information Systems) is obligated to protect the sys-
system and its users from injury or damage. A system administrator may temporarily suspend access privileges if necessary to maintain the integrity of the computer system or network. The UCIS directors (CNS, CSO, and CSS), and only they, can authorize the inspection of private data or monitoring of messages (including electronic mail) when there is reasonable cause to suspect improper use of computer or network resources.

A system administrator must obtain approval from a UCIS director to investigate reported or suspected improper use. Once approval is granted to conduct an investigation, the director must notify the university's Computer Security Review Panel within 24 hours that an investigation has been authorized. After the investigation has been approved by the director, the system administrator may take whatever action is needed to gather relevant evidence. If evidence of improper use is detected, it is reported to the Computer Security Review Panel, who may forward the information to appropriate authorities within or outside the university.

The university is committed to promoting ethical and responsible use of computer and network resources, and will not tolerate their misuse. Improper use may lead to one or more of the following consequences: loss of access privileges; requirement to reimburse GMU or the commonwealth of Virginia for misappropriated computer or network resources; disciplinary action under faculty standards, employee policies, or student judicial or honor codes; and/or prosecution under civil or criminal laws.

Motor Vehicles Policy

All faculty, staff, students, visitors, and guests who park in areas owned or operated by George Mason University must display a valid decal or day pass, park in the Parking Deck, or park at a meter. Decal and day pass enforcement runs from 7 a.m. to 8 p.m., Monday through Thursday, and until 5 p.m. on Friday. Metered areas are enforced from 7 a.m. until 11 p.m. seven days a week.

Three types of parking decals are available: yearly, semester, and summer. Day passes cost $2 per day for faculty, staff, and students with valid ID; $3 for visitors and guests. Decals and multiple day passes may be purchased at the Parking Services Sales Office located in Room 201 off the main lobby of Student Union Building I. The hours of operation are 9 a.m. to 7 p.m., Monday through Thursday, and until noon on Friday when classes are in session.

Single day passes may be purchased at the information booths located in front of Finley Building and in Lot K off Roanoke Lane. The information booths are open from 7 a.m. until 8 p.m., Monday through Thursday, and until 5 p.m. on Friday.

Handicapped parking is available at a number of convenient locations at George Mason University facilities. A decal or day pass must be displayed along with valid handicapped identification in order to avoid citation. Parking in or blocking access to a handicapped space carries a fine of $100.

Parking in the 615-space Parking Deck costs $1 per hour or $5 per day. Semester subscriptions are also available.

Some parking lots and some spaces have special designations. Please read all signs at entrances to lots. For additional parking information, call 993-2710.

Sexual Assault Policy

The following policy applies to all members of the George Mason University community: students, faculty, administrators, staff, contract employees, and visitors.

The university is committed to providing an institutional environment where all persons may pursue their studies, careers, duties, and activities in an atmosphere free of the threat of unwelcome and unwanted sexual actions. It strongly condemns sexual offenses and will not tolerate sexual offenders.

Rape and sexual assault are serious violations of the university's student judicial code, faculty standards, and university employee policies. They are crimes under state law and are punishable by fines and/or imprisonment. In addition, these actions are subject to civil suit for damages.

The university will respond promptly, fairly, and decisively to all reports of sexual assault and rape. Members of the university community accused of these actions will be subject to university disciplinary procedures when the alleged incident has occurred on campus or when the action has occurred off campus and materially affects the learning environment or operations of the university.

Sexual assault is defined as the attempt or act of rape, forced sodomy (anal intercourse), forced oral copulation (oral-genital contact), or forced penetration by a foreign object including a finger. Sexual assault also includes the act of touching of an unwilling person's intimate parts such as genitalia, groin, breast, or buttocks or the clothing covering these parts, or forcing an unwilling person to touch another's intimate parts. Intoxication of the assailant shall not diminish the assailant's responsibility for sexual assault.
Rape is defined as unwanted sexual intercourse. Unwanted sexual intercourse is defined as sexual intercourse committed against a person's will as evidenced by refusal of consent or the use of force, threat, or intimidation. Sexual intercourse committed with a person who, by virtue of mental incapacity or physical helplessness, is unable to give or withhold consent is also defined as rape. This definition of rape includes, but is not limited to, incapacity or helplessness caused by alcohol or other drugs. Intoxication of the assailant shall not diminish the assailant's responsibility for rape.

