INFORMATION TECHNOLOGY (IT)

100 Level Courses

IT 102: Discrete Structures. 3 credits.
Introduces ideas of high-level program design and discrete structures. This course focuses on problem-solving and includes an introduction to programming, Boolean algebra, symbolic logic, digital circuits, set theory, combinatorics, discrete probability, mathematical induction, recursion and a basic introduction to trigonometry. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (MATH 108C, 108XS, 113C, 113XS, HNRT 225C or 225XS or ((MATH 123C or 123XS) and (MATH 124C or 124XS))).

* May be taken concurrently.
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 104: Introduction to Computing. 3 credits.
This course, using both lecture and laboratory practice, introduces students to basic computer concepts in hardware, software, networking, computer security, programming, database, e-commerce, decision support systems, and current developments in 3-D printing, virtualization, and Siri-like systems. Additional lectures examine social, legal, ethical issues including privacy, intellectual property, health concerns, green computing, and accessibility. Students learn techniques to search, evaluate, validate, and cite information found online. Hands-on lab includes spreadsheets, databases, presentation, HTML 5, CSS, cybersecurity, blogs, wiki, and mobile app development. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Mason Core: Info Tech & Computing (http://catalog.gmu.edu/mason-core/)

Schedule Type: Laboratory, Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 105: IT Architecture Fundamentals. 3 credits.
Introduces students to fundamental hardware and software concepts of information technology (IT) to understand the basics of modern computing environments. Students acquire a comprehensive understanding of a computer system's essential components, component interdependence, and binary functions, factoring in performance, data communication models, telecommunication basics, and information security. Recent trends and advancements in mobile computing, telecommunications, and IT infrastructures are discussed. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:

IT 106: Introduction to IT Problem Solving Using Computer Programming. 3 credits.
Introduces techniques for developing solutions to business problems using procedural programming as an IT resource/tool. Students apply problem solving concepts by analyzing problems and constructing, testing, and implementing algorithms using pseudocode, desk checking, and procedural programming. Topics include: program flow, control structures, programming fundamentals, and integrating program modules into a cohesive solution. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 103C, 103T, 103X, 104C, 104XS or 104T) and (MATH 112C, 125C, 125XS, IT 102C or 102XS).

* May be taken concurrently.
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Laboratory, Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 109: Introduction to Computer Programming. 3 credits.
This foundation course is designed to teach students problem-solving skills using procedural programming that is required for the Information Technology degree program. The course accomplishes the goals through hands-on experience in the lecture class as well as through computer laboratory work. Topics to be discussed include, but are not limited to: variables, conditionals, functions, strings, iteration, testing, storage types and files. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 103C, 103T, 103X, 104C, 104XS or 104T) and (MATH 112C, 125C, 125XS, IT 102C or 102XS).

* May be taken concurrently.
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Laboratory, Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)
IT 191: Review of Computing Fundamentals. 1 credit. Provides an extensive understanding of computing fundamentals. Topics include: hardware, software, networking, computer security, programming, database, e-commerce, decision support systems, and other emerging technologies. Open only to students with transfer credit comparable to IT 103 or IT 104 who have not attempted IT 191 or IT 104. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions: Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading: This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 193: Review of Multimedia and Web Design. 1 credit. Provides an extensive understanding of concepts and techniques for designing and developing attractive and accessible websites with multimedia components. Introduces and discusses technological, aesthetic, and human factors. Open only to students with transfer credit comparable to IT 213 who have not attempted IT 193 or IT 213. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to three attempts.

Registration Restrictions: Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading: This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 194: Review of Database Fundamentals. 1 credit. Provides an extensive understanding of database fundamentals. Topics include: database classifications, data models with extensive coverage of the relational model, entity-relationship and extended entity relationship models, normalization, advanced data modeling, and Structured Query Language (SQL) programming. Open only to students with transfer credit comparable to IT 214 who have not attempted IT 194 or IT 214. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions: Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading: This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 196: Review of IT Problem Solving Using Computer Programming. 1 credit. Provides an extensive understanding of techniques for developing solutions to business problems through an iterative design and implementation approach. Open only to students with transfer credit comparable to IT 106 who have not attempted IT 106 or IT 196. (MATH 112 prior completion or co-registration is strongly recommended.) Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions: Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading: This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

