

APPLIED INFORMATION TECHNOLOGY (AIT)

500 Level Courses

AIT 500: *Quantitative Foundations for Information Systems Analysis*. 3 credits.

Provides common background in basic quantitative areas focused on decision making, information processing, and telecommunications. Topics include review of precalculus, introduction to matrix algebra, problems in optimization, and introduction to probability and statistics. Notes: Does not fulfill any VSITE graduate degree requirement. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: MATH 108 or equivalent.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 502: *Programming Essentials*. 3 credits.

Introduces basic procedural and object-oriented programming. Topics include: variables, data types, assignments, conditionals, loops, arrays, input/output, static methods, libraries, recursion, data types, API, classes, access modifiers, instance variables, constructors, instance methods, testing, encapsulations, immutability, interface inheritance, implementation inheritance, exceptions, assertions, analysis of algorithms, order of growth, memory usage, binary search, insertion sort, merge sort, stacks, array implementation of stacks, linked list implementation of stacks, queues, generics, autoboxing, iteration, symbol tables, hash tables, binary search trees, examples and applications. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Basic information technology knowledge.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

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

AIT 504: *Issues of Cyberspace*. 3 credits.

Student panels explore, report on, and make recommendations regarding major and novel problems presented by the explosive and intrusive growth of 'cyberspace'. Legal, ethical, financial, security, utility and

value to users and organizations, feasibility, and desirability aspects are considered. Each semester features a major topic area. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

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Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 510: *Learning Technology: Theory, Application and Design*. 3 credits.

Introduces students to theory, application and design of learning technologies, discussing why technology should be used for learning and education, how it should be applied, and how one can design digital tools to improve learning and education. Use of data, analytics, and emerging applications such as social media will also be discussed. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: (IT 415 or equivalent) and (SYST 469 or equivalent).

Registration Restrictions:

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Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 512: *Algorithms and Data Structures Essentials*. 3 credits.

Introduces analysis of algorithms and basic data structures assuming basic programming knowledge. Topics include: collections, sorting, searching, graphs, strings, B-Trees, and analysis of algorithms. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: AIT 502 with B- or above, or other academic or industry experience with programming.

Registration Restrictions:

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Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing or University (Provost) colleges.

Schedule Type: Lecture

Grading:

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

AIT 516: *Introduction to Human-Computer Interaction*. 3 credits.

Introduction to HCI aims at helping early-stage students to learn foundations and concepts in HCI so that they can be ready to take advanced HCI-related courses over 600 levels. Mindset-wise, the course will cover foundational theories that span the interdisciplinary nature of HCI, including psychology and sensemaking, information visualization, interaction design, social computing, and explainable AI. Skillset-wise, the course will cover (1) how to understand human users' challenges and potential requirements of a new technology before we commit our effort towards implementation, (2) how to build real-world human-faced interactive tools that empower humans in leveraging state-of-the-art AI-driven innovation and beyond, and (3) how to scientifically measure human behavior and perception about using the new tools. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

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

AIT 518: *Introduction to Interaction Design*. 3 credits.

This course covers the interaction design process in HCI from the initial formulation of a design problem to creation of digital prototypes using interaction design methods and skills, sketching techniques, scenarios, storyboarding, wireframing, and prototyping. Students will learn how to think critically about design and design solutions and justify and defend their design methods in the context of interaction design. A portion of this class will be dedicated to learning the latest practices and thinking about accessible, inclusive, and ethical design. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

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Schedule Type: Lecture

Grading:

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

AIT 521: *Software Engineering Essentials*. 3 credits.

Provides an overview of essential topics in software engineering, including problem solving with computers, requirements, software design, software development, testing, verification, validation, usability, and management. Discuss concepts related to building software, including data structures, object-oriented programming, event handling in GUIs, and web application technologies and how these concepts are handled in various languages, but without requiring the students to program.

Notes: This course does not count towards MS programs offered in the Computer Science Department and cannot be used to satisfy course requirements for PhD IT students. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

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Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 524: *Database Management Systems*. 3 credits.