The above acts constitute sexual assault when they are committed through force, threat, or intimidation; when the perpetrator has been informed that his/her actions are unwanted; and through the use of the victim's mental or physical helplessness of which the accused was aware or should have been aware. The degree of impairment of the victim's ability to give or withhold consent may be introduced as pertinent information at any university disciplinary hearing.

Other Regulations

Weapons
The unauthorized possession, storage, display, or use of any kind of ammunition, firearms, fireworks, explosives, air rifles, air pistols, or other lethal instruments are prohibited on university property. Any questions regarding this regulation should be directed to the University Police (993-2810).

Smoking
Smoking is not permitted in classrooms, lecture halls, theaters, or in the university libraries. Areas in the student union buildings and other university buildings have been set aside for this purpose.

Bicycles/Skateboards
Bike racks are provided at various on-campus locations for the convenience of students who bike to and from the university. For resident students, there are bike racks in the residential complexes. Bikes and skateboards are not permitted on sidewalks, ramps, footpaths, or grassy areas of the campus or inside university buildings.

Pets
No pets are permitted in university buildings at any time. Additionally, pets that are on campus grounds must be on a leash and under supervision at all times.

Solicitors and Salesmen
Solicitors and salesmen, except on official business with the university, are not permitted on the campus without prior approval of the Auxiliary Enterprises office.
Campus Map and Telephone Directory
Legend

1. Academic Module
2. Amherst Hall
3. Arts Module
4. Baker House
5. Brunswick Hall
6. Buchanan House
7. Carroll Hall
8. Central Module
9. College Hall
10. Commerce Building
11. Commonwealth Hall
12. Concert Hall
13. Cross Cottage
14. David J. King Hall
15. Dickinson Hall
16. Dominion Hall
17. East Building
18. Essex Hall
19. Facilities Planning
20. Field House
21. Field House Module
22. Fine Arts Building
23. Finley Building
24. Franklin Hall
25. George's Hall
26. Grayson Hall
27. Greenhouse
28. Hanover Center
29. Harris Theatre
30. Housing III

H Handicapped Parking
M Metered Parking
## Telephone Directory

The general information number for George Mason University is (703) 993-1000. The university exchange is "993" except where indicated.

<table>
<thead>
<tr>
<th>Department/Office</th>
<th>Extension</th>
</tr>
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<tbody>
<tr>
<td>Academic Affairs, Provost</td>
<td>8770</td>
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<tr>
<td>D103 Mason Hall</td>
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<tr>
<td>Academic Advising Center</td>
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<td>Accounting and Business Legal Studies</td>
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<td>Department</td>
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<td>B441 Robinson Hall</td>
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<td>Administration, Executive Vice President</td>
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<td>Statistics Department</td>
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<td>159 Science and Technology II</td>
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<tr>
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<td>100C/205 Finley Building</td>
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<td>2100</td>
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<tr>
<td>Food Service</td>
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<tr>
<td>2014 Student Union II</td>
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<tr>
<td>Foreign Languages and Literatures</td>
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<td>Department</td>
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<td>Honor Committee</td>
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<td>321 Student Union I</td>
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<td>Housing and Residential Life</td>
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<td>Commerce I Building, 3rd Floor</td>
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<td>Information</td>
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<td>1000</td>
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<td>Information and Software Systems</td>
<td></td>
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<td>Engineering Department</td>
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<td>Institute of the Arts</td>
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<td>Institute for Humane Studies</td>
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</table>