200 Level Courses

IT 206: Object Oriented Techniques for IT Problem Solving. 3 credits. Introduces techniques for developing solutions to business problems using object-oriented programming as an IT resource/tool. Students apply problem solving concepts by analyzing problems and constructing, testing, and implementing object-oriented solutions using object-oriented analysis and design, data modeling, and object-oriented programming fundamentals. Topics include: Unified Modeling Language (UML), classes, inheritance, polymorphism, and exception handling. Notes: Students cannot receive credit for both IT 108 and IT 206. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions: Required Prerequisites: (IT 106, 108, 196) and (IT 102, 102XS, MATH 112, 125 or 125XS). Requires minimum grade of C. XS Requires minimum grade of XS.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Laboratory, Lecture

Grading: This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 207: Applied IT Programming. 3 credits. Building on fundamentals of problem solving, logic and algorithm development, and procedural programming, this course further develops these skills while covering server side scripting languages and relational database connectivity. Students will use open source software tools to develop database-enabled web applications. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions: Required Prerequisites: (IT 106, 106XS, 109C, 109XS, 196C, CS 112C or 112XS) and (IT 102, 102XS, MATH 112, 125C or 125XS) and (IT 214, 214XS or 194C). Requires minimum grade of C. XS Requires minimum grade of XS.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading: This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)
IT 209: Introduction to Object Oriented Programming. 3 credits.
Introduction to Object Oriented Programming (OOP) is intended for
students who want to advance their basic programming skill to the
next level by learning the OO programming paradigm. This course is
designed to teach the benefits of OOP, including faster development,
code reusability and less code maintenance. The course accomplishes
the goals through hands-on experience with a number of coding
assignments. Topics include, but are not limited to: OOP design, objects,
class, methods, inheritance, testing, debugging, graphical user interfaces
(GUIs). Offered by Info Sciences & Technology (http://catalog.gmu.edu/
colleges-schools/engineering/information-sciences-technology/). Limited
to two attempts.

Registration Restrictions:
Required Prerequisites: ((IT 109C or 109XS) and (IT 102C, 102XS,
MATH 112C, 125C or 125XS)).
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Laboratory, Lecture
Grading:
This course is graded on the Undergraduate Regular scale. (http://
catalog.gmu.edu/policies/academic/grading/)

IT 213: Multimedia and Web Design. 3 credits.
Through lecture, class demonstration, class discussion, and hands-
on lab experience, introduces multimedia and web computer graphics.
Focuses on development of web-enabled multimedia applications from
practical business perspective. Introduces and discusses technological,
aesthetic, and human factors. Offered by Info Sciences & Technology
(http://catalog.gmu.edu/courses-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 103C, 103T, 103X, 104C, 104XS or 104T).
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Students cannot enroll who have a major in Civil and Infrastructure Engr,
Computer Engineering, Computer Science, Electrical Engineering or
Systems Engineering.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Laboratory, Lecture
Grading:
This course is graded on the Undergraduate Regular scale. (http://
catalog.gmu.edu/policies/academic/grading/)

IT 214: Database Fundamentals. 3 credits.
Covers fundamentals of relational database management systems
and their use in business environments. Topics include: database
classifications, data models with extensive coverage of the relational
model, entity-relationship and extended entity-relationship models,
normalization, advanced data modeling, and Structured Query Language
(SQL) programming. Students design and implement a real-world
relational database and create complex SQL queries to retrieve data
from the database. Offered by Info Sciences & Technology (http://
catalog.gmu.edu/courses-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 103C, 103T, 103X, 104C, 104XS or 104T) and (IT
101C, 105C or 105XS).
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Students cannot enroll who have a major in Civil and Infrastructure Engr,
Computer Engineering, Computer Science, Electrical Engineering or
Systems Engineering.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture
Grading:
This course is graded on the Undergraduate Regular scale. (http://
catalog.gmu.edu/policies/academic/grading/)

IT 216: Systems Analysis and Design. 3 credits.
Students survey and apply techniques in analyzing and modeling
information systems. Requirements are derived in various domains and
abstracted at conceptual, logical, and physical levels. Process, data,
and state modeling are applied through a project that follows a systems
development lifecycle. Object modeling is explored and contrasted
with data and process modeling. Individual and group modeling
assignments are required. Offered by Info Sciences & Technology (http://
catalog.gmu.edu/courses-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 106C, 106XS, 109C, 109XS, 196C, CS 112C or
112XS) and (IT 206C, 206XS, 209C, 209XS, CS 211C or 211XS) and (IT 194C,
214C or 214XS).
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture
Grading:
This course is graded on the Undergraduate Regular scale. (http://
catalog.gmu.edu/policies/academic/grading/)