Introduces the fundamental concepts necessary for designing, using, and implementing database systems and database applications. Stresses the fundamentals of database modeling and design, the languages and models provided by the database management systems, and database system implementation techniques. Covers the relational data model, the entity-relationship model, database design theory and normalization, query languages and database programming, and examines commercial systems. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Academic or industry experience with database systems.

Registration Restrictions:

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Enrollment limited to students in the Engineering Computing or University (Provost) colleges.

Schedule Type: Lecture

Grading:

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

AIT 526: *Introduction to Natural Language Processing*. 3 credits.

This is an introductory course in natural language processing (NLP). It explores a broad set of NLP tasks and introduces the students to the data, methods, and baseline solutions related to each. Topics covered include n-gram language models, text classification, part of speech tagging, word sense disambiguation, named entity extraction, information retrieval, and question answering. Methods explored include rule-based systems, classification with naïve bayes, sequence labeling with hidden Markov models and conditional random fields, as well as end-to-end systems. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Python programming. Statistics or probability. Machine learning (desirable).

Registration Restrictions:

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Schedule Type: Lecture

Grading:

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

AIT 542: *Fundamentals of Computing Platforms*. 3 credits.

Contemporary information systems are platforms inextricably combining operating systems and networks. This graduate course provides an overview of OS and networking elements of information systems, and examines the particular issues relating to the range of platforms, from handheld mobile devices to cloud and supercomputer systems. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Academic of industry experience with operating systems and computer networks.

Registration Restrictions:

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Schedule Type: Lecture

Grading:

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

AIT 580: *Analytics: Big Data to Information*. 3 credits.

Course provides an overview of Big Data and its use in commercial, scientific, governmental and other applications. Topics include technical and non-technical disciplines required to collect, process and use

enormous amounts of data available from numerous sources. Lectures cover system acquisition, law and policy, and ethical issues. It includes brief discussions of technologies involved in collecting, mining, analyzing and using results. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

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Schedule Type: Lecture

Grading:

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

AIT 581: *Problem Formation and Solving in Big Data*. 3 credits.

The course explores challenges facing analysts exploiting Big Data or Bespoke Data in combination with Big Data, and looks at solutions, mindful of the fact that our intellectual and practical practices are based entirely on the 5000 year old Bespoke Data paradigm, and considering that Big Data practices are too recent to lead to comparable Big Data tools and practices. Notes: Course may be used in other certificate and degree programs. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

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Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 582: *Metadata Analytics for Big Data*. 3 credits.

Course explores technical and analytical issues, solutions and gaps in processing large volumes of data by leveraging metadata. The goal is to find "facts of interest" (Intelligence) that represent threats to, or even opportunities for, a given industry or domain (e.g., healthcare, finance or national intelligence/national defense) where there is limited time. Notes: Course may be used in other Certificate or Degree programs. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

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Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 590: *Topics in Applied Information Technology*. 3 credits.

Topics in the application of information technology. Students are expected to participate actively through class dialogues and the crafting of IT solutions to specific problem areas. Notes: Course cannot be used to satisfy course requirements for PhD IT students. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May be repeated within the term for a maximum 6 credits.

Specialized Designation: Topic Varies

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 597: *Developing IT Leaders of Integrity*. 3 credits.

Considers the cultural and organizational influences and focuses on leadership's ethical dimensions. Students identify their core values, study the attributes of effective and toxic leaders, and examine the difference between managing and leading through selected readings, discussions, team projects, in-class activities and guest presentations. Students practice and receive in-class coaching to hone their leadership skills. Notes: Course cannot be used to satisfy course requirements for PhD IT students. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Registered student in MS, Applied IT or instructor's permission.

Registration Restrictions:

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Schedule Type: Lecture

Grading:

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

600 Level Courses

AIT 601: *Foundations of Applied Information Technology*. 3 credits.

Introduces students to foundational scholarship in applied information technology. Reviews seminal readings and applications of information technology. Students learn about the interdisciplinary history of the field, are introduced to influential scholars and important topics, and get an overview of key theoretical paradigms in applied information technology. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Admission to a graduate program in Applied IT.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 602: *Introduction to Research in Applied Information Technology*. 3 credits.

