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 programs and degrees offered by the Graduate School. 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) 993-1000.

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Table of Contents

Academic Calendar, 1992-94 ........................................... 2
Profile of George Mason University ................................. 6
The Graduate School ...................................................... 12
  Graduate Programs ..................................................... 12
  Educational Centers ................................................... 14
Graduate Policies and Procedures .................................... 20
  Registration .............................................................. 23
  Graduate School Policies ............................................. 26
  Degree Requirements .................................................. 29
  Honor System and Code ............................................... 32
Tuition, Expenses, and Financial Aid ................................ 38
Student Life .................................................................. 46
Areas of Study ................................................................ 52
  Accounting ................................................................. 52
  Art ........................................................................... 55
  Biology ....................................................................... 58
  Business Administration ............................................... 65
  Chemistry ..................................................................... 74
  Community College Education ....................................... 76
  Computational Sciences and Informatics ......................... 79
  Computer Science ........................................................ 86
  Conflict Analysis and Resolution .................................... 90
  Dance .......................................................................... 94
  Economics ................................................................... 96
  Education ................................................................. 100
  Electrical and Computer Engineering .............................. 118

English ................................................................. 124
Foreign Languages and Literatures ................................... 131
Geographic and Cartographic Sciences .............................. 135
History .................................................................. 137
Information and Software Systems Engineering ................ 142
Information Technology ................................................. 148
Interdisciplinary Studies .................................................. 156
Mathematics ............................................................... 162
Music ........................................................................ 166
Nursing ........................................................................ 169
Operations Research and Applied Statistics ....................... 176
Physical Education .......................................................... 179
Physics ....................................................................... 181
Psychology .................................................................. 184
Public Administration ...................................................... 193
Public Policy .................................................................. 199
Sociology ....................................................................... 203
Statistics ...................................................................... 206
Systems Engineering ....................................................... 211
Telecommunications ......................................................... 217

Programs and Additional Graduate Courses ....................... 220
General Policies ............................................................. 226
Campus Map ................................................................. 232
Telephone Directory ......................................................... 234
Index .......................................................................... 237
Academic Calendar
Academic Calendar, 1992-94

Fall Semester 1992

August 31
First day of classes.

September 7
Labor Day; university closed.

September 15
Last day for schedule adjustment and registration.

October 2
Last day to drop without dean's permission.

October 11-13
Columbus Day recess (Monday classes and laboratories meet on Wednesday this week only).

November 26-29
Thanksgiving recess; university closed.

December 12
Last day of classes.

December 14-19
Examinations (for times, see Schedule of Classes).

Spring Semester 1993

March 14-21
Spring recess.

May 8
Last day of classes.

May 12-18
Examinations (for times and snow day make-up, see Schedule of Classes).

May 22
Commencement.

May 31
Memorial Day observed; university closed.

June 2
Summer Term begins.

Summer Term 1993

Summer Term consists of three sessions of five or eight weeks from June 2 to August 6. More than 650 day or evening classes are scheduled, making it possible to earn up to 12 credits. For details, consult the Summer Term Catalog, available in early March.

Fall Semester 1993

August 30
First day of classes.

September 6
Labor Day; university closed.

September 14
Last day for schedule adjustment and registration.
October 1
Last day to drop without dean’s permission.

October 10-12
Columbus Day recess (Monday classes and laboratories meet on Wednesday this week only).

November 25-28
Thanksgiving recess; university closed.

December 11
Last day of classes.

December 15-21
Examinations (for times, see Schedule of Classes).

Spring Semester 1994

January 24
First day of classes.

February 7
Last day for schedule adjustment and registration.

February 25
Last day to drop without dean’s permission.

March 13-20
Spring recess.

May 7
Last day of classes.

May 11-17
Examinations (for times and snow day make-up, see Schedule of Classes).

May 21
Commencement.

May 30
Memorial Day observed; university closed.

June 1
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 1994

Summer Term consists of three sessions of five or eight weeks from June 1 to August 5. More than 650 day or evening classes are scheduled, making it possible to earn up to 12 credits. For details, consult the Summer Term Catalog, 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 almost 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 60 other GMU centers and institutes enhance university scholarship and contribute, both directly and indirectly, to the intellectual growth of the George Mason student.

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, School of Nursing, Graduate School, and School of Law. GMU offers more than 100 degree programs, including 53 undergraduate, 35 master's, 12 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 88 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 undergraduate 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 643 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 and the Law Library at the Arlington Campus, house collections of approximately 900,000 volumes, with annual additions of 14,000 books. Periodical subscriptions total 6,700. 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 third 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.

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/racquetball, and volleyball courts; a baseball and softball diamond and batting cage; a weight room; saunas; and golf and archery nets. 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 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, 6:00, and 7:20 p.m. Non-credit courses are scheduled from 8 a.m. to 4 p.m. Approximately 500 non-credit courses are taught in the Professional Center. More than 11,000 credit and non-credit students are served.

The 200-seat Conference Center hosts an additional 15,000 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.

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, and financial services and real estate—that allow students to supplement their general legal education with in-depth study of a specialized area of practice. Two additional tracks, litigation and international business transactions, are being offered in the 1992-93 academic year.

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.

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 is by permit or decal only, Monday through Friday from 7 a.m. to 8 p.m. 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. Adopted January 1991.
The Graduate School
The Graduate School

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 Graduate School encourages research, inquiry, and scholarship at the highest levels from both students and faculty.

The Graduate School offers 44 master's programs, 12 doctoral programs, and 10 certificate programs. Nearly all graduate courses are offered in the late afternoon and early evening. In fall 1991 there were 5,000 master's and doctoral students at George Mason, and 1,600 postbaccalaureate students were taking courses through extended studies enrollment.

Organization
The Graduate Faculty is the governing body for all academic policies and procedures of the Graduate School. The Graduate Faculty 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. The Graduate Council is the executive and policymaking body of the Graduate Faculty.

Administration
Kingsley E. Haynes, Dean

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
Graduate School requirements 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 the Areas of Study section, where they are 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. (Accounting and Business Legal Studies)
Applied and Engineering Physics M.S. (Physics)
Biology M.S. (Biology)
Graduate Programs 13

Business Administration M.B.A., E.M.B.A. (School of Business Administration)
Chemistry M.S. (Chemistry)
Community College Education D.A. (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)
Curriculum and Instruction M.Ed. (Graduate School of Education)
Dance M.F.A.
Economics M.A., Ph.D. (Economics)
Education D.A.Ed. (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)
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. (Graduate School)
International Transactions M.A.I.S. (International Institute)
Law J.D. (School of Law)
Mathematics M.S. (Mathematical Sciences)
Music M.A. (Music)
Nursing M.S.N., Ph.D. (School of Nursing)
Physical Education M.S. (Human Services)
Psychology M.A., Ph.D. (Psychology)
Public Administration M.P.A. (Public Affairs)
Public Policy Ph.D.
Sociology M.A. (Sociology and Anthropology)
Software Systems Engineering M.S. (Information and Software Systems Engineering)
Special Education M.Ed. (Graduate School of Education)

Systems Engineering M.S. (Systems Engineering)
Taxation M.S. (Accounting and Business Legal Studies)
Telecommunications M.A. (Graduate School)

Certificate 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.
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 undergraduate students who have secured the permission of the department offering the course may select from these courses to accumulate the hours necessary for completion of an undergraduate degree. With the written permission of the Graduate School, they may take these courses for reserve graduate credit.
600-699 Open only to graduate students (admitted 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 reserved for the uses designated:
600-609 Limited applicability graduate credit courses. Courses intended for in-service professional development and not directly leading to a graduate degree. A limited number of hours from these courses may be applied to a graduate degree.
798 Master's project research.
799 Master's thesis research.
800 Studies for the Doctor of Arts in Education 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:

Accounting
American Studies
Art History
Art Studio
Astronomy
Biology
Business Legal Studies
Chemistry
Communication
Community College Education
Community College Education
Computational Sciences
Computer Science
Conflict Management
Dance
Decision Sciences
Doctor of Arts in Education
Economics
Education
Education: Administration/Supervision
Education: Elementary/Secondary
Education: Guidance/Counseling
Education: Reading
Education: Research
Education: School Psychology
Education: Special Education

Electrical and Computer Engineering
English
Finance
Foreign Language
French
Geographic and Cartographic Sciences
Geology
German
Government and Politics
History
Information Systems
Information Technology
Interdisciplinary Studies
International Transactions
Management
Management Information Systems
Marketing
Mathematics
Music
Nursing
Operations Research
Philosophy and Religious Studies
Physical Education
Physic
Psychology
Public Administration
Public Affairs
Public Policy
Society
Spanish
Statistics
Software Systems Engineering
Systems Engineering
Urban Systems Engineering

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 Applied Research and Development in Education (CARD)
A collaboration between GMU's Graduate School of Education and school divisions in Northern Virginia to establish networks and develop projects from a range of funding sources.

Center for Artificial Intelligence Research
Conducts basic and experimental research on fundamental problems of artificial intelligence and cognitive science, such as machine learning and
ference, cognitive models of human plausible reasoning, computer vision, second-generation expert systems, and intelligent autonomous robots.

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 Geography and Earth Systems Science.

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 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.

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

Center for Economic Education
Helps pre-college educators (K-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.

Center for European Community Studies
Appointed a European Documentation Center by the Commission of European Communities, it is the only center in the U.S. 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 (C^3I)
Nation's first university-based comprehensive technology development program. Performs research in data fusion, command decision-making theory, communications, simulations, and C^3I systems engineering. Offers programs/communication between large and small companies.

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.

Center for Health Care 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
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 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 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 the Study of 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, Market Process, and affiliated with the Economics Department.

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 Economics Department.

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.

Educational 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.

Employee Development Institute
Offers specialized training for each personnel group in a company, as well as training in skills to improve quality and productivity. Managers contribute to course design.

English Language Institute
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 Small Business Development Center and the Entrepreneurship Development Program.

First Liberty Institute
Promotes a new curriculum that introduces concepts of religious pluralism in social studies lessons for upper elementary, junior high, and high school students, and serves as a national training and resource center for teaching principles of religious freedom.

Indochina Institute
Serves as a clearinghouse for information and research on Indochina and its refugees, and sponsors conferences and workshops. Affiliated with the Public Affairs Department.

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" (gap between implementation of information systems and the user's knowledge).
Institute of the Arts
Aspires to make 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.

Institute for Computational Sciences and Informatics (ICSI)
Combines research from the Biology, Mathematics, and Physics departments with the School of Information Technology and Engineering. 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.

Institute 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.

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.

The Institute of Public Policy
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 policy management, 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 with Argentina, Chile, Bulgaria, Czechoslovakia, Poland, Romania, Yugoslavia, Spain, Sudan, and Egypt.

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.

Law and Economics Center (LEC)
Demonstrates the applicability of economic scholarship to legal policy and to the substance and procedures of law. Offers residential programs for federal judges, law professors, and academic economists.

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 BTAP Regional Center
This center is located in the Graduate School of Education at George Mason University. Funded by the State of Virginia, the role of BTAP (Beginning Teacher Assistance Program) is twofold: (1) to assess beginning teachers in the classrooms to ensure that they possess certain minimum competencies; and (2) to assist beginning teachers in meeting these competencies. Successful completion of BTAP is required for a teacher to receive a five-year renewable Collegiate Professional Certificate.

Northern Virginia Institute
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.
Northern Virginia Mediation Service
Helps mediate interpersonal conflicts by using impartial third-party volunteers trained in communications or ex-Conflict Center students.

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.

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 Sociology and Anthropology Department.

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

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

Public Management Institute
A service of the Public Affairs Department, the institute promotes more effective exchange among government managers, the university, and business organizations by mutually improving government management.

Shared Research Instrumentation Facility (SRIS)
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 Development Center (GMU/SBDC)
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.

Technical Assistance Center
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.

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.

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.

The 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 Prospectus.

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 the Graduate School. Although the primary mission of the Graduate School 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 School 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, Fairfax, VA 22030-4444; (703) 993-2400 or 993-2404. An applicant seeking admission to the Graduate School must submit the following:

1. An application form.
2. Two official copies of transcripts from each institution attended.
3. A $25 application fee (nonrefundable).
4. A Virginia Domicile Classification form.
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. A notarized Affidavit of Financial Support Form for Foreign Students (J-1 and F-1 visas).
8. A student from a non-English-speaking country must complete the Test of English as a Foreign Language (TOEFL) and attain a score of 575 or higher. A TOEFL score of at least 600 is required of teaching and research assistants.

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 Prospectus for any variation in deadlines.

Master's Programs:

- Fall semester . . . . . . . . . May 1
- Spring semester . . November 1
- Summer Term . . . . . . . . . March 1
(Economics does not admit in the spring. Only selected programs offer summer admission; see program for details.)

Doctoral Programs:

- **Biology:**
  - Fall, April 1
  - Spring, November 1

- **Community College Education:**
  - Fall, July 1
  - Spring, November 1

- **Computational Sciences and Informatics:**
  - April 1

- **Conflict Analysis and Resolution:**
  - Fall only, April 1

- **Economics:**
  - Fall only, April 1
  - (February 1 for students applying for graduate assistantship)

- **Education:**
  - Fall, February 1
  - Spring, November 1

- **Information Technology:**
  - Fall, May 1
  - Spring, November 1

- **Nursing:**
  - Fall only, March 1

- **Psychology:**
  - Fall only, February 1
  - (Preferred filing date: January 15.)

- **Public Policy:**
  - Fall only, May 1

**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, or 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 Academic Testing, Finley Building, (703) 993-2390. Applicants also may write directly to GRE, Box 955, or GMAT, Box 966, Princeton, NJ 08540. A telephone number in the Washington, D.C., area for the Educational Testing Service is (202) 659-0620.

**Graduate School Foreign Language Tests**

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. Information concerning the Graduate School Foreign Language Tests (GSFLT) may be obtained from Academic Testing.

**Admission of International Students**

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 in-
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 to the Graduate School
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 applies. 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 the Graduate School
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 four 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 600-level graduate courses. Prospective enrollees are required to supply unofficial evidence of their academic background along with the enrollment request packet.
to the Extended Studies Enrollment office. 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 who wish to apply for graduate admission to the university may do so at any time by following the regular graduate admission procedures.

If a student applies for admission to the Graduate School and is accepted into a degree program, a maximum of 12 hours of graduate credit earned through extended studies enrollment may be applied toward a master's degree program with approval of the graduate dean. After admission to the Graduate School and during initial registration as a degree student, the student is responsible for initiating a request on a Transfer of Credit Form for courses completed while enrolled through the extended studies division. If the student also has transferable credit from another institution, the amount of applicable credit earned through extended studies enrollment 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. An enrollment packet for requesting guest matriculant status may be obtained from the Extended Studies Office.

**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.

**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 in the Graduate School is permitted only after the student has been notified of admission. Admitted students are given preference over nonadmitted 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, Graduate School, 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 the Graduate School and all applicable departmental requirements that govern the individual program of
study. Students should consult with their advisers before registration each semester.

For newly admitted graduate students, the course request form must be signed by the faculty adviser prior to registration.

Schedule of Classes and Course Request Form

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. Dropping or adding a course and procedures for making other changes in registration are also outlined in the schedule.

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 the Course Request Form to be used at the time of registration. 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 entered on the Course Request Form. For newly admitted graduate students, the Course Request Form must be signed by the faculty adviser prior to registration.

Registration Procedures and Information

The Schedule of Classes contains instructions for registering. Any graduate student who fails to appear for registration within the specified period will not be permitted to register unless the delay can be explained to the satisfaction of the department chair.

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 and the Graduate School 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 institutional attended, and other similar information.

Students desiring to withhold directory information from the public should request such withholding 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 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 normal full-time academic load is 12 semester hours. The minimum full-time academic load is nine hours per semester during the regular academic year. 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 department offering the courses. Permission must be obtained in writing prior to registration. Forms are available in the Graduate School office. 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.

Graduate School 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 an Add/Drop Form and submit it at the registration site. Forms may be obtained from the appropriate department, at the Office of the Registrar, or at the registration site.

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 the Graduate School.

Upon approval by the dean of the Graduate School, 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 Graduate School 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 School 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 graduate 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 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 may be assigned a letter grade or S (satisfactory), NC (no credit), or IP (in progress). 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 graduate dean. (Refer to Challenge 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).

Challenge 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 challenge 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 performs satisfactorily during any academic period (semester or summer session) in which the student receives a grade point average of 3.0 or higher. 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 unsatisfactory 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 Graduate School dean 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 to the Graduate School in nondegree status may request a change to degree-seeking status within the same program. To do so, the student must secure departmental and Graduate School approval on the Graduate School’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 Graduate School’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 graduate dean, 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 School. 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 graduate 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 Graduate School. 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 graduate 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 Graduate School. 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 graduate dean prior to registering at the other institution. Permission to take course work elsewhere forms are available in the Graduate School office. The student is responsible for requesting transfer credit for such courses after their completion and for having an official transcript submitted to the Graduate School 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 the graduate 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 graduate dean. The graduate 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, doctoral students who have been inactive more than one year or master's students who have been inactive more than two years 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 must secure a degree application from the Office of the Registrar and return it with departmental signatures to the Graduate School 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 es-
Graduate Catalog 1992-1994
George Mason University

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 Graduate School.

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. Doctoral students may attend Commencement only if all requirements have been completed, including dissertation defense.

Degree Requirements

Requirements Applicable to All Master's Degrees
Candidates must satisfy all Graduate School 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 or GMU Extended Studies 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. 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 Graduate School.

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 graduate 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. Each program that requires a thesis or that gives students the thesis option specifies 3-6 hours of 799. Students who are still writing their theses after they have met the 3-6 hour requirement must register for 1 hour of thesis (799) each semester until the thesis is completed.

The master's thesis committee is named by the candidate's department chair, who also designates a member of the Graduate Faculty from that de-
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 Graduate School representative, and the graduate dean.

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 within five years following the semester of advancement to candidacy. 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 of the Graduate School 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 of the Graduate School. 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 dean of the Graduate School, 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 dean of the Graduate School 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 in the Graduate School office. 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. 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 and a schedule of such registration must be filed with the Graduate School at the time of the doctoral student's advancement to candidacy. Registration and billing for 999 will then be automatic each semester. When the student completes the minimum number of required dissertation hours the student will automatically be billed for the required one credit of continuous doctoral registration.

Once the minimum 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
dissertation 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 reponsible for making all required changes promptly,
securing the signatures of the director and other
members of the dissertation committee, and submit-
ting the original and required copies to the
Graduate School office for the graduate dean’s
approval.

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 Micro-
films 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, at-
temted 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 re-
port, 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 administra-
tion. It is made up of students selected by the
student body and has the primary duty of espous-
ing the values of the Honor Code. Its second-
ary function is to sit as a hearing committee on all
alleged violations of the code.

At the beginning of each semester faculty mem-
bers 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 respon-
sibility, respect, trust, and fairness among all mem-
ers of George Mason University, and with the
desire for greater academic and personal achieve-
ment, we, the members of George Mason Univer-
sity, 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 unautho-
rized, 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 an-
other 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 ac-
knowledgment.
2. Borrowing the sequence of ideas, the ar-
rangement of material, or the pattern of
thought of someone else without proper ac-
knowledgment.
C. Lying encompasses the following:
The willful and knowledgeable telling of an un-
truth, as well as any form of deceit, attempted

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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 counselors 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 requirements 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 or 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 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 Dean of the Graduate School 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
By registering, students accept responsibility for the charges of the entire semester. The basic rules are:

1. Registration shall not be completed unless all outstanding balances due the university are paid in full.
2. Payments are due at the Cashier's Office on or before due dates (regardless of postmark if mailed).
3. Failure to receive a bill does not waive the requirement for payment when due.
4. The student is responsible for maintaining a current billing address at the Office of the Registrar.
5. Determination of domicile requires completion of the Virginia Domicile Classification Form available in the Office of Admissions.
6. The entire student registration is cancelled if payment or payment arrangements are not made in full.
7. The Office of the Registrar must receive written notice of withdrawal from students who find they cannot attend classes during the semester for which they are registered.

Payment and Cancellation Schedule
For payment and cancellation schedule information, student should refer to the semester's Schedule of Classes.

Continuing/Late Registration
Students registering on or after the date on which the reminder bills are mailed will receive a class confirmation schedule showing tuition due at time of registration. The full amount shown must be paid directly to the Cashier's Office on the day of registration. The entire registration will be canceled if payment or payment arrangements are not made for the full amount.

Tuition and Related Fees
Tuition Charges Per Semester 1992-93

<table>
<thead>
<tr>
<th></th>
<th>In-State</th>
<th>Out-of-State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per-credit-hour</td>
<td>$139.00</td>
<td>$358.50</td>
</tr>
<tr>
<td>Related Fees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application fee</td>
<td>$25.00</td>
<td>$25.00</td>
</tr>
<tr>
<td>Late fee</td>
<td>25.00</td>
<td>25.00</td>
</tr>
<tr>
<td>Return check charge</td>
<td>25.00</td>
<td>25.00</td>
</tr>
<tr>
<td>Reinstatement fee</td>
<td>25.00</td>
<td>25.00</td>
</tr>
<tr>
<td>Withdrawal fee</td>
<td>25.00</td>
<td>25.00</td>
</tr>
<tr>
<td>Nonpayment cancellation fee</td>
<td>25.00</td>
<td>25.00</td>
</tr>
</tbody>
</table>

Returned Check Fee
A check returned by the bank means the student has an unpaid account. In addition to this balance due, a $25 returned check fee and a $25 late fee will be added. The total due must be paid within 10 days or the student will be placed on financial suspension.

Withdrawal Fee
A $25 withdrawal fee will be charged to all students who withdraw after the cancellation date through the first week of classes.

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

On-Campus Housing Costs
Room Rental Charges Per Semester

<table>
<thead>
<tr>
<th></th>
<th>2-person</th>
<th>4-person</th>
<th>6-person</th>
<th>Double rooms</th>
<th>Single rooms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apartments</td>
<td>$1,975.00</td>
<td>1,820.00</td>
<td>1,615.00</td>
<td>1,575.00</td>
<td>1,850.00</td>
</tr>
<tr>
<td>Commonwealth and Dominion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Commons</td>
<td></td>
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<td></td>
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<tr>
<td>University Park</td>
<td></td>
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<tr>
<td>Patriots Village</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Residence III</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
All rates are per person. Four persons are assigned to a two-bedroom townhouse.

### Meal Plan Charges Per Semester

<table>
<thead>
<tr>
<th>Meals per Week</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>$880.00</td>
</tr>
<tr>
<td>15</td>
<td>800.00</td>
</tr>
<tr>
<td>10</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, 106 Krug Hall, 9 a.m. to 4:30 p.m.
- Drop Box outside Cashier's Office, 107 Krug Hall
- 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.
- **Credit card** (subject to credit approval): MasterCard or Visa. Authorizations in writing only. Daytime phone number must be provided.

For payment information or information on payment plan options, please call the Bursar's Office at 993-2490.

### Payment Plan Options

#### Installment Payments-Academic Year

Full-time students may budget all or part of the annual tuition, room, and board in 10 equal monthly installments. The annual fee of $45 includes a Life Benefit Insurance plan. For information, call Academic Management Services at 800-556-6684 toll free.

#### Deferred Payments-Semester

A contract must be completed at the Bursar's Office and be 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.

The deferred balance due must be received on or before the due dates as stated on the contract.

A $25 late fee is assessed by GMU on all payments received late.

### Financial Penalties

#### Late Fee

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

### 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.

### Reinstatement Fee

Students placed on financial suspension because of outstanding obligations in excess of $50 are assessed a $25 reinstatement fee.

### Collection ofAccounts

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 any additional costs incurred in collecting 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.

### Refunds

#### Tuition

Students withdrawing from the university before the beginning of the semester or during the first week of classes may have their tuition refunded, less an administrative charge of $25. Assessed penalties are nonrefundable. Partial refunds for a semester are processed after the schedule adjustment period.

Tuition is refunded on a graduated scale for voluntary drops and withdrawals during the second and third weeks of classes. The calculation of the amount of refund is based on the date of the drop or withdrawal as certified by the Office of the Registrar. Hours dropped after the third week of classes must be paid for in full. To initiate the refund process, the student submits a request to the Bursar's Office.

Students who fail to submit a written withdrawal request to the Office of the Registrar are liable for full tuition charges.

**Tuition Refund Scale:**
- **Week 1** 100% less $20
- **Week 2** 66.7% of total
- **Week 3** 33.3% of total
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 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.

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. Tuition rates may vary for courses taken as a GMU student through another institution.

Credits Earned Elsewhere

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

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 present in Virginia with the intention of remaining in the state permanently.

Domicile, however, is primarily a question of intent and the burden of proof of domicile is upon the student seeking the benefit of in-state tuition. See the receptionist in Finley Building for a copy of the complete domicile legislation.

Change of Domicile Classification

Students requesting a change of classification from out-of-state to in-state must file the required form before the first day of the semester for which in-state status is sought. Forms are available in the Finley Building reception area.

Penalties

A student who provides false information or refuses or conceals information for the purpose of achieving in-state status, or who fails to notify the university of a change of facts that might affect reclassification from in-state to out-of-state status, shall be required to pay retroactively any tuition and fees that would normally have been charged and shall be subject to appropriate disciplinary action.

Other Expenses

International Student Health Insurance

Health insurance is required for all F-1 and J-1 Visa holders. Health insurance fees are deducted from the student's account.
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, loans, and employment. Awards are based on financial need. Located in 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.

To apply for financial aid, each year new and currently enrolled students must complete a Financial Aid Form and forward it to the College Scholarship Service in Princeton, New Jersey. The Office of Student Financial Aid has a priority filing date of March 1.

Applications received after the deadline are evaluated according to the availability of funds.

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

Federal Programs
The Perkins Loan
Long-term, five-percent-interest loans from the federally sponsored Perkins Loan Program are available to qualified students. Repayment begins six months after graduation and may be deferred for students entering graduate school, the Peace Corps, VISTA, or military service. Repayment may be deferred three years for those temporarily disabled. Students must be enrolled at least half-time to qualify. Half-time is defined as 6 credit hours for both undergraduate and graduate students.

Stafford Student Loan Program (SSL)
Students must demonstrate need through the Financial Aid Form and be enrolled in a degree program at least 6 hours to qualify. Eligible students may borrow up to $7,500 per graduate grade level up to a total of $54,750 (including $17,250 of undergraduate SSLs). The government pays the 8 percent interest until the repayment period begins six months after the student leaves school. Interest remains at 8 percent through the fourth year of repayment and increases to 10 percent beginning the fifth year of repayment.

Supplemental Loan Program (SLS)
SLS is an additional form of financial aid to be used in conjunction with or in lieu of the Stafford Student Loan (SSL) program. SLS loans are available to students who are ineligible for the SSL program or need funding above the SSL amounts. This program can aid middle-income families and others who are not able to meet the cost of education through grants, scholarships, SSLs, and other financial aid programs. This is a non-need program, so anyone may participate. For specific information, contact the Office of Student Financial Aid.

Virginia Programs for State Residents
State Nursing Scholarships
The Bureau of Public Health Nursing provides limited scholarships to Virginia residents. These scholarships are based on need and are available to graduates and undergraduates. Applications are made directly to the Bureau of Public Health Nursing. The application deadline for students previously enrolled in a nursing program is March 1. The deadline for new students entering a nursing program is June 1. Applications are available in the Office of Student Financial Aid.

Graduate Assistance
Graduate School 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 9 hours of graduate work each semester. Applications must be submitted to the Graduate School for review by the department of the student's major. Prospective graduate students must also have a completed application file in the Office of Admissions to be considered. Applications are available in the admissions packet for students applying to the university. Students already admitted to a graduate program
may obtain an application by calling the Graduate School at (703) 993-8862.

**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 to the Graduate School for study leading to a profession. The field of study and the amount of the award varies. Applications are available in the Graduate School office at (703) 993-8862 for information and an application. The application deadline is April 15 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 1992-93 academic year. Applications for a graduate assistantship should be sent to the department where the student seeks an assistantship. Applications are available in the admissions packet for students applying to the university. Students already admitted to a graduate program may obtain an application by calling the Graduate School at (703) 993-8862.

**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 Program**

**Mary E. Ferguson Emergency Loan Program**
Currently enrolled students may borrow funds for legitimate emergencies. Tuition and fees, books, and supplies are not considered emergencies. Emergency loans must be repaid within 30 days; overdue payment results in a late charge of $5. Failure to repay the loan within 30 days, without requesting an extension for a reasonable excuse, will result in financial suspension. Students financially suspended for nonpayment of an emergency loan are ineligible for any future emergency loans.