IT 223: Information Security Fundamentals. 3 credits.
Introduces concept of information security. Discusses need for
organizational policy to define required services such as confidentiality,
authentication, integrity, nonrepudiation, access control, and availability,
and mechanisms to implement those services. Covers different types
of security including physical security, computer security, and network
security, common threats to and attacks against information systems,
including accidental damage, identity theft, malicious software, and
"spam"; and defensive measures. Notes: Students cannot receive credit
for both IT 221 and IT 223. Offered by Info Sciences & Technology (http://
catalog.gmu.edu/courses-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 103C, 103T, 103X, 104C, 104XS or 104T) and (IT
101C, 105C or 105XS).
C Requires minimum grade of C.
XS Requires minimum grade of XS.
Students cannot enroll who have a major in Civil and Infrastructure Engr, Computer Engineering or Computer Science.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading: This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 293: Applied IT: Junior Transition. 1 credit.
Focuses on transition issues for sophomores and transfer students in Information Sciences and Technology programs. Assists sophomore and transfer students with choice of concentration, course selection, and career readiness. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions: Students with a class of Freshman may not enroll.

Enrollment is limited to students with a major in Information Technology.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Seminar

Grading: This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

300 Level Courses

IT 300: Modern Telecommunications. 3 credits.

Registration Restrictions: Required Prerequisites: (((IT 101C and 212C) or IT 105C or 105XS) and (MATH 108C, 108XS, 113C, 113XS, HNRT 225C or 225XS) or ((MATH 123C or 123XS) and (MATH 124C or 124XS))) and (IT 102C, 102XS, MATH 112C, 125C or 125XS)). C Requires minimum grade of C.
XS Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchny Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading: This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 306: Data Structures and Algorithms in Java. 3 credits.
Fundamentals of data structures and analysis of algorithms. Large programs written in a modern, high-level programming language. Stresses abstraction, modular design, code reuse, and correctness. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions: Required Prerequisites: (IT 206B or CS 211B) and (IT 102C, 102XS, MATH 112C, 125C or 125XS) and (IT 216D or 216XS).
B Requires minimum grade of B.
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchny Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading: This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 309: Data Structures and Algorithms in Python. 3 credits.
Fundamentals of data structures and analysis of algorithms. Large programs written in a modern, high-level programming language. Stresses abstraction, modular design, code reuse, and correctness. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions: Required Prerequisites: (IT 209B or CS 211B) and (IT 102C, 102XS, MATH 112C, 125C or 125XS) and (IT 216D or 216XS).
B Requires minimum grade of B.
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Students with the terminated from VSE major attribute may not enroll.
Supporting organizations’ needs for reliable data that are captured, covers methodology and tools used to work with health data structures.

**IT 322:** This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 314: Database Programming.** 3 credits.
The course introduces students to the Oracle Developer application development utilities and tools and describes how to create and manipulate databases in Oracle database management system. The course provides an extensive overview of SQL and introduction to PL/SQL. Topics include data definition and manipulation languages, stored procedures, triggers, indexing techniques, and elementary query optimization. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

**Registration Restrictions:**
Required Prerequisites: (IT 106 C, 106 XS, 109 C, 109 XS, 196 C, CS 112 C or 112 XS) and (IT 214 B or 194 B).
C Requires minimum grade of C.
XS Requires minimum grade of XS.
B Requires minimum grade of B.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchngy Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 315: Mobile Development.** 3 credits.
Introduces students to Mobile Development on the iOS and Android Platforms. Provides an overview of mobile platforms and devices including evaluation, uses, design and development of applications. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

**Registration Restrictions:**
Required Prerequisites: (IT 206 C, 206 XS, 209 C, 209 XS, CS 211 C or 211 XS) and (IT 213 B or 193 B).
C Requires minimum grade of C.
XS Requires minimum grade of XS.
B Requires minimum grade of B.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchngy Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 328:** Health Information Technology Fundamentals. 3 credits.
Explores challenges in the development and implementation of information systems and informatics tools in healthcare environment. Discusses the importance and benefits of electronic health records (EHRs). Students learn about EHRs’ creation, management, and evolution, and their use for clinical decision support. In addition, students will learn about health care access, telemedicine models, health information security, privacy, federal laws, regulations and standards, and discuss their impact on healthcare delivery. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

**Registration Restrictions:**
Required Prerequisites: (IT 214 B or 194 B) and (STAT 250 C, 250 XS, 344 C or 344 XS).
B Requires minimum grade of B.
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchngy Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 322: Health Data Challenges.** 3 credits.
Covers methodology and tools used to work with health data structures supporting organizations’ needs for reliable data that are captured, stored, processed, integrated, and prepared for further querying, decision making, data mining and knowledge discovery for a variety of clinical and organizational purposes. Data security and privacy, data standards, data interoperability, health information exchange, and big data analytics are discussed. Tools like R and R Studio are used to work with data sets at a statistical level, analyze, visualize and predict outcomes. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts. Equivalent to BENG 322.