http://catalog.gmu.edu
Institutional Planning and Research ..... 8839
D205 Mason Hall
International Programs and Services ..... 2970
308 Student Union I
Library—Fenwick ..... 2249
Library—Law, Arlington Campus ..... 8100
Management Department ..... 1820
B375 Robinson Hall
Marketing Department ..... 1840
B437 Robinson Hall
Mathematical Sciences Department ..... 1460
203 Science and Technology I
Minority Student Affairs ..... 2700
345 Student Union I
Music Department ..... 1380
A417 Performing Arts Building
Northern Virginia Writing Project ..... 1168
A409 Robinson Hall
Nursing Program ..... 1900
A357 Robinson Hall
Operations Research and Engineering Department
111 Science and Technology I ..... 1670
PAGE Office ..... 1110
222 Thompson Hall
Philosophy and Religious Studies Department ..... 1290
D108 Dickenson Hall
Physics and Astronomy Department ..... 1280
303 Science and Technology I
President ..... 8700
D103 Mason Hall
Prince William Institute
7946 Donegan Drive, Manassas ..... 8350
Program on Social and Organizational Learning ..... 1133
B333 Robinson Hall
Psychology Department ..... 1342
2003 King Hall
Public and International Affairs Department ..... 1400/1401
A201 Robinson Hall
Registrar's Office ..... 2446
110 Krug Hall
ROTC ..... 2707
28 South Physical Education Module
Sociology and Anthropology Department ..... 1440
B305 Robinson Hall
Student Financial Aid ..... 4350
201 Finley Building
Student Government ..... 2923
252A Student Union I
Student Health Center ..... 2830
232 Student Union I
Student Publications
GMView (video yearbook) ..... 2911
254B Student Union I
Broadside (newspaper) ..... 2945
253 Student Union I
Hispanic Culture
Review (literary magazine) ..... 2915
254A Student Union I
Phoebe (literary magazine) ..... 2915
239A Student Union I
So To Speak (literary magazine) ..... 2915
254A Student Union I
Student Services ..... 2884
302 Student Union I
Study of the Americas, Center for the ..... 1266
A441 Robinson Hall
Summer Information Center ..... 2300
132 East Building
Testing Center ..... 2390
100 Finley Building
Theater Division ..... 1120
A407 Performing Arts Building
Tutorial Services ..... 2999
350 Student Union I
University Activities ..... 8844
D21 Mason Hall
University Police—Fairfax Campus ..... 2810/2811
Police Building
Arlington Campus ..... 8070
University Relations ..... 8860
D115 Mason Hall
University Scholars Program ..... 2304
129 East Building
Veterans Services ..... 2448
112 Krug Hall
Vice President ..... 8850
D101 Mason Hall
WGMU Radio Station ..... 2940
213 Thompson Hall
Women's Studies Research and Resource Center ..... 2896
234 Student Union I
Writing Center ..... 1200
A116 Robinson Hall
Graduate Catalog 1994-1996
George Mason University
http://catalog.gmu.edu
Index
Index

A

Academic calendar, 2, 4
Accounting
  courses (ACCT), 134
  faculty, 132
  M.S., 132
Accreditation, 9
Activities
  musical, 52
  performing arts, 52
Adding and dropping courses, 27
Admission
  change in field of graduate study, 24
  deadlines, 22
  extended studies enrollment, 24
  guest matriculant, 24
  of graduate degree holders, 23
  of international students, 23
  offer of, 23
  policies, 22
  reactivation of deferred applications, 24
  readmission to a graduate program, 24
  records maintenance and disposal, 24
  Summer Term, 25
Admissions
  foreign language requirements, 23
Application for admission
  deadlines, 22
  requirements, 22
Applied and Engineering Physics, M.S.
  See Physics and Astronomy
Archeology courses (ANTH), 242
Archeology, M.A.I.S.
  See Interdisciplinary Studies
Arlington Campus Professional Center, 8
Art History courses (ARTH), 127, 255
Art Studio courses (ARTS), 128
Arts center, 7
Assistantships, 43
Astronomy courses (ASTR), 102
Athletic facilities, 7, 47
Auditing a course, 27