**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, 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 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 Veterans Administration with the school certification.

4. Students must request the veterans' counselor to send an enrollment certificate to the Veterans Administration Regional Office each school year (each semester if the students are under half-time, 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 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 (notify VARO immediately)
   e. withdrawal from school (notify immediately)
Forms for making these changes are available at the Office of Veterans' Services, Finley Building, Room 201.

6. VA benefits are paid on the following basis:

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<thead>
<tr>
<th></th>
<th>Undergraduate</th>
<th>Graduate</th>
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</thead>
<tbody>
<tr>
<td>Full time</td>
<td>12 hours</td>
<td>9 or more hours</td>
</tr>
<tr>
<td>3/4 time</td>
<td>9-11 hours</td>
<td>6, 7, 8 hours</td>
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<tr>
<td>1/2 time</td>
<td>6-8 hours</td>
<td>4, 5 hours</td>
</tr>
<tr>
<td>less than 1/2 time</td>
<td>4-5 hours</td>
<td>3 hours</td>
</tr>
<tr>
<td>more than 1/4 time</td>
<td>less than 4 hours</td>
<td>less than 3 hours</td>
</tr>
</tbody>
</table>

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 Veterans Administration does not pay for audit courses.

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 campus.

Tutorial Service for Veterans

The VA will pay $84 per month, not to exceed $1,008 per year, for needed tutorial services. For further information, see the Veterans' Services Office on campus.

Virginia War Orphans Education Program

The Virginia War Orphans 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.
Student Life
Students Life

Student Support Services

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

Student Unions

The two student unions are the centers for co-curricular life on the campus. They emphasize educational programs, student activities and services, and act as a focal point to bring together all members of the GMU community. The unions have one basic goal—to enrich university life outside of the classroom.

SUB I serves as the center for student life. It is home to 200 student organizations and several administrative offices. Students and staff can relax in the gameroom, meet in the meeting rooms, study in the Quiet Study Lounge, write papers in the Typing and Computer Lab, and socialize in the Patriot’s Lounge. SUB I houses the Mini-Mall, which includes a bank, credit union, copy shop, sports boutique, and a school supply and gift store. Food is available at H.B. Quick’s, the Rathskeller, and the Pizza Hut Express. The Quickstop serves as a one-stop shopping convenience store.

SUB II serves primarily as a conference and event center, housing a ballroom and 10 fully equipped meeting rooms. The university Bookstore and University Dining Services by Marriott are also located there. Students and staff can eat in the Resident Dining Hall, the Marketplace, the University Room, and the brand new Court Cafe.

Both unions have a scheduling office for room reservations and an information desk to provide current information on campuswide events. Call SUB I, 993-2855, or SUB II, 993-2859, for details about union services.

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 1990s Patriot Center events were the Moscow Circus, NCAA Volleyball Championships, James Taylor, Michael Bolton, and Randy Travis.

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

Performing Arts Facilities

The Concert Hall, built to seat 2,000, can present full-scale music, dance, and theater productions. Designed by renowned theater architect George C. Izenour, it can be converted to an intimate, 800-seat space by lowering a light bridge and curtain between the orchestra and the grand tier sections. TheaterSpace and the Black Box Theater provide one of the most versatile performance spaces in the complex and can accommodate almost any seating configuration and staging specifications. Harris Theater, adjacent to the Concert Hall, is a proscenium venue seating 500. Three dance studios are each equipped with sprung wooden floors, mirrors, barres, marley floor coverings, and floor-to-ceiling mirrors. One studio also converts to a dance performance space.

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 Health Center
The GMU Student Health Center is operated through a partnership between the Office of Student Services and the School of Nursing. The principle mission of the Student Health Center is the provision of the highest quality of primary health services for the students of George Mason University. The Health Center offers a comprehensive, confidential health service for students, targeted to their particular primary care health needs. This includes 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 Health Center. The full-time Health Center staff includes a registered nurse clinic coordinator and administrative personnel. A part-time physician (medical director) and several nurse practitioners provide full-time medical/health care coverage.

The Student Health Center is located on the Fairfax Campus in Student Union I, Suite 232, (703) 993-2830. Hours are Monday through Friday 8:30 a.m. to 5 p.m. (except noon hour) when the university is in session. Students born in 1957 or later must submit documentation of two MMR (measles) immunizations via the Confidential Medical Form to the Student Health Center.

Health Insurance and Dental Plan
All students of George Mason University are eligible, on a voluntary basis, to enroll in the university-endorse 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 fee per year, 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, claim forms, and dental plan information, may be obtained at the Student Health Center, Student Union I, Suite 232, (703) 993-2827.

Disability Support Services
Students with disabilities, including learning disabilities, have access to a wide range of services and assistance. Because students who need special considerations in curriculum, assignments, or testing must provide documentation of their disabilities, they are advised to forward existing documentation to Disability Support Services. Please contact the advisor at (703) 993-2474 (voice/TDD) 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.

Housing and Residential Life
Affordable on campus housing is available to married and single graduate students. We have developed a residential environment and program to be supportive of the needs of graduate students.

Spaces are available in one bedroom apartments, shared by two students, two-bedroom townhouse units shared by four students, and single room suites sharing a bathroom. The apartments and townhouses have kitchen units.

http://catalog.gmu.edu
Each unit is fully furnished, all utility charges are included, and cable service is available in the townhouses.

For information about housing costs refer to the Tuition, Expenses, and Financial Aid section of the catalog. For more information about on-campus housing and meal plans, call or write the Office of Housing and Residential Life, Student Union I, Room 310, (703) 993-2720. Office hours are 8:30 a.m. to 5 p.m., Monday through Friday.

Counseling Center Services
The Counseling Center is staffed by qualified professionals who are available at no charge to all graduate students for both individual and group counseling. Assistance is provided for concerns about marital and other relationships, stress management, coping with multiple roles, uncertainty about life goals, and dealing with emotions that interfere with academic performance. The center also provides consultation regarding referrals to mental health agencies or practitioners.

The main office is in Student Union I, Room 364 and is open Monday through Friday from 8:30 a.m. to 5 p.m., and Tuesday evenings. For information about the following Counseling Center services call 993-2380: mental health services, self-assessment, black peer program, consultation, training and supervision, and referral to other mental health services. For information about study skills and tutoring call Learning Services at 993-2999.

The university Counseling Center is accredited by the International Association of Counseling Services. All services to students are confidential and no information is released without the student's written consent.

Career Development Center
The Career Development Center provides career consultation, career information, cooperative education, part-time and full-time job listings, and job hunting assistance to students and alumni. 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 offered:

Career Consultation. Through individual sessions with the consultant for their major, students learn a career-planning, decision-making process that can be used throughout their lives. Thorough self-assessment of personal interests, skills, values, and motivations is emphasized prior to research-
interview requirements is made available at that time.

Job Leads. Graduating students and alumni can register to receive weekly bulletins of full-time job vacancies. Job notices are 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.

Veterans' Services

The university's Office of Veterans' Services assists veterans, service personnel, dependents, and survivors in obtaining authorized educational benefits. The office helps veterans adjust to university life. Located in Finley Building, Room 210, the office is open Tuesday through Friday from 9: a.m. to 3 p.m., and Monday 9 a.m. to 1 p.m.

Minority Student Services

Minority Student Services is an administrative office that coordinates the university's planning and programming for ethnic (minority students), Asians, Hispanics, and Native Americans. The office staff works with minority students to help them understand their academic needs and then find appropriate ways to meet those needs. The office also 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 understanding and create an educational atmosphere in which minority students will be successful. Minority Student Services is in Student Union I, Room 345, (703) 993-2700.

Women's Studies Research and Resource Center

The Women's Studies Research and Resource Center is located in Student Union Building I, Room 206A, (703) 993-2896. The center is open to the public and to the university community. 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.

Campus Ministry

The Campus Ministry is an ecumenical group available on campus to assist students, faculty, and staff. The ministry includes religious counsel-
Student Life Programs

Student participation helps shape the character and 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 through 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. It is the individual student's responsibility to notify an organization when becoming ineligible.

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 Department 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.

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, academic, 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.

Recognized student organizations are also members of larger umbrella organizations. These clusters of organizations facilitate coordinated development of campus activities, interaction with other student organizations, and fee funding for student organizations. They also provide a university mailing address, access to file and storage space, duplicating services, and a channel of communication with the university administration regarding support services for student organizations.

The Student Organization and Programs Center maintains updated information on names and phone numbers of contact persons in each organization. The Student Organization Information Packet, a "how-to" resource handbook for student leaders, can be obtained there. The office staff also consults with students or student organizations that are planning programs for students; assists new clubs in attracting members and receiving recognition; and offers leadership training through workshops, retreats, and credit course formats to organization members and to students not affiliated with a club.

Broadside is the university's student-run newspaper. The paper provides opportunities in news writing, sports reporting, feature writing, editing, layout, advertising, public relations, and many other areas. Contact the Broadside staff in Student Union I for more information.

Student Alumni Association

The Student Alumni Association consists of students who work with and assist the Alumni Association and the Alumni Affairs Office. They participate in homecoming, the annual pho­nathon, and other events and activities.

The Office of Alumni Affairs is located in Mason Hall, Room D201. Alumni and students are welcome to visit the office from 8:30 a.m. to 5 p.m. daily. For more information, call 993-8696.
Areas of Study
Areas of Study

Accounting

Faculty
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
Eyler, Kel-Ann S., Ph.D., Georgia State University, 1990; 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
Harr, David J., Ph.D., University of Wisconsin, 1978; CPA, Assistant Professor
Heller, Kenneth H., Ph.D., University of Texas, Austin, 1977; CPA, Professor, Department Chair
Horn, Betty C., Ph.D., Georgia State University, 1987; Assistant 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
Tucker, Michael J., Ph.D., University of Houston, 1980; J.D., New York University, 1974; CPA, Associate Professor
Wilkie, Patrick J., Ph.D., University of Michigan, 1984; Assistant Professor

Accounting, M.S.
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 Accounting Department’s programs are fully 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. and M.S.T. programs 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.

Admission Requirements
Students registering for graduate-level courses numbered 600 or higher offered by the School of Business Administration must have graduate standing (i.e., be admitted to the Graduate School.)

Degree applicants must fulfill the general admission requirements of the Graduate School.

Admission to the M.S. degree 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.
Degree Requirements
The programs each require 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 common bodies of knowledge. 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 common bodies of knowledge as defined by the School of Business Administration includes 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 in the M.S.A. or M.S.T. program. M.S.T. students must have previously completed a course in accounting information systems or complete ACCT 712 Accounting Systems as an elective.

M.S. in Accounting
Each candidate must complete the following accounting core courses unless, in the opinion of the department faculty, the candidate has had previous comparable graduate-level course work that would justify substitution of other graduate accounting courses.

1. ACCT 712 Accounting Systems
2. ACCT 713 Managerial Accounting Theory
3. ACCT 732 Financial Accounting Theory
4. ACCT 762 Advanced Auditing Theory and Practice

5. A tax course from the 700-level graduate tax courses

M.S.A. 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 600-level or higher, which may include a course in international business as approved by the program director.

Accounting:
Any 700-level accounting or taxation course

Finance:
FNAN 711 Corporate Financial Policy
FNAN 717 International Finance
FNAN 721 Investment Analysis
FNAN 722 Portfolio Analysis

Decision Sciences:
Any decision science course at the 700 level

Management Information Systems:
Any management information systems course at the 700 level

Taxation Track. Twelve additional hours must be taken in taxation. ACCT 740 Tax Research is required. The remaining 9 hours of taxation must be from any combination of 700-level graduate tax courses. The remaining 3 hours must be from 600-level or higher graduate courses, which may include a course in international dimension of business as approved by the program director.

M.S. in Taxation
The M.S.T. program prepares students for professional careers in taxation. The faculty includes both full-time faculty members and some extraordinarily qualified adjunct faculty from the metropolitan Washington professional community. Currently, all taxation courses with the M.S.T. program are offered at the George Mason Arlington Campus.

Each candidate must complete 15 hours of tax core courses as follows:
1. ACCT 740 Tax Research
2. ACCT 741 Corporate Federal Income Taxation I
3. ACCT 742 Corporate Federal Income Taxation II
4. ACCT 743 Partnership Taxation
5. ACCT 744 Federal Estate and Gift Taxation
In addition, 9 hours of tax courses must be selected from the following:

- ACCT 745 Tax Exempt Organizations
- ACCT 746 International Taxation
- ACCT 747 Advanced Tax Topics
- ACCT 748 State and Local Taxation
- ACCT 749 Pensions and Deferred Compensation

The remaining 6 hours may be elected from 600-level or higher graduate courses and may include ACCT 712 Accounting System and/or a course in the international dimension of business as approved by the program director.

### Accounting Courses (ACCT)

#### 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 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 MBA 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. Accounting systems design and integration with other information systems.

#### 713 Managerial Accounting Theory (3:3:0). Prerequisite: ACCT 650. Controllership function in public or private organizations, particularly in regard to development of policy and evaluation of performance.


#### 740 Tax Research (3:3:0). Prerequisite: 24 credits of graduate and/or undergraduate accounting courses. Study of the process necessary to research a tax problem, to arrive at a defensible solution, and to communicate that solution. Emphasis is on the tools of tax research: Internal Revenue Code, Treasury Regulations, and administrative and judicial sources of tax law.

741 Corporate Federal Income Taxation I (3:3:0). Prerequisite: 24 credits of graduate and/or undergraduate accounting courses. Concepts and principles that relate to federal income taxation of corporations and their shareholders. Emphasis is on research of fact 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.

742 Corporate Federal Income Taxation II (3:3:0). Prerequisite: ACCT 741. Concepts and principles that relate to the more complex issues of federal income taxation of corporations and their shareholders. Emphasis is on research of fact situations. Coverage includes corporate reorganizations, multiple corporations, and consolidated returns.

743 Partnership Taxation (3:3:0). Prerequisite: 24 credits of graduate and/or undergraduate accounting courses. 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.

744 Federal Estate and Gift Taxation (3:3:0). Prerequisite: 24 credits of graduate and/or undergraduate accounting courses. 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.

745 Tax Exempt Organizations (3:3:0). Prerequisite: ACCT 740 recommended. Tax issues dealing with tax-exempt organizations, including tax exempt status, qualifying as a charitable organization, non-charitable exempt organizations, and unrelated trade or business income.

746 International Taxation (3:3:0). Prerequisite: ACCT 740 recommended. Taxation of individuals and corporations with foreign source income and tax liability to the United States.

747 Advanced Tax Topics (3:3:0). Prerequisite: ACCT 740 recommended. 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.

748 State and Local Taxation (3:3:0). Prerequisite: ACCT 740 recommended. Detailed analysis of the principal forms of state and local taxation.

749 Pensions and Deferred Compensation (3:3:0). Prerequisite: ACCT 740 recommended. Analysis of the structure, operation, and requirements for obtaining and maintaining IRS approval of tax-qualified pensions, profit-sharing, and deferred compensation plans.

752 Federal Taxation and Business Planning (3:3:0). Prerequisite: ACCT 650. Topics include organizations, acquisitions, mergers, spinoffs, and other divestitures from the viewpoint of profit planning, cash flow, and tax deferral. Emphasis on tax problems of corporations. This course is not available to M.S. in accounting students.


782 International Accounting (3:3:0). Prerequisite: ACCT 650. Principles, practices, and techniques used by multinational enterprises in international trade and investment. Topics include financial and managerial accounting, auditing, foreign currency translations, and U.S. tax policy toward the multinational firm.

792 Seminar in Accounting (3:3:0). Prerequisite: ACCT 650. Study of selected areas in accounting theory, practice, and methodology, and the influence of selected aspects of other disciplines upon the development of accounting concepts.

796 Independent Study and Directed Readings (3:0:0). Prerequisite: ACCT 650. By special arrangement with professor and approval of the accounting chair.

800 Seminar in Research Methodology in Accounting I (3:3:0). Prerequisite: Admission to the accounting Ph.D. program. Introduction to the basic tenets of scientific inquiry, ranging from the development of a legitimate research question to the development of an appropriate research methodology. Special emphasis on research methodologies common to accounting research.

810 Financial Accounting Research Seminar (3:3:0). Prerequisite: ACCT 800. In-depth review of classical and contemporary research in financial accounting, examined from both theoretical and methodological perspectives.

820 Managerial Accounting Research Seminar (3:3:0). Prerequisite: ACCT 800. In-depth review of classical and contemporary research in managerial accounting, examined from both theoretical and methodological perspectives.

830 Seminar in Research Methodology in Accounting II (3:3:0). Prerequisite: ACCT 810 and 820. Capstone course in the accounting doctoral program. Each student develops and presents a research proposal in the student's special area of interest. Although not mandatory, this research proposal may serve as the first step in the development of a dissertation proposal. The seminar is also a forum for topical scholarly presentations by faculty, some of which may be in areas not covered in ACCT 800-820.

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 doctoral supervisory committee. May be repeated with no more than 24 semester hours applied to the Ph.D. degree requirements.

Art

Faculty
Clapsaddle, Jerry, M.F.A., Indiana University, 1966; Associate Professor
Hammond, Mary, Ph.D., Ohio State University, 1986; Associate Professor
Kravitz, Edward Walter, M.F.A., Syracuse University, 1967; Associate Professor
Mones-Hattal, Barbara, M.F.A., Rhode Island School of Design, 1979; Assistant Professor
Sokolove, Deborah, M.F.A., California State University, Los Angeles, 1986; Assistant Professor
Ward, Nicholas, M.F.A., Maryland College of Art, 1971; Associate Professor

Visual Information Technologies M.A., M.F.A.

Offered through the Department of Art and Art History, the Visual Information Technologies program provides graduate studies in electronic and digital media technology, areas that affect computer imaging and animation (computer graphics) and visual communication design (graphic design).

The M.A. degree requires 45 credit hours and is a professional program aimed at the needs of high-tech industries and businesses. These include video production houses, graphic design firms, federal and local government training programs, and computer industries.

The M.F.A. requires 60 credit hours and is a terminal degree that allows students to explore their areas of concentration in depth. Students are encouraged to explore new forms of expression by integrating traditional media with new tools. The program offers historical and philosophical learning experiences, as well as applied and professional ones.

Admission Requirements
Candidates for the M.A. or M.F.A. in Visual Information Technologies must meet the following requirements in addition to the general requirements for admission to the Graduate School:

B.A. or B.F.A. degree
Portfolio review
Graduate Record Examination scores
Letter/statement of intent
Letters of reference
The student's portfolio is a major selection criterion for graduate admission, regardless of area of application. Evidence of applications in the arts using emerging technologies for both the fine and applied arts is of particular interest. Diversity among the group of students accepted for study is another consideration. Applicants with degrees in areas other than art may be required to complete the undergraduate art studio core. A personal interview is strongly recommended. Students who have previously earned M.A. degrees and wish to earn M.F.A.'s must complete a minimum of 30 credits.

Degree Requirements

Basic requirements .......................... 12

M.A. students must complete the following courses for a total of 15 hours:
- ARTH 600 Research Methods .................. 3
- ARTH 620 Philosophy of Art .................. 3
- ARTS 670 Teaching Practicum
  and/or ARTS 693 Apprenticeship ............. 3
- ARTH 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 art studio 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 videographer, the computer artist, or any other creative artist who wishes to use these technologies for art forms.

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 Department of Art and Art History is in the Center for the Arts complex and has individual studio spaces available. The department has three computer labs, video and darkroom facilities, and a separate graphic design studio. It has strong ties to other programs within the College of Arts and Sciences and to the rest of the university.

Art History Courses (ARTH)

592 Exhibitions Projects (3:3:0). Prerequisite: B.A. 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: B.A. or equivalent or permission of instructor. 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.

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 Research Methodologies (3:3:3). 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 of Art (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.

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 typeface that is used in a self-promotional package consisting of both hardcopy and hypertext.


616 Hypertext and Hypermedia (5:2:6). 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). 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 programs.

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 concentrat-
ing 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.

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.

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).
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 student 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). 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 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.

Biology

Faculty

Adamkewicz, S. Laura, Ph.D., University of Virginia, 1968; Associate Professor
Andrykovitch, George E., Ph.D., University of Maryland, 1968; Associate Professor
Birchard, Geoffrey F., Ph.D., Dartmouth Medical School, 1985; Associate Professor
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
Gretz, Michael R., Ph.D., Arizona State University, 1981; Associate Professor
Hart, Jayne T., Ph.D., University of Wisconsin, 1969; Professor
Helliotis, Francis D., Ph.D., University of Wisconsin, 1985; Associate 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
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
Shaffer, 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; Robinson Professor of Biological Sciences and History of Science.

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.

Admission Requirements

An applicant for the M.S. program 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 subject biology portion with no raw subscore less than 60 (40th percentile).

Degree Requirements

A student must complete at least 30 semester hours, including two hours of seminar, one of which must be BIOL 690 Introduction to Graduate Studies in Biology. The student is first assigned an academic adviser and then must form a three-member graduate committee within the first 15 hours of course work. At the conclusion of the program, the student must successfully complete an oral and written comprehensive examination or defend a thesis. A student who completes a thesis presents his or her research in a public seminar. 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. Systematic, Evolutionary, and Population 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, populations, and experimental biology.

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

Admission Requirements
Those holding a baccalaureate degree in natural or earth sciences, engineering, resource planning, or related fields from an accredited institution, with a GPA of 2.75 (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 one or two deficiencies before being permitted to enroll in the program. Three letters of recommendation should be submitted including at least one from a former professor. The aptitude portion of the Graduate Record Examination is required and a substantial statement of interest in the program, potential area of specialization, and of career goals should be submitted with the standard application. An interview is recommended.

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.

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, computing 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 environment science seminar must be taken once.

Course requirements can be filled from a variety of departments on campus. With the recommendation of an advising committee and approval of the graduate dean, a student may transfer up to 6 semester hours of graduate credit earned at another accredited institution prior to acceptance and enrollment in the Graduate School and apply it toward the master's degree requirements. Up to 12 credits may be transferred within the Cooperative Engineering Program.

Research
Students have the option to conduct either a formal thesis for which up to 6 credits of BIOL 799 (master's thesis) could be earned, or a project for which up to 3 credits of BIOL 798 (master's research project) 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. Thesis or project research credits count for Category 4. 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—Public Policy, Ph.D.

The Ph.D. program in environmental science-public policy offers training in the traditional research-oriented disciplines of ecology and environmental science, as well as in public affairs, business administration, and economics. Graduates develop research, technical, and administrative skills that enable them to deal effectively with pure and applied environmental research, policy issues, environmental legislation, and implementation of environmental law. Prospective students who are already employed as environmental scientists by government, industry, or consulting firms have the opportunity to upgrade and broaden their skills. Recent bachelor's or master's degree recipients gain practical experience and important contacts during the internship phase of their training.
Admission Requirements
An applicant should have a bachelor's degree with an overall grade point average of at least 3.0 (on a scale of 4.0) unless adequate experience or other qualifications are presented at the time of application. The application deadline for admission in the fall semester is April 1 and for the spring semester, November 1.

All applicants for degree status must submit:
1. Scores on the aptitude portion of the Graduate Record Examination;
2. Three letters of recommendation;
3. Official transcripts from each college or university attended;
4. A recent resume and a substantial statement of interest in the program, potential area of specialty, and career goals.

Degree Requirements
The Environmental Science and Public Policy doctoral program encourages an independent and creative approach in the development of curricula. Students are required to form a supervisory committee and submit a program of study for approval within the first 12 credits of course work.

The program requires a minimum of 78 graduate credits beyond the bachelor's degree (48 beyond the master's) distributed among the students individual program focus and three area categories. This distribution provides both depth and breadth in knowledge related to environmental problems. The student's individual program focus should include a minimum of 45 credits, which reflect a cohesive area of study. Graduate seminars for credit and research hours belong in this category.

The doctoral seminar must be taken twice. Internships appropriate to each student are encouraged especially when the traditional academic instruction does not provide appropriate expertise. The student's advisory committee has the responsibility for final approval of course work and other requirements, subject to Graduate School approval.

Category 1. Natural Sciences. A minimum of 12 credits is required in areas such as biology, geology, geography, chemistry, or environmental engineering.

Category 2. Social Sciences. A course in environmental law is required. Other courses in areas such as public policy, economics, sociology, geography, ethics, business, or conflict management are required for a total of 12 credits (including the law course) in this category.

Category 3. Methods and Technology. A minimum of 6 credits in research skills such as statistics, remote sensing, cartography, analytical chemistry, computing, mathematics, modeling, or management and information systems.

Course requirements can be filled from a variety of departments on campus. A list of potential courses that fulfill category requirements is available from the program coordinator. This list is neither fixed nor exhaustive and should only be viewed as a guide. Appropriate off-campus courses are available with prior committee and Graduate School approval.

Dissertation Research
Students must complete a dissertation (12-24 credits). At the conclusion of the program, students must defend their dissertation and present their results in a public seminar.

Sequence of Study
Upon admission to the program, a plan of course work is developed by the student and his or her committee. As soon as possible, the student should establish a supervisory committee, consisting of a major professor and at least two additional faculty members including one from the Biology Department. When course work has been completed, a second phase of the program—advancement to candidacy—is entered. The student is advanced to candidacy upon (1) enlarging the supervisory committee to include two other members, one of whom must be from one of the non-biology departments participating in the doctoral program; (2) successfully completing a written and oral qualifying examination; and (3) submitting an acceptable dissertation proposal.

Residency, Candidacy, and Other Requirements
A student must advance to candidacy (complete the qualifying examination) within five years of initial registration. Once advanced to candidacy, a student is expected to be in continuous residence on a full-time basis. The minimum period of full-time residency is one year. The dissertation and final examination must be completed within six years after advancing to candidacy.

Electron Microscopy Laboratory
This facility provides high-resolution transmission and scanning electron microscopic facilities for the university community. The laboratory supports faculty research in such areas as investigations of fine structure of marine bacteria, algal polysaccharide immunocytochemistry, fern ultrastructure, insect ultrastructure, and fine structure of epithelial and muscle cells in animals. It also
serves several local agencies. An ultrastructure course offered each year provides graduate and undergraduate instruction for use of the facility.

**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 Paleocology (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. Modes of speciation in 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.

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 biochemical. Bacteriophage and animal viruses emphasized. Fall.

564 Techniques in Virology (2:1:3). Corequisite: 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, prokaryotes, and eukaryotes, 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. Fall, odd-numbered years.

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. Fall, even-numbered years.

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. Spring, even-numbered years.

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. Spring, odd-numbered years.

577 Biogeochernistry: 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 biogeochernical 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-demonstrations, 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.

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, energet-
ics 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, tectons, 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 biochemical 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, programming experience, 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 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 undergraduate 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 regulations.

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.

798 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 798.
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 Arts in Education (variable credit). Prerequisite: D.A.Ed. student admission 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 research under direction of supervisor.

894 Internship (3-12:0:0). Prerequisite: Permission of chair and of student's doctoral committee. Training in application of ecological skills to environmental management and policy under 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, but some address more basic environmental biology. May be repeated. Required of all Ph.D. students.

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. May be repeated. No more than 24 credit hours in BIOL 998 and 999 may be applied to the doctoral degree requirement.

999 Doctoral Dissertation Research (1-12:3:0). Prerequisite: Approval of dissertation proposal. Research on a basic or applied problem in environmental science.

**Business Administration**

**Faculty**

Anderson, Evan E., Ph.D., Cornell University, 1970; Professor, Decision Sciences and M.I.S.

Buchanan, Phillip G., Ph.D., Temple University, 1982; Associate Professor, Accounting

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

Cohen, Debra J., Ph.D., Ohio State University, 1987; Assistant Professor, Management

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; Associate Professor, Finance

Das, Sidhartha R., Ph.D., University of Houston, 1985; Assistant 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

English, Jon, Ph.D., University of Florida, 1972; Professor, Management

Entrikin, Richard, Ph.D., St. Louis University, 1976; Associate Professor, Marketing

Evans, Paul D., Ph.D., University of Michigan, 1989; Assistant Professor, Decision Sciences and M.I.S.