**Registration Restrictions:**
Required Prerequisites: (IT 214 B or 194 B) and (STAT 250 C, 250 XS, 344 C or 344 XS).
B Requires minimum grade of B.
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchngy Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 328:** Health Information Emerging Technologies. 3 credits.
Provides an introduction to networking in the healthcare environment and covers a wide range of topics on emerging health information technologies. Discusses internet protocols, safety procedures, and data privacy considerations in healthcare environments, and processes required to design, secure, and troubleshoot a network to support healthcare organizations. Mobile computing, patient portals, personal health records, telehealth, health information exchange are discussed. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-
Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 331: Web I: Web Development. 3 credits.
Introduces the principles and techniques necessary for successful client-side web development. Topics such as HTML5, Cascading Style Sheets, JavaScript, DOM, XML, AJAX, and jQuery are presented. Students will learn to develop interactive and engaging web pages and applications and use client-side web-scripting languages to solve problems both with a text editor and more powerful WYSIWYG HTML editors. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 106C, 106XS, 109C, 109XS, CS 112C, 112XS or IT 196C) and (IT 213B or 193B).
C Requires minimum grade of C.
XS Requires minimum grade of XS.
B Requires minimum grade of B.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchny Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 341: Data Communications and Network Principles. 3 credits.
Focuses on primary aspects of data communications and networking. Open Systems Interconnection (OSI) and Internet models; Layer 1 interfaces and cabling configurations; IP network addressing, network design, router and port configurations; security protocols; static routing, RIPv2, and OSPF configurations; TCP, UDP, data reliability, and error correction methods; Telnet, FTP, TFTP, HTTP, SMTP, POP, and DNS protocols. Notes: This course is 50 percent lab work of configuration of routers and network design, implementation, and testing. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: ((IT 101C and 212C) or (IT 105C or 105XS)) and (IT 106C, 106XS, 109C, 109XS, 196C, CS 112C or 112XS) and (MATH 108C, 108XS, 113C, 113XS, HNRT 225C or 225XS or ((MATH 123C or 123XS) and (MATH 124C or 124XS)) and (IT 300C or 300XS)).
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchny Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)
IT 342: Operating Systems Fundamentals. 3 credits.
Practices and procedures for installing and configuring modern operating systems, including user accounts, file, print, and terminal servers, mobile computing, and disaster recovery. Through practical lab sessions, students receive real-world experiences with multiple operating systems. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: ((IT 101\textsuperscript{C} and 212\textsuperscript{C}) or (IT 105\textsuperscript{C} or 105\textsuperscript{XS})) and (IT 106\textsuperscript{C}, 106\textsuperscript{XS}, 109\textsuperscript{C}, 109\textsuperscript{XS}, 196\textsuperscript{C}, CS 112\textsuperscript{C} or 112\textsuperscript{XS}).
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Information Technology, Applied Science, Individualized Study, Information Technology or Inftmn Tchny Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture
Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 343: IT Project Management. 3 credits.
Provides essential strategies and procedures for planning, organizing, staffing, monitoring, and controlling design, development, and production of system to meet stated IT-related need in effective and efficient manner. Fulfills writing-intensive requirement for BS in information technology. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Specialized Designation: Writing Intensive in Major

Registration Restrictions:
Required Prerequisites: IT 293\textsuperscript{C} or 293\textsuperscript{XS}.
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Enrollment limited to students with a class of Junior, Senior Plus or Senior.

Enrollment is limited to students with a major in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchny Entrepreneurship.

Enrollment limited to students in a Bach of Individualized Study, Bachelor of Applied Science or Bachelor of Science degrees.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture
Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 353: Information Defense Technologies. 3 credits.
This course will examine and assess the role of information technology as a tool of warfare and civil defense. Topics will be discussed from both defensive and offensive perspectives and will include asset tracking, asymmetric warfare, network centric warfare, physical attacks, cyberterrorism, espionage, psyps, reconnaissance and surveillance, space assets, and applications of GPS and cryptographic technology. Students will research and write about the social, ethical, and political effects of such technology. Notes: For INFT and AIT majors, minors and certificates, and BAS cybersecurity concentration only. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 101\textsuperscript{C}, 105\textsuperscript{C} or 105\textsuperscript{XS}) and (IT 223\textsuperscript{B}).
C Requires minimum grade of C.
XS Requires minimum grade of XS.
B Requires minimum grade of B.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Inftmn Tchny Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture
Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 357: Computer Crime, Forensics, and Auditing. 3 credits.
Covers computer crime, relevant laws, agencies, and standards. Presents auditing, logging, forensics, and related software. Explores legal principles such as chain of evidence, electronic document discovery, eavesdropping, and entrapment. Students get hands-on experience with forensics tools. Notes: For INFT and AIT majors, minors and certificates, and BAS cybersecurity concentration only. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
**IT 103X**: 3 credits. Introduces fundamental computer concepts and basic programming skills in Python with an emphasis on problem solving using Python. Students will learn to develop, debug, and test small Python applications. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchngy Entrepreneurship.