B

Bicycles, 265
Biology
  admission requirements, 55
  courses (BIOL), 57
  degree requirements, 55
  environmental science and policy
  specialization, 56
  faculty, 54
  M.S., 54
  specializations, 55
Black Box Theater, 7
Black Peer Counseling Program, 48
Business Administration
  accounting courses (ACCT), 134
  business legal studies courses (BULE), 138
  decision sciences courses (DESC), 139
  Executive M.B.A., 137
  faculty, 135
  finance courses (FNAN), 140
  M.B.A., 136
  management courses (MGMT), 142
  management information systems
  courses (MIS), 141
  marketing courses (MKTG), 143
  taxation courses (TAX), 135
Business legal studies courses (BULE), 138

C

Calendar, academic, 1994-96, 2
Campus facilities, 7
Campus map, 268
Campus Ministry, 50
Campus Networks, 50
Career Development Center, 47
Career Library, 47
Center for Applications of Mathematics, 15
Center for Basic and Applied Science, 15
Center for Behavioral and Cognitive Studies, 15
Center for Business Expert Systems Research, 15
Center for Computational Statistics, 15
Center for Cross-Cultural Understanding, 15
Center for Economic Education, 15
Center for European Union Studies, 15

http://catalog.gmu.edu
Center for Global Market Studies, 15
Center for Government, Society, and the Arts, 15
Center for Health Policy, 15
Center for Health Promotion, 15
Center for Human disAbilities, 15
Center for Image Analysis, 16
Center for Instruction Software in Astronomy, 16
Center for Interactive Educational Technology, 16
Center for Market Processes, 16
Center for Outdoor Education, 16
Center for Parallel Computation, 16
Center for Recreation Resources Policy, 16
Center for Robotics and Control, 16
Center for Secure Information Systems, 16
Center for Software Systems Engineering, 16
Center for Study of International Technologies, 16
Center for Study of Public Choice, 16
Center for Study of Regional Mobility, 16
Center for the Arts, 7
Center for Transportation and Land Policy, 16
Certificate programs listing, 13
Certificates
federal statistics, 197
gerontology, 221
international nursing, 217
nursing administration, 217
nursing education, 218
software systems engineering, 183
teaching English as a second language, 73
Chemistry
admission requirements, 60
courses (CHEM), 61
degree requirements, 61
faculty, 60
M.S., 60
Citizens' Applied Research Institute, 16
Commencement, 30
Commonwealth Graduate Engineering Program, 203, 254
Communication courses (COMM), 255
Community College Education courses (EDCC and COMC), 148
diploma program, 148
Doctor of Arts, 146
faculty, 146
Computational Sciences and Informatics associated faculty, 224
courses (CSI), 228
Ph.D., 226
Computer Science courses (CS), 169
faculty, 168
M.S., 168
specializations, 169
Computer use policy, 263
Computing facilities, 7
Concert Hall, 7
Conflict Analysis and Resolution courses (CONF), 236
faculty, 234
M.S., 235
Ph.D., 235
Consortium of Universities of the Washington, 8
Consortium on Peace Research, Education, and Development, 17
Cooperative Education program, 47
Counseling and development courses (EDGC), 160
Counseling Center, 48
Counseling services, 48
Course numbering, 13
Course symbols, 14
Creative Writing, M.F.A., 73
Cultural Studies admission requirements, 65
courses (CULT), 65
degree requirements, 65
faculty, 63
Ph.D., 64
D
Dance courses, 239
faculty, 238
M.F.A., 238
Dance company, 52
Dance Performance Studio, 7
Decision sciences courses (DESC), 139
Deferred payment plan, 39
Dental Plan, 50
Disability Support Services, 49
Dismissal, academic, 28
Doctoral degrees, 33
advancement to candidacy, 32
continuous registration, 33
dissertation, 33
dissertation committee, 32
dissertation submission and fee, 33
final doctoral examination, 33
program of study, 32
requirements, 31
research skill requirements, 32
residence requirement, 32
time limit, 32
Drug and alcohol policy, 261
E
Early Childhood Special Education Technical Assistance Center, 16
Economics courses (ECON), 68
  faculty, 66
  M.A., 66
  Ph.D., 67
Education courses (EDUC), 164
Education Graduate School of
  M.Ed. programs, 150
Education research courses (EDRS), 162
Education Study Center, 17
Education, Graduate School of
  counseling and development
    courses (EDGC), 160
  Counseling and Development, M.Ed., 153
  courses (EDUC), 164
  Curriculum and Instruction, M.Ed., 151
  Ph.D., 155
  education research courses (EDRS), 162
  Educational Leadership, M.Ed., 154
elementary/secondary education courses
  (EDCT), 157
  faculty, 149
  instructional technology (EDIT), 161
  leadership/supervision courses (EDAS), 156
  reading education courses (EDRD), 162
  school psychology course (EDSP), 164
  special education courses (EDSE), 163
  Special Education, M.Ed., 154
  teacher licensure programs, 151
Electrical and Computer Engineering
  courses (ECE), 174
  Electrical Engineering, M.S., 172
  faculty, 172
Elementary/secondary education
  courses (EDCI), 157
Eligibility for in-state tuition, 41
Emergency loan program, 43
Engineering
  electrical and computer, 172, 173, 175–177
  information and software systems, 178, 179,
  181, 183
  systems, 201, 203, 205, 207, 209
English
  concentration in literature, 72
  concentration in professional writing
    and editing, 72
  concentration in teaching of writing
    and literature, 72
  courses (ENGL), 74
  Creative Writing, M.F.A., 73
  faculty, 70
  graduate programs, 71
  Linguistics, M.A., 72
  M.A., 72
  teaching English as a second language
    certificate, 73
  English Language Institute (ELI), 17
  Enterprise Hall, 7
Entrepreneurship Center, 17
Environmental Science and Public Policy
  admission requirements, 79
  courses (EVPP), 80
  degree requirements, 79
  faculty, 78
  Ph.D., 79
  Program on Global Change, 80
Equal Opportunity/Affirmative Action, 260
Executive M.B.A., 137
Exercise Science and Health
  courses (EXSH), 213
  faculty, 212
  M.S., 212
Extended studies enrollment, 24
Externships, 47