Eyster, Kel-Ann S., Ph.D., Georgia State University, 1990; Assistant Professor, Accounting

Fagenson, Ellen A., Ph.D., Princeton University, 1981; Assistant Professor, Management

Ferri, Michael G., Ph.D., University of North Carolina, 1975; Professor, Finance

Fink, Laurence S., Ph.D., Purdue University, 1990; Assistant Professor, Management

Geriner, Pamela Texter, Ph.D., Pennsylvania State University, 1998; Assistant Professor, Decision Sciences and M.I.S.

Godfrey, James T., Ph.D., University of Michigan, 1967; Professor, Accounting

Gopalakrishnan, V., Ph.D., University of North Texas, 1986; Assistant Professor, Accounting

Griffith, Rodger W., Ph.D., University of South Carolina, 1981; Professor, Management

Gulledge, Thomas R., Jr., Ph.D., Clemson University, 1981; Associate Professor, Decision Sciences and M.I.S.

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

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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
Hogan, Eileen A., Ph.D., University of California, Berkeley, 1983; Assistant Professor, Management
Horn, Betty C., Ph.D., Georgia State University, 1987; Assistant Professor, Accounting
Hysom, John L., Ph.D., The American University, 1973; Associate Professor, Finance
Jackson, Janice J., D.B.A., Memphis State University, 1990; Assistant Professor, Management
Johnston, Robert D., Ph.D., University of Alabama, 1974; Associate Professor, Finance; Associate Dean for Graduate Programs
Kernan, Jerome B., Ph.D., University of Illinois, 1962; Professor, 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
Millspaugh, Peter E., J.D., The American University, 1968; Associate Professor, Business Legal Studies
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
Robbins, D. Keith, Jr., Ph.D., University of South Carolina, 1990; Assistant 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; Assistant Professor, Finance
Tetzlaff, Ulrich A., Ph.D., Technische Hochschule Darmstadt, Germany, 1990; Visiting Assistant Professor, Decision Sciences and M.I.S.
Tongren, Hale N., D.B.A., The George Washington University, 1968; Professor, Marketing
Tucker, Michael J., Ph.D., University of Houston, 1980; J.D., New York University, 1974; Associate Professor, Accounting
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
Zahra, Shaker A., Ph.D., University of Mississippi, 1982; Associate Professor, Management

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
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

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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 Legal Aspects of Information Resource Management (3:3:0). Prerequisite: MIS 600. Examination of the special problems of applying existing laws and legal doctrines to the management of information resources. Emphasis on how the public policy process responds to

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the unique problems posed by information processing technology as well as how managers can influence public policy. Readings, case analysis, lecture, reports (same as MIS 770).

**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. 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 Management (3:3:0).** Prerequisite: DESC 650. Focus on project scheduling with PERT and CPM, time-cost tradeoffs, multiproject scheduling, resource constrained scheduling, budgeting, cost control, and monitoring.

**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.

**742 Management Science (3:3:0).** Prerequisite: DESC 650. Operations research techniques for systems analysis. Addresses prominent mathematical programming and stochastic process topics from linear programming, networks, integer programming, goal programming, decision theory, dynamic programming, Markov processes, inventory theory, and queueing theory. Use of computer software in problem solving and in case study analyses.

**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.

**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: DESC 600 and graduate standing. 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 and multiple goals, market supply and demand,
production and cost functions, monopoly, oligopoly and perfect competition, product and resource pricing, capital budgeting and investment and general equilibrium. (Same as DESC 601).

650 Managerial Finance (3:3:0). 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.

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.

753 Land Development (3:3:0). Prerequisite: FNAN 650. The business of creating new communities of residential, commercial, and industrial space; includes land acquisition, overall planning, project management, financing, land preparation, and construction. Techniques involve site selection, location analysis, market feasibility studies, and legal and social analysis. Microcomputer applications.

761 Options and Other Derivative Securities (3:3:0). Prerequisite: Calculus and FNAN 650. Survey of the options futures and derivative securities, the theoretical aspects of option pricing models, and the application of these models to the pricing of derivative securities.

771 Risk Management (3:3:0). Prerequisite: FNAN 650. Examination of risk from a microeconomic perspective to explore how organizations can deal with risk. The focus is on the key aspects of risk management: risk identification and evaluation, risk control and risk finance, and implementation and review.

772 Managerial Economics II (3:3:0). Prerequisite: FNAN 650. Application of economic analysis to business management; government economic policy; the use of national economic statistics; interpreting economic trends and developments; forecasting. Current economic problems and their effects.

796 Independent Study and Directed Readings (3:0:0). Prerequisite: FNAN 650. By special arrangement with professor and approval of the Finance Department chair.

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 Analysis and Design of Computer Systems (3:3:0). Prerequisite: MIS 600. Computer systems life cycle with emphasis on information requirement analysis, feasibility studies, system design, equipment selection, and the implementation process. Student teams are assigned system development projects to work with users to define system requirements and to prepare implementation plans.

processes. Concentrates on technical and administrative issues facing companies and agencies involved in meeting complex information needs. Integrates user and manager perspectives. Investigation of strategies and techniques for planning, designing, and implementing DSS in various organizational environments. Introduction to DSS generators and tools. Project and computer lab.

735 Management Information Systems (3:3:0). Prerequisite: MIS 600. Conceptual foundations, structure, and development of management information systems from an organizational perspective are featured. Information-based support systems for the management of knowledge work are also covered. Term project.

740 Distributed Systems Applications (3:3:0). Prerequisite: MIS 600. Technical and managerial issues in the planning, installation, support, use, and operation of business data communication systems. Term project and laboratory.

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 Legal Aspects of Management Information Systems (3:3:0). Prerequisite: MIS 600. Examination of the special problems of applying existing laws and legal doctrines to the management of information resources. Emphasis on how the public policy process responds to the unique problems posed by information processing technology, as well as how managers can influence public policy. Readings, case analysis, lecture, reports. (Same as BULE 770).

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.

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).** 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 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.

**775 Theory and Policies of International Business (3:3:0).** Prerequisites: FNAN 650, MKTG 650, and MGMT 600. Introduction to the theory, environments, and practices of international business. Emphasis on international entry strategies and environmental risk assessment. Lecture, cases, and discussion.

**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.
Chemistry

Faculty
Chen, Holly Ho, Ph.D., University of California, San Diego, 1969; Associate Professor
Cozzens, Robert F., Ph.D., University of Virginia, 1966; Professor
Davies, Keith M., Ph.D., University of Wales, 1967; Associate Professor
Davis, Stephen L., Ph.D., Yale University, 1976; Associate Professor, Associate Chair
Foster, Gregory D., Ph.D., University of California, Davis, 1985; Assistant Professor
Hussam, Abul, Ph.D., University of Pittsburgh, 1982; Assistant Professor
Mushrush, George W., Ph.D., George Washington University, 1968, Professor, Department Chair
Roth, Ronald J., Ph.D., Columbia University, 1972; Associate Professor
Slayden, Suzanne W., Ph.D., University of Tennessee, 1976; Associate Professor
Stalick, Wayne M., Ph.D., Northwestern University, 1969; Professor
Weber, Jon P., Ph.D., University of California, Santa Cruz, 1980; Assistant Professor

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 of the Graduate School.

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 may 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 may 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 laboratory track is for students planning to continue work for the Ph.D. degree or to begin or continue careers in chemical research. The thesis written by a student on this track may be based on either experimental or theoretical research. The non-laboratory 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 but does not involve laboratory work.

A student must complete at least 30 credit hours of graduate course work. Of these, 12 must be in core courses in chemistry (one in each of four different areas chosen from analytical, biological, environmental, inorganic, organic, and physical chemistry), 3 must be in an elective course in chemistry or related fields, 3 must be in CHEM 690 (Graduate Seminar in Chemistry), and 6 must be in either CHEM 798 (for a student on the non-laboratory track) or CHEM 799 (for a student on the laboratory track). Courses acceptable toward the core-course requirement are identified in the following list of courses.

A final oral examination is required on each track. Each student on the laboratory track presents a thesis on an experimental or theoretical research project and takes final examination given by a thesis committee. Each student on the non-laboratory track presents a written report on a non-laboratory research project and takes final examination given by an advisory committee. The student's thesis or advisory committee is appointed during the first semester of registration in CHEM 798 or 799.

Chemistry Courses (CHEM)
500 Selected Topics in Modern Chemistry (3:3:0).
Topics of interest in analytical, biological, inorganic, organic, and physical chemistry. Recommended for teachers of chemistry and general science.
501 Laboratory Demonstration Techniques 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 (3:3:0). Prerequisite: CHEM 313 and 314, BIOL 383, or permission of department. 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.

513 Synthetic and Mechanistic Organic Chemistry (3:3:0). Prerequisite: CHEM 313 and 314. Emphasis on topics such as heterocycles, natural products, and biologically active compounds. Relation of applied organic chemistry to consumer products, including drugs and agricultural chemicals. Satisfies the core-course requirement in organic chemistry, or may be taken as an elective course if CHEM 514 is used to satisfy the core course requirement in that field.

514 Physical Organic Chemistry (3:3:0). Prerequisite: CHEM 313, 314, or permission of instructor, but not 513. The principles underlying molecular structures, reactivities, 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. Satisfies the core-course requirement in organic chemistry, or may be taken as an elective course if CHEM 513 is used to satisfy the core-course requirement in that field.

521 Theory of Analytical Processes (3:3:0). Prerequisite: CHEM 422 or permission of instructor. Physicochemical principles and analytical techniques applicable to the analysis of solutions, including activity coefficients, solvation and ionic size, titration-curve theory, acidity functions and pH-scales, kinetic analysis, and modern techniques for designing experiments and interpreting data. Satisfies the core-course requirement in analytical chemistry.

523 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 spectrometry, fluorescence analysis, neutron activation analysis, and spark-source mass spectrometry. Applications to the determinations of traces of metals in environmental samples.

524 Principles of Chemical Separation (3:3:0). Prerequisite: CHEM 321 and 422 or 521, or permission of department. Theories and models of separation, with applications to the analyses of a wide range of chemical, biological, and environmental samples. Topics include capillary and high resolution gas chromatography, and high performance liquid chromatography. Emphasis on the theory of reversed-phase, normal-phase, ion-exchange, size-exclusion, and affinity-based separations. Instrumentation such as detectors, pumps, columns, and data acquisition and analysis is also presented.

525 Electroanalytical Chemistry (3:3:0). Prerequisite: CHEM 422 or permission of instructor. Theory of polarography, stationary-electrode and hydrodynamic voltammetry, chronopotentiometry, controlled-potential electrolysis and coulometry at controlled potential, coulometric titration, and a number of related techniques, with emphasis on their use in analysis and research.

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, magnetic resonance spectroscopy, atomic emission absorption spectrometry, and electroanalytical methods. The student, with approval of his or her research committee, is free to choose the methods studied.

531 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.

533 Chemical Thermodynamics and Kinetics (3:3:0). Prerequisite: CHEM 331 and 332. Advanced study of thermodynamics and kinetics. Satisfies the core-course requirement in physical chemistry.


546 Bioinorganic Chemistry (3:3:0). Survey of the structures, functions, and properties of metal ions in biological systems. Modern inorganic coordination chemistry and the study of metal-ion sites in metalloenzymes and metalloproteins. Enzymatic catalysis, oxygen carriers, electron-transport phenomena, and inorganic model systems. Satisfies the core-course requirement in inorganic chemistry.

551 Environmental Chemistry (3:3:0). Prerequisite: CHEM 313 and 314 or permission of department; CHEM 331 or 335. Chemical behavior of pollutants in air, water, and soil environments. Emphasis is on thermodynamic principles and chemical transformation processes important in the fate, transport, and effects of natural and synthetic organic substances in the environment. Major topics include partitioning, photolysis, biodegradation, aqueous geochemistry, and modeling. Chemical basis of prominent environmental problems such as ozone depletion and acid rain are presented.

563, 564 Biochemistry (3:3:0), (3:3:0). Prerequisite: CHEM 313 and 314. CHEM 563 is a prerequisite to CHEM 564. A previous course in biology is recommended but not required. Important biological compounds, including proteins, carbohydrates, lipids, and nucleic acids, and their interrelations. CHEM 563 satisfies the core course requirement in biochemistry.

565, 566 Biochemistry Lab (2:1:3), (2:1:3). Prerequisite or corequisite: CHEM 563. CHEM 565 is a prerequisite for CHEM 566. Introduction to experimental methods used to study the chemical and physical properties of proteins, carbohydrates, lipids, and nucleic acids. Complements the corresponding lecture courses (CHEM 563 and 564). Designed for those who have had
no previous exposure to the specialized techniques used in biochemical research. One hour recitation.

567 Protein Biochemistry (3:3:0). Prerequisite: CHEM 563 and 564, or permission of instructor. Topics include the structural, transport, and immunological behaviors of proteins with emphasis on their roles as biological catalysts. General 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.

690 Graduate Seminar (1:1:0). 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. Each graduate student in chemistry must register for this course each semester. Three credits of CHEM 690 are required for the M.S. degree.

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 for the M.S. degree, but credit will not be given for both.

799 Master's Thesis (1-6:0:0). Prerequisite: Permission of department. A laboratory research project is chosen and completed under the guidance of a graduate faculty member. A thesis acceptable to the student's thesis committee and a final oral defense of that thesis are required. Six credits of either CHEM 798 or 799 are required, but credit will not be given for both.

800 Studies for the Doctor of Arts in Education (variable credit). Prerequisite: D.A.Ed. student admission to study in chemistry. Program of studies, designed by student's discipline director and approved 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 D.A.Ed. summer seminar. Enrollments are repeated according to each student's program.

## Doctor of Arts in Community College Education

The Doctor of Arts in Community College Education is administered by the 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, chemistry, computer science, economics, English, foreign languages and literatures, health and physical education, history, information systems, nursing, operations research and applied statistics, psychology, 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 of the Graduate School, 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 Center for Community College Education or from the Office of Admissions);

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3. Submit a short statement (500 to 1,000 words) describing the applicant's interest in the program and how it will help achieve career objectives;
4. Submit a writing sample if English is the applicant's knowledge area;
5. Schedule an interview with the staff of the Center for Community College Education, and;
6. 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:

**Minimum Requirements**

| Knowledge Area | 24 credits |
| Core Curriculum | 12 credits |
| Internship | 3 credits |
| Doctoral Project | 10 credits |
| Total | 49 credits |

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 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 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), and EDCC 850 Research: Using Research to Improve Teaching (3 credits). Each student also chooses at least two 3-credit hour elective courses from the list below.

| COMC 897 Directed Readings in Community College Education (1-3 credits) |
| EDCC 802 Community College Teaching through Learning Styles (3 credits) |
| EDCC 805 Teaching Thinking (3 credits) |
| EDCC 806 Communication Skills for Teaching (3 credits) |
| EDCC 892 Special Topics in Community College Education (3 credits) |
| EDUC 840 Adult Development and Learning (3 credits) |
| EDUC/ENGL 695 Writing Across the Curriculum (3 credits) |

**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 reinterpration 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 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 requisite 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)
- EDCC 802 Community College Teaching through Learning Styles (3)
- EDCC 805 Teaching Thinking (3)
- EDCC 806 Seminar in Communication Skills for Teaching (3)
- EDCC 850 Using Research to Improve Teaching (4)
- EDCC 892 Special Topics in Community College Education (3)

All students are required to complete EDCC 801 The Community College. A maximum of three 3 credits—with the permission of the 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 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.

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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 Style (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 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 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 Center for Community College Education. Independent reading on a topic agreed to by the student and a faculty member assigned by the 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 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 Center for Community College Education. Independent study on the doctoral project.

Computational Sciences and Informatics

Faculty

Alligood, Kathleen T., Ph.D., University of Maryland, 1979; Associate Professor

Anderson, Evan, Ph.D., Cornell University, 1970; Distinguished Professor

Black, W. Murray, Ph.D., Pennsylvania State University, 1971; Associate Professor

Blaisten-Barojas, Estela, Ph.D., Universite de Paris VI, 1974; Professor

Bolstein, Richard A., Ph.D., Purdue University, 1967; Associate Professor

Carr, Daniel, Ph.D., University of Wisconsin, 1976; Associate Professor

Ceperly, Peter H., Ph.D., Stanford University, 1973; Associate Professor

Davis, Stephen, Ph.D., Yale University, 1976; Associate Professor

Denning, Peter J., Ph.D., Massachusetts Institute of Technology, 1968; Professor

Dworzecka, Maria, Ph.D., Warsaw University, 1969; Professor

Ehrlich, Robert, Ph.D., Columbia University, 1964; Professor

Ellsworth, Robert, Ph.D., University of Rochester, 1965; Professor

Evans, John C., Ph.D., University of Michigan, 1966; Associate Professor

Foster, Gregory D., Ph.D., University of California, 1985; Associate Professor

Gantz, Donald T., Ph.D., University of Rochester, 1974; Associate Professor

Haack, Barry, Ph.D., University of Michigan, 1977; Associate Professor

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Areas of Study

Habib, Muhammed, K., Ph.D., University of North Carolina, 1979; Professor
Harris, Carl M., Ph.D., Polytechnical University of Brooklyn, 1966; Professor
Haynes, Kingsley, E., Ph.D., Johns Hopkins University, 1971; Graduate Dean
Heltrots, Francis D., Ph.D., University of Wisconsin, 1985; Associate Professor
Hoffman, Karla L., Ph.D., George Washington University, 1975; Professor
Jones, R. Chris, Ph.D., University of Wisconsin, 1980; Associate Professor
Kafatos, Menas, Ph.D., Massachusetts Institute of Technology, 1972; Professor
Kan, Ittai, Ph.D., University of Illinois, 1984; Assistant Professor
Kerschberg, Larry, Ph.D., Case Western, 1969; Professor
Lawrence, James F., Ph.D., University of Washington, 1975; Associate Professor
Lleb, B. Joseph, Ph.D., William & Mary, 1971; Professor
Loustaunau, Philippe, Ph.D., University of Wisconsin, 1988; Assistant Professor
Manitius, Andrzej Z., Ph.D., Polytechnical University of Warsaw, 1968; Professor
Miller, John J., Ph.D., Stanford University, 1974; Associate Professor
Moore, John H., Ph.D., University of Virginia, 1966; Professor
Morowitz, Harold, Ph.D., Yale University, 1951; Robinson Professor
Nash, Stephen G., Ph.D., Stanford University, 1982; Associate Professor
Sachs, Robert L., Ph.D., Courant Institute, 1980; Associate Professor
Saperstone, Stephen H., Ph.D., University of Maryland, 1970; Professor
Satija, Indubala, Ph.D., Columbia University, 1983; Associate Professor
Sauer, Timothy D., Ph.D., University of California, 1982; Associate Professor
Sibley, Edgar H., Ph.D., Massachusetts Institute of Technology, 1967; Professor
Soffer, Ariela, Ph.D., George Washington University, 1984; Associate Professor
Sood, Arun, Ph.D., Carnegie-Mellon University, 1971; Professor

Soyfer, Valery N., Ph.D., Byelorussia State University, 1964, 1974; Robinson Professor
Struppa, Daniele C., Ph.D., University of Maryland, 1981; Professor
Sutton, Clifton, Ph.D., Stanford University, 1987; Assistant Professor
Taub, Steven R., Ph.D., Indiana University, 1960; Professor
Treffil, James, Ph.D., Stanford University, 1966; Robinson Professor of Physics
Walbridge, Mark R., Ph.D., University of North Carolina, 1986; Assistant Professor
Wechsler, Harry, Ph.D., University of California, 1975; Professor
Wegman, Edward J., Ph.D., University of Iowa, 1968; Dunn Professor
Willett, James D., Ph.D., Massachusetts Institute of Technology, 1965; Professor
Williams, Peter A., Ph.D., Indiana University, 1986; Assistant Professor
Zoltek, Stanley M., Ph.D., State University of New York, 1976; Associate Professor

Research Faculty
Dreiling, Leslie A., University of Maryland, 1976; Research Associate Professor
Druker, Andrzej, Ph.D., Niels Bohr University, 1972; Research Professor
Geldzahler, Barry, Ph.D., University of Pennsylvania, 1980; Research Associate Professor
Jensen, Craig, Ph.D., University of Utah, 1983; Research Associate Professor
Macdonald, Andrew, Ph.D., University of Western Ontario, 1984; Research Assistant Professor
Shipley, Scott, Ph.D., University of Wisconsin, 1978; Research Associate Professor
Summers, Mike, Ph.D., California Institute of Technology, 1985; Research Associate Professor
Thorslund, Todd W., Sc.D., Johns Hopkins, Research Scientist

Computational Sciences and Informatics, Ph.D.

Although past endeavors in scientific research can be classified as either theoretical or experimental, the last forty years has seen the growth of computational sciences to equal footing. Computing is more than just a tool; it provides insight and understanding that theory or experiment cannot.
The rapid and enormous increase in the power of computers has provided the scientific community with an opportunity to expand their research activities both conceptually and quantitatively, as well as to dramatically increase the speed of calculations. These improvements increase the capacity of computer modeling and simulation so that complex physical systems, which were essentially intractable two decades ago, are now accessible.

The multidisciplinary doctorate in Computational Sciences and Informatics responds to the new role of computation in the sciences. Offered through the Institute for Computational Sciences and Informatics, the doctoral program focuses on a number of specialty areas including bioinformatics, computational chemistry, earth systems and global changes, computational mathematics, computational physics, space sciences, and computational statistics. The program emphasizes three intellectual elements: a common computational sciences and informatics core; specialty tracks of computationally intensive courses; and doctoral research.

A variety of teaching and research resources are available: an Intel Hypercube iPSC/2 D4/VX, a number of workstations (VAX 3100, Silicon Graphics IRIS 4D/120GTX, IBM RISC 6000, HP 9000 Server, NeXT), and a variety of microcomputers. Access to supercomputers, including the CRAY Y-MP at the NASA/Goddard Space Flight Center, is also available.

Degree Requirements

Candidates for the degree must successfully complete 72 credit hours beyond the baccalaureate degree. For those holding a master's degree, the required credit hours may be reduced depending on courses previously completed. Scheduled courses and sequences accommodate part-time students, with courses offered in the late afternoon or early evening one or two nights a week.

Applicants are encouraged to apply their knowledge to a broad range of scientific 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.

Degree requirements are divided into the following categories:

1. 12 hours from the common computational sciences and informatics core;
2. 12 hours from a required core in one of the seven specialty tracks;
3. 12 hours in electives from specialty courses in one of the seven tracks;
4. 12 hours from either additional computational core courses, specialty research, individualized study based on professional experience and research, transfer credit or other electives; and
5. 24 hours in dissertation research. More specifically:
   a. Common computational sciences and informatics core of 12 credit hours that includes CSI 801, 803, and 810; the remaining 3 credit hours varies with the specialty track:
      Bioinformatics. Either CSI 717, 728, 771, or 806. Computational Chemistry. Either CSI 717 or 806.
      Earth Systems. Either CSI 717, 728, 771, or 806.
      Computational Mathematics. CSI 717.
      Computational Physics. Either CSI 728, 741, or 806.
      Computational Statistics. Either CSI 717, 771, or 806.
      Space Sciences. Either CSI 728 or 806.
   b. Required specialty track core of at least 12 credit hours from:
      Bioinformatics. Either BIOL 552, 657, 646, 650, 752, or 753.
      Computational Chemistry. PHYS 502, 780; CSI 735; CHEM 731.
      Earth Systems. PHYS 575; GECA 553; BIOL 650; CSI 750.

Admission Requirements

Students interested in applying to the doctoral program in Computational Sciences and Informatics should have an academic background in computer science, engineering, math, or science. The undergraduate degree should be from an accredited institution and applicants should have earned a GPA of 2.75 in their last 60 hours of study. Applicants should forward a completed 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 their undergraduate degree was earned more than five years ago, students should submit a resume or statement of work experience. Fall application and fellowship deadline is April 1.
Areas of Study

Computational Mathematics. Either CSI 718 or MATH 625; CSI 741, 747, 748, 806, 840, 842, 847, 848; MATH 661, 677, or 678.

Computational Physics. PHYS 502, 510, 513, and either 514 or 780.

Computational Statistics. Either CSI 876, 877, 972, 973, and 773 recommended.

Space Sciences. Either PHYS 510, 513, 575, 780, or ASTR 530.

c. Electives, after consultation with adviser, from specialty courses. The list includes 12 credit hours from but not limited to the following:

Bioinformatics. CSI 739, BIOL 680, 692/694, PSYC 702, 688, FRLN 680.


Earth Systems. PHYS 676, GEOCA 579, 652, CHEM 551, BIOL 577, CSI 741, 865, PUAD 739, 610, INF'T 833.

Computational Physics. PHYS 511, 514, 613, 780, CSI 728.


Space Sciences. PHYS 531, 532, 535, 676, CSI 761, 764, 765, 865, 873.

d. After consultation with adviser, either additional computational core courses, specialty research, individualized study based on professional experience and research, transfer credit or other electives, 12 credit hours.

e. Dissertation research, at least 24 credit hours: CSI 998, 999.

Computational Sciences and Informatics Courses (CSI)

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 that is 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 graphics techniques are used to enhance interpretation of results through visualization.


728 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, hydrodynamical systems, galactic structure and interactions, and cosmology.

735 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.

739 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.

741 Nonlinear Dynamical Systems (3:3:0). Prerequisites: Knowledge of linear algebra, advanced calculus, and differential equations. Contemporary topics in the field of nonlinear dynamical systems are illustrated in mathematical models from the natural sciences and engineering. Traditional qualitative analysis of difference and differential equations provides the background for understanding chaotic behavior when it occurs in these models. Topics include stability of equilibria and periodic orbits, bifurcation theory, Hamiltonian systems, Lyapunov exponents, and chaotic attractors.

747 Spectral Theory of Linear Operators (3:3:0). Prerequisites: MATH 675. Linear operators arise throughout mathematics, physics, engineering, and elsewhere. Topics covered include examples in finite dimensions; examples in infinite dimensional spaces; spectral theory of bounded self-adjoint operators; unbounded operators, adjoints, closures, domains; spectral theory of self-adjoint operators; functional calculus; approximation of operators arising in numerical methods; perturbation methods, including iterative algorithms for numerical evaluation; applications.

748 Computer Algebra (3:3:0). Prerequisites: An undergraduate degree in a scientific discipline and a course in abstract algebra. Provides the mathematical and computational background for computational algebraic geometry and its applications. Includes notions of algebra, geometry, algorithms, the concept of Groebner bases, and automatic theorem proving, serial and parallel algorithms and their complexity. These topics will be related to applications in engineering and computer science. Students will be expected to complete a project.

749 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.

750 Earth Systems and Global Changes (3:3:0). Prerequisites: Course in ecology, environmental geology, atmospheric physics, or permission of instructor. Provides an introduction to the global system interactions that are re-
possible for global environmental change. The emphasis is on those concepts that provide a global description of the earth system and on the basic environmental processes that influence global change. Discusses 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 include climate and hydrological systems, ecological system dynamics, earth system history, human interactions, solid earth processes, and solar influences. Also 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 and 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 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 Computational Astrophysics (3:3:0). Prerequisites: PHYS 530. 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.


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 652. Covers the basic computationally 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.

773/STAT 663 Exploratory Data Analysis (3:3:0). Prerequisites: Permission of instructor. Special 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/INFT 746 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/INFT 776 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 foundations. 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.

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.

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 master's 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 (1-6:0:0). Prerequisite: 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 for credit as necessary.

801 Foundations of Computational Science (3:3:0). Prerequisite: 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 visualization methods. Case
studies in bioinformatics, space science, physics, and global change demonstrate important scientific accomplishments enabled by computation. Working in teams including scientists and information technologists, students learn the mathematical models, abstract algorithms, and concrete algorithms for these cases, and conduct experiments and simulations with them.

803/INFT 875 Scientific and Statistical Visualization (3:3:0). Prerequisites: STAT 654 or 663 or 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. 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.

806 Symbolic Computation (3:3:0). Prerequisites: An undergraduate degree in a scientific discipline. Provides an introduction to the representation of integers, fractions, polynomials, algebraic and symbolic algorithms using modular and p-adic methods, and will cover formal integration and algebraic and asymptotic solutions of ordinary differential equations. Students are expected to complete a project.

810/INFT 810 Scientific Databases (3:3:0). Prerequisites: INFS 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. 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 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. Develops the tools of mathematical modeling, while simultaneously carrying out numerical simulations of the models. Examples from across the sciences are 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; and 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 develops 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.

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 databases 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 transform, 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 nonparametric hypothesis testing, parameter estimation, spatial analysis, and image analysis. Emphasis is placed on the imperfect nature of actual data sets and hypotheses. Examples are drawn from areas of current astrophysical interest.