Introduces students to research methods required to conduct data-driven and theory-based research in information sciences and technology. The course will review different research approaches and methods, discusses issues of data collection, reliability, data analysis, and interpretation. Throughout, seminal research papers will be used as case studies, and students will learn to understand and design research. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Admission to a graduate program in Applied IT.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

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Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 603: *Research Practice*. 3 credits.

Complementing AIT 602's treatment on the nature of AIT research, this course examines various pragmatic aspects of conducting research, including: research venues, public & private funding sources, grant proposals, publishing, regulation and reporting obligations, operating labs and centers, legal and intellectual property issues, collaboration nationally and internationally. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: AIT 602 or equivalent.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

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Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 611: *Rapid Information Systems Prototyping*. 3 credits.

Presents software engineering, programming techniques, platforms and tools necessary for rapid development of information systems, including cloud platforms; data storage solutions; multi-platform application development; prototyping programming languages. The course will provide a general overview of such techniques but will concentrate on selected ones in each term. The students will work in small teams and must develop and deploy an information system prototype during the course. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Proficiency in an object-oriented programming language, basic data structures and algorithms knowledge.

Registration Restrictions:

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Schedule Type: Lecture

Grading:

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

AIT 614: *Big Data Essentials*. 3 credits.

Hands-on course discusses emerging technologies for big data analytics and their applications in real-world environments. Students apply learned concepts and best practices using several emerging technology tools simulating development, implementation, and use of big data analytical systems. Topics include RDBMS, SQL, NoSQL, R, MapReduce Programming paradigm, Hadoop, HDFS, HIVE, PIG and others in the

Hadoop ecosystem for unstructured data analytics. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: AIT 524, or industry experience with database systems.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

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Schedule Type: Lecture

Grading:

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

AIT 616: *Interactive Machine Learning and Artificial Intelligence*. 3 credits.

This course is designed for students who aim at learning (1) how they can build, investigate, and iterate their ML/AI models through a set of toolkits known as interactive ML and explainable AI (XAI) and (2) how they can develop human-faced interactive tools that apply ML models in providing benefit in human-AI collaboration. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

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Schedule Type: Lecture

Grading:

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AIT 622: *Determining Needs for Complex Big Data Systems*. 3 credits.

Explores the requirements, design, organization, and management of large data analytics ("Big Data") projects, including architecture of data analytics systems, roles of Data Scientists and Data Analytics Project Managers, tools and methods for conducting data analytics research, and data governance, security, curation, privacy, and legal issues. Includes review of case studies from social media, government, and industry, definitions and concepts, and communication requirements. Principles, explained and demonstrated, are applied by students to case study based projects and individual assignments/labs. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Admission to a graduate program in Applied IT or Health Informatics, or permission of the instructor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

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Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 624: Knowledge Mining from Big-Data. 3 credits.

Introduction to methods and tools related to knowledge mining/representation/visualization, and annotation and retrieval for Big-Data Applications from an applied perspective with the focus on emerging research problems. This course combines survey lectures with in-depth presentation of relevant issues through seminars, and hands-on experience using existing technologies and public data sources. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

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Schedule Type: Lecture

Grading:

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

AIT 631: Advanced Decision Making in IT Ventures. 3 credits.

The course provides students with an understanding of decision making processes and methodologies needed to successfully run IT companies. Topics include: assessment of IT ideas and investments; measuring IT investments performance; forecasting methods; multi-criteria information technology decision making methods; decision support systems; value analysis and benefit/risk methodologies. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: IT 496 or equivalent.

Registration Restrictions:

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Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 636: Interpretable Machine Learning. 3 credits.

One of the most common tasks performed by data scientists and data analysts is prediction and machine learning. Machine learning combines advanced topics in statistics, probabilities, linear algebra, and calculus to design mathematical models that learn from data or experience to solve new problems. Computers usually do not explain their predictions which is a barrier to the adoption of machine learning. This course focuses on making the decisions from algorithms more understandable for humans. In other words, making machine learning models and their decisions interpretable. This course covers simple, interpretable models such as decision trees, decision rules and linear regression. It also covers general model-agnostic methods for interpreting black box models like feature importance and model settings. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

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Schedule Type: Lecture

Grading:

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AIT 642: Interaction Design and Accessibility. 3 credits.