F
Faculty
  number of full-time, 7
Federal Perkins Loan Program, 42
Federal Statistics certificate, 197
Fellowships
  See scholarships and fellowships
Fenwick Library, 7
Final examinations policy, 27
Finance courses (FNAN), 140
Financial aid, 41
  college work-study program, 42
  Stafford student loan, 42
  state nursing scholarships, 42
Financial penalties, 39
  collection of accounts, 40
  financial suspension, 40
  late fee, 39
  reinstatement fee, 40
  returned check fee, 40
Foreign language requirements, 23
  master's degrees, 30
Foreign Languages and Literatures
  concentration in one language, 81
  concentration in Spanish/bilingual education, 82
  concentration in two languages, 82
  courses (FRLN), 82
  faculty, 81
  French courses (FREN), 83
  German courses (GERM), 84
  M.A., 81
  Spanish courses (SPAN), 84
  French courses (FREN), 83

G
Geographic and Cartographic Sciences
  courses (GECA), 86
faculty, 85
M.S., 85
Geology courses (GEOL), 257
George Mason University Press, 9
German courses (GERM), 84
Gerontology certificate, 221
Gerontology, M.A.I.S.
See Interdisciplinary Studies
Grading system, 28
academic dismissal, 28
academic termination, 28
challenge of grade, 28
change of grade, 28
Graduate admission examinations
GMAT, 23
GRE, 23
Graduate Council, 12
Graduate course enrollment by undergraduates, 26
Graduate programs, listed, 12
Graduate study
administration, 12
program listing, 12
purpose of, 12
Guest matriculant, 24
Guide for Preparing Graduate Theses, Dissertations, Projects, 31, 33, 217

H
Harris Theater, 7
Health Center, 49
Health Education Center, 50
Health Insurance and Dental Plan, 50
History
courses (HIST), 89
faculty, 87
M.A., 88
Honor System and Code, 33
Housing, 46
costs, 39
refund policy, 40