Students with the terminated from VSE major attribute may **not** enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 206**: 3 credits. Introduces basic programming principles and techniques using Python. Students will develop applications in a variety of domains and gain experience using diverse software development tools. This course is an introduction to the Python programming language. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchngy Entrepreneurship.

Students with the terminated from VSE major attribute may **not** enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 207**: 3 credits. Introduces basic programming principles and techniques using Python. Students will develop applications in a variety of domains and gain experience using diverse software development tools. This course is an introduction to the Python programming language. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchngy Entrepreneurship.

Students with the terminated from VSE major attribute may **not** enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 213**: 3 credits. Introduces basic programming principles and techniques using Python. Students will develop applications in a variety of domains and gain experience using diverse software development tools. This course is an introduction to the Python programming language. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchngy Entrepreneurship.

Students with the terminated from VSE major attribute may **not** enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)
**IT 410: Web Programming.** 3 credits.
This course covers layers of the n-tier architecture. Students will build web applications using available frameworks at each tier, such as Java Server Faces and Servlets for the UI tier, Web Services for the business tier and Java Database Connectivity for the persistence tier. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: IT 206\(^B\) or CS 211\(^B\).
\(^B\) Requires minimum grade of B.
Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchny Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 413: Digital Media Editing.** 3 credits.
Examines three areas of digital media editing- tools for editing, content and logic decision process, and information technology used by major corporations for development and distribution-through video examples from entertainment industry and corporate productions as well as hands-on editing experience. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 213\(^C\), 213\(^XS\) or 193\(^C\)).
\(^C\) Requires minimum grade of C.
\(^XS\) Requires minimum grade of XS.
Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchny Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 414: Database Administration.** 3 credits.
Explores advanced concepts of database administration using enterprise-level database management system. Topics include: backup, recovery, corruption, automatic management, resource management, job scheduling, space management, memory management, storage management, diagnosis and corresponding tools. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 314\(^C\) or 314\(^XS\)) and (IT 214\(^B\) or 194\(^B\)).
\(^C\) Requires minimum grade of C.
\(^XS\) Requires minimum grade of XS.
\(^B\) Requires minimum grade of B.
Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchny Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 415: Information Visualization.** 3 credits.
Provides an overview of information visualization applications in intelligence analysis, decision support systems, and network monitoring. Covers human factors, human interface with information, and current and future trends in information visualization. Students also learn to develop a rudimentary visualization application. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 213\(^B\) or 193\(^B\)).
\(^B\) Requires minimum grade of B.
Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchny Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 429: Security Accreditation of Information Systems.** 3 credits.
This course explains basic principles of performing FISMA certification and accreditation (C&A) of an IT System. The course covers methodology for completing C&A, explains the role of the Certifier and the Information System Security Officer (ISSO), and gives students real world experience with IT Systems in the Federal Government. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 105\(^C\), 105\(^XS\) or 212\(^C\)) and (IT 223\(^B\)).
\(^C\) Requires minimum grade of C.
\(^XS\) Requires minimum grade of XS.
\(^B\) Requires minimum grade of B.
Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchny Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)
IT 431: Web II. Advanced Web Development. 3 credits.
Introduces students to database-driven Web application design and development on cloud platforms and frameworks, and Web presentation using server-side coding and advanced techniques. Additional topics include LINQ, AJAX, and RESTful Web services. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 331^C or 331^XS) and (IT 213^B or 193^B).
C Requires minimum grade of C.
XS Requires minimum grade of XS.
B Requires minimum grade of B.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchny Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture
Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 441: Network Servers and Infrastructures. 3 credits.
Covers IP networking concepts and practices for IPv6 addressing, DHCP and DNS in IPv6 networks, secure communication over VPNs, VoIP architecture, Virtual Computing, Cloud Computing, MPLS, traffic monitoring and network connectivity between operating systems. Students learn the latest technologies of IP networks and understand application-level services used in the Internet. Lab sessions focus on installation of applications on virtual servers. Notes: Term project. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 341^B or L341) and (IT 102^C, 102^XS, MATH 112^C, 125^C or 125^XS).
B Requires minimum grade of B.
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchny Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture
Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 445: Advanced Networking Principles. 3 credits.
This course focuses on Layer 2 and 3 of the OSI model and WAN technologies. Frame Relay and ISDN, complex router configurations of Variable Length Subnet Masking (VLSM), Classless Inter-Domain Routing (CIDR), Network Address Translation (NAT), Dynamic Host Configuration Protocol (DHCP), and study of Network Management Systems available for Data Communications Networks. Layer 2 involves Ethernet-switching components, including detailed hands-on configuration covering all aspects of switches using the command-line interface method. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 341^B or L341).
B Requires minimum grade of B.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchny Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture
Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 451: Cloud Services Management. 3 credits.
The course offers a top-down view of cloud services management including the techniques for building, deploying and maintaining various cloud models. Through hands-on lab assignments and real-world standard projects students will learn how to deal with cloud architecture challenges, such as load balancing, auto scaling, configuration management, caching, adaptive virtualization, on-demand resources provisioning, monitoring, and access control. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: IT 442^C or 442^XS.
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture
Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 455: Wireless Communications and Networking.** 3 credits.
Covers fundamental principles underlying wireless data communications. Topics include wireless transmission basics, radio propagation issues, antennas, digital modulation, spread spectrum techniques and their applications, and popular standards: WiFi, WiMAX and Bluetooth. Also presents practical knowledge to enable the design, testing, deployment, debugging and commissioning of WiFi, WiMAX networks and point-to-point microwave systems. Discussions on cellular network technologies are also included. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