The overarching objective of the course is to help students to learn how to design interactive tools. The class aims at helping students to learn which specific application areas remain unexplored in the frontier of Human-Centered Computing. Students will learn core theoretical foundations and the practical skills that have been developed in the fields of Human-Computer Interaction. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

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Schedule Type: Lecture

Grading:

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

AIT 650: Distributed Systems and Overlay Networking. 3 credits.

This graduate level seminar examines advanced networking research topics and potential applications, including distributed systems, peer-to-peer and overlay net workings, routing, protocols, replication strategies, tree formation, resource sharing, fault tolerance, and network modeling. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Thorough understanding of computer networking, IP and TCP protocols, congestion control, queuing, and addressing and routing mechanisms.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

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

AIT 655: Project Management Concepts and Methods. 3 credits.

This course provides knowledge of industry standard methodologies and best practices utilized by IT professionals for managing technical projects in organizations. The course will have a focus on the project planning process including methods for creating successful project plans, efficient and accurate project scheduling, cost determination, resources evaluation and allocation, constraints definition, integration planning and risk assessment. It will provide a thorough understanding of the project development and implementation methods to include problem solving strategies, conflict resolution techniques, change management, quality management and effective team management. Throughout the course the students will learn, analyze and hold discussions on current and impending project management practices, tools and methodologies. This is a highly interactive course and active course participation will be required from all students. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

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

AIT 660: Cyber Security Fundamentals. 3 credits.

Introduces fundamental security principles and real-world applications of cyber security. Topics covered in the course include access control, common classes of attacks, monitoring, attack and intrusion detection, basic cryptography, computer security models, legal and privacy issues, and risk analysis. The course also provides students with opportunities to gain hands-on experience with several security tools (e.g., protocol analyzers). Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the following colleges:

- College of Science
- Engineering Computing
- Schar School of Policy and Gov
- University (Provost)

Schedule Type: Lecture

Grading:

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

AIT 664: Information: Representation, Processing and Visualization. 3 credits.

The course explores basic concepts to understand and analyze the design of information systems, and focuses on conceptual understanding of data, information, and knowledge, boundaries in representing and processing information for humans and machines, information theory, and basic techniques to organize, structure, and interact with the information through visualization. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: AIT 524 or permission of department.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing or University (Provost) colleges.

Schedule Type: Lecture

Grading:

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

AIT 665: Managing Information Technology Programs in the Federal Sector. 3 credits.

This case-study and research seminar introduces students to the unique complexities of acquisition in the Federal Sector including Congressional and Executive Branch oversight and reporting. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Permission of instructor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Seminar

Grading:

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

AIT 669: *Advanced Information Security Risk Management*. 3 credits.
This course is intended to introduce students to advanced concept and principles of information security risk management, with application to organizational operations (including mission, functions, image, reputation), organizational assets, individuals. As an advanced course, it will cover technical concepts as well as managerial, strategic and policy topics. The purpose of the course lectures, assignments, reading, in-class presentations, and examinations are to ensure students have sufficient technical awareness and operational knowledge that will enable them to apply information security policy and risk management in real-life situations. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Required Prerequisites: AIT 660^{B-} or CYSE 610^{B-}.

^{B-} Requires minimum grade of B-.

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

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

AIT 670: *Cloud Computing Security*. 3 credits.
Offers a survey of security and privacy issues in Cloud Computing systems, along with an overview of current solutions and available technologies. Examines cloud computing models and threat model and security issues related to data and computation outsourcing, and explores practical applications of secure Cloud Computing. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: AIT 542.

Registration Restrictions:

Required Prerequisites: (AIT 660^{B-} or CYSE 610^{B-}).

^{B-} Requires minimum grade of B-.