I
Incubator Program, 17
Individualized Studies, M.A.I.S.
See Interdisciplinary Studies
Indochina Institute, 17
Information and Software Systems Engineering
courses (INFS), 181
faculty, 178
Information Systems, M.S., 179
software systems engineering certificate, 183
Software Systems Engineering, M.S., 182
Information Technology
courses (INFT), 188
Ph.D., 185
Inservice training program for teachers, 43
Institute for Advanced Study in the Integrative Sciences, 17
Institute for Computational Sciences and Informatics, 17
Institute for Conflict Analysis and Resolution, 17
Institute for Educational Transformation, 17
Institute of the Arts, 17
Institute on the Federal Theatre Project and the New Deal Culture, 17
Interdisciplinary Studies
archaeology courses (ANTH), 242
archaeology track, 241
courses (MAIS), 242
faculty, 240
gerontology, 242
individualized studies track, 240
Liberal Studies courses (LS), 241
liberal studies track, 240
M.A.I.S., 240
International Center for Applied Studies..., 18
International Institute, 18
International student health insurance, 38
International Student Services, 50
International students admission, 23
International Transactions
courses (INIL), 244
faculty, 243
M.A.I.T., 243

J
Job Center, 48

K
Krasnow Institute for Advanced Study, 18

L
Law and Economics Center (LEC), 18
Law, School of, 8
Leadership Academy, 18
Leadership/supervision courses (EDAS), 156
Learning in Retirement, 25
Liberal Studies courses (LS), 241
Liberal Studies, M.A.I.S.
See Interdisciplinary Studies
Libraries, 7
Arlington Campus, 7
Penwick, 7
Prince William Institute, 7  
School of Law, 7  
Linguistics, M.A., 72

Ph.D., 216  
special requirements, 214  
state scholarships, 42

Management courses (MGMT), 142  
Management information systems courses (MIS), 141  
Marketing courses (MKTG), 143  
Master's degrees  
degree applications, 30  
foreign language requirement, 30  
general requirements, 30  
thesis, 31  
thesis and nonthesis options, 31  
time limit, 31

Mathematics  
faculty, 92  
M.S., 92  
mathematical sciences courses (MATH), 93  
options in operations research and statistics, 93

Meal plan charges, 39  
Minority Student Affairs, 50  
Mission of the university, 9  
Monthly installment payment plan, 39  
Motor vehicle registration fees, 41  
Motor vehicles policy, 264

Music  
courses (MUSI), 97  
faculty, 95  
M.A., 95  
scholarships, 44

Philosophy and Religious Studies crs. (PHIL), 257

Physics  
Applied and Engineering Physics, M.S., 99  
courses (PHYS), 100

Physics and Astronomy  
astronomy courses (ASTR), 102  
faculty, 99  
M.S., 99  
specializations, 100

Policies, general, 260–266  
Prince William Institute, 6, 8, 18  
Privacy of student records, 260  
Procurement Technical Assistance Program, 18  
Program of study, doctoral students, 32  
Program on Global Change, 80  
Program on Social and Organizational Learning  
See Social and Organizational Learning, Program on  
Provisional status, change to degree, 29  
Psychological Clinic, 19  
Psychology  
Clinical Psychology, Ph.D., 110  
courses (PSYC), 111  
Developmental Psychology, Ph.D., 110  
Experimental Neuropsychology, M.A., 107  
faculty, 105  
Human Factors Engineering, M.A., 107  
Human Factors Engineering, Ph.D., 109  
Industrial/Organizational, M.A., 107  
Industrial/Organizational, Ph.D., 110  
Life-Span Development, M.A., 107  
M.A., 106  
Ph.D., 108  
School Psychology, M.A., 107  
Public Administration  
courses (PUAD), 117

National Policy Board for Education Administration, 18  
Nondegree status, change to degree, 29  
Northern Virginia Institute (NVI), 18  
Northern Virginia Mediation Service (NVMS), 17, 18  
Northern Virginia Small Business Development Center, 18  
Northern Virginia Survey Research Center, 18  
Northern Virginia Writing Project, 18

Nursing  
continuing education, 217  
courses (NURS), 218  
courses at George Washington University, 221  
faculty, 213  
international nursing certificate, 217  
M.S.N., 214  
M.S.N./M.B.A., 215  
nursing administration certificate, 217  
nursing education certificate, 218

On-campus interviews, 48  
Operations Research and Engineering courses (OR), 196  
faculty, 194  
Operations Research and Management Science, M.S., 195