**Registration Restrictions:**
**Required Prerequisites:** (IT 101C, 105C or 105XS) and (IT 102C, 102XS, MATH 112C, 125S or 125XS) and (IT 341B or L341).  
C Requires minimum grade of C.  
XS Requires minimum grade of XS.  
B Requires minimum grade of B.  

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmnt Tchny Entrepreneurship.  
Students with the terminated from VSE major attribute may not enroll.

**Schedule Type:** Lecture  
**Grading:** This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 461: Application Development in Cloud.** 3 credits.
Introduces techniques for developing applications to take advantage of availability, security, performance, and scalability of the cloud. Students will learn the serverless framework and deploy and test serverless applications on a cloud platform. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

**Registration Restrictions:**
**Required Prerequisites:** (IT 106C, 106XS, CS 112C, 112XS, IT 196C, 196XS, 105C or 105XS) and (IT 214C, 214XS, 194C or 194XS)).  
C Requires minimum grade of C.  
XS Requires minimum grade of XS.  

Students with the terminated from VSE major attribute may not enroll.

**Schedule Type:** Lecture  
**Grading:** This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 462: Applied Cyber Threat Analysis.** 3 credits.
Studies security policies, models, and mechanisms for secrecy, integrity, availability, and usage controls. Topics include models and mechanisms for mandatory, discretionary, and role-based access controls; authentication technologies; control and prevention of viruses and other rogue programs; common system vulnerabilities and countermeasures; privacy and security policies and risk analysis; intellectual property protection; and legal and social issues. Notes: For INFT and AIT majors, minors and certificates, and BAS cybersecurity concentration only. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

**Registration Restrictions:**
**Required Prerequisites:** (IT 105C, 105XS or 212C) and (IT 223B) and (IT 369B or 369XS).  
* May be taken concurrently.  
C Requires minimum grade of C.  
XS Requires minimum grade of XS.  
B Requires minimum grade of B.  

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmnt Tchny Entrepreneurship.  
Students with the terminated from VSE major attribute may not enroll.

**Schedule Type:** Lecture  
**Grading:** This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 466: Foundations of Cryptography and Security.** 3 credits.
Detailed study of certain symmetric and asymmetric cryptographic schemes; analysis of network data (including “packet sniffing”); security at different network layers (including IPSec, SSL/TLS and Kerberos); and secure e-commerce. Teaches principles of designing and testing secure networks, including use of network partitioning, firewalls, intrusion detection systems, and vulnerability assessment tools. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

**Registration Restrictions:**
**Required Prerequisites:** ((IT 223B) and (IT 366C or 366XS) and (IT 341C or 341XS) and (IT 206C, 206XS, 209C, 209XS, CS 211C or 211XS) and (IT 102C, 102XS, MATH 112C, 125S or 125XS)).  
B Requires minimum grade of B.  
C Requires minimum grade of C.  
XS Requires minimum grade of XS.  

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmnt Tchny Entrepreneurship.  
Students with the terminated from VSE major attribute may not enroll.