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 671: *Information System Infrastructure Lifecycle Management*. 3 credits.
Examines information system infrastructure lifecycle management including the audit process, IT governance and best practices, system and infrastructure control, IT service delivery and support, protection of information assets, physical security, business and disaster recovery. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Registration in MS, Applied IT program or permission of Instructor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 672: *Identity and Access Management*. 3 credits.
Provides a hands-on in-depth description of the principles, concepts, and technology of Identity Management. Topics include digital identity, credentials, authentication, authentication protocols, trust frameworks, cryptography and digital signatures, identity tokens (smart cards), and smart card-based identity verification and authorization applications. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Admission into MS AIT program or permission of instructor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 673: *Cyber Incident Handling and Response*. 3 credits.

Examines Computer Emergency Response Team (CERT), including Incident Response, Vulnerability Assessment, Incident Analysis, Malcode Analysis, Forensics and Investigations. Includes exercises in CERT operations and a final Incident Handling project. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: AIT 670 or permission of instructor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 674: *Research, Development and Technology in the Intelligence Community*. 3 credits.

Provides overview of research, development and engineering components of agencies within U.S. Intelligence Community, how they prioritize research and deliver products used in collection, processing, and dissemination of information. Examines different types of technical intelligence and related phenomenologies employed in their collection. Highlights evolution of technologies used in gathering and discusses new and emerging trends in intelligence collection and analysis. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 675: *Overview of the National Intelligence Community*. 3 credits.

Introduces structure and basic operations of the U.S. national intelligence community (IC). Students learn general information about organization, structure and missions of the IC and about the tools and techniques employed by intelligence agencies of the U.S. and other intelligence services. Surveys the range of intelligence problems and challenges, types of data and data collectors employed, and how information is processed, analyzed, and disseminated. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

computing/school-computing/information-sciences-technology/). May not be repeated for credit.

Recommended Prerequisite: Admission into the MS-AIT degree program or permission of instructor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 676: *Intelligence Technologies, Research and Development in the Intelligence Community*. 3 credits.

Overview of R & D and engineering components of agencies within U.S. Intelligence. Describes: process by which these agencies prioritize research and deliver products to collect, process and disseminate information; types of technical intelligence and the related phenomenologies employed in their collection; evolution of technologies used in gathering, and; discusses new and emerging trends in intelligence collection and analysis. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Admission into the MS-AIT degree program or permission of instructor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 677: *Intelligence Analysis Methods*. 3 credits.

Presents various intelligence analysis methods addressing basic topics: substance-blind analysis of evidence and its credentials, chain of custody analysis, combination of evidence, divide and conquer paradigm for analysis, sources of uncertainty, competing hypotheses and analyses. Discusses case studies in various domains following a hands-on approach using educational analysis tools. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: AIT 524.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 678: National Security Challenges. 3 credits.

Presents the process by which decision makers identify and prioritize intelligence problems and allocate collection and analysis resources to their solutions. Discusses nation-state issues such as Russia, China, and Iran, and transnational issues such as terrorism, weapons proliferation, narcotics and smuggling, and cyber conflict and the intelligence shortcomings and needs in regard to these problems. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Admission into the MS-AIT degree program or permission of instructor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 679: Law and Ethics of Big Data. 3 credits.

Course examines key ethical and legal issues for entry level professionals in data science and analytics. Topics include Intellectual Property, Privacy, Algorithm Bias, Free Speech, and Commercial data exploitation. Students will examine and discuss case studies and assigned readings on these topics, examine the ethical basis and practices of Big Data Analytics. Students will be expected to identify and report on technical, legal, and ethical issues with the use of big data and to discuss the appropriate laws, policies, and ethical frameworks which might be used to resolve them. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Admission to the MS, AIT program or permission of instructor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 680: Social Media in Homeland Security Operations. 3 credits.

Overview of social media uses by Homeland Security agencies and U.S. adversaries, in both active and passive modes, including recruitment and disinformation. Examines regulations and laws governing social media usage. Explores future technological developments. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Registered students in Homeland Security Information Systems and Cyber MS or permission of Instructor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 681: Secure Software Development. 3 credits.

Provides secure software development approaches for putting software security principles into practice and addressing software-induced security risk by studying software security fundamentals and software security best practices. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Required Prerequisites: AIT 542^{B-} or 542^{XS}.