876/INFT 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 /INFT 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. Develops the foundations of geometric methods for statistics. Topics include n-dimensional Euclidian 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.

899 Colloquium in Computational Sciences and Informatics (2:2:0). 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 to the institute followed by a group discussion with the speaker. 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 (3:3:0). 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. Seminars 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 (3:3:0). 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 (3:3:0). 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 (3:3:0). 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. Seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

931 Seminar in Bioinformatics (3:3:0). Prerequisites: Permission of instructor. A consideration of selected topics in bioinformatics either not covered in fixed-content bioinformatics courses or as an extension of fixed-content courses. 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 (3:3:0). 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. 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 (3:3:0). 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. 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 (3:3:0). Prerequisites: Permission of instructor. A consideration of selected topics in earth systems and global change either not covered in fixed-content courses or as an extension of fixed-content courses. 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 (3:3:0). 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. 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.
86 Areas of Study

970 Seminar in Computational Statistics (3:3:0). 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. Seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

972/INFT 972 Mathematical Statistics I (3:3:0). Prerequisites: STAT 652, CSI 778. 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/INFT 973 Mathematical Statistics II (3:3:0). Prerequisites: CSI 972. Continuation of CSI 972. Concentrates on the theory of hypothesis testing. Topics will include characterizing the decision process, simple versus simple hypothesis tests, Neyman-Pearson Lemma, uniformly most powerful tests, unbiasedness of tests, invariance of tests. Applications of the testing principles will be made to situations in the normal distribution family and to other families of distributions.

976/INFT 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/INFT 987 Statistical Analysis of Signals (3:3:0). Prerequisites: STAT 644 and 658 or permission of instructor. 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 sat-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 (3:3:0). 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. 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). Prerequisite: Permission of instructor. Selected topics in computational sciences and informatics either not covered in fixed-content courses or as an extension of fixed-content courses. Seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

992 Seminar in Computational Sciences and Informatics (3:3:0). 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. Seminar with student participation in the presentation of various aspects of the selected topic. May be repeated once for credit.

996 Doctoral Directed Reading and Research (1-6:0:0). 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. May be 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 (1-12:0:0). Prerequisites: Approval of the Graduate Committee. Research on 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.

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

http://catalog.gmu.edu
Littman, David, Ph.D., Yale University, 1989; Ph.D., Cornell University, 1976; Assistant Professor.

Michalski, Ryszard, Ph.D., Polytechnical 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 computer science courses in the areas of software engineering, artificial intelligence, parallel processing, image processing and computer vision, and foundations of computer science and actively participates in the program leading to the Ph.D. degree in information technology in the School of Information Technology and Engineering. A certificate in Software Systems Engineering with an M.S. in Computer Science is also possible.

Appropriate courses may be transferred, with adviser 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 VAX 8820 dual CPU machine running VMS, a VAX 8530 running Ultrix. Microcomputer and workstation laboratories across the campus provide engineering software and a large graphics capability. Departmental laboratories house an HP 9040 for graphics work, Macintosh SE and IIs, Sun 3s and 4s and Symbolics workstations for AI and software engineering, a MicroVax II Perceptics and Intel Hypercube for vision and image understanding, and an INMOS Transputer workstation for parallel algorithm research.

Ethernet and Sytek wideband local area networks support remote peripheral access, as well as inter­national connectivity via Internet, Bitnet, etc. The network also provides access to large parallel computing systems and supercomputers.

Admission Requirements

Students seeking admission to the M.S. in Computer Science program must satisfy the following requirements:

1. Fulfill admission requirements of the Graduate School of George Mason University.

2. Hold a baccalaureate degree that includes the following courses or their equivalents in practical experience: Data Structures and Algorithms (CS 211, 330), Assembly Language Programming (CS 265), and Computer Architecture (CS 365). In addition, students should have completed one year of mathematics beyond first-year calculus, including a substantial course in discrete mathematics (MATH 305 or MATH 125). 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 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, if available, official Graduate Record Examination (GRE) report.

Degree Requirements

In addition to the general requirements of the university, completion of this program requires the following:
1. Completion of 33 hours of graduate course credit, including:
   a. 9 hours comprising the following courses:
      CS 540 Language Processors
      CS 571 Operating Systems
      CS 583 Analysis of Algorithms
   b. 12 or more hours of computer science courses at the 600 level or above, excluding CS 611, 612, 798, and 799
   c. Either 3 hours of project work or 3 to 6 hours of thesis for a total of not more than 6 hours;
      or 3 additional hours of CS course work at or above the 600 level
   d. Additional graduate-level courses in computer science or in closely related fields, chosen with 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.

Specialization in Software Systems Engineering

Students may pursue a specialization in software engineering by completing at least four courses chosen from CS/SWSE 619, 620, 621, 623, and 625. Completion of all five of these courses is required for the 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. Topics include the role of exchanges, concentrators, multiplexors, buffering; network analysis, cost and design; software considerations.


580 Introduction to Artificial Intelligence (3:3:0). Prerequisite: CS 330 and MATH 305. Principles of representation, heuristic search, and control in the context of specific intelligent systems in such areas as problem solving, vision, medical diagnosis, and natural language. The LISP, PROLOG, or expert systems programming languages as a means of representation.

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, image processing), the analysis of specific algorithms falling into these classes, NP-Hard and NP-Complete problems.

611 Principles of Computer Science (3:3:0). A survey of computer science for persons with no prior computing experience. Instruction and practice in the use of a computer programming language as a problem-solving tool. Credits are not applicable to the M.S. in Computer Science degree.

612 The Use of Computer Statistical Packages (3:3:0). Prerequisite: Course in statistics. 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 perform computer statistical analyses of data relevant to their respective fields of study. Credits are not applicable toward the M.S. in mathematics or CS, but may be applicable toward a degree in some other fields.


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 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 algo-
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 or object oriented languages; and other selected topics in the current literature.


666 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 measuring and evaluating digital computer systems. Topics include systems analysis techniques, simulation techniques, data acquisition, programmed measurement techniques, instrumented measurement techniques, and presentation of data.

680 Natural Language Processing (3:3:0). Prerequisite: CS 580 or equivalent. 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 580. 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/EC 651 Intelligent Systems for Robots (3:3:0). Prerequisite: CS 580 or ECE 650 or permission of instructor. 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: 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.

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.

790 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 intended 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.

Conflict Analysis and Resolution

Core Faculty

Clark, Mary E., Ph.D., University of California, Berkeley, 1960; Druce French Cumbie Professor of Conflict Analysis and Resolution

Laue, James H., Ph.D., Harvard University, 1966; Vernon M. and Minnie I. Lynch Professor of Conflict Analysis and Resolution

McFerson, Hazel M., Ph.D., Brandeis University, 1976; Visiting Associate Commonwealth Professor of Government and Politics and Conflict Analysis and Resolution

Mitchell, Christopher R., Ph.D., University of London (University College), 1977; Director of the Institute for Conflict Analysis and Resolution; 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

Professional and Administrative Faculty

Bleichman, Frank O., B.A., University of Virginia, 1969

Dugan, Maire A., Ph.D., Syracuse University, 1979; Professor of Conflict Analysis and Resolution

Warfield, Wallace, M.P.A., University of Southern California, 1986

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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

Broome, Benjamin J., Ph.D., University of Kansas, 1980; Associate Professor of Communication

Clark, Robert P., Ph.D., Johns Hopkins University, 1969; Professor of Government and Politics

Paden, John N., Ph.D., Harvard University, 1968; Robinson Professor of International Studies

Rader, Victoria F., Ph.D., University of Chicago, 1973; Associate Professor of Sociology

Sclmecca, 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

Wilkins, Roger W., L.L.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.

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 seven 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 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 seven years beyond their last examination, applicants may retake any of the above or take the 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. Students may enroll on a full- or part-time basis.

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.

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. In addition, students are expected to obtain a background in a substantive area of conflict, usually related to the topic of the dissertation.

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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 potential for doing 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 Theory and Practicum Program (details of which are still under discussion, but to be numbered 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 advanced 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)

501 Introduction to Conflict Resolution (3:3:0). Prerequisite: corequisite for all courses; must be taken with 613. 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 or permission of instructor. 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-root conflict. Focus is on analysis as a tool.

609 War, Violence, and Conflict Resolution (3:3:0). Prerequisite: CONF 501 or permission of instructor. 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 or permission of instructor. 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: CONF 501 or permission of instructor. 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 or permission of instructor. 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 understanding diverse groups, but in gaining first-hand insights into the wide variation in world views and values understandings held by different people.

620 Law and Jurisprudence in Conflict Resolution (3:3:0). Prerequisite: CONF 501 or permission of instructor. Contrasts legal processes and institutions with alternative approaches to dispute resolution. Defines and distinguishes among law, "alternative dispute resolution," and problem-solving analysis as methods for resolving rather than controlling conflict. Asks to what extent legal procedures are truly applicable to resolving deep-rooted conflict.

621 Ethnic and Cultural Factors in Conflict Resolution (3:3:0). Prerequisite: CONF 501 or permission of instructor. 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, or permission of instructor. 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.

626 Global Contexts of Conflict (3:3:0). Prerequisite: CONF 501 and CONF 613 or permission of instructor. Provides a comprehensive overview of the historical trends on the planet that are both causes of and context for present and future conflicts. By combining information from all disciplines, students learn to view conflicts in a holistic way that facilitates understanding and resolution. Includes environmental, population, ethnic and religious, economic, development, and political-military issues.

633 Laboratory and Simulation III: International and Intercultural 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, 601, and 605, or permission of instructor. 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 and 613, or permission of instructor. CONF 623 recommended. 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 ethical assessment of third-party interventions in a variety of conflict settings.

642 Integration of Theory and Process (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.

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.

802 Theory 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 Theory 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 research.
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 (4:3:1). Prerequisites: CONF 501, 601, and 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.

830 The Persistence of Evil (3:3:0). Introduction to the major theological, psychological, and social theory of the causes of evil. These theories are applied to case studies of evil acts at the international, group, and individual levels. Possible case studies include the holocaust, genocide in Cambodia, and the massacre at My Lai.


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 of the Iran-Iraq war, the Cyprus dispute, and the Eritrean conflict.

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. Up to 6 credits of CONF 897 may be applied to doctoral degree.

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 underlying 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 disserta-

DANCE

Faculty

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; Assistant Professor

Dance, M.F.A.

The M.F.A. in Dance is a 60-hour program designed for graduate students who have demonstrated their artistic excellence, professional commitment, and desire to pursue a professional level of study in performance, choreography, or teaching. It allows for and encourages apprenticeships and internships in professional and resident companies, experimentation in academic pursuits, and the development of independent artistic projects, especially for returning artists who seek a terminal degree.

Admission Requirements

In addition to fulfilling the admission requirements of the Graduate School, the applicant must audition for acceptance into the M.F.A. program, submit two letters of recommendation, and submit a ten-minute VHS video that demonstrates his/her work in either performance or choreography. Applicants must contact the Institute of the Arts to arrange for auditions. Auditions will be scheduled at least twice yearly. Applicants with degrees other than a B.F.A. in Dance may be required to make up certain course deficiencies.
Degree Requirements

Students are required to pass 60 hours of course work including a required performance/choreography thesis.

M.F.A. students are expected to participate independently in a wide variety of experiential programs that include internships, apprenticeships, and residencies.

Involvement with other art forms is strongly encouraged.

All students are required to take:

Dance Technique (12 hours of DANC 527/DANC 541)
Performance (6-9 hours of DANC 570)
Choreography (6-9 hours of DANC 560)
Management (3 hours of DANC 680)
Laban Movement Analysis (3 hours of DANC 580)
Contemporary Trends (3 hours of DANC 615)
Philosophy and Aesthetics (3 hours of DANC 598)
Advanced Teaching Seminar (3 hours of DANC 627)
Apprenticeship/Internship (6 hours of DANC 790)
Thesis Project (6 hours of DANC 799)
Electives (6 hours)

Total: 60 hours

The university does not guarantee the availability of these courses every semester. Some will be offered in alternate years.

Dance Courses (DANC)

510 Independent Study (3:0:0). Prerequisite: Dance major with 84 hours, graduate standing in dance, or permission of instructor. 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 12 credits.

520 Special Topics in Dance (3:3:0). 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.

527 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.

541 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 12 credits.

560 Advanced Choreography (3:3:0). Prerequisite: DANC 360 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 (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.

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 (3:0:0). Prerequisite: Graduate standing and permission of advisor. Off-campus 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 advisor, 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.
Economics

Faculty
Alexeev, Michael V., Ph.D., Duke University, 1984; Associate Professor
Bennett, James T., Ph.D., Case Western Reserve University, 1970; William P. Snavely 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., Washington 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
Ellig, Jerome R., Ph.D., George Mason University, 1988; Assistant Professor
Grier, Kevin B., Ph.D., Washington University in St. Louis, 1984; Associate Professor
Heiner, Ronald A., University of California, Los Angeles, 1975; Professor
High, Jack C., Ph.D., University of California, Los Angeles, 1980; Associate Professor
Lavoie, Donald C., Ph.D., New York University, 1981; Associate Professor
Ley, 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
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 Universitaet Berlin 1974; Dr. habil., Universitaet 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.

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), economic history (ECON 623 or 823), 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.

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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.

**ECON 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 system estimation along with their associated problems. (Students who take ECON 535 may not take ECON 637 for credit.)

**ECON 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.

**ECON 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.

**ECON 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.

**ECON 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.

**ECON 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.

**ECON 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.

**ECON 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.

**ECON 676 Comparative Economic Systems (3:3:0).** Capitalism, socialism, and corporatism historical perspective. Includes examination of the economies of representative contemporary countries.

**ECON 715 Macroeconomic Theory I (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.

**ECON 812 Microeconomic Theory II (3:3:0).** Prerequisite: ECON 611. Nature of the firm, theory of supply, and production functions, factor pricing, and supplies. Introduction to microeconomic foundations of theories of public finance and public choice.

**ECON 815 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.

**ECON 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.

**ECON 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.

**ECON 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.

**ECON 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.

**ECON 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.

832 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 retarding 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 interest 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.

799 Thesis (1-6:0:0). Students 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 Arts in Education (variable credit). Prerequisite: D.A.Ed. student admission to 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. The paper is presented in a subsequent D.A.Ed. summer seminar. Enrollments are repeated according to each student's program.

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 889 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.

Education

Faculty

Anderson, Bonita, M.Ed., George Mason University, 1985; Assistant Director, Office of Teacher Education

Batholomew, Cheryl, Ph.D., Syracuse University, 1980; Associate Professor

Behrmann, Michael M., Ed.D., Columbia University, 1978; Associate Professor

Beyer, Barry K., Ph.D., University of Rochester, 1962; Professor

Bonfadini, John E., Ph.D., Virginia Polytechnic Institute and State University, 1976; Associate Professor

Bowen, Larry S., Ph.D., Ohio State University, 1970; Professor, Dean Emeritus

Brown-Azarowicz, Marjory, Ph.D., University of Washington, 1961; Professor Emeritus

Carroll, Jack C., Ed.D., The American University, 1970; Associate Professor

Chickering, Arthur W., Ph.D., Columbia University, 1958; University Professor, Interim Dean
Chu, Harold, Ph.D., University of Minnesota, 1973; Associate Professor
Collier, Virginia P., Ph.D., University of Southern California, 1980; Associate Professor
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
Dunklee, Dennis R., Ph.D., Kansas State University, 1985; Assistant Professor
Dzama, Mary A., Ed.D., University of Virginia, 1972; Associate Professor
Edgemon, Albert W., Ed.D., Columbia University, 1964; Professor
Finkelstein, James F., Ph.D., Ohio State University, 1980; Associate 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
Isernberg, Joan P., Ed.D., Rutgers University, 1978; Associate Professor
Jacob, Evelyn J., Ph.D., University of Pennsylvania, 1977; Associate Professor
Jones, Edward V., Ed.D., Virginia Polytechnic Institute and State University, 1977; Associate Professor; Director, Office of Adult Learning and Professional Development
Jones, Julie K., Ph.D., University of Pittsburgh, 1978; Assistant Professor
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 Southern California, 1973; Associate Professor
Martin, William R., Ph.D., University of Minnesota, 1968; Professor
Mellander, Gustavo, Ph.D., George Washington University, 1966; Director, Center for Community College Education
Montebello, Mary S., Ph.D., Ohio State University, 1964; Professor
Mosier, Tolula, M.Ed., George Mason University, 1989; Assistant Director, Office of Adult Learning and Professional Development
Palmer, James C., Ph.D., University of California, Los Angeles, 1987; Associate Director, Center for Community College Education
Pierce, Lorraine Valdez, Ph.D., Georgetown University, 1984, Associate Professor
Raines, Shirley C., Ed.D., University of Tennessee, 1979; Associate Professor
Schuchman, Betty Jane, Ed.D., Indiana University, 1967; Associate Professor
Sears, Carol J., Ph.D., The American University, 1976; Associate Professor
Seligman, Linda H., Ph.D., Columbia University, 1974; Professor
Smith, Donald F., Ed.D., The American University, 1968; Associate Professor
Sokett, Hugh T., Ph.D., Kings College, University of London, 1974; Professor
Spikell, Mark A., Ed.D., Boston University, 1972; 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
Thorp, Eva K., Ed.D., George Washington University, 1987; Assistant Professor
White, Charles, Ph.D., Indiana University, 1985; Associate Professor
Williams, Herma, Ph.D., Iowa State University, 1976; 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 are 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 certification with the option of earning a master's degree;
2. Persons certified 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;
3. Persons seeking preparation in a specialization not requiring a Virginia certification or endorsement.
The Graduate School of Education and other units at George Mason University also offer courses for educators' continuing professional development and/or recertification. However, recertification 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 certification 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 certification area are available from the Graduate School of Education. Students who do not know the name of their academic advisor should contact the Office of Academic Student Affairs in 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
- EDCI: Elementary/Middle/Secondary Curriculum and Instruction
- EDGC: Counseling and Development
- 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 certification, and also in seven specializations for persons who are certified or experienced educators.

Initial Teacher Certification with M.Ed. Degree Option
The Graduate School of Education offers the following state-approved programs for initial certification/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, Economics, English, English as a Second Language, French, General Math, General Science, Geography, German, Government, History, History/Social Sciences, Latin, Mathematics, Physics, Psychology, Russian, Russian Studies, Sociology, Spanish, Speech Communication
- **Special Education (Grades K-12).** Emotional Disturbance, Learning Disabilities, Emotional Disturbance/Learning Disabilities, Severely Disabled, Early Childhood (add-on endorsement)

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 K-12).** Instrumental, Vocal and General (offered through the Department of Music in the College of Arts and Sciences)
- **Health Education (Grades K-12).** With endorsement for Physical Education (offered through the Department of Human Services)
- **Physical Education (Grades K-12).** With endorsement for Health Education (offered through the Department of Human Services)

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.

Admissions Requirements for Teacher Certification Programs

All graduate-level teacher certification programs provide the M.Ed. option through the completion of course work beyond what is required for certification. Whether or not applicants seek the degree, they must meet the following admission requirements for the Graduate School:

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 Professional Knowledge components of the National Teacher Examination (NTE)
4. A transcript analysis (called the departmental form) showing unmet requirements for the desired certification area

Detailed instructions about the admissions process are available in program handbooks and at group orientation sessions provided by the Office of Teacher Education (703) 993-2080. Distributed at these monthly sessions are Graduate School applications, NTE 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 Certification Program Requirements

All initial teacher certification programs have general education requirements, prerequisite course work (which may be taken as an undergraduate), professional course work, and additional course work for the M.Ed. degree. 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 certification area are available from the program coordinators or 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 a major, minor, or concentrations of 12 hours in the disciplines taught in grades 4-8.

Prerequisite Professional Course work: 9 semester hours (May be taken as an undergraduate).

Professional Course work: 30-43 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: 27 semester hours of professional course work, 12 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: 12 semester hours, half of which may be taken as an undergraduate.
Additional Course work according to endorsement area, including at least 15 weeks of internship.

Additional Course work for M.Ed.: 3-12 hours, depending on the area of certification.

M.Ed. Programs for Persons Certified 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 (K-12)
- Teaching English as a Second Language (K-12)
- Reading (K-12)
- Information Technology in Education (ITE) (K-Postsecondary)

(The ITE specialization has several tracks that prepare individuals for a variety of instructional technology roles in education and training.)

The Reading specialization program 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 and the Center for Applied Research and Development. Practitioners are enrolled in teams from designated schools and follow a two-and-a-half-year integrated program of school-based research linked to a subject specialization (e.g., language, arts, character education).

Admission Requirements

Applicants for the M.Ed. degree in Curriculum and Instruction must:
1. Meet the general admissions requirement of the Graduate School (GPA of 3.0 on last 60 hours of undergraduate study)
2. Be certified as teachers or have several years of successful experience as a teacher/trainer or educational administrator

3. Submit recommendations by three persons qualified to judge the applicant's professional competence
4. Submit an expanded goals statement
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 Information Technology in Education.

The specific course work required for each specialization is available from the Faculty Support Office, Robinson Hall, Room A339, (703) 993-2020, 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 meet the requirements of the Graduate School, and have an undergraduate grade point average of at least 3.0, at least one year of experience relevant to the profession of counseling.
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 prerequisites 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 certification 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.
3. Two years of successful teaching experience; in 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.

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**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 requirements of the Graduate School and the following:

1. An undergraduate grade point average of at least 3.0.
2. Three letters of recommendation (from professional educators; at least one of whom has observed the applicant's teaching or administrative experience).
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.

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**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), bilingual/multicultural special education (BMSE),
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 specializations in BMSE and SET do not lead to teacher certification or endorsement.

Bilingual/Multicultural Special Education is taken in conjunction with one of the other areas of special education (LD, ED, ECSE, SD). Specific requirements will be those of the area selected and at least one additional course (including EDUC 532: Bilingualism and Language Acquisition Research). Students seeking the BMSE specialization must be admitted to the Special Education Program.

Degree applicants must meet the requirements of the Graduate School, and have an undergraduate grade point average of at least 3.0. In addition, the applicant must satisfy the requirements listed below:

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;
4. be interviewed and recommended for acceptance.

Prior to state endorsement in Early Childhood Special Education (2-5 years of age), students must pass or qualify for Collegiate Professional Certification and have completed two years of experience as an elementary or special education teacher.

A total of 33-61 graduate credit hours are 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, Robinon 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 Arts in Education, D.A.Ed.

The Graduate School of Education, in cooperation with the College of Arts and Sciences, offers a Doctor of Arts in Education degree as its major degree in education. The D.A.Ed. degree provides advanced liberal arts professional education for experienced educational practitioners pursuing or planning careers in nontraditional as well as traditional educational settings.

The D.A.Ed. 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:

- DAED 800, 802; EDRS 810, 811, 812; DAED 895 (or its equivalent); and DAED 994, 998, and 999.

A sequence of at least three courses (9 semester hours) must also be taken in a specific area of special scholarship 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, in-

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cluding 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 D.A.Ed. 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. 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 D.A.Ed. 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. Approximately 15 students are admitted to the program each year.

In addition to completing all Graduate School admission requirements, each applicant 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 D.A.Ed. 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 Doctor of 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 no 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 D.A.Ed. 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.

502 Developing Concepts in Early Childhood Mathematics and Science (3:3:0). Prerequisite: Admission to teacher education program or permission of department. 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 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 interrelatedness 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 required.

504 Introduction to Educational Technology (3:3:0). Prerequisite: Admission to Graduate School or senior standing and permission of department. Examines uses and issues in educational technology, explores curriculum integration of technology, and focuses on learning and using commercially available applications software.

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 Parent-Teacher Communication (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.

515 Practicum in Secondary Education (12:0:12). Prerequisite: Admission to and completion of all additional course work in the secondary education certification program, admission to and good standing in the Teacher Education 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. Participation in scheduled group sessions required.

517 Bilingual Education (3:3:0). Analysis of concepts, principles, and issues of bilingual education; its present status, and its future direction. Focus on current programs and their relationship with curricula in English as a second language.

518 Multicultural Education (3:3:0). A survey of multicultural education that examines problems faced by an individual in an alien culture, theories of bilingual/multicultural education, relationships between nonverbal communication and language systems, and interpersonal skills needed for encouraging harmony between our dominant culture and minority ethnic communities.

519 Methods of Teaching in Bilingual/English-as-a-Second-Language Settings (3:3:0). Examination of past and current methods and techniques for teaching English as a Second Language (ESL) in bilingual/ESL classrooms. Students analyze all program models and methods of instruction for students of limited English proficiency; practice teaching strategies based on recent second language acquisition research; and examine materials, textbooks, and resources available in the field. This course includes a field experience component and meets Virginia certification requirements for ESL teachers.

520 Assessment in Bilingual/English-as-a-Second-Language Settings (3:3:0). Examination of issues in testing students of limited English proficiency for placement, diagnosis, exit, and evaluation; analysis of current assessment instruments; and practice in development of a language evaluation.


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 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 required.

530 Programming Microcomputers in BASIC for Instructional Applications (3:3:0). Students will learn the fundamentals of operating a microcomputer. The major focus of the course will be learning to use the BASIC language to program microcomputers for instructional applications.

532 Programming Microcomputers in LOGO for Instructional Applications (3:3:0). Prerequisite: EDCI 530 or permission of instructor. Students learn to write and use programs in LOGO, an interactive programming language used in schools. They create microcomputer activities that develop problem-solving skills and programming skills.

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 required for those seeking initial teacher certification. Fall semester only.


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 Integrating Microcomputers into the Early Childhood Curriculum (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 on-line and off-line computer activities.

603 Trends, Issues, and Research in Early Childhood Education (3:3:0). Prerequisite: Admission to Graduate School and EDRE 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 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 Literature 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.

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 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 required.


612 Content Area Reading in Middle Education (3:3:0). Study of theory, methods, diagnostic instru-
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 Observing, Assessing, and Guiding Behavior of Young Children (3:3:0). Prerequisite: Admission to Graduate School and Teacher Education program; corequisite: EDCI 790. 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.

730 Designing Learning Activities for Microcomputer (3:3:0). Prerequisite: EDCI 530 and EDCI 705. Students design, write, implement and evaluate microcomputer learning activities and ancillary materials for microcomputers.

737 Observing, Assessing, and Guiding Behavior in Middle Education (3:3:0). Prerequisite: Admission to Graduate School and Teacher Education program; corequisite: EDCI 790. 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 (3:3:0). 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.

790-B Internship in Middle Education (3:3:0). 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.

790-C Internship in Secondary Education (6:6:0). Prerequisite: Admission to and completion of all additional course work in the secondary education certification program, admission to and good standing in the Teacher Education 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. Participation in scheduled group sessions required.

895 Emerging Issues in Curriculum and Instruction (3:3:0). Prerequisite: Admission to the D.A.Ed. 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 (EDGC)

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). 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: EDGC 525 or equivalent and EDGC 605. Advanced course in M.Ed.—counseling and develop-
Areas of Study

ment 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: EDGC 605. Theories appropriate to various types of groups and descriptions of group practices, methods, dynamics, and facilitating skills. Attention to application of theory to practice.

610 Career and Educational Counseling (4:3:2). Prerequisite: EDGC 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: EDGC 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: EDGC 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.

666 Counseling and Development for Special Populations (3:3:0). Prerequisite: EDGC 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: EDGC 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 (3:6:8). Prerequisite: 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 EDGC 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 D.A.Ed. 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.

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 in Multicultural/Multilingual Settings (3:3:0). Develops competencies in reading methods for students from multicultural or multilingual origins.
Educational 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 D.A.Ed. 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.

544 Post-secondary Transition (3:3:0). Exploration of factors for developing vocational independence in individuals with disabilities and/or limited English proficiency.

551 Classroom Management: Theory and Practice (3:3:0). Focus on identifying, recording, changing, and evaluating social and academic behaviors. Theories of classroom management are explored and various approaches to management are practiced. Development of
individual education programs emphasized. Field experiences required.


554 Adaptive Methods in Education (3:3:0). Prerequisite: EDUC 523. Students apply theory to practice as they adapt different levels of general education curriculum to accommodate various learning styles and needs. Emphasis is placed on adaptation of materials, intervention methods, and the development of an ongoing system for evaluation of student progress.

600. See EDUC 600.

615 Intervention for At Risk and Handicapped Infants and Toddlers (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 adviser. Focus on recording and analyzing behaviors for application of theory to develop techniques that increase learning by handicapped students.