**Schedule Type:** Lecture  
**Grading:** This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 467: Network Defense.** 3 credits.
Practices and procedures for defending business-class, heterogeneous networks against threats (including system failure, environmental events, human error) and attacks (including intrusion, malicious software, denial of service). Through practical lab sessions, students receive real-world experience designing networks, installing and configuring system components, detecting and recovering from problems and attacks, and gathering data to support prosecution of offenders and refinement of countermeasures. Offered by Info Sciences & Technology (http://
catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 366^C or 366^XS) and IT 223^B.
C Requires minimum grade of C.
XS Requires minimum grade of XS.
B Requires minimum grade of B.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchngy Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 471: Big Data on Cloud Systems. 3 credits.
This course focuses on cloud-based big data solutions. Students learn to create and use big data analytical environments using cloud data services and tools. Also covered is employing best practices for designing big data cloud environments for performance, security, and cost effectiveness. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (CS 112^C, 112^XS, IT 106^C, 106^XS, 196^C, 109^C or 109^XS) and (IT 214^C, 214^XS, 194^C or 194^XS) and (IT 442^C or 442^XS)).
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 479: Digital Media and Web Design Capstone. 3 credits.
Student team-based experience grounded in the work of the preceding courses in the digital media and web design minor. Each individual student will produce a portfolio of digital media and web-design related products and features that demonstrate core competencies in coding, design, content, and accessibility. Students will work in cross-disciplinary teams to carry out a client-based web design project, the process and outcomes of which will also be represented in the individual portfolio. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts. Equivalent to AVT 479, COMM 479, ENGH 479.

Recommended Prerequisite: Before enrolling in the Capstone seminar, students need to have completed all required courses for the Digital Media and Web Design Minor.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 481: Cloud Security. 3 credits.
This course covers the fundamentals of building security into cloud platforms and how to securely manage and access cloud environments using hands-on lab environments. Students will learn how to access cloud environments using IPSec utilizing the respective cloud VPN gateways. Students will also be exposed to identity and access management in the various platforms, how to create and assign roles to users and groups, how to audit actions taken, and how most commonly utilized security services in the cloud environments operate. Students will learn to separate out environments using virtual networks for project and system segmentation and learn how to apply virtual firewall rules and network access control lists. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: IT 223^C or 223^XS.
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 484: Voice Communications Technologies. 3 credits.
Examines current and emerging technologies for transmission of voice signals over telecommunications systems. Highlights significant differences between the requirements for voice and other forms of data. Topics provide a balance between traditional voice technologies and those that use data networks. Real-world implementations are analyzed to determine reliability, quality, and cost effectiveness. Includes lab experiments with analog and digital technologies. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 300^D or 300^XS) and (IT 341^B or L341).
C Requires minimum grade of C.
XS Requires minimum grade of XS.
B Requires minimum grade of B.

Enrollment is limited to students with a major, minor, or concentration in Applied Information Technology, Applied Science, Individualized Study, Information Technology or Infmtn Tchngy Entrepreneurship.

Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 488: Fundamentals of Satellite Communications. 3 credits.
Provides a comprehensive overview of the principles of satellite communications systems. Major topics include satellite orbits and constellations, the space segment, antennas, modulation, coding, satellite access methods and link analysis. Also covers satellite applications, with emphasis on recent developments in the satellite communications field. Hands-on design experience is gained through the use of readily available vendor software systems. Offered by Info
Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (IT 300C or 300XS) and (IT 341B and (MATH 108C, 108XS, 113C, 113XS, HNRT 225C or 225XS or ((MATH 123C or 123XS) and (MATH 124C or 124XS))).
C Requires minimum grade of C.
XS Requires minimum grade of XS.
B Requires minimum grade of B.

Registration Restrictions:
Required Prerequisites: IT 209B and (STAT 250C or 250XS).
B Requires minimum grade of B.
C Requires minimum grade of C.
XS Requires minimum grade of XS.

XS Requires minimum grade of XS.

Enrollment limited to students with a class of Senior Plus or Senior.

Registration Restrictions:
Required Prerequisites: IT 492C or 492XS.
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Enrollment is limited to students with a major in Applied Information Technology or Information Technology.

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 498: Independent Study in Information Technology. 1-3 credits.
Directed self-study of special topics of current interest in IT. Notes: Topics must be arranged with instructor and approved by department chair before registering. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). May be repeated within the term for a maximum 6 credits.

Recommended Prerequisite: 60 credits.

Registration Restrictions:
Students with the terminated from VSE major attribute may not enroll.