^{B-} Requires minimum grade of B-.

^{XS} Requires minimum grade of XS.

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 682: *Network and Systems Security*. 3 credits.

Introduces the principles and practices of cryptography, network security, and secure software by covering security policies, models, and mechanisms for secrecy, integrity, and availability; basic cryptography and its applications; secret key cryptography; hash functions; basic number theory and public key cryptography; trusted intermediaries, and network security (firewalls, IDS, IPsec, and SSL) etc. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: AIT 660.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing or University (Provost) colleges.

Schedule Type: Lecture

Grading:

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

AIT 684: *Interactive Visualization and Data Analytics*. 3 credits.

The course is designed for students who aim at understanding core theoretical concepts and practical skills that a broader data science community share when (1) collecting and processing data in a scalable way, (2) creating cognitively efficient interactive visualization, (3) formulating statistical testing and conducting analysis, and (4) topics in interactive ML. The course is suitable for students who aim at establishing their background as data scientists, quantitative researchers, marketers, and other relevant roles. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

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

AIT 685: *Capstone Seminar*. 3 credits.

Student team-based experience grounded on solid understanding of the proceeding nine courses mastered in each of the program's three areas of study. Teams analyze cases of mega-system programs from the 20th Century. Notes: Course cannot be used to satisfy course requirements

for PhD IT students. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Completion of all core courses and at least nine credits of concentration courses in the program, or permission of department.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment limited to students in the EC-MS-AIT program.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Seminar

Grading:

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

AIT 686: *Capstone: Student Design Solution*. 3 credits.

Student teams examine several historical or hypothetical cases that demonstrate vulnerabilities to the homeland security of the nation. Task is to choose one case, conduct appropriate outside research, then design and brief detection/prevention/mitigation processes that can protect the nation. Must be among the last two courses attempted in the degree program. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Seminar

Grading:

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

AIT 687: *IoT and Edge Systems*. 3 credits.

This course covers the emerging Internet of Things (IoT) systems, the key enabling technologies, and their synergistic integration with edge/cloud computing platforms where various modern IoT applications are built upon. The course covers the IoT system basics, IoT architecture, AI/ML techniques for IoT, IoT Edge/Cloud Continuum, modern IoT systems such as UAV and drone technologies, and other advanced issues such as IoT data privacy issues. It includes projects on the cutting-edge research topics on IoT and edge/cloud systems. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Required Prerequisite: AIT 542^B.

^B Requires minimum grade of B-.

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

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

AIT 688: *IoT Security*. 3 credits.

This course covers the cutting-edge IoT security techniques of the emerging Internet of Things (IoT) systems. The course covers the IoT system basics, IoT security architecture, major threats and vulnerabilities with the IoT devices and edge cloud, and emerging IoT security technologies for defense and mitigation. It includes projects on both the vulnerabilities and defense of the IoT edge/cloud systems and technologies. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Required Prerequisite: AIT 660^B.

^B Requires minimum grade of B-.

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

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

AIT 690: *Advanced Topics in Applied Information Technology*. 3 credits.

Students participate actively through class dialogues and the crafting of IT solutions to specific problem areas. Notes: Course cannot be used to satisfy course requirements for PhD IT students. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May be repeated within the term.

Specialized Designation: Topic Varies

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 697: *Leading Organizations Through Change*. 3 credits.

Introduces students to the critical tools for leading organizations through sustainable change. Through selected readings, discussions, team projects, in-class activities and guest appearances, students learn how to prepare the organization, plan the details, execute a change process across an organization and measure the plan's effectiveness and the change it brings to achieve continuous improvement. Students practice and receive in-class coaching to hone their leadership skills. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Graduate Standing in MS, AIT program or permission of instructor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 699: *Research Project*. 3 credits.

Research project chosen and completed under guidance of graduate faculty member that results in technical report. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Open only to students in the MS AIT program with at least 18 credit hours of coursework prior to registration and with advisor approval.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

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

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Independent Study

Grading:

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

700 Level Courses

AIT 701: *Cyber Security: Emerging Threats and Countermeasures*. 3 credits.