622 Augmentative Communication (3:3:0). Prerequisite: Graduate standing, EDSE 552 (can be taken concurrently), and permission of adviser. 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). Study of manifestations of learning and behavioral differences and their impact on academic and social performance. Theories of deviance as they relate to emotional disturbances and learning disabilities are presented. Field experiences required.

647 Medical and Health Aspects of Handicapping Conditions (3:3:0). Prerequisite: EDUC 523 or permission of adviser. 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). Explored are concepts, purposes, terminology, and practices basic to formal and informal assessment strategies. Emphasis is placed on examination of procedures and interpretation of group and individual screening and diagnostic instruments. Practice in scoring and interpreting tests 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 (3:3:0). Prerequisite: Permission of adviser. Emphasis on planning, organizing, implementing, and evaluating programs for handicapped children ages two to eight.

661 Curriculum and Methods—Severely Profoundly Handicapped (3:3:0). Prerequisite: Permission of adviser. Formulation, implementation, and evaluation of individualized educational programs for severely/profoundly handicapped individuals.

662 Educational Consultation (3:3:0). Prerequisite: Teaching certification 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 Handicapped Children (3:3:0). Focus on strategies for developing and strengthening bonds between school and family for the benefit of the handicapped child. Home training approaches, programs, and materials are explored. Due process rights, legal roles of parents, and legislation governing substance and child abuse are emphasized.

668 Vocational and Leisure Education for Severely Handicapped (2:2:0). Prerequisite: Graduate standing. Focus on methods and techniques for vocational and leisure training of severely handicapped individuals in school and nonschool settings.

669 Transdisciplinary Approach to Rehabilitation (3:3:0). Prerequisite: Graduate standing and permission of adviser. Introduction to adaptive equipment and special techniques used by medical disciplines to enhance independence in the physically/multiple handicapped population. Incorporation of therapeutic modalities into other settings is explored via the educational/medical team approach.

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.
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.

506 Education and Culture (3:3:0). Prerequisite: Admission to Graduate School or permission of instructor. Examination and application of studies in educational anthropology, with focus on the process of cultural transmission in the U.S. through formal and informal institutions. Analysis of U.S. values, cultural discontinuity, hidden transmission of values in schools, U.S. schools' response to cultural pluralism, and cultural transmission in educational systems within other countries.

509 Advanced Human 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.

515 (formerly 684) History and Philosophy of Vocational Education (3:3:0). Prerequisite: Completion of undergraduate degree or appropriate educational requirement. Study of historical, philosophical, and societal backgrounds of vocational education. Several specialty areas of vocational education and their relationship to general education. Students study current trends in their own areas of specialty with attention to the backgrounds of those trends.

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., handicapped, bilingual) in applications of computer technology for instructional programs and career skills. Students learn to use computer technology designed specifically for special populations.

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. 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.

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.

581 Cooperative Work Study Programs (Curriculum and Methods) (3:3:0). Prerequisite: Completion of undergraduate requirements in vocational education for industrial cooperative instructors. Prepares teachers to develop curriculum material for cooperative work study courses. Opportunity to gain proficiency in the techniques of planning and teaching generally related and directly related curriculum materials.

587 Administration and Coordination of Cooperative Work Programs (ICT) - (COE) (3:3:0). Prerequisite: Completion of undergraduate requirements in vocational education for industrial cooperative instructors. Prepares teachers to develop and select cooperative work stations. Teachers gain proficiency in planning and working with advisory groups. Included in the course are materials related to employment opportunities, rules and regulations of employment, and design and completion of necessary documentation. State certification for Cooperative ICT Instructors requires completion of this course. The course is the second in the required sequence for certification.

589 Materials and Processes Technology (Variable, 3-12). Advanced lab course focusing on the implementation of new technological methods of manufacturing and testing materials, energy utilization and products. Students build, research, and test individual products and ideas including the strategies required for classroom implementation.

596 Project in Applied Education (2:2:0). The completion of a research and development project or paper as one of two culminating courses for the master's degree in education. The completed project or paper will contribute to the field of education within the student's specialization.

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.

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). Prerequisite: ENGL/EDUC 695 or NVWP Summer Institute. 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.

699 Computer Applications in Education (3:1:2). Introduces graduate students to the instructional and database management uses of microcomputers and mainframe computers in school settings. Emphasis is on study, analysis, and exploratory application in laboratory classes of selected concepts of computer usage to achieve objectives common to a variety of formal education settings.

752 Seminar in Instructional Application of Computers (3:3:0). Prerequisite: EDUC 699 or permission of instructor; mastery of BASIC. Concentrates on principles and techniques of implementation of instructional curricula using computers, especially microcomputers. Emphasizes computer-assisted, computer-managed, and computer-based instruction, the use of instructional programming and authoring languages, courseware authoring systems, and the evaluation and validation of educational software for instructional purposes.

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.
805 Doctoral Seminar in Education (2:2:0). Prerequisite: Admission to the D.A.Ed. program. In-depth study of selected topics in education. Students participate in an information exchange with other students, faculty members 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 D.A.Ed. requirements.

840 Seminar in Adult Development and Learning (3:3:0). Prerequisite: Admission to the D.A.Ed. program or permission of instructor. An advanced course in the nature of the adult learner and the processes of adult learning and development. Emphasizes adults as learners, motivations of adult learners and their participation patterns in adult education activities, and learning theory implications for adult learners.

881 Seminar in Bilingual Education: Policy (3:3:0). Prerequisite: Admission to the D.A.Ed. program. Examines the historical development of bilingual education in the U.S., focusing on federal and state legislation and court decisions of the last two decades. Policy issues and programmatic models developed in response to legal mandates and legislative decisions affecting bilingual education are explored in depth from federal, state, and local points of view.

882 Seminar in Bilingual Education: Theory and Research (3:3:0). Prerequisite: Admission to the D.A.Ed. program. Examines the theoretical foundations of bilingual education through focus on linguistic, anthropological, sociological, psychological, and educational research in the areas of first and second language acquisition, language use in a bilingual classroom, code-switching, bilingualism and intelligence, cognitive style, the teaching of reading, language dominance, proficiency assessment, achievement testing, special needs assessment, and research on the effectiveness of bilingual education.

895 Emerging Issues in Early Childhood Education (3:3:0). Prerequisite: Admission to the D.A.Ed. program or permission of the instructor. A seminar devoted to the study of selected emerging issues or problems in early childhood education. Students engage in research, study, discussion, and writing about various topics selected for study.

890 Doctoral Internship in Education (3:3:0) or (1:1:0 to 6:6:0). Prerequisite: Admission to the D.A.Ed. program and prior approval of adviser and D.A.Ed. director. Requires 100 hours of on-site internship completed over at least a five-week period. Interns work with an appropriate staff member in a cooperating school, school system, or other educational institution, agency, or setting. Up to 6 hours of EDUC 890 may be applied toward D.A.Ed. degree requirements.

895 Seminar in Emerging Issues of Education (3:3:0). Prerequisite: Satisfactory completion of EDUC 800 and DAED 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 D.A.Ed. requirements.

896 Doctoral Seminar in Curriculum Areas (2:2:0). Prerequisite: Successful completion of DAED 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 implications for the educational area today and in the future. Usually taken near the end of D.A.Ed. course work.

897 Independent Study for the Doctor of Arts in Education (varying credit). Prerequisite: Admission to the D.A.Ed. program and prior approval of adviser and D.A.Ed. 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). Prerequisite: Admission to the D.A.Ed. program and prior approval of adviser and D.A.Ed. 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 appropriate 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). Prerequisite: Admission to candidacy in the D.A.Ed. program, successful completion of the doctoral qualifying examination and EDRS 810, 811, and 812 or their equivalents.

999 Doctoral Dissertation Research (1-9:1-9:0). Prerequisite: Admission to candidacy in the D.A.Ed. program and faculty approval of dissertation proposal. Continued faculty assistance on an individual basis in the completion of the dissertation planned in DAED 998 and the initiation of new projects. May be repeated. No more than 11 hours of DAED 998 and 999 may be applied toward the minimum D.A.Ed. degree requirements.

Other courses. For other D.A.Ed. courses see EDUC 699, 840, 881, 882; EDRS 810, 811, 812, 820, 895; EDCI 701 and 705; EDAS 895; EDGC 895; EDCI 895.
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; Assistant Professor
Black, W. Murray, Ph.D., Pennsylvania State University, 1971; Associate Professor
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
Gertler, Janos, Sc.D. Hungarian Academy of Sciences, 1980; 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
Manilius, Andrej Z., Ph.D., Polytechnical School of Warsaw, 1968; Professor
Mulpuri, V. Rao, Ph.D., Oregon State University, 1985; Associate Professor
Orsak, Geoffrey C., Ph.D., Rice University, 1990; Assistant Professor
Olurotimi, 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
Stewart, Clayton V., Ph.D., Air Force Institute of Technology, 1978; 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 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 assistantships, research grants with a project conducted at the university, 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 adviser 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 students.
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 applicants professional accomplishments.
4. A detailed statement of career goals and aspirations.
5. For students whose native language is not English, a score of 575 or higher on the Test of English as a Foreign Language (TOEFL). A minimum score of 600 is required for applicants who wish to be considered for a graduate teaching assistantship.
6. Satisfactory performance on the Graduate Record Examination (GRE).

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, provisional students must achieve a 3.0 grade point average after 12 semester hours, must remove all undergraduate deficiencies (by taking the corresponding courses with a B or better), and must receive a grade of B or better in each of the graduate core courses ECE 521, 528, 546 or 548, and 584. Nondegree students who wish to enter the degree program must formally apply for admission.

Non-ECE Students
Outstanding students with B.S. or M.S. degrees in ECE-related disciplines (for example, computer science, mathematics, mechanical engineering, or physics) are encouraged to apply for admission. As a general guideline, students who do not have adequate preparation in some of the ECE undergraduate core areas are required to complete 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 303)
6. Differential Equations (MATH 304)
7. Probability (MATH 351 or STAT 344)
8. Pascal and Data Structures (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 permitted by the Graduate School, 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
2. A minimum of three courses at the 600 or 700 level (not including ECE 798 or 799).
3. A minimum of two courses outside the student's area of specialization.

4. A maximum of two 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 seminars.

Research/Nonthesis Option—Students may select one of the following options:

Thesis option. Thesis students register for ECE 799 Master's Thesis (6 hours). This option involves a significant research effort, 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 consists of three full-time faculty members, including two from the student's major area and one from outside the area. A fourth member, possibly from outside the department or university, may be optionally added. Thesis students may not register for ECE 798 Research Project.

Nonthesis option. Students who select this option must pass a written comprehensive examination in their major area. Each examination consists of six sections, corresponding to the following courses:

1. Communications: ECE 528, 535, 542, 630, 631, 642
2. Computers: ECE 511, 516, 542, 546, 548, 641
3. Control and Robotics: ECE 512, 521, 528, 620, 624, 650
4. Electronics: ECE 520, 565, 584, 586, 587, 680, 689

The student may select any four sections from the examination in his or her major area. Registration for the comprehensive must be approved by the student's academic adviser, and submitted to the graduate coordinator by the end of the fourth week of the semester during which the student plans to take the examination. Students who fail the comprehensive exam once may repeat the entire examination at the next regularly scheduled time for the exam. A student who fails the comprehensive examination twice and elects to take it for a third time must first complete nine additional credits, as approved by the ECE graduate coordinator, with a grade of B or better in each course. Students who fail the comprehensive examination for the third time will be dismissed. Non-thesis students may register for 3 hours of ECE 798 Research Project.

Electrical and Computer Engineering Courses (ECE)

500 Signals and Systems: Theory and Applications (3:3:0). Prerequisite: MATH 213, MATH 303, MATH 351; not open to Electrical and Computer Engineering students. Fundamental and advanced techniques for system analysis; review of Fourier series and integral; convolution, correlation, power spectrum, bandwidth; communication systems and modulation techniques; sampling and quantization; 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. Microcomputer memory. Microcomputer I/O, interrupt, DMA, interface. Microcomputer development systems. Applications examples. Introduction to 16-bit microprocessors. The course includes a project involving hands-on experience with microcomputer systems.

512 Real-Time Microprocessor Systems (3:3:0). Prerequisite: ECE 421 and 511 or equivalent. A course on real-time microprocessor systems with emphasis on control, 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 communication. The course includes a simulation and design project.

513 Applied Electromagnetic Theory (3:3:0). Prerequisite: ECE 305 and 360, or equivalent. Maxwell's equations, electromagnetic 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. The course includes a laboratory project and demonstration involving the Intel 8086 and MC68000 systems.

520 Electronic Systems Analysis (3:3:0). Prerequisite: ECE 433. A study of electronic circuits from a systems viewpoint. Topics consist of the analog building block circuits used in system design including operational amplifiers, voltage regulators, video amplifiers, oscillators, modulators, phase-locked loops, multiplexers, active filters, A/D and D/A converters, and optoelectronic circuits.

526 Random Processes in Electrical and Computer Engineering (3:3:0). Prerequisite: ECE 360, MATH 351, 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, Tellegen's 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-
tion, Kalman filtering, Linear Quadratic Gaussian problem, computational issues, stochastic dynamic programming, and applications in process control and in decision making under uncertainty.

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 MESFETs, 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, 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-hypotheses, 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 encipher 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.
643 Telecommunication Switching Systems (3:3:0).
Prerequisite: ECE 528 and 542. Basic concepts of switching with application to digital telecommunication networks. Topics include circuit switched networks, space-division and time-division switching, digital switching system architecture, stored-program control, traffic theory, numbering concepts, signaling networks, intelligent networks, and fast packet switching.

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; and systems methods for regular decomposition, image desegmentation, 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; and 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 Engineering (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 transmission lines, waveguides, resonators, scattering parameters, Smith charts, measurement techniques, instrumentation, and microwave devices.

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 1 (3:3:0). Prerequisite: ECE 528, 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 structures, 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.


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). Prerequisites: 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 coding, 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, multisolution 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 (focusing 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 typology. 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.

English

Faculty

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

Brady, Laura A., Ph.D., University of Minnesota, 1988; Assistant Professor

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

Brown, Stephen J., Ph.D., Yale University, 1959; Professor

Brunette, Peter C., Ph.D., University of Wisconsin, 1975; Professor

Cheuse, Alan, Ph.D., Rutgers University, 1974; Associate Professor

Comito, Terry A., Ph.D., Harvard University, 1968; Professor

D'Andrea, Paul, Ph.D., Harvard University, 1966; Robinson Professor

Forche, Carolyn, M.F.A., Bowling Green State University, 1975; Associate Professor

Foreman, Joel E., Ph.D., The George Washington University, 1975; Associate Professor

Foster, John B., Ph.D., Yale University, 1974; Associate Professor
Fuchs, Cynthia, Ph.D., University of Pennsylvania, 1989; Assistant Professor
Gallehr, Donald R., Ph.D., The Catholic University of America, 1974; Associate Professor
Golden, Marita, M.Sc., Columbia University, 1973; Assistant Professor
Goodwin, Stephen H., M.A., University of Virginia, 1969; Associate Professor
Gras, Vernon W., Ph.D., University of Chicago, 1967; Professor
Hammond, Jeffrey A., Ph.D., Kent State University, 1979; Associate Professor
Henry, James M., Ph.D., University of Pennsylvania, 1990; Assistant Professor
Hodges, Devon L., Ph.D., State University of New York, Buffalo, 1979; Associate Professor
Holisky, Dee Ann, Ph.D., University of Chicago, 1980; Associate Professor
Irvine, Lorna M., Ph.D., The American University, 1977; Associate Professor
Jann, Rosemary, Ph.D., Northwestern University, 1975; Associate Professor
Jones, Charles, Ph.D., University of Massachusetts, 1985; Assistant Professor
Kaplan, Deborah, Ph.D., Brandeis University, 1979; Associate Professor
Karlson, Robert Emil, Ph.D., The George Washington University, 1970; Associate Professor
Kaufmann, David, Ph.D., Yale University, 1989; Assistant Professor
Keaney, Winifred G., Ph.D., University of Maryland, 1975; Associate Professor
Kelley, Michael R., Ph.D., The Catholic University of America, 1970; Professor
Klappert, Peter, M.F.A., University of Iowa, 1968; Associate Professor
Kuebrich, David L., Ph.D., University of Chicago, 1973; Associate Professor
Lathbury, Roger D., A.M., Indiana University, 1968; Associate Professor
Leith, Wilkie, M.A., George Mason University, 1983; Director, The Writing Center; Visiting Assistant Professor
Melosh, Barbara, Ph.D., Brown University, 1979; Associate Professor
Mobley, Marilyn B., Ph.D., Case Western Reserve University, 1987; Assistant Professor
Moylan, Thomas P., Ph.D., University of Wisconsin, 1981, Associate Professor
Nadeau, Robert L., Ph.D., University of Florida, 1970; Professor
O'Connor, John S., Ph.D., University of Virginia, 1974; Associate Professor
Owens, Collin D., Ph.D., Kent State University, 1975; Associate Professor
Radner, John B., Ph.D., Harvard University, 1966; Associate Professor
Rutledge, Amelia A., Ph.D., Yale University, 1974; Associate Professor
Shreve, Susan R., M.A. University of Virginia, 1969; Professor
Story, Patrick L., Ph.D., Northwestern University, 1968; Associate Professor
Sypher, Eileen B., Ph.D., University of Connecticut, 1976; Associate Professor
Thaliss, Christopher J., Ph.D., Northwestern University, 1975; Associate Professor
Tichy, Susan, M.A., University of Colorado, 1979; Assistant Professor
Tsukui, Nobuko, Ph.D., University of Nebraska, 1967; Associate Professor
Weinberger, Steven H., Ph.D., University of Washington, 1988; Assistant Professor
Williams, C. K., B.A., University of Pennsylvania, 1959; Professor
Yocom, Margaret, Ph.D., University of Massachusetts, 1980; Associate Professor

Graduate English Programs
The Department of English offers graduate programs that provide professional training in the study and practice of writing and literature to students with widely differing aims. 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 creative writing (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 Doctor of Arts in Education degree.

English, M.A.
Admission Requirements
In addition to fulfilling Graduate School admission requirements, applicants must submit one copy of a 1,000-word nonfiction writing sample
and two letters of recommendation. The writing sample may be a paper written for an undergraduate class or any other material that gives evidence of writing and interpretive skills. 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 language 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 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.
3. Concentration in the Teaching of Writing and Literature
   a. General requirements
   b. Six hours in writing 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 arranged 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, bilin-
gual 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.

Admission Requirements
In addition to fulfilling Graduate School admission requirements, applicants must submit two letters of recommendation, one copy of a 1,000-word nonfiction writing sample, and two copies of a portfolio of fiction and/or poetry. 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. Students must give a public reading of their work at the end of the semester in which their thesis is approved.

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

Students must pass an 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 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: 6 hours of English courses numbered above 300, including one advanced writing course—309, 310, 397, 398, 458, 464, 489, 497—or permission of department. Instruction 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 (3:0:0). Prerequisite: Open to senior English majors and graduate students pursuing the M.A. in English or the M.P.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.

507 (EDCI 507) Internship in Applied Linguistics (3:0:0). 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 530) Issues in Literature and Philosophy (4:3:1). 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 or 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 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 systems 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 lexis, 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. 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 form and practice of 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 465 or equivalent and permission of instructor. 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 varia-
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.)

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 (1:0:0). Prerequisite: Open to graduate students currently enrolled in ENGL 615-A. Subject to approval of the Writing Center director. Qualified students serve as tutors for three hours a week in the English Department Writing Center under the guidance of the Writing Place director. A journal on the experience is kept and a paper submitted at the end of the semester synthesizing what students have learned and describing their progress as teachers. 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 in grading papers, and study of lab method of instruction.

616 The Writing of Nonfiction (3:3:0). Prerequisite: Permission of instructor. Writing of original essays, biographies, documentaries, reports, and other forms of nonfiction.

617 Poetry Writing Workshop (3:3:0). Prerequisite: ENGL 564 or equivalent and permission of instructor. 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 for credit with permission of department.

618 Fiction Writing Workshop (3:3:0). Prerequisite: ENGL 566 (565) or equivalent and permission of instructor. 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 for credit with permission of department.

619 Special Topics in Writing (3:3:0). Prerequisite: Two graduate writing courses and/or permission of instructor. 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 for credit with permission of department.

622 The Structure of Contemporary American English (3:3:0). Introductory survey of the phonology, morphology, and syntax of contemporary American English, with discussion of language attitudes and dialect variation due to region, social class, and sex. This course is intended primarily for nonlinguistics majors; it cannot be taken for credit by students who have taken both ENGL 520 and 522.

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 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 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 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 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 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 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 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 for credit with permission of department.
Areas of Study

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 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 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 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 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 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.

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 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 meta-theory. 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 (3:3:0). 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 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 NVWP 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). Prerequisite: ENGL/EDUC 695 or NVWP Summer Institute. 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 six 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 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. 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. 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, quantifica-
tion, 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 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. Non-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 for credit with permission of department.

798 Directed Reading and Research (3:0:0). Prerequisite: Open only to 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 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 Arts in Education (varied credit). Prerequisite: D.A.Ed. admission 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. The student presents a research paper in a subsequent D.A.Ed. summer seminar. May be repeated as required.

Foreign Languages and Literatures

Faculty

Aggera, Victorio G., Ph.D., The Catholic University of America, 1971; Professor
Berrua, 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, 1978; Assistant Professor
Cordero, Anne D., Ph.D., The George Washington University, 1968; Associate Professor
Elston, 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
Meyer, Henry P., Ph.D., University of Maryland, 1970; Associate Professor
Ricouart, Janine, Ph.D., University of California at Davis, 1986; Assistant Professor
Wagner, Irmgard, 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 of the Graduate School, 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 remaining 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)
FREN 580 Contemporary French Culture and Society (3)
or
SPAN 359 Introduction to Translation (3)
SPAN 576 Advanced Translation (3)
SPAN 580 Contemporary Hispanic Institutions (3)

Required practical experience (3 credits):
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 department. 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.


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, linguistics, 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), (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 lexis, 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
Areas of Study

French (FRAN)

500 History of the French Language (3:3:0). Scientific study of the evolution of the French language from its origin to the present.

560 History of the French Language and Literature (3:3:0). Study of the development of the French literary and cultural heritage, from its origins to the present. May be repeated for credit with permission of the department.


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 FRAN 798 and then elect the thesis option receive 3 credits for FRAN 799 upon completion of the thesis. Students who do not take FRAN 798 receive 6 credits for FRAN 799 upon completion of the thesis.

800 Studies for the Doctor of Arts in Education (varied credit). Prerequisite: DA.Ed. admission to study in French. 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. The student presents a research paper in a subsequent DA.Ed. summer seminar. May be repeated. 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.

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 Arts in Education (varied credit). Prerequisite: DA.Ed. admission 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. The student presents a research paper in a subsequent D.A.Ed. summer seminar. 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 to 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 precis 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 Don Quixote (3:3:0). Intensive study of Don Quixote and the major critical approaches to the work.

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). Prerequisites: 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 D.A.Ed. (variable credit). Prerequisites: D.A.Ed. admission 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. The student presents a research paper in a subsequent D.A.Ed. summer seminar. Enrollments may be repeated.

Also see FRLN listing.

Geographic and Cartographic Sciences

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; Affiliate Assistant Professor
Wheeler, Douglas J., Ph.D., University of Utah, 1985; Professor
Williams, Peter A., Ph.D., University of Indiana, 1986; 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 Graduate School requirements for admission, 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:

http://catalog.gmu.edu
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 nonthesis 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). 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). 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, relocation, relative orientation, and analytic aero triangulation.

579 Remote Sensing (3:3:0). Prerequisite: GECA 550 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 416 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). Designed to 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 geographic 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: Degree status and 18 hours in geography. Historical development of geographic thought and the current philosophy of geography. Analysis of the rationale for the discipline’s various subfields. Geographical research techniques and methods of analysis.


698 Directed Readings and Research (1-3:0:0). 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 geographical 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.
Areas of Study

Wade, Rex A., Ph.D., University of Nebraska, 1963; Professor
Walker, George E., Ph.D., Columbia University, 1975; J.D., Georgetown University Law Center, 1989; Associate Professor
Wilkins, Roger, L.L.B., University of Michigan, 1956; Robinson Professor

History, M.A.

The Department of History provides graduate training in historical methods and analysis for students with widely varying goals. The four 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 requirements of the Graduate School and the Department of History. These include (1) satisfactory scores on the GRE, including the subject examination in history, 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.

For those with little formal training in history, the history exam is used to evaluate deficiencies. 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. Six hours of internship;
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 or the research seminar. 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. Students are encouraged to take courses in a wide range of areas;
2. Twelve credits in graduate education courses, including EDCI 567.

**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 Marxist 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.

**565 Problems in African History (3:3:0).** Analysis of selected problems in African history. Emphasis on reading and discussion of historical interpretations and development of bibliography. Course may be repeated once when content differs.

**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.

**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 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 Attempts to Control the U.S. Westward Movement (3:3:0). Study of attempts by the East to control the West, how and by whom control was attempted, to what extent it was effective, to what extent the need for such control existed, and in what manner the West resisted Eastern domination.

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 the 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). Pre-requisite: 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.

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?


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 fo-
cases 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. General 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 Arts in Education (various credit). Prerequisite: D.A.Ed. admission 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. Paper is presented in a subsequent D.A.Ed. summer seminar. Enrollments 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.
Areas of Study

Information and Software Systems Engineering

Faculty
Aiken, Peter, Ph.D., George Mason University, 1989; Visiting Assistant Professor
Ammann, Paul E., Ph.D., University of Virginia, 1988; Assistant Professor
Baum, Richard, Ph.D., University of Michigan, 1969; Associate 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
Kerschberg, Larry, Ph.D., Case Western Reserve University, 1969; Professor and Chair
Motro, Amihai, Ph.D., University of Pennsylvania, 1981; Associate Professor
Palmer, James D., Ph.D., University of Oklahoma, 1963; BDM International Professor of Information Technology, Associate Dean
Rine, David, Ph.D., University of Iowa, 1970; Professor
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
Sanden, Bo, Ph.D., Royal Institute of Technology, Stockholm, 1978; Associate Professor
Sandhu, Ravi S., Ph.D., Rutgers University, 1983; Associate Professor
Sibley, Edgar H., Sc.D., Massachusetts Institute of Technology, 1967; University Professor and Eminent Scholar

Adjunct Faculty
Carlson, Christopher, D.P.A., University of Southern California, 1985
Davis, Carolyn, Ph.D., Texas A&M University, 1988
Long, Eric, Ph.D., Georgia Institute of Technology, 1989
Napollelo, Michael F., Ph.D., Virginia Tech, 1987
Nidiffer, Kenneth, D.Sc., George Washington University, 1988
Thompson, Paul, Ph.D., University of California at Berkeley, 1986
Wexelblat, Richard, Ph.D., University of Pennsylvania, 1965

Information Systems, M.S.

The Master of Science in Information Systems (MSIS) is a professional degree program that focuses on the technical, managerial, and policy issues 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 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, decision support systems, user interface design, artificial intelligence, graphics, and programming language environments.

An MSIS graduate can look forward to pursuing 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.
Graduate Catalog 1992-1994
George Mason University

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 two George Mason University courses, or equivalent:

- INFS 501 Discrete and Logical Structures for Information Systems
- 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 transferred, with adviser 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.
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 adviser 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 600 Computer Architecture and Operating Systems
- 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.

http://catalog.gmu.edu
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:

- SWSE 619 Software Construction
- SWSE 621 Software Design
- SWSE 623 Formal Methods and Models in Software Engineering
- SWSE 625 Software Project Management

Information Systems Courses (INFS)

501 Discrete and Logical Structures for Information Systems (3:3:0). Prerequisites: 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, Boolean algebras and lattices, trees and graphs, finite state machines, formal languages and their relation to automata, computability and computational complexity, formal semantics-operational, and axiomatic and denotational approaches.

510 Computer Systems and Software (3:3:0). Prerequisite: Graduate standing. Examination of information systems. Lecture and computing lab, including programming in a structured language, such as C or Pascal.

590 Program Design and Data Structures (3:3:0). Prerequisite: Acceptance into MSIS program, INFS 510, and INFS 501 (may be taken concurrently). Study of the fundamentals of data structures and algorithms applied in programming solutions to application problems. Stress on structures programmed in a modern high-level language. Laboratory required.