Parking, 9, 41  
Patriot Center, 7, 47  
Performing arts activities, 52  
Performing arts facilities, 7, 47  
Pets, 265

http://catalog.gmu.edu
doctoral study, 117
faculty, 115
M.P.A., 115
management and analysis track, M.P.A., 116
Public Affairs course (PUAF), 117
Public Policy
courses (PUBP), 250
faculty, 247
Ph.D., 248

R
Reading education courses (EDRD), 162
Recreational facilities, 47
Registration
academic load, 26
for non-enrolled students, 26
permission to register, 25
procedures and information, 26
Repeating a course, 27
Research skill requirements, doctoral degrees, 32
Residence halls, 8, 46
Residence requirement, doctoral students, 32
Robinson Professors, 7

S
Schedule of Classes, 25
Scholarships and fellowships
music, 44
Student Education Association Endowment Fund, 44
University fellowships, 42
Woodrow Wilson Foundation, 43
Zonta scholarship, 43
School psychology course (EDSP), 164
Self-Development Center, 48
Senior citizens enrollment, 24
Shared Research Instrumentation Facility, 19
Skateboards, 265
Small Business Institute (SBI), 19
Smoking, 265
Social and Organizational Learning, Program on
courses (LRNG), 103
faculty, 102
Sociology
applied sociology track, 122
conflict analysis track, 122
courses (SOCI), 122
Crime, delinquency, and corrections track, 122
cultural studies track, 122
faculty, 121
general sociology track, 122
M.A., 121
race and ethnicity track, 122
sex and gender track, 122
Software Systems Engineering
certificate, 183
courses (SWSE), 184
M.S., 182
Software Systems Engineering certificate, 169
Solicitors and salesmen, 265
Spanish courses (SPAN), 84
Special education courses (EDSE), 163
Special registration fee, 38
Sports and Recreation Complex, 7, 47
Stafford Student Loan Program, 42
Starting Small, 17
Statistics
courses (STAT), 200
doctoral study, 199
faculty, 197
federal statistics certificate, 197
M.S., 198
Student Health Center, 49
Student information, 26
Student Leadership Center, 52
Student organizations, 52
Student Unions, 46
Student Volunteer Center, 52
Study of the Americas courses (STAM), 257
Summer Term, 2, 3, 25–27
Systems Engineering
Command, Control, Communications,
and Intelligence track, 204
courses (SYST), 206
faculty, 201
M.S., 202
Urban Systems Engineering course (USE), 209

T
Taxation
courses (TAX), 135
Taxation, M.S.
degree requirements, 134
Teacher certification programs, 151
Teaching English as a Second Language
certificate, 73
Telecommunications
areas of specialization, 125
faculty, 124
M.A., 124
Telephone directory, 270
Termination, academic, 28
The Institute of Public Policy (TIPP), 17
The National Center for Community College Education, 18
Theater of the First Amendment, 19, 52
TheaterSpace, 7
Thesis committee, 31
Thesis submission deadlines, 31

http://catalog.gmu.edu
Time limit
   doctoral degrees, 32
   master's degrees, 31
Transfer of credit, 29
criteria for, 29
Tuition and fees, 38
   application for in-state tuition rates, 41
   charges, 38
   credits earned elsewhere, 38
   deferred payment plan, 39
   in-state tuition, 41
   international student health insurance, 38
   monthly installment plan, 39
   nonpayment cancellation fee, 40
   special enrollment fee, 38
   withdrawal fee, 40

V
Veterans services, 51
tutorial services, 44
Virginia War Orphans Education Program, 44
Virginia Economic Bridge Initiative, 19
Visiting the campuses, 9
Visual Information Technologies, 126
course work, 127
facilities and equipment, 127
faculty, 126
M.A., 126
M.F.A., 126

W
Washington Research Library Consortium, 7
Weapons, 265
Withdrawal fee, 40
Withdrawal from all classes, 27
Women's Studies Research and Resource Center, 19, 51
Writing Center, 19, 51

X
XLibris, 7
Graduate Reply Card

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