Schedule Type: Independent Study
Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

IT 499: Special Topics in Information Technology. 3 credits.
Topics of special interest to undergraduates. Notes: May be repeated if topics are substantially different. Offered by Info Sciences & Technology
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**700 Level Courses**

**IT 796: Directed Reading and Research**. 1-6 credits.
Reading and research on specific topic in information technology under direction of faculty member. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). May not be repeated for credit.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

**Recommended Prerequisite:**
Completion of all coursework for the PhD in Information Technology, or permission of instructor.

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 797: Directed Reading and Research**. 1-3 credits.
Reading and research on specific topic in information technology under direction of faculty member. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). May not be repeated for credit.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

**Recommended Prerequisite:**
Completion of all coursework for the PhD in Information Technology, or permission of instructor.

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**800 Level Courses**

**IT 896: Directed Readings and Research in IT**. 1-6 credits.
Students pursue research on a specific topic under direction of faculty Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). May be repeated within the degree for a maximum 6 credits.

**Recommended Prerequisite:**
Completed qualifying exams, or permission of instructor.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 897: Directed Readings and Research in IT**. 1-3 credits.
Students pursue research on a specific topic under direction of faculty Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). May not be repeated for credit.

**Recommended Prerequisite:**
Completed qualifying exams, or permission of instructor.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 898: Doctoral Dissertation Proposal**. 1-12 credits.
Work on research proposal that forms basis for doctoral dissertation. Notes: No more than 24 credits of IT 998 and 999 may be applied to doctoral degree requirements. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). May be repeated for credit. Equivalent to CEIE 990, CS 990, ME 990, STAT 990.

**Recommended Prerequisite:**
Completion of all coursework for the PhD in Information Technology, or permission of instructor.

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 990: Dissertation Topic Presentation**. 1 credit.
Students put together a professional presentation of a research proposal and present it for critique to fellow students and interested faculty. Notes: This course is only offered once per year in the Spring semester. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). May not be repeated for credit. Equivalent to CEIE 990, CS 990, ME 990, STAT 990.

**Recommended Prerequisite:**
Completion of all coursework for the PhD in Information Technology, or permission of instructor.

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 997: Directed Readings and Research in IT**. 1-6 credits.
Students pursue research on a specific topic under direction of faculty Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). May not be repeated for credit.

**Recommended Prerequisite:**
Completed qualifying exams, or permission of instructor.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 998: Doctoral Dissertation Proposal**. 1-12 credits.
Work on research proposal that forms basis for doctoral dissertation. Notes: No more than 24 credits of IT 998 and 999 may be applied to doctoral degree requirements. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). May be repeated for credit. Equivalent to CEIE 990, CS 990, ME 990, STAT 990.

**Recommended Prerequisite:**
Completion of all coursework for the PhD in Information Technology, or permission of instructor.

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**IT 999: Dissertation Topic Presentation**. 1 credit.
Students put together a professional presentation of a research proposal and present it for critique to fellow students and interested faculty. Notes: This course is only offered once per year in the Spring semester. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). May not be repeated for credit. Equivalent to CEIE 990, CS 990, ME 990, STAT 990.

**Recommended Prerequisite:**
Completion of all coursework for the PhD in Information Technology, or permission of instructor.

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**900 Level Courses**

**IT 990: Dissertation Topic Presentation**. 1 credit.
Students put together a professional presentation of a research proposal and present it for critique to fellow students and interested faculty. Notes: This course is only offered once per year in the Spring semester. Offered by Info Sciences & Technology (http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/). May not be repeated for credit. Equivalent to CEIE 990, CS 990, ME 990, STAT 990.

**Recommended Prerequisite:**
Completion of all coursework for the PhD in Information Technology, or permission of instructor.

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**Grading:**
This course is graded on the Satisfactory/No Credit scale. (http://catalog.gmu.edu/policies/academic/grading/)
IT 999: *Doctoral Dissertation*. 1-12 credits.
Formal record of commitment to doctoral dissertation research under direction of faculty member in information technology. Note: Students must be advanced to candidacy before registering for this course. Students may not take IT 998 and 999 at the same time. Offered by Info Sciences & Technology ([http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/](http://catalog.gmu.edu/colleges-schools/engineering/information-sciences-technology/)). May be repeated within the degree.

**Recommended Prerequisite:** Admission to Doctoral candidacy; students must submit the Doctoral proposal and have it approved prior to registering for this course.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy.

*Enrollment is limited to Graduate level students.*

Enrollment limited to students in the Volgenau School of Engineering college.

**Schedule Type:** Dissertation

**Grading:**
This course is graded on the Satisfactory/No Credit scale. ([http://catalog.gmu.edu/policies/academic/grading/](http://catalog.gmu.edu/policies/academic/grading/))