611 Comparative Programming Languages (3:3:0). Prerequisite: INFS 600. Investigation of the variety of environments for computer applications. Selection of the appropriate computing language for a specific application is demonstrated through case studies. Examples of languages are C, Assembler, Pascal, COBOL, PL/I, FORTRAN, ADA, LISP, Prolog. Computing lab.

612 Data Communications and Distributed Processing (3:3:0). Prerequisite: INFS 600. 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 600. Generalized database management systems: their internal and external structure, development, implementation, management, and use. Covers logical and physical database design and access methods. Several commercial systems are examined. Computing lab.

622 Information Systems Analysis and Design (3:3:0). Prerequisite: INFS 614, with INFS 612 also recommended. 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).

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.

762 Information Systems Security (3:3:0). Prerequisites: INFS 612 and INFS 614; or permission of instructor. Study of security policies, models, and mechanisms for secrecy, integrity, and availability. Hardware mechanisms for memory and domain management. 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-
Software Systems Engineering, M.S.

The M.S. in Software Systems Engineering (MS-SWSE) 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 engineering is a young and emerging discipline based on computer analysis, design, construction, testing, maintenance, economics, and management issues of software engineering. A pragmatic approach to problem solving is the hallmark of a software engineer. 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.

Software systems engineers are in demand in every segment of society affected by computing technology. Typical employers include companies that build and sell computers, software companies, research and development laboratories, aerospace contractors, banks, insurance companies, and manufacturing organizations. The master's program is concerned with both technical and managerial issues, but primary emphasis is placed on the technical aspects of building and modifying software systems.

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. 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.

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.
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 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 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 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, for students pursuing a terminal master's degree in software systems engineering; 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. Also, it is desirable, but not necessary, for applicants to have at least one year of appropriate work experience in the software field upon admission.

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 School 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, achieving a 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
Information and Software Systems Engineering  

SWSE 623 Formal Methods and Models in Software Engineering  
SWSE 625 Software Project Management  

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: Undergraduate courses or equivalent knowledge in structured programming in a high-level language, data structures, and machine organization. A working knowledge of Ada programming is desirable. In-depth study of software construction in 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: Undergraduate courses or equivalent knowledge in structured programming in a high-level language, data structures, and machine organization. In-depth study of methods, tools, notations, and validation techniques for the analysis and specification of software requirements. Students participate in a group project on software requirements.

621 Software Design (3:3:0). Prerequisite: SWSE 619 with SWSE 620 also recommended. 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.


625 Software Project Management (3:3:0). Prerequisite: Undergraduate courses or equivalent knowledge in structured programming in a high-level language and data structures. 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 (may be taken concurrently), and 625, or permission of instructor. Students are involved in analysis, design, implementation, and management of a software system project. 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: Undergraduate courses or equivalent knowledge in structured programming in a high-level language and data structures. Software testing at the module, subsystem, and system levels; quality assurance techniques, including inspections, version control, and configuration management. The role of standards, policies, and procedures. Organizational concerns.

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 requirements engineering. Focuses on critical problems in software systems engineering and discusses how their resolution might enhance the quality and productivity of real software and system developments in industry.

721 Advanced Software Design Methods (3:3:0). Prerequisite: SWSE 621. Study of advanced software design methods for large-scale software systems, including concurrent, real-time, and distributed systems. Students apply one or more methods to the design of a relatively complex software system.

796 Directed Readings in Software Systems Engineering (3:3:0). Prerequisite: Permission of instructor. Analysis and investigation of a contemporary problem in software engineering. Prior approval by a faculty member who supervises the student's work is required. Written report.

799 Thesis (6:0:0). Prerequisite: Permission of adviser. A research project completed under the supervision of a faculty member, which results in a technical report accepted by a three-member faculty committee. The report must be defended in an oral presentation.
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 and Graduate Record Examination aggregate scores of 1200 on the aptitude tests are normal 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.

http://catalog.gmu.edu
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 Applied 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 ORAS course 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 Applied 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. An exception to this may be requested for the instance when the third course is a stated prerequisite for a departmental 700-level course or an INFT 800- or 900-level course that is in the approved Plan of Study.
5. A GPA of 3.5 is required.
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 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 a faculty member from the student’s intended major area, who is selected by the student to become chair of the doctoral supervisory committee. Other committee members are selected to form a committee of at least four people. At least two of the departments of the School of Information Technology and Engineering must be represented on this committee. In addition, industrial representatives and faculty members from departments
outside of the school are highly desirable but are not required on the committee. The doctoral supervisory committee administers the comprehensive examination, the dissertation proposal presentation, and the dissertation defense. Permission to take each of these is requested from the SITE Dean on the basis of a written request and plan that has been approved by the Supervisory Committee.

Advanced Specialty Area Requirement

Students must include in the Plan of Study a well-defined advanced specialty area. Successful completion of this requirement should enable the student to do basic or applied research in a significant contemporary area in information technology.

The doctoral plan of study generally includes at least 48 semester hours of appropriate graduate-level course work beyond the bachelor's degree, and at least 18 of these must be information technology courses in the advanced specialty area of study.

Comprehensive Course Requirements

The comprehensive course requirements are as follows:

1. Six INFT 800- and/or 900-level courses that represent a coherent Plan of Study that support the student's research area (two approved 700-level courses may be used in place of INFT courses).
2. This Plan of Study must be recommended by the Ph.D. Advisory Committee and the SITE dean and approved by the graduate dean.
3. One directed reading course, INFT 796 or 797, may be included in the set of six INFT courses. (If the student's research area does not have adequate course selection at the INFT level, alternate proposals may be made.)
4. A Plan of Study that has been recommended by a Ph.D. Advisory Committee and the SITE dean should be considered a requirement that the student must complete prior to taking INFT courses. (When a student waits until all comprehensive courses have been completed to obtain the necessary recommendations, there is no guarantee that the courses taken will be accepted.)

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 Presentations. 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 and then forwarded to the Graduate School.
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 Graduate School’s 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, completion of the advanced specialty areas of study and the associated advanced specialty portions 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 Applied 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 one of a two-course sequence. The second course is 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.

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. (Revised course description only.)

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.

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). Prerequisites: 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 Architectures for Knowledge-Based Vision Systems (3:3:0). Prerequisite: ECE 644 or equivalent. Introduction to knowledge-based vision systems. Topics include image analysis, vision system architectures (human visual system, homogeneous, heterogeneous, autonomic), vision system operations (focus and zooming), picture recognition languages, introduction to knowledge-based and expert systems, learning algorithmic schemes, applications. Course includes a design project.

836 Special Topics in Detection and Estimation Theory (3:3:0). Prerequisites: ECE 734. Advanced topics in detection, estimation, and signal processing in areas of current research interest. Topics may include spectral es-
timation, speech recognition, array processing, SAR, underwater acoustics, or higher order spectra.

639 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 serving, 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, Shaf�er-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 521 and ECE 528 or equivalent. Study of mathematical methods in pattern recognition. Topics include perceptions, categorization, induction, entropy minimization, covariance diagonalization, statistical decision making, discrimination, feature selection, learning, fuzzy objective function clustering, string and high dimensional pattern grammars, stochastic languages, error-correcting automata, and grammatical inference.

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.

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 614. 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.

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.

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 eigenvalue 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 evaluation. 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). **Prerequisites:** 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-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 soft-
ware issues that have far-reaching consequences, like software configuration management.

925 Advanced Topics in C^2 System Engineering (3:3:0). Prerequisite: SYST 680/ECE 670. Special topics in C^2; content varies in different terms. Representative areas include quantitative evaluation of C^2 systems, applications of artificial intelligence in C^2 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, matrix-t, 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 encipher and DES 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.

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 queuing, 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, detection 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 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 endorsements, nonmonotonic reasoning, default reasoning, measures of information, knowledge fusion, propagation of beliefs in networks, and applications to knowledge support systems.

945 Advanced Topics in Microelectronic Systems (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.

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 the framework 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.

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 (1-3:0:0). 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.

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.

Interdisciplinary Studies

Faculty
Debra Bergoffen, Coordinator, Liberal Studies
Don Lavoie, Director, Graduate Interdisciplinary Programs

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 in-
Interdisciplinary Studies

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, religion, 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.

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 Analogies is required for the M.A.I.S. program.

Degree Requirements
Both the IS and LS tracks require 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 assistant dean for Individualized Study Programs, a 6-credit IS thesis may be substituted for the project.

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 credits 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). A master's project (MAIS 798) or thesis (MAIS 799) is also required of each student.

For additional information contact Ann M. Palkovich, Associate Professor, Archaeology Pro-
grams, 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 cross-cultural 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 adaptation, 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 or 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 historical or biological anthropology. 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 advisor. 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, adaptation, 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, 993-8862.

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)
798 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 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 Coordinator, MAIS-IT Program
Dinan, Desmond, Ph.D., National University of Ireland, 1985; Associate Professor of History, Deputy Director, International Institute
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 coordinator. No thesis or foreign language competence is required. For information, contact (703) 993-8200.

**International Transactions Courses (INTL)**

NOTE: Not all courses earn three hours of graduate credit. The exact format of some courses may vary in length of time offered and thus credits earned. Some course requirements are subject to change.

**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. Identifies important themes that have been postulated by different approaches to the study of international transactions. Specialists from different fields assess one or more themes and highlight the characteristic 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 Community, on the national and supranational levels. This course essentially consists of problem solving. Emphasis is placed on different fact patterns involving combinations of issues drawn from the fields of international trade, technology, mar-
Areas of Study

Marketing, and commercialization. Staff members of the Center for Innovative Technology participate in this course.

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 trading 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 a particular trade issue 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.

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.

711 Legal Regulation of International Transactions I (3:3:0). An overview of U.S., international, and foreign regulation of transnational activity. Identifies current public policy issues (legal and political) in the context of international competitiveness and free trade with emphasis on the perspective of public and private policy makers. Examines broad legal dimensions of the international environment and particular transactions and focuses on the political and regulatory systems in the United States with a detailed review of trade legislation. Subsequent attention is given to the legal and political aspects of the international system, the regulatory system established under the GATT (General Agreement on Tariffs and Trade) and foreign regulation (both national and regional).

712 Legal Regulation of International Transactions II (3:3:0). A continuation of INTL 711. Refer to the course description for INTL 711. 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. Assesses the tension between political and economic issues within the context of national security concerns.

714 Transborder Data Flow 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 on those issues on international 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 Communities 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 Community), Japan, and the 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. Focuses on the importance of technology in Japan's domestic and international trade policies. Emphasis on current business and political issues in the context of the global trading system. Focuses on particular policies and practices which are at issue in the current GATT negotiations and in bilateral trade relations with the U.S. and the European Communities. An assessment of these policies and practices 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 Community, 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. Focuses on formulating specific export marketing plans for particular Virginia firms and industries.

753 Virginia in the Global Economy (3:3:0). Examines the role of states in the international marketplace and then focuses on the role of Virginia. 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

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Graduate Catalog 1992-1994
George Mason University
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, the essentials of market planning are studied and then implemented. 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. The completed market plan is presented to invited industry experts for their dissemination and use.

759 Export Licensing, Controls, and Documentation (1-3:1-3:0). Examines the legislation and practices governing exports and reexporting of U.S. goods and technology. In particular, considers the Commerce Control List (CCL), Coordinating Committee on Multilateral Controls (COCOM), and 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). At the conclusion of the United National Conference on Environment and Development (Rio, Spring 1992), 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 Toward Political Union; History, Policies, and Institutions of the European Community (3:3:0). The first part examines the political and institutional development of the European Community from the post-war movement for European integration to the latest efforts to achieve European Union. Special attention is paid to the changes introduced as a result of the 1991 Inter-Governmental Conferences on European Political Union and Economic and Monetary Union—collectively called European Union—which culminated in the Maastricht Summit. The second part focuses on the impact of European Union on enhanced regional integration on the community's main trading and alliance partners. In particular, the course analyses the 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 in the 1990s. Concludes with an evaluation of current economic theory and tools as they relate to particular international transactions. Intended for those students who want a more detailed understanding of economics, from a pragmatic perspective, as it relates specifically to the broad field of international transactions today.

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 in Virginia. 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. Purpose is to give 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.

Mathematics

Faculty

Alligood, Kathleen T., Ph.D., University of Maryland, 1979; Associate Professor
Beslagic, Amer, Ph.D., University of Wisconsin, 1986; Assistant Professor
Colonna, Flavia, Ph.D., University of Maryland, 1985; Assistant Professor
Fischer, Klaus G., Ph.D., Northwestern University, 1973; Associate Professor
Gabel, Michael R., Ph.D., Brandeis University, 1972; Associate Professor
Kan, Ittai, Ph.D., University of Illinois, 1984; Assistant Professor
Kiley, W. Thomas, Ph.D., Brown University, 1969; Associate Professor
Kulesza, John S., Ph.D., State University of New York, Binghamton, 1987; Assistant Professor
Lawrence, James F., Ph.D., University of Washington, 1975; Associate Professor
Lawrence, L. Brian, Ph.D., State University of New York, Binghamton, 1984; Assistant Professor
Levy, Ronald F., Ph.D., Washington University, 1974; Professor, Department Chair
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; Assistant Professor
McDaniel, Andrew L., Ph.D., Brandeis University, 1985; Assistant Professor

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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 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 Graduate School admission requirements, 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 Graduate School degree requirements, 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, and Differential Equations. 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 Department of Information and Software Systems 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.

The following requirements apply to this specialization:
1. 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.
2. The departmental examination must consist of the basic unit in operations research and the advanced unit in any area.

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
3. The department examination must consist of the basic unit in the area of statistics and an advanced unit in any area.

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.

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 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 the 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.

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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 Lebesque integration theory may be included.


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 Arts in Education (varied credit). Prerequisite: D.A.Ed. admission 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. The paper is presented in a subsequent D.A.Ed. summer seminar. Enrollments may be repeated.
Areas of Study

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, Arnold 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
Maiello, Anthony J., M.S., Ithaca College, 1967; Professor
Miller, Patricia A., M.M., New England Conservatory of Music, 1974; Visiting Commonwealth Associate Professor of Music
Smith, Glenn E., D.Mus., Indiana University, 1973; Associate 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 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, and accompanying.

Admission Requirements

In addition to fulfilling the admission requirements of the Graduate School, 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

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. Before beginning the thesis or upon completion of Orff Schulwerk certifica-
tion, students must pass a comprehensive exami-
nation in music education.

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 prac-
tical experience in conducting. In most cases,
each student accepted is offered an opportunity
to gain conducting experience by serving as as-
sistant 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 concen-
tration must show evidence of having com-
pleted 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 semes-
ter of undergraduate study for each of the lan-
guages not previously studied. The
recommended music history and literature
courses are in the vocal, operatic, or chamber
music areas.

Music Courses (MUSI)

511 Analytical Techniques (3:3:0). Prerequisite: Bac-
calaureate degree in music or permission of instructor. A
detailed formal and stylistic examination of music se-
lected 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:
Baccalaureate degree in music with a minimum of 3 hours
of study in orchestration or permission of instructor. Inten-
sive 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 meth-
ods of notation. Late twentieth-century performance
practices.

513 Advanced Topics in Music Theory (3:3:0). Pre-
requisite: Baccalaureate degree in music or permission of
instructor. Intensive study and analysis of music from the
theoretical point of view, comparing trends in composi-
tional techniques through various works. May be re-
peated for credit as topics change.

531 Advanced Topics in Music History and Litera-
ture (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 second-
ary source materials are studied in historical and/or ana-
lytical 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: Bacc-
calaureate degree in music or permission of instructor. His-
torical and analytical study of the concepts which produced
the concerto form and its extensive literature, from
the seventeenth through the twentieth centuries.

561 Advanced Topics in Music Education (1-3:1-
3:0). Prerequisite: Degree in music education or permis-
sion of instructor. Intensive examination of specific areas
of concern to music educators engaged in teaching vocal,
instrumental, and general music at all levels of function-
ing 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 Learn-
ing (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.

580 Wind Ensemble (1:0:3). Prerequisite: Audition.
Highly selective group of instrumentalists performing
works from the wind ensemble repertoire. Public con-
certs will be given. May be taken for credit four times.

581 Graduate Choral Ensembles (1:0:3). Prerequi-
site: Audition. Performance of works from the choral rep-
ertoire. 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: Audii-
tion. Performance of works from the chamber music rep-
ertoire. 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.

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 Arts in Education (variable credit). Prerequisite: Open only to D.A.Ed. students admitted 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. The paper is presented in a subsequent D.A.Ed. summer seminar. 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. The 3-credit sequence is designed for students who work toward the M.A. degree with a concentration in performance, composition, conducting, or accompanying.

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.
Nursing

Faculty

Allinger, 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; Associate Professor and Coordinator, Doctoral Program
Conti, Roberta M., M.S.N., University of Maryland, 1969; 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
Roche, Joan M., Ph.D., The Catholic University of America, 1982; Adjunct Associate Professor
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 in Primary Care major is a collaborative program with George Washington School of Medicine and Health Sciences. The Adult or Gerontological Nurse Practitioner major has been approved by the state boards of nursing and medicine in Virginia. A Family Nurse Practitioner major is planned and the course work has been approved and is included in this catalogue (NURS 631, 675, 720, 722). This major will not be offered in the 1992-93 academic year. 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. A variety of health care and health-related settings are used for clinical practice experiences.

Admission Requirements

In addition to meeting the Graduate School 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 Adult or Gerontological 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. It is recommended that students applying to the Advanced Clinical Nursing and the Adult/Gerontological 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, and a seminar in concepts of nursing research. The student has the option of writing a thesis or working on 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.

**Core Courses—Required of all students:**

- NURS 755 Theoretical Foundations Related to Nursing (3)
- NURS 759 Approaches to Data Analysis in Nursing Research (3)
- NURS 790 Seminar in Concepts of Nursing Research (3)
- NURS 791 Projects in Nursing Research (3) or NURS 799 Thesis (6)

**Nursing Majors—Select one major**

**Major in Adult or Gerontological Nurse Practitioner in Primary Care**

- NURS 622 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 (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)

  **Related Discipline Support Courses (3)**

- Management/Organizational Theory (3)
- Recommended courses include SOCI 602, PUAD 620, PSYC 632, or MGMT 600

  **Related Discipline Support Course (3)**

**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 of the Graduate School for 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, Graduate Record Examination (GRE) scores in the quantitative, verbal, and analytic areas 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.

The Graduate School 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 Graduate School doctoral degree 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), cognate core (3 semester hours), research core (24 semester hours), and nursing and related discipline electives (12 semester hours). Prior to advancement to candidacy and enrollment for dissertation credit, the student's program of study must be approved within the School of Nursing and by the dean of the Graduate School.

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 dean of the School of Nursing recommends advancement to candidacy for approval by the dean of the Graduate School.

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 graduate school dean. 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 graduate school.

Doctoral Dissertation Proposal
The proposal must focus on a topic in nursing and must be approved by the Doctoral Supervisory Committee, doctoral program coordinator, School of Nursing dean, and Graduate School dean. The dissertation proposal and written dissertation must be consistent with the guidelines of the Graduate School of the university outlined in

http://catalog.gmu.edu
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, School of Nursing dean, and Graduate School dean.

Final Oral Doctoral Examination
The chair of the Doctoral Supervisory Committee, upon preliminary approval of the doctoral dissertation by the committee, petitions the dean of the Graduate School 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 Graduate School for approval by the graduate dean.

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 School of Nursing and the university. Activities are planned to meet the special needs of individuals and groups in the community. The School of Nursing offers opportunities for credit and non-credit 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.

See Programs and Additional Graduate Courses in this catalog for information about graduate certificate programs 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 Graduate School of the university. A requirement for the certificate is 15 credits of graduate course work in which a 3.0 GPA is earned.

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 adviser.

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 Graduate School 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 School of Nursing.)  
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 Pathophysiology: 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. Presented 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. *Collosted with George Washington University School of Medicine and Health Sciences.

565 Issues in Oncology Nursing (3:3:0). Addresses the major professional nursing concerns in the field of cancer nursing. These encompass philosophical, ethical, and legal aspects of nursing practice. The issues of collaborative roles, professional organizations, and research in oncology nursing are addressed.

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 and 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.


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 effective 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.

655 Quality Assurance in Health Care (3:3:0). Issues, trends, and methodologies in nursing quality assurance with particular emphasis on roles and responsibilities of the nurse middle manager in health-related agencies.

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.)


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 or Corequisite: 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. Prerequisite: NURS 631, 675, 552, and HCS 206. 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 and 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 and clinical practicum.


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 School or master's degree. Investigation of selected theory decision analysis 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 (3:3:3). 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. Foundational 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 an 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 759. Research projects by students, individually or in groups, under direction of faculty.
799 Thesis (1-6:0:0). Prerequisite: NURS 790. Exploration of a nursing problem using appropriate research methodology under supervision of graduate faculty member(s).

800 Contemporary Health Care Issues Seminar (3:3:0). Focus is on executive decision making related to contemporary issues affecting administration in nursing education and nursing service.

863 Health Care Administration (3:3:0). Focus is on creating awareness of the principal underlying forces that will influence the role of the nurse executive in the care delivery system, including educational and service environments.

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). A critical assessment and synthesis of the process of development and testing of theoretical foundation of nursing science.

990 Advanced Empirical Nursing Research Seminar (3:3:0). An in-depth examination of advanced principles of empirical research methodologies from the formulation of the research question to preparation of data for analysis. The student is expected to develop and defend an appropriate proposal in nursing administration.


993 Advanced Methods in Nursing Research (3:3:0). Prerequisite: NURS 955 and 992, and intermediate statistics. Pre- or corequisite: NURS 871. Examination of advanced principles and special problems in research methodology from the formulation of the research question through 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). Pre- or corequisite: All required courses except NURS 999. 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). 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.

Operations Research and Applied Statistics

Faculty

Bolstein, A. Richard, Ph.D., Purdue University, 1967; Associate Professor

Carr, Daniel B., Ph.D., Wisconsin University; Associate Professor

Friesz, Terry, Ph.D., The Johns Hopkins University, 1977; Professor

Gantz, Donald T., Ph.D., University of Rochester, 1974; Associate Professor

Greenberg, Irwin, Eng.Sc.D., New York University, 1964; Professor

Habib, Muhammed, Ph.D., University of North Carolina, Chapel Hill, 1979; Associate 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

Miller, John J., Ph.D., Stanford University, 1974; Associate Professor

Nash, Stephen, Ph.D., Stanford University, 1982; Associate Professor

Schum, David A., Ph.D., Ohio State University, 1964; Professor
To be admitted to the program, a candidate must:

1. Fulfill all admission requirements of the Graduate School;
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 303 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 645 Stochastic Models in Operations Research II
- OR 743 Applications Seminar
- 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 must complete three courses from OR 641, 642, 643, 644, 676, 682, and 741. 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 de-
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, 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 applied systems modeling. 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 adviser'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 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.


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 size-decrement 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.

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 671.

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.

**Physical Education**

**Faculty**

Bever, David L., Ph.D., Purdue University, 1978; Associate Professor

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, 1970; Professor and Department Chair

Schack, Frederick K., Ph.D., Ohio State University, 1976; Associate Professor

Weiler, Robert M., Ph.D., Southern Illinois University, 1991; Visiting Assistant Professor

Wiggins, David K., Ph.D., University of Maryland, 1979; Professor

**Physical Education, M.S.**

This program is offered through the Department of Human Services. It serves the needs of those currently employed in teaching and fitness fields; those with baccalaureate degrees in either physical education or health education who desire to improve their skills before entering a career; and those who wish to earn a master's degree as a prelude to additional graduate work in physical education, exercise science, health promotion, or related areas.

**Teacher Certification**

Students may also design a program leading to teacher certification in physical education with a health education endorsement. Contact the department for details.

**Admission Requirements**

In addition to fulfilling Graduate School admission requirements, the applicant must hold a bachelor's degree in physical education, health education, or a related field; must submit three letters of recommendation; transcripts of all college course work; and must have completed courses in human anatomy and physiology, kinesiology, and exercise physiology. Applicants who do not meet these requirements may be offered provisional or nondegree status in accordance with the general regulations of the Graduate School.
Departmental Program Options and Degree Requirements

In addition to fulfilling the Graduate School degree requirements, the candidate must complete the following program:

1. Core Content (18 semester hours required of all students; contact department for specific courses):
   - Research Design (3)
   - Statistics (3)
   - Historical/Philosophical Foundations (3)
   - Advanced Exercise Physiology (3)
   - Environmental/Epidemiological Health (3)
   - Ethical Issues: Relationships to Social Responsibility and Policy (3)

2. Cognate Area Courses (6 semester hours): students will complete graduate courses in the parent discipline undergirding their area of emphasis (i.e., biology, history, psychology, sociology, etc).

3. And either a thesis (6 semester hours of PHED 799).

4. Or Electives (6 semester hours in either major or cognate).

Total: 30 hours

Students must successfully complete a written comprehensive examination at the end of course work and prior to beginning the thesis. Thesis students must also present an oral defense of their thesis.

Program Patterns

Two program patterns are available:

Nonthesis Pattern

<table>
<thead>
<tr>
<th>Course</th>
<th>18 hours</th>
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<tbody>
<tr>
<td>Core</td>
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</tr>
<tr>
<td>Cognate</td>
<td>6 hours</td>
</tr>
<tr>
<td>Electives</td>
<td>6 hours</td>
</tr>
<tr>
<td>Total</td>
<td>30 hours</td>
</tr>
</tbody>
</table>

Thesis Pattern

<table>
<thead>
<tr>
<th>Course</th>
<th>18 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td></td>
</tr>
<tr>
<td>Cognate</td>
<td>6 hours</td>
</tr>
<tr>
<td>Thesis</td>
<td>6 hours</td>
</tr>
<tr>
<td>Total</td>
<td>30 hours</td>
</tr>
</tbody>
</table>

These patterns enable students to identify their personal goals and professional directions more precisely according to personal interests and professional directions of each student.

Graduate Assistantships

Administrative, research, and teaching-related graduate assistantships are available in the Department of Human Services. To be eligible for an assistantship, a student must be admitted to degree status and take a minimum of 6 semester hours of graduate credit each semester. Interested students should contact the Department of Human Services for applications.

Physical Education Courses (PHED)

500 Workshop in Physical Education (1-3:0:0). Prerequisite: Graduate standing or permission of instructor. Concentrated full-time workshops, weekend seminars, and workshops dealing with selected topics in physical education and ancillary fields. May be repeated. No more than 6 semester hours may be applied for degree credit.

599 Independent Study in Physical Education (1-3:0:0). Prerequisite: Graduate standing or permission of instructor. Study of a problem area in physical education research, theory, or practice under the direction of faculty. May be repeated, but no more than 3 hours total credit may be Earned.

605 History of Sport and Physical Education from Renaissance to Present (3:3:0). Prerequisite: Graduate standing or permission of instructor. Role of sport and physical education in Europe and its impact on developments in America.

610 Advanced Exercise Physiology (3:3:0). Prerequisite: PHED 450, graduate standing or equivalent, or permission of instructor. Lecture, demonstration, and seminar experiences in the application of research findings to the understanding of physiological function and the effects of exercise on people.

630 Exercise, Health, and Fitness Program Development (3:3:0). Prerequisite: Graduate standing or permission of department. Health and exercise program development related to fitness and health of adult populations. Three to 6 hours of field experience.

660 Management and Administration of Physical Education and Sport (3:3:0). Prerequisite: Graduate standing or permission of instructor. Advanced study in fiscal management, legal liability, facility planning, and policy development.

680 Seminar in Current Issues in Physical Education and Sport (3:3:0). Prerequisite: Graduate standing or permission of instructor. Advanced study in current issues of physical education and sport identified and analyzed.

799 Thesis (1-6:0:0). Prerequisite: Graduate standing or permission of instructor. Exploration of a physical education problem using appropriate research methodology under supervision of graduate faculty member(s).

802 Readings for the Doctor of Arts in Community College Education (3:9:0:0). Prerequisite: Admission to the Doctor of Arts program in 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 that is potentially publishable.

Graduate Certificate in Gerontology

Committee: Rita Ailinger, Frieda Butler, Molly Davis, Eileen Fuerbach, Douglas Hershey, Aliza
Kolker (Chair), Robert Ruhlmg, B. J. Schuchman, James Willett

The Graduate Certificate in Gerontology is administered by the Department of Human Services.

Eight departments, including Sociology and Anthropology, Psychology, Nursing, Biology, Graduate School of Education, Human Services, Public Policy, and M.A.I.S. have developed a graduate certificate program in gerontology. This program combines theoretical and applied course work in aging with the student’s graduate curriculum in one of these departments. Since gerontology is by definition multidisciplinary, the certificate program requires students to take course work outside their major field.

A student applying to the certificate program must be in graduate degree status or hold a master’s degree in psychology, education, nursing, or a service-related discipline (e.g., social work, recreational therapy, sociology, public affairs, management, physical therapy). A student who already holds a master’s degree must choose an area of specialization. The certificate requires 18 hours of graduate courses: 6 in the major area of specialization, 6 outside the major, and 6 hours of practicum.

Students may obtain counseling and an application form from the Department of Human Services, (703) 993-2060. A gerontology track is available in the M.A.I.S. program, see Interdisciplinary Studies.

Physics

Faculty

Blaisten-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
Esswirth, 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
Mielezarek, Eugenie, Ph.D., The Catholic University of America, 1963; Professor
Satija, Indubala, Ph.D., Columbia University, 1983; Associate Professor
Treff, James, Ph.D., Stanford University, 1966; Robinson 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 adviser’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 502, 510, and 513. Students who have completed PHYS 502 or its equivalent as undergraduates will be required to take PHYS 514 in place of PHYS 502. (Before 1986 a somewhat different set of core requirements applied — see earlier catalogs.)

2. For the applied physics track, any three of the following five courses: PHYS 511, 512, 514, 610, 613.

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.

Computational Physics Track in the Computational Sciences and Informatics, Ph.D.
A computational physics track exists as part of the doctoral program in computational sciences and informatics (see Computational Sciences and Informatics for degree and admission requirements).

Astronomy Course (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.

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. Experimental basis 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.

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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.

530 Astrophysics (3:3:0). Prerequisite: PHYS 342 or 351 and MATH 113 or 115. Topics include physical concepts, magnitudes of stars, Hertzsprung-Russell diagram, stellar radiation, interstellar matter, dust, molecules, and other topics.

531 Relativity and Cosmology (3:3:0). Prerequisite: PHYS 352, MATH 214 or 216, and PHYS 303, 305, or permission of instructor. Special relativity, 4-dimensional space-time, general relativity, non-Euclidean geometries, geodesic and field equations, tests of general theory of relativity, black holes, cosmology, models of the universe, remnant blackbody radiation, big bang cosmology, thermodynamics and the universe.


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). Prerequisites: 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 states and the various processes defining these layers. Other topics include cloud formation, atmospheric dynamics, waves and turbulence, ozone photochemistry, solar-terrestrial atmospheric circulation, modeling, predictability, and climatic 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 Electrooptics (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 imaging, underwater acoustic imaging and mapping, side-looking radar, antenna arrays, and applicable computer methods.

613 Computational Physics II (3:3:0). Prerequisite: PHYS 503, 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 Radiation Hydrodynamics (3:3:0). Prerequisite: PHYS 303 and 305; PHYS 510 recommended or equivalent course in hydrodynamics. Study of high-temperature plasma flows in which radiative processes contribute significantly to the transfer of energy and momentum. Course includes review of tensor calculus and hydrodynamics formulation, dynamics of viscous and heat conducting fluids, relativistic fluid flow, waves, shocks, winds, radiative transfer, radiative contributions to plasma flows. Some applications to computer methods in modeling radiating plasma flows are included.

676 Atmospheric Physics II (3:3:0). Prerequisite: PHYS 575. A continuation of PHYS 575. Topics include atmospheric evolution, global change, computer simulations, biogeochemical cycles, greenhouse effect and global warming, planetary atmospheres, terrestrial and Jovian planets, and climatic changes on other planets.

780 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.

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 Arts in Education (variable credit). Prerequisite: D.A.Ed. admission 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. The paper is presented in a subsequent D.A.Ed. summer seminar. Enrollments may be repeated.

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; Assistant Professor (Undergraduate Coordinator)
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)
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; Assistant 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
Mandel, Evans J., Ph.D., The George Washington University, 1966; Professor
Mellinger, Jeanne, Ph.D., University of Chicago, 1952; Emeritus Professor
Moretz, Walter J., Ph.D., Florida State University, 1970; Associate Professor
Mumford, Michael, Ph.D., The University of Georgia, 1983; Associate Professor
Olson, Carl, Ph.D., University of California, Berkeley, 1978; Research Associate Professor
Pasnak, Robert, Ph.D., Pennsylvania State University, 1969; Professor
Riklin, John H., Ph.D., Yale University, 1977; Associate Professor
Rugel, Robert P., Ph.D., Florida State University, 1971; Associate Professor
Sanford, James F., Ph.D., Kansas State University, 1971; Associate Professor
Short, Jerome L., Ph.D., Arizona State University, 1990; Assistant Professor
Smith, Robert F., Ph.D., University of Wisconsin, 1976; Associate Professor (Administrative Coordinator)
Smith, Virginia, Ph.D., University of Maryland, 1981; Adjunct Assistant Professor
Tangney, June Price, Ph.D., University of California, 1985; Assistant Professor
Tyer, Zita E., Ph.D., Texas Tech University, 1968; Professor
Wahl, Otto F., Ph.D., University of Pennsylvania, 1974; Affiliate Associate Professor
Weisman, David S., Ed.D., The Catholic University of America, 1979; Adjunct Associate Professor
Zaccaro, Stephen, Ph.D., University of Connecticut, 1981; Associate Professor (Industrial/Organizational Master's Coordinator)

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Psychology, M.A.

The Department of Psychology offers an M.A. degree in industrial, human factors engineering, school, life-span development, and experimental neuropsychology. The department does not offer an M.A. in clinical or counseling psychology; therefore, only students in the school psychology program may enroll in the clinical skills courses such as psychological assessment.

The industrial/organizational specialization trains students in the conduct and application of psychological research to work settings. Particular expertise can be developed in a variety of areas including personnel selection, training, leadership, motivation, and human performance assessment.

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 of the Graduate School, 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 financial aid are sent to applicants when their application is received by the Graduate School. 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, 677, 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 the gerontology specialization may take 6 hours of approved electives from outside the department in addition to their gerontology practicum.

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 status, applicants are not assured that such requests will be granted. If granted, however, no more than 12 semester hours of credit earned in nondegree status may be applied to a degree program.

Provisional Status Students

Students who are admitted in provisional status must take 12 semester hours in psychology before applying for degree status. A minimum GPA of 3.25 must be earned in those courses. The grade point average is a major (but not sole) factor in determining acceptance to the degree program. The courses needed before a student requests a change to degree status are PSYC 553 and 9 additional graduate hours, excluding Individualized Study.

Psychology, Ph.D.

The goal of the doctoral program is to train students in the principles and applications of psychology. To accomplish this, the program provides the student with both knowledge of the basic content areas in psychology and practical experience in applying these principles to problems arising in non-academic work settings. The program contents are applied experimental, clinical, and developmental psychology. The applied experimental program with specialization in industrial/organizational and human factors engineering is focused on educating psychologists in the use of psychological knowledge and methods employed 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 School with the following materials by February 1 to be considered for admission:

1. Completed Graduate School 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 15.

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 proseminars, two quantitative courses, and a course in history and systems. The 12-semester-hour proseminar 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:

- 15 hours of proseminars from PSYC 701, 702, 703, 704, and 705
- 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:

- 15 hours of proseminars from PSYC 701, 702, 703, 704, and 705
- 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
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 proseminars: 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
Dissertation and electives

The Psychology of Work Motivation (3:3:0). Prerequisite: PSYC 230 or permission of instructor. Examination of the psychological literature of the need, cognitive, and reinforcement theories of motivation; 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). 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 class. 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 325. 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 to evaluate the human effectiveness of organizations and mental health programs.

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 principles 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/critical incident analysis, task analysis, mission analysis, reliability/error analysis, workload measures, and training evaluation techniques.

650 Clinical Research Methods (3:3:0). Open only to degree students. Prerequisite: PSYC 553 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 social relationships, development of aggressive 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 (1-6:0:0). 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.

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. Prerequisite: PSYC 617 or 822 and PSYC 320 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 organicity; 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.
Areas of Study

734 Seminar in Human Factors Engineering (3:3:0). Prerequisite: PSYC 530 or graduate experimental course in psychology or PSYC 701. Rotating this course relates to organizational change and development. Actual training in organizational diagnosis and change through supervised field work. May be repeated for credit.

735 Psychological Perspectives on Organizational Development (3:3:0). Prerequisite: 3 graduate credits in I/O psychology or permission of instructor. Theories and methods in I/O psychology and the human factors in computer systems, office automation) announced in advance. May be repeated for credit.

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 control systems, nuclear power plant control consoles, and personal computer-human interfaces). Considered is the problem solving, design, 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 passing test 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 theoretical 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 enable the acquisition, organization, and use of knowledge, such as attending, remembering, and thinking.

776 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 psychological hazards. Emphasis is on techniques of behavioral assessment of adverse drug or chemical effects.

786 Assessment and Treatment in Gerontology (3:3:0). Prerequisite: PSYC 530 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.

792 Practicum in Developmental and Physiological Psychology (3:1:0). Prerequisites: 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 Arts in Education (variable credit). Prerequisite: D.A.Ed. 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 expands 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 psychodynamic, 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 practica 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/interpersonal 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 (3:3:0). 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). Open only to Ph.D. clinical students. Clinical students are required to enroll for the first two-and-one-half years they are in the program. Focuses on the role of psychologists in various work settings. Consideration given to the functions performed by psychologists in those settings; to contributions by psychologists to the overall goals of those settings; to relationships with other professionals, managers, and personnel; and to management and policy issues arising in the various settings. Ethical issues addressed. 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 (1-3:0:0). 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 a dissertation committee. May be repeated. No more than 24 credit hours of PSYC 998 and 999 may be applied to doctoral degree requirements.

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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

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http://catalog.gmu.edu
Master of Public Administration, M.P.A.

The Master of Public Administration program falls within the Public 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 degrees and positions of responsibility in the public sector teach some classes. Thus, a good balance between theory and practice is maintained.

Admission Requirements

In addition to fulfilling the entrance requirements of the Graduate School, 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. Training certificates or other work-related or postbaccalaureate training information (no credit is given for this experience, but the information is used in helping to make admissions decisions and to plan the student's education program);
5. 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.

Graduate Catalog 1992-1994
George Mason University

http://catalog.gmu.edu
Students may also design, with advisement, a concentration tailored to their particular career needs. All students take an issues course that explores a current management topic or policy problem. They 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 Affairs, and the dean of the Graduate School, graduate credits earned at other accredited colleges or universities may be accepted for transfer. Normally, 6 hours of graduate credit may be transferred at the time of admission. With prior approval, an additional 6 hours may be earned at other institutions while students are enrolled in the program. A maximum of 12 semester hours from all sources (including extended studies) is accepted.

**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

- **Policy Studies Concentration:**
  - PUAD 640 Public Policy Process
  - PUAD 641 Public Policy Analysis
  - ECON 602 or 611 Economic Analysis (or equivalent section of PUAD 749)

- **International Management Concentration:**
  - PUAD 504 Managing in the International Arena: Theory and Practice
  - Course in Microeconomics (ECON 602, or ECON 611, or PUAD 749, Economic Analysis)

When available, take section of courses designated for international issues.
Graduate Catalog 1992-1994
George Mason University

Areas of Study

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 Arts in Education (variable credit). Prerequisite: D.A.Ed. admission 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. The paper is presented in a subsequent D.A.Ed. summer seminar. Enrollments 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 school 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. 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 Managing Development Projects and Programs (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.

641 Policy Analysis (3:3:0). Prerequisite: PUAD 610 and 611. Substantive issues in the conceptualization and practical applications of policy science and other formal perspectives to policy articulation, program formulation and program evaluation in the public sector.

642 Program Evaluation (3:3:0). Prerequisite: PUAD 611. Practical exploration of assessment techniques utilized by central analytical units in government, including program impact and program strategy evaluations, cost analysis, field experiments, productivity studies, and evaluation research.

650 Intergovernmental Relations in the United States (3:3:0). In-depth study of intergovernmental relations, with emphasis on contemporary patterns of fiscal relations and operational grant programs.

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 Managerial Accounting for Public Administrators (3:3:0). Prerequisite: PUAD 660 or permission of department. Managerial accounting concepts, terminology, and techniques used in decision making by non-accountant 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). Prerequisite: Final semester of a student's 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.


731 International Political Economy (3:3:0). Prerequisite: PUAD 504. 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). Prerequisite: PUAD 502 and 504 or permission of department. 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). Prerequisite PUAD 504. 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). Prerequisite: At least one course from the PUAD 630 sequence. 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.

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.

795 Research Design (3:0:0). Prerequisite: PUAD 612 and at least 12 hours of approved graduate credit and completion of proficiency tools. Review of project-related background material. The research design must include a statement of purpose, identification of data sources, data collection strategies, possible alternate hypotheses to be tested, the framework of analysis and a statement of anticipated results.

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 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 significant 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 reform, presidential 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.
PUAD 827 Doctoral Seminar in Risk Assessment and Decision Making (3:3:0). Prerequisite: Admission to the doctoral program. This doctoral seminar examines decision making under risk and uncertainty. The topic is explored through seminar discussions of readings and guest speakers. The readings introduce the major intellectual perspectives on the topic and are drawn from journal articles from a variety of academic disciplines, including biology, economics, law, and psychology. The guest speakers are administrators and scientists who must make significant decisions under conditions of uncertainty.

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. Examine 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.

996 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 (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.

Public Policy

Faculty
Bowen, Lawrence S., Ph.D., Ohio State University, 1970; University Professor of Education and Public Policy

Gulledge, Tom, Ph.D., Clemson University; Associate Professor of Public Policy and Decision Sciences

Harrington, James W., Ph.D., University of Washington, 1983; Associate Professor of Geography and Public Policy

Haynes, Kingsley E., Ph.D., Johns Hopkins University, 1970; Professor of Public Policy, Director, The Institute of Public Policy

Heck, Hugh, Ph.D., Yale University, 1970; Clarence J. Robinson Professor of Comparative Public Policy

Kash, Don E., Ph.D., University of Iowa; John T. Hazel, Sr., and Ruth D. Hazel Professor of Public Policy

Lipset, Seymour Martin, Ph.D., Columbia University, 1949; Virginia E. Hazel and John T. Hazel, Jr., Professor in Public Policy

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

Rivlin, Alice M., Ph.D., Radcliffe College, 1958; Omer L. and Nancy H. Hirst Professor of Public Policy

Stough, Roger R., Ph.D., Johns Hopkins University, 1978; Northern Virginia Professor of Public Policy; Director of Graduate Programs

Warfield, John N., Ph.D., Purdue University, 1952; University Professor

White, Louise G., Ph.D., American University, 1974; Professor of Public Affairs

Public Policy Ph.D.

The Ph.D. in Public Policy program is distinctive in its heavy emphasis on the influence of culture, values, and institutions. Participants in the program investigate the increasing tension between rapidly changing technical capabilities driven by science and engineering and our less fluid culture and institutions.

The Ph.D. program has three substantive tracks: science and technology policy, regional develop-
ment 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. Undergraduate degree from an accredited institution;
2. Grade point average of 3.0 in the last two years of undergraduate work;
3. Satisfactory scores on the Graduate Record Examination (verbal and quantitative sections) (GRE) or General Management Aptitude Test (GMAT).

Applicants must submit three letters of recommendation from faculty at the prospective student's previous institutions or those acquainted with policy-relevant work, a two- to three-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 must pass the two 4-hour core courses, pass two 4-hour concentration courses, and make up all deficiencies during the first year they are in the program. At the start of the second year in the program students must pass a comprehensive examination that covers the core and concentration curricula. The comprehensive examination will be held at the end of the summer each year.

Students who enter the program with a master's degree may transfer up to 30 semester hours of credit at the discretion of the graduate program director. Credit is not given for comprehensive examinations from other universities.

All doctoral students must take PUBP 800 Culture and Policy and PUBP 801 Macro Policy. Also students must take a sequence of two required courses in a substantive area: 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; and, PUBP 840 and PUBP 841 for those concentrating in Governance and Public Management Policy.

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
- DESC 743 Seminar in Applications of Management Science
To be eligible for continuing financial aid, students must successfully complete their methodology requirements during the summer before and after the first academic year of coursework. 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 continuing financial aid, students must successfully complete the comprehensive examination. 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 their first year of study.

**Public Policy Courses (PUBP)**

**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.

**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.

**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, polities 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 awareness 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 macroeconomic models can help to pinpoint impending trouble spots for public policy.

**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 modeling, 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 exam-
812 Industrial Location and Regional Development (2:2:0 to 4:3:1). Focuses on: 1. Theories of industrial location that consider spatial differentiation at interregional scales and that consider industrial needs at the scales of an industry, a company, and specific facilties; 2. Discussion of regional impacts of industrial location change; 3. Investigation of actual patterns of industries' location and change.

813 Graduate Seminar on Service Activities and Regional Development (2:2:0 to 4:3:1). This is a reading seminar on the location and local impact of service activities. Students should have some background in the study of industrial location and regional economic development, preferably by having taken PUBP 812. The four-credit version of this course requires a discussion section and a research laboratory.

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 stakeholders (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.

Area of Study

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 context 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 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.

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 who work in the area of Science and Technology Policy. 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 causual 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 in Science and Technology Policy. 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.

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 830, PUBP 831) 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 harms, 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.

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.

Sociology

Faculty

Avruch, Kevin A., Ph.D., University of California, San Diego, 1978; Associate Professor

Bateson, Mary Catherine, Ph.D., Harvard University, 1963; Robinson Professor

Black, Peter W., Ph.D., University of California, San Diego, 1977; Associate Professor

Borkman, Thomasina S., Ph.D., Columbia University, 1969; Professor

Colvin, Mark W., Ph.D., University of Colorado, 1985; Assistant 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, Louis, Ph.D., Stanford University, 1976; Associate Professor

Guagnano, Gregory A., Ph.D., University of California, Davis, 1986; 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; Associate Professor

Lancaster, Roger N., Ph.D., University of California, Berkeley, 1987; Assistant Professor

Laue, James H., Ph.D., Harvard University, 1966; Vernon M. and Minnie I. Lynch Professor of Conflict Resolution

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; 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 de-
Admission Requirements
In addition to meeting the general admissions requirements of the Graduate School, 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.

Acceptance of applicants to the program will depend upon assessment by the departmental graduate committee. While the Graduate Record Examination is not required for admission, it is recommended.

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 or equivalent.

General Sociology
The degree requires 33 semester hours, including a core of 6 hours of social theory (SOCl 611, 612) and 6 hours of research methods (SOCl 620, 630).

Applied Sociology
The degree requires 33 semester hours, including a core of 3 hours of social theory (SOCl 612), 6 hours of research methods (SOCl 620, 630), and 9 hours of applied sociology (SOCl 515, 632, 640).

Sex and Gender
The degree requires 33 semester hours, including a core of 6 hours of social theory (SOCl 611, 612), 6 hours of research methods (SOCl 620, 630), and 9 hours in the sex and gender concentration (SOCl 505, 525, and 696).

Conflict Analysis
The degree requires 33 semester hours, including a core of 6 hours of social theory (SOCl 611, 612), 6 hours of research methods (SOCl 620, 630), and 9 hours in the sociology of conflict and conflict management. Students are also required to complete a master's thesis or equivalent.

Race and Ethnicity
The degree requires 33 semester hours, including a core of 6 hours of social theory (SOCl 611, 612), 6 hours of research methods (SOCl 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 (SOCl 611, 612); 6 hours of research methods (SOCl 620, 630); and 9 hours in the crime, delinquency, and corrections concentration (SOCl 607, 608, 609).

The Master's Thesis
A master's thesis or equivalent, such as a research report, is required for the M.A. degree in sociology to demonstrate a candidate's capacity to carry out independent research. The thesis or its equivalent 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 per-
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 and juvenile correctional systems. In-depth analysis of current American correctional ideology of 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, ethnomet hodology, humanist sociology, and critical theory are examined. Contemporary theorists are analyzed in relation to the schools.

615 Social and Cultural Change (3:3:0). Prerequisite: Graduate standing in sociology or permission of instructor. Social and cultural change in a 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 development (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.

660 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.

665 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.

666 Sociology of Aging (3:3:0). Prerequisite: Graduate standing or permission of instructor. Analysis of sociological issues in aging. Issues include class and cultural factors, 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 Arts in Education (variable credit). Prerequisite: D.A.Ed. admission 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. The paper is presented in a subsequent D.A.Ed. summer seminar. Enrollments may be repeated.

Statistics

Faculty

Bolstein, A. Richard, Ph.D., Purdue University, 1967; Associate Professor

Carr, Daniel B., Ph.D., University of Wisconsin, 1976; Associate 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, marketing, computer science, economics, geography, psychology, sociology, information systems, 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 seek-
ing 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 of the Graduate School, 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 linear algebra. Course work taken to correct deficiencies in undergraduate preparation is not counted toward the degree.

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 maybe 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 of the Graduate School, 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 School 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
of the Graduate School, 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.

634 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, autocovariance functions, autocorrelation 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.

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. 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, logistic 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 and 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
Adelman, Leonard, Ph.D., University of Colorado, 1976; Associate Professor
Buede, Dennis M., Ph.D., Stanford University, 1977; Associate 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)
Might, Robert, Ph.D., University of North Carolina, 1981; Visiting Associate Professor

Palmer, James D., Ph.D., University of Oklahoma, 1963; BDM International Professor of Information Technology, Associate Dean
Rathbone, Daniel B., Ph.D., Texas A&M University, 1979; Associate Professor
Ryan, Terrance C., Ph.D., University of Illinois, 1974; Visiting Professor
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

Graduate Systems Engineering Programs
The Systems Engineering Department Master of Science program has three specialty areas:
1. Systems Engineering
2. Command, Control, Communications, and Intelligence (C3I) Systems Engineering
3. Urban Systems Engineering
In addition, the Systems Engineering Department offers a Certificate in Command, Control, Communications and Intelligence (C3I).

All three programs have the same admissions requirements, foundation requirements, advising procedures, and general degree requirements. These requirements are listed below.

Admission Requirements
In addition to the general admission requirements, the academic background requirements for entrance into the program include an undergraduate degree in engineering, mathematics, physical sciences, economics, psychology, 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, 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 primary purpose of this is to ascertain prior background in quantitative methods for engineering systems analysis and design, related engineering problem-solving approaches, and fluency in computer usage. The articulation program, when required, will consist of up to three graduate courses that provide preparation for further graduate study through intensive study in these areas.

Foundation Requirements
Students who enter the program should have a background in engineering, mathematics, statistics, and computer science. A student lacking this foundation may apply for admission to the program, but will be required to take one or more foundation courses. These foundation courses are listed below.

Computer Systems and Software
INFS 610 Computer Systems and Software
SYST 500 Quantitative Foundations for Systems Engineering

Probability and Statistics
STAT 610 Statistical Foundations for Technical Decision Making

Upon acceptance, students will be informed as to the foundation courses that they must take. 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
Each student admitted to the program is assigned a faculty adviser with whom the student confers on matters related to degree requirements. A plan of study for the M.S. degree should be completed and submitted for approval by the student soon after admission to the program.

Degree Requirements
To obtain a Master of Science degree in any of the three Systems Engineering program options, students must complete a plan of study with a minimum of 30 semester hours of graduate level courses and research. The plan of study must be approved by the student's faculty adviser, in writing, before the student begins course work. There are two options.

Option A. 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/USE 798). A project objective is selected with the approval of the faculty project adviser. A project report is submitted at the end of the semester while registered for three hours of SYST 798/USE 798, and must be approved by the faculty project adviser. Although a student may register for more than three semester hours of independent research, no more than three hours will be applied toward the degree.

Option B. 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/USE 799). The master's thesis should reflect a significant independent research effort. The work is conducted under the guidance of a faculty project adviser, and the final written thesis and oral defense are approved by a three-member faculty committee and submitted through the School of Information Technology and Engineering to the dean of the Graduate School. The thesis work is expected to be completed while taking six semester hours of SYST 799/USE 799. Although a student may register for more than six semester hours, no more than six hours will be applied toward the degree.

Cooperative Graduate Engineering
Students may take courses through the Cooperative 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.

Systems Engineering, M.S.
The graduate program leading to the Master of Science in Systems Engineering prepares students for research and 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. 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.

To earn the master of science degree, students must complete an approved plan of study. This plan of study must include three core courses, two methods courses, three or four electives in a con-

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The program leading to the Master of Science in Systems Engineering, with a concentration in Command, Control, Communications, and Intelligence (C³I), is a specialization within the systems engineering degree program. C³I 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.

Civilian government examples include the air traffic control systems, the drug enforcement C³I system, law enforcement agency systems, and various emergency preparedness systems. Military systems include national-level crisis management systems, nuclear C³I systems, the NATO command and control system, and various tactical C³I 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 program educates students in the theory and practice of C³I and prepares them for careers in research, design, and development of C³I systems, or in the use and management of C³I systems. The program emphasizes the analytical and behavioral aspects of engineering a complex C³I system design.

Curriculum
C³I Core Courses. Students must complete the following three courses:

- SYST 680/ECE 670 Principles of C³I Part I
- SYST 681/ECE 671 Principles of C³I Part II
- SYST 683 Modeling, Simulation, and Gaming

Systems Engineering Core Courses. Students must complete two of the following:

- 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

Basic Methods Course. Students must complete ECE 528 Random Processes in Electrical and Computer Engineering

Standard Concentration Areas
Communications

- ECE 630 Statistical Communication Theory
- ECE 631 Digital Communications
- ECE 637 Spread Spectrum Communications
- ECE 639 Satellite Communications
Areas of Study

ECE 642 Design and Analysis of Computer Communication Networks

Sensing and Fusion
ECE 634 Detection and Estimation Theory
SYST 684 Sensor Data Fusion

Software Systems Engineering
SWSE 619 Software Construction
SWSE 620 Software Requirements and Prototyping
SWSE 621 Software Design
SWSE 623 Formal Methods and Models in Software Engineering
SWSE 625 Software Project Management

Information Systems
INFS 510 Computer Systems and Software
INFS 600 Computer Architecture and Operating Systems
INFS 612 Data Communications and Distributed Processing
INFS 614 Database Management

Expert Systems and Decision Support Systems
CS 580 Introduction to Artificial Intelligence
SYST 671 Judgment and Choice Processing and Decision Making
SYST 642 Decision Support Systems Engineering
SYST 687 Information and Decision Systems Test and Evaluation
SYST 664 Bayesian Inference and Decision Analysis

Advanced C³I
SYST 760, SYST 761 Special topics courses whose contents vary from term to term.

Students planning a Ph.D. program in information technology may wish to include some of the electives from the doctoral core in their systems engineering master's plan of study.

Seminar Requirements
All degree candidates must attend a minimum of ten C³I Center seminars.

Certificate in C³I Systems Engineering
The graduate certificate program in C³I systems engineering is for those who have a master's degree in a scientific or engineering discipline or who are enrolled in an appropriate master's degree program. It is designed for professionals involved in the many aspects of command, control, communications, and intelligence systems for the public and private sectors and for students interested in careers in C³I. Multidisciplinary by nature, the program addresses all aspects of the substance and technology of C³I.

Students learn the basics of C³I systems engineering. A set of core courses define the field; provide an analytical framework for understanding the systems design and development process; describe the major disciplines and fields of inquiry used by C³I systems engineers; and demonstrate how command, control, communications, and intelligence combine to achieve military and civilian objectives.

The certificate program responds to the need for excellence in a growing field of inquiry, preparing students for a variety of basic and applied positions in the field.

Student may pursue the certificate 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 the graduate program have been completed.

Admission Requirements
Applicants should hold a master's degree in an engineering, scientific, or technical discipline from an accredited university or be in graduate status in such a program. Admission to GMU graduate programs in systems engineering or electrical engineering are logical paths toward the certificate.

Foundation Requirements
Students who enter the program should have a background in engineering, mathematics, statistics, and computer science. A student lacking this foundation may apply for admission to the program, but will be required to take one or more foundation courses. These foundation courses are listed below.

Computer Systems and Software
INFS 610 Computer Systems for Management
Matrix Algebra, Transforms
SYST 500 Quantitative Foundations for Systems Engineering
STAT 610 Statistical Foundations for Decision Making

Applicants are required to submit a brief (one to two pages) statement of educational and work experience in the C³I field that includes a statement of career goals in C³I systems engineering and to complete a self-assessment form that provides summary information concerning background and preparation for the program. Application for the certificate program in C³I systems engineering is

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made through the Graduate School of the university.

**Certificate Requirements**

To obtain the certificate, candidates must complete the following courses with a grade of B or better in each, for a total of 15 credits:

- ECE 528 Random Processes in Electrical Computer Engineering or OR 542 Operations Research: Stochastic Models
- SYST 680/ECE 670 Principles of C^3I Part I
- SYST 681/ECE 671 Principles of C^3I Part II
- SYST 682 C^3I Systems Engineering
- SYST 683 Modeling, Simulation, and Gaming

An elective course in an area relevant to C^3I Systems Engineering (e.g., communications, fusion, artificial intelligence, software systems engineering) may be substituted for one of the above courses with permission of the certificate program coordinator.

Candidates must also attend a minimum of five C^3I Center seminars or an equivalent set of state-of-the-art seminars in the C^3I area.

Applicants may obtain more information by contacting the C^3I certificate program adviser in the C^3I Center in Room 330, Science and Technology II, (703) 993-1645.

**Systems Engineering Courses (SYST)**

- **500 Quantitative Foundations for Systems Engineering (3:3:0).** Prerequisite: MATH 316. Provides the quantitative foundations necessary for core courses in the Systems Engineering master's program and the certificate program in C^3I. Topics include vectors and matrices, differences 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.

- **570 Quality Control (3:3:0).** Prerequisite: Course in statistics. Systems and management for total quality control and assurance in both manufacturing and nonmanufacturing applications. Topics include quality considerations in design and management, process vs. design tolerances, acceptance sampling, control chart methodology, and applications.

- **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—Systems Design and Integration (3:3:0).** Prerequisites SYST 611. 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. Numerous 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 611. 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.

- **642 Decision Support Systems Engineering (3:3:0).** Prerequisite: SYST 611 and 612. Introduction to computerized systems that are designed to support individual and/or organizational decision making. Emphasizes that a DSS is the end product of a development process, and it is this process that is a key to successful integration of a DSS into an organization. A systems engineering approach to DSS development is taken. Any DSS is built on a theory (usually implicit) of what makes for successful decision support in a given context. 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. The role of theory in the DSS engineering process is examined.

- **659 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.

- **660 Systems Engineering—Methods and Design (3:3:0).** Prerequisite: ENGR 390 and MATH 351. An overview of the systems engineering process. Brief overview of approaches for formulating, analyzing, and interpreting issues. Systems design and systems integration engineering, project selection, and information system design for planning and decision support.

661 Systems Engineering—Economic Analysis (3:3:0). Prerequisite: MATH 351 and 394. Introduction to economic systems analysis, including production and theory of the firm and the consumer, supply-demand equilibria and microeconomic models, normative or welfare economics, external effects and imperfect competition, time value of money concerns, cost-benefit and cost-effectiveness analysis. Case studies of economic systems analysis.

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.

675 Reliability Analysis (3:3:0). Prerequisite: STAT 654 or equivalent. Introduction to the concept of system reliability and its relationship to product quality, maintenance costs, and safety engineering. A series of topics are developed that incorporate the statistical and mathematical point of view in reliability as a means of helping students develop the capability to design, model, and make inferences on complex systems.

680/ECE 670 Principles of Command, Control, Communications, and Intelligence (C2I)—Part I (3:3:0). Prerequisite: ECE 528 and OR 542 or equivalent. Fundamentals of C2I 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 C2 systems; and evaluations of C2 systems.

681/ECE 671 Principles of Command, Control, Communications, and Intelligence (C2I)—Part II (3:3:0). Prerequisite: SYST 680/ECE 670. Technology required for C2I systems is developed. Technology areas include sensors, communications, and computer-based systems. The C2I required for mission areas such as strategic, theater, and tactical are developed and analyzed. Electronic warfare and counter-C2I is discussed.

682 Command, Control, Communications, and Intelligence (C2I) 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 C2I 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 models are critical to the C2I process. Exercises and games are used to demonstrate the value of properly developed C2I 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.

687 Information and Decision Systems Test and Evaluation (3:3:0). Prerequisite: SYST 612 or 660 or 682 or equivalent, or permission of instructor. Stresses methods for evaluating user requirements, design candidates, software modules, user and system interfaces, overall system performance of information and decision systems, and management of the testing function.

695/ECE 695 Petri Nets (3:3:0). Prerequisites: ECE 521 or SYST 660. 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.

758 Computational Models for Probabilistic Inference (3:3:0). Prerequisite: SYST 658 or STAT 652. 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 C2I area with different content in different terms. Representative areas include quantitative evaluation of C2I systems, applications of artificial intelligence in C2I systems, and military communications systems.

761 Advanced Topics in Command, Control, Communications, and Intelligence Systems Engineering (3:3:0). Prerequisite: SYST 680, 681, and 683. Advanced topics in the C2I. Representative areas include advanced modeling and analysis techniques, case studies of C2I architectures, and applications of detection and estimation techniques in ASW.


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.

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Urban Systems Engineering

This program leads to a Master of Science in Systems Engineering degree with an Urban Systems Engineering specialization within the systems engineering program. Urban Systems Engineering is the study of land, transportation, water, energy, and telecommunications systems from the engineering as well as social, political, economic, and environmental perspectives. It focuses on how these systems are conceived, developed, designed, built, operated, and maintained in a complex urban setting such as the metropolitan Washington area.

Urban Systems examples include water supply and distribution; public utilities; solid waste management; streets, roads, and highways; alternative energy; wastewater treatment and management; the built environment; mass transit; stormwater management; communication networks; facilities management; etc. The urban systems engineer can look forward to a career with land development, architecture/engineering and construction firms, or with government organizations.

The program educates students in the theory and practice of urban systems engineering including construction and project management, engineering management, water systems engineering, transportation systems, facilities management, and environmental engineering. The student is exposed to information technology and computation applications in the engineering decision environment.

The 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 an approved plan of study, which serves as a learning strategy between the student and the university. The plan must contain at least 30 semester hours of graduate-level course work. Either a thesis or a research project is required for the degree. Articulation requirements for candidates needing additional work in mathematics or engineering are also included in the plan of study but extend the credit hour requirements beyond the minimum of 30 semester hours.

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

General Systems Courses. Students must complete one of the following:

Any other SYST course
OR 541 Deterministic Models in Operations Research
OR 542 Stochastic Models in Operations Research
STAT 644 Applied Probability
ECE 521 Modern Systems Theory

Concentration Areas. Each student must select four or five electives that together constitute a clearly defined area. With the prior approval of a faculty adviser, a student may design his or her own concentration area. Alternatively, students may select from one of several standard concentration areas. These standard concentration areas include:

- Systems Management
- Construction Management
- Transportation Systems
- Environmental Engineering
- Water Resource Systems Engineering
- Facilities Management

Urban Systems Engineering Courses (USE)

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.

Telecommunications

Telecommunications, M.A.

The Master of Arts in Telecommunications is an interdisciplinary program that includes courses in engineering, law, administration, education, and communication, recognizing that telecommunications is both a technological 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.
Degree Requirements
The program consists of 30 hours of graduate work, 12 in the following four core courses, 15 hours in the specialization area (including at least one mandatory track core course), and 3 hours in a coordinating seminar:

- INFS 699 Advanced Topics in Information Systems
- LAW 181 Telecommunications Law and Regulations
- MGMT 796 Independent Study and Directed Readings (Telecommunications Management)
- COMM 555 Theories of Telecommunications Production

Students may choose from six specialization areas: administration, communication, educational technology, information systems, international telecommunications, and systems engineering.

The coordinating seminar, which further emphasizes the interdisciplinary nature of the field, is taken toward the end of the student’s course work.

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.

For more information about the program, contact the university’s Office of Interdisciplinary Programs at (703) 993-8862.
Programs and Additional Graduate Courses
Programs and Additional Graduate Courses

Northern Virginia Cooperative Graduate Engineering Program

Graduate programs in engineering and information technology are offered under the auspices of a Cooperative 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 C3I 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 Cooperative 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 to
Additional Graduate Courses

American Studies Courses (AMST)

502 Problems in American Culture (3:3:0). Prerequisite: Graduate standing. Interdisciplinary study of a particular aspect of American culture. 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 AMST program with employers involved in interdisciplinary AMST issues. Qualified students are placed with area schools, interest groups, agencies, museums, parks or corporations. Placement depends upon availability of positions.

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. Provides 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). Investigation 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, humanistic, 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 is 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 differences 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.

For program information, contact the Cooperative Graduate Engineering Program, School of Information Technology and Engineering, GMU, (703) 993-1520.
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 environment in the classroom. Nonverbal aspects of space, time, action, and form are considered as they impact teaching choices. Verbal patterns for skills of classroom management: questioning skills, enhancing students' self-concept, systematic feedback, parental communication, and student development.

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 Arts in Education (variable credit). Prerequisite: D.A.Ed. student admission 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. The paper is presented in a subsequent D.A.Ed. summer seminar. 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.

504 Geochemistry of Environmental Hazards (1-3:1-3:0). Prerequisite: CHEM 131 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.

618 Geochemical Methods of Analysis (4:3:3). Prerequisite: Baccalaureate degree in geology or permission of instructor. Principles and application of geochemical analysis as applied to rocks found in areas of energy resources. Concentration on techniques of x-ray and optical spectroscopy and atomic absorption.

http://catalog.gmu.edu
620 Organic Geochemistry (4:3:3). Prerequisite: Baccalaureate degree in geology or permission of instructor. The production of natural organic compounds. Discussions on the influence of diagenetic factors such as hydrolysis, heat, and pressure on such compounds as cellulose, lignin, proteins and lipids, and a consideration of the origin of soil organic matter, carbonaceous shales, coal, and crude oil. May include field trips.

800 Studies for the Doctor of Arts in Education (variable credit). Prerequisite: D.A.Ed. admission 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. The paper is presented in a subsequent D.A.Ed. summer seminar. Enrollments 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 cross-listed 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.

800 Studies for the Doctor of Arts in Education (variable credit). Prerequisite: D.A.Ed. admission 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. The paper is presented in a subsequent D.A.Ed. summer seminar. May be repeated.
General Policies
General Policies

Statement on Equal Opportunity/ Affirmative Action

George Mason University is an equal opportunity/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, sex, sexual orientation, or age (except where sex or age is a bona fide occupational qualification).

Appropriate procedures shall be adopted for the promotion of this principle 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, and minorities. The university will make every reasonable accommodation to enable students with disabilities to undertake work or study for which they qualify.

Students should bring problems or questions regarding EO/AA/Sexual Harassment policies to the attention of the harasser's supervisor, department chair, the dean for Student Services, an academic dean, the director of Human Resources, the university ombudsperson, a trusted staff or faculty member, the Women's Studies Center, or to the vice president and university equity officer, D111 Mason Hall, 993-8730. Students with disabilities can contact Disabled Student Services at 993-8730.

As required by the Civil Rights Restoration Act of 1987, the university is committed to the broad application of Title IX of the Education Amendments of 1972, Section 504 of the Rehabilitation Act of 1973, the Age Discrimination Act of 1975, and Title VI of the Civil Rights Act of 1964.

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) 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 Associate Dean and Director of Judicial Affairs 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 of 1974. This act, with which the institution intends to comply fully, protects the privacy of education records, to establish the right of students to inspect and review their education records, and to provide 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 (FERPA) 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 Directory of Records listing all education records maintained on students by this institution.
Questions concerning the Family Education Rights and Privacy Act may be referred to the Office of Student Records.

Drug and Alcohol Policy
The Drug and Alcohol Policy was adopted by the Board of Visitors May 1987, and revised 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 is 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 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.

Further information on the university’s drug policy and educational programs is available from the Drug Education Center, Room 352, Student Union I, 993-3686.

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 and 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, including 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, 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 that 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 .10 percent or higher. Sobriety spot-checks to detect drunken drivers are legal.

C. 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 uni-
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

Drug Education Center—Nancy Schulte, LCSW, 993-3686
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—Phyllis Anderson, Psy D., 993-2380
A. Personal and group counseling
B. ACOA and recovery support groups

Human Resources—Norman Kerr, 993-2600
A. Information and referral services for employees

The State Employee Assistance Service (SEAS) 786-6741
A. Call to make an appointment

Alcoholics Anonymous—for campus meetings call 993-3686; or in Virginia, 824-0071; in Maryland and Washington, D.C., 966-9155
Narcotics Anonymous—in Virginia, call 281-8638; in Maryland, 731-7221
Northern Virginia Hotline 527-4077
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

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, and 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 that 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.
the university's two newspapers: *The Broadside* and *The 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 Services.

**Motor Vehicles Policy**

The privilege of operating and parking a motor vehicle at George Mason University is extended to all students, subject to the following procedures:

Vehicles must be registered with the Parking Services Office. At the time of registration, operators must certify that (a) vehicles have a valid registration and valid insurance from a recognized insurance company, evidencing coverage for public liability in conformance with the laws of the commonwealth of Virginia; (b) they have a valid driver's license; and (c) they understand they will be governed by *University Motor Vehicle and Traffic Rules and Regulations*, a copy of which is furnished at the time of registration of the vehicle. A state vehicle registration card must be shown at the time of registration.

There is a fee for registering vehicles. Decals may be purchased for the full academic year or by the semester or Summer Term.

Day passes are also available. They may be purchased singly at the booths or in bulk at the office.

The Parking Services office is in the main lobby of Student Union I. The hours of operation are Monday through Thursday, 9 a.m. to 7:30 p.m., and Friday, 9 a.m. to 4:30 p.m. when school is in session.

For special parking requests or problems, go to the main office in Room 354 of Student Union I or call 993-2710.

For special parking requests or problems, go to the main office in Room 354 of Student Union I, or call 993-2716.

Registered vehicles must display in full view the university's vehicular registration decal, affixed immediately upon issue as per the instructions on the reverse side of the decal.

**Other Regulations**

**Firearms**

The unauthorized possession, storage, display, or use of any kind of ammunition, firearms, fireworks, explosives, air rifles, air pistols, or other lethal instruments is prohibited on university property. Any questions regarding this regulation should be directed to the University Police at 993-2810.

**Smoking**

Smoking is not permitted in classrooms, lecture halls, theaters, or in the university libraries. Lounge areas in the student union buildings and other university buildings have been set aside for this purpose.

**Bicycles/Skateboards**

Bicycles are to be parked only in bike racks, which are provided at various locations on campus. Bicycles and skateboards are not permitted on sidewalks, ramps, footpaths, grassy areas of campus, or inside university buildings.

**Pets**

No pets are permitted in university buildings at any time, with the exception of guide dogs for the blind or hearing impaired. 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 Business and Finance Office.
Campus Map and Telephone Directory
Campus Map

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
# Telephone Directory

The general information number for George Mason University is (703) 993-1000. The university exchange is "993" except where indicated.

## Graduate School

<table>
<thead>
<tr>
<th>Name</th>
<th>Grade</th>
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<tbody>
<tr>
<td>Kingsley Haynes</td>
<td>Dean</td>
<td>8870</td>
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<tr>
<td>Anne M. Miner</td>
<td>Student</td>
<td>8867</td>
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<tr>
<td>Marianne Marsolais</td>
<td>Student</td>
<td>8864</td>
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## Departments and Chairpersons

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<tr>
<th>Department</th>
<th>Phone</th>
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<tr>
<td>Accounting/Business Legal Studies</td>
<td>1770</td>
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<tr>
<td>Kenneth Heller</td>
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<tr>
<td>B441 Robinson Hall</td>
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<tr>
<td>Art and Art History</td>
<td>1010</td>
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<tr>
<td>Carol Mattusch</td>
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<td>C200 College Hall</td>
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<td>Biology</td>
<td>1050</td>
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<td>James D. Willett</td>
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<td>3005 David J. King Hall</td>
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<td>Business Administration Program</td>
<td>1880</td>
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<td>Cornelis de Kuyver</td>
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<td>B413 Robinson Hall</td>
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<td>Chemistry</td>
<td>1070</td>
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<tr>
<td>George W. Mushrush</td>
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<tr>
<td>343 Science and Technology Building I</td>
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<tr>
<td>Communication</td>
<td>1090</td>
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<td>Don Boileau</td>
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<tr>
<td>212 Thompson Hall</td>
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<tr>
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<td>Foreign Languages and Literatures</td>
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<td>Geography and Earth Systems Science</td>
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<td>Human Services, Dept. of</td>
<td>2060</td>
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<td>Robert Ruiling</td>
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<td>205 Physical Education Building I</td>
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<td>History Dept.</td>
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<td>Marion Deshmuk</td>
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<td>Information and Software Systems</td>
<td>1640</td>
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<td>Engineering, School of</td>
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<td>430 Science and Technology Building II</td>
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<td>Music Dept.</td>
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<td>Rita Carty</td>
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<td>Operations Research and Applied</td>
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<td>Statistics Dept.</td>
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<td>Miriam Raskin, Coordinator</td>
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<td>206 Physical Education Building</td>
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<td>Sociology and Anthropology Dept.</td>
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<td>John Stone</td>
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<td>B305 Robinson Hall</td>
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<td>Veterans' Services</td>
<td>2353</td>
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<td>201 Finley Building</td>
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</tr>
</tbody>
</table>
Index

A

Accounting
courses (ACCT), 54
faculty, 52
M.S., 53
Accreditation, 8
Activities
performing arts, 50
Adding and dropping courses, 25
Admission
change in field of graduate study, 22
extended studies enrollment, 22
guest matriculant, 23
of graduate degree holders, 22
of international students, 21
offer of, 22
policies, 20
reactivation of deferred applications, 22
readmission to the Graduate School, 22
records maintenance and disposal, 22
summer session, 23
summer term, 23
Alcohol policy, 227
Alumni Association, Student, 50
American studies courses (AMST), 221
Applied and Engineered Physics, M.S., 181
Application for admission
deadlines, 20
requirements, 20
Archaeology
See Interdisciplinary Studies
Arlington Campus Professional Center, 7
Art
faculty, 55
history courses (ARTH), 56
studio courses (ARTS), 57
Visual Information Technologies,
M.A., M.F.A., 55
Arts center, 7
Assistantships, 42
Astronomy course (ASTR), 182
Athletic facilities, 7, 46
Auditing a course, 26

B

Bicycles, 229
Biology
courses (BIOL), 62
environmental biology — public policy, Ph.D., 60
environmental science and policy specialization, 60
faculty, 58
M.S., 59
Broadside, 50
Business Administration
accounting courses (ACCT), 54
business legal studies courses (BULE), 68
decision sciences courses (DESC), 69
Executive M.B.A., 67
faculty, 65
finance courses (FNAN), 69
M.B.A., 66
management courses (MGMT), 71
management information systems courses (MIS), 70
marketing courses (MKTG), 73
Business legal studies courses (BULE), 68

C

Calendar, academic, 1992-94, 2
Campus facilities, 7
Campus map, 232
Campus Ministry, 49
Career Development Center, 48
Center for the Arts, 7
Certificates
command, control, communication,
and intelligence systems engineering, 214
federal statistics, 207
gerontology, 180
international nursing, 172
nursing administration, 172
nursing education, 173
software systems engineering, 146
teaching of English as a second language, 127
translation, 132
Chemistry
courses (CHEM), 74
faculty, 74
M.S., 74
Command, Control, Communications,
and Intelligence Systems Engineering
certificate, 214
Communication courses (COMM), 221
Community College Education
courses (EDCC and COMC), 79
diploma program, 78
Doctor of Arts, 76
faculty, 76
Computational Sciences and Informatics
courses (CSI), 82
faculty, 79
Ph.D., 80
Computer Science
courses (CS), 88
faculty, 86
M.S., 87
software systems engineering specialization, 88
Computer use policy, 229
Computing facilities, 7
Conduct, 226
Conflicts Analysis and Resolution
courses (CONF), 92
faculty, 90
M.S., 91
Ph.D., 91
Cooperative education, 48
Counseling and Development courses
(EDGC), 111
Counseling and Development, M.Ed., 104
Counseling Center services, 48
Course numbering, 13
Course symbols, 14
Creative Writing, M.F.A., 127
Curriculum and Instruction, M.Ed., 102

D

Dance
courses (DANC), 95
faculty, 94
M.F.A., 94
Decision sciences courses (DESC), 69
Dental plan, 47
Disability Support Services, 47
Dismissal, academic, 27
Doctoral degrees, 31
  advancement to candidacy, 31
  continuous registration, 31
  dissertation, 31
  dissertation submission and fee, 32
  final doctoral examination, 31
  program of study, 31
requirements, 30
research skill requirements, 30
residence requirement, 30
supervisory committee, 30
time limit, 30
Drugs and alcohol, statement on, 227

E

Economics
courses (ECON), 98
faculty, 96
M.A., 96
Ph.D., 97
Education
counseling and development courses
(EDGC), 111
Counseling and Development, M.Ed., 104
courses (EDUC), 115
Curriculum and Instruction, M.Ed., 102
Doctor of Arts in Education, 106
Doctor of Arts interdisciplinary courses
(DAED), 117
education research courses (EDRS), 113
Educational Leadership, M.Ed., 105
elementary/secondary education courses
(EDCI), 108
faculty, 100
leadership/supervision courses (EDAS), 107
reading education courses (EDRD), 112
school psychology course (EDSP), 115
special education courses (EDSE), 113
Special Education, M.Ed., 105
Education research courses (EDRS), 113
Electrical and Computer Engineering, 118
Electrical and computer engineering
courses (ECE), 120
Electrical Engineering, M.S., 118
Electron Microscopy Laboratory, 61
Elementary/secondary education courses
(EDCI), 108
Emergency Loan Program, 42
Employee Development Institute, 16
English
  concentration in literature, 126
  concentration in professional writing
  and editing, 126
  concentration in teaching of writing
  and literature, 126
courses (ENGL), 128
Creative Writing, M.F.A., 127
faculty, 124
graduate programs, 125
Linguistics, M.A., 126
M.A., 125
teaching of English as a second language
certificate, 127

http://catalog.gmu.edu
Environmental Biology – Public Policy, Ph.D., 60
Executive M.B.A., 67

Graduate course enrollment by undergraduates, 25
Graduate programs, listed, 12
Graduation fee, 41
Guest matriculant, 23.

Harris Theater, 7
Health insurance and dental plan, 47
History
- courses (HIST), 139
- faculty, 137
- M.A., 138
Honor System and Code, 32
Housing, 47
costs, 38
Human Services, Department of, 179

In-state tuition, 40
- change of domicile classification, 40
- penalties, 40
Information and Software Systems Engineering
- courses (INFS), 144
- faculty, 142
- Information Systems, M.S., 142
- software systems engineering certificate, 146
- software systems engineering courses (SWSE), 147
Software Systems Engineering, M.S., 145
Information Technology
- courses (INFT), 151
- Ph.D., 148
Inservice training program for teachers, 42
Interdisciplinary Studies
- archaeology courses (ANTH), 158
- archaeology track, 157
- faculty, 156
- gerontology track, 158
- individualized studies track, 156
- interdisciplinary studies courses (MAIS), 158
- international transactions courses (INTL), 159
- international transactions track, 158
- liberal studies track, 157
- M.A.I.S., 156
International student health insurance, 40
International Student Services, 49
International Transactions, 158
Internships, 48
L
Lab cards, 41
Law, School of, 8
Leadership/supervision courses (EDAS), 107
Libraries, 7
Linguistics, M.A., 126

M
Management courses (MGMT), 71
Management information systems courses (MIS), 70
Marketing courses (MKTG), 73
Master's degrees
degree applications, 28
foreign language requirement, 28
general requirements, 29
thesis, 29
thesis and nonthesis options, 29
time limit, 29
Mathematics
faculty, 162
M.S., 163
mathematical sciences courses (MATH), 164
options in operations research and statistics, 163
Meal plan charges, 39
Minority Student Services, 49
Mission of the university, 8
Motor vehicle registration fees, 41
Motor vehicles policy, 229
Music
courses (MUSI), 167
faculty, 166
M.A., 166

N
Nondegree status, change to degree, 27
Northern BTAP Regional Center, 17
Northern Virginia Cooperative Graduate Engineering program, 220
Nursing
continuing education, 172
courses (NURS), 173
faculty, 169
international nursing certificate, 172
M.S.N., 169
nursing administration certificate, 172
nursing education certificate, 173
Ph.D. in nursing administration, 170
state scholarships, 41

O
Operations Research and Applied Statistics
faculty, 176
Operations Research and Management Science, M.S., 177
operations research courses (OR), 178

P
Parking, 8
Patriot Center, 7, 46
Performing arts activities, 50
Performing arts facilities, 7
Pets, 229
Philosophy and religious studies
courses (PHIL), 223
Physical Education
courses (PHED), 180
faculty, 179
gerontology certificate, 180
M.S., 179
Physics
Applied and Engineering Physics, M.S., 181
astronomy course (ASTR), 182
courses (PHYS), 182
faculty, 181
Privacy of student records, 226
Program of study, doctoral students, 31
Provisional status, change to degree, 27
Psychology
Clinical Psychology, Ph.D., 189
courses (PSYC), 189
Developmental Psychology, Ph.D., 189
Experimental Neuropsychology, M.A., 186
faculty, 184
Human Factors Engineering
M.A., 185
Ph.D., 188
Industrial/Organizational Psychology
M.A., 185
Ph.D., 188
Life-Span Development, M.A., 186
M.A., 185
Ph.D., 186
School Psychology, M.A., 186
Public Administration
courses (PUAD), 196
faculty, 193
M.P.A., 194
public affairs course (PUAF), 196
Public Management Institute, 18
Public Policy
courses (PUBP), 201
faculty, 199
Ph.D. 199
Reading education courses (EDRD), 112
Recreational facilities, 46
Registration
academic load, 25
for non-enrolled students, 24
permission to register, 23
procedures and information, 24
Repeating a course, 25
Research skill requirements, doctoral degrees, 30
Residence requirement, doctoral students, 30
Robinson Professors, 7
Room rental charges, 38

Schedule of Classes, 24
Scholarships and fellowships
Graduate School fellowships, 41
Woodrow Wilson Foundation, 42
Zonta Scholarship, 42
School psychology course (EDSP), 115
Senior citizens enrollment, 23
Skateboards, 229
Smoking, 229
Sociology
applied sociology track, 204
conflict analysis track, 204
courses (SOCI), 204
crime, delinquency, and corrections track, 204
crime, delinquency, and corrections track, 204
faculty, 203
general sociology track, 204
M.A., 203
race and ethnicity track, 204
sex and gender track, 204
Software Systems Engineering
certificate, 146
courses (SWSE), 147
M.S., 145
Solicitors and salesmen, 229
Spanish courses (SPAN), 134
Special Education
courses (EDSE), 113
M.Ed., 105
Sports and Recreation Complex, 7, 46
Statistics
courses (STAT), 209
faculty, 206
federal statistics certificate, 207
Statistical Science, M.S., 207
Student Employment Resource Center, 48
Student Health Center, 47
Student information, 24
Student organizations, 50
Student Unions, 46
Summer Term, 2, 3, 23, 25

Systems Engineering
C'I certificate, 214
command, control, communications, and intelligence concentration, 213
faculty, 211
systems engineering courses (SYST), 215
Systems Engineering, M.S., 212
urban systems engineering courses (USE), 217
urban systems engineering concentration, 217

Taxation, M.S.
degree requirements, 53
Teacher certification programs, 103
Teaching of English as a Second Language certificate, 127
Telecommunications, M.A., 217
Telephone directory, 234
Termination, academic, 27
Time limit
doctoral degrees, 30
master's degrees, 29
Transfer of credit, 27
criteria for, 28
Translation certificate, 132
Tuition and fees
change of domicile, 40
charges, 38
credits earned elsewhere, 40
financial penalties, 39
in-state tuition, 40
off-campus courses, 40
payment and cancellation schedule, 38
payment methods, 39
payment plan options, 39
refunds, 39

Undergraduates' enrollment in graduate courses, 25
University, profile of, 6
Urban systems engineering courses (USE), 217
Urban Systems Engineering, M.S., 217

Veterans' services
educational benefits, 42
tutorial services, 43
Virginia War Orphans Education Program, 43
Visiting the campuses, 8
Visual Information Technologies, M.A., M.F.A.
see Art, 55
W

Washington Research Library Consortium, 7
Withdrawal from all classes, 25

Women's Studies Research and Resource Center, 49
Writing Center, 46
**Graduate Catalog 1992-1994**

**George Mason University**

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<table>
<thead>
<tr>
<th>Name</th>
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<th>First</th>
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