The course covers the most modern and challenging cyber threats organization must defend against, and discusses existing solutions and

open research problems. Topics include, but are not limited to, advanced persistent threats, attacks on cyber physical systems, ransomware, and identity theft. Through the course, students are challenged to think about innovative solutions to address some of the most pressing open problem. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Required Prerequisites: (AIT 660^{B-} or 660^{XS}) and (AIT 512^{B-} or 512^{XS}).

^{B-} Requires minimum grade of B-.

^{XS} Requires minimum grade of XS.

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 702: Incident Handling and Penetration Testing. 3 credits.

Presents students with a principled approach to ethical hacking, and offers an in-depth analysis of the overall process, including aspects related to scanning, testing, ethically attacking, and eventually securing systems and networks. The course covers popular attack tools such as Social Engineering and DDoS, and concludes with a discussion about open challenges and current research in the area. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Required Prerequisites: AIT 660^{B-} or 660^{XS}.

^{B-} Requires minimum grade of B-.

^{XS} Requires minimum grade of XS.

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 710: Design of Learning and Educational Technologies. 3 credits.

Examines foundations, theoretical perspectives, underlying learning theories, case studies, and key enabling technologies to provide context for understanding, designing, and researching learning and educational technologies. Considers technologies for diverse areas and users including teachers, instructors, higher education and K-12 learners, and learning among informal communities of interest. Technologies demonstrations are combined with hands-on activities involving participation in multiple learning environments. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: AIT 501 or permission of department.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 711: Rapid Development of Scalable Applications. 3 credits.

Presents software engineering, programming techniques, security practices, platforms and tools necessary for rapid development of applications. Provides a survey of programming techniques and static code analysis, including security and privacy consideration throughout the application life cycle. Students work in small teams and develop or maintain scalable applications exercising risk based analysis and techniques and practices presented in the course. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Required Prerequisites: (AIT 512^{B-} or 512^{XS}) and (AIT 524^{B-} or 524^{XS}).

^{B-} Requires minimum grade of B-.

^{XS} Requires minimum grade of XS.

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 712: Applied Biometric Technologies. 3 credits.

The need for accurate automatic human identification has been increasing as people are becoming more electronically connected. Thus, the use of biometrics has spread rapidly. Identity is very valuable and the ability to establish identity is critical to many transactions. Biometric recognition has been incorporated in several high security applications such as protection of critical resources, fraud prevention and border control. This course concentrates on advantages that biometrics brings to computer security as well as on current challenging issues such as security strength, recognition rates, and privacy. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Basic knowledge of Digital Image Processing

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

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

AIT 716: *Advanced Human Computer Interaction*. 3 credits.

Covers advanced topics of Human Computer Interaction, including: (1) Definitions and motivations of HCI, interaction paradigms, design principles and models; (2) User-centered design methods, user studies, quality factors, evaluation methods and techniques for data analysis; (3) Research frontiers of HCI, accessibility, universal design, and ubiquitous computing (mobile and wearable applications). Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Engineering Computing or Schar School of Policy and Gov colleges.

Schedule Type: Lecture

Grading:

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

AIT 721: *Design of IT Artifacts, Applications and Systems*. 3 credits.

This course will introduce students to design principles and design thinking in applied information technology. Students will learn different approaches to design IT applications across a range of domains. Students will learn how to approach design of systems for large organizations and also for individuals. Students will learn about the interdisciplinary nature of design and get introduced to influential designers. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Enrollment in the IST concentration of the PhD in IT program and AIT 501, or permission of department.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 722: *Theories and Models in Geo-Social Data Analytics*. 3 credits.

This course introduces a broad spectrum of theories, conceptual models, machine learning, and computational modeling that are used in and related to geospatial and social data. Course contents include discussions of, and hands-on exercise with, geo-social data analytics, map-based visualization, community dynamics models, smart cities theories, and GIS-based system development. This course aims to help students grow as IT professionals who can (1) understand critical issues in smart and connected communities (S&CC), (2) combine data-driven approaches in understanding and addressing the problems, and (3)

communicate the geographically-embedded social patterns based on data analysis results through visualizations and interactive systems. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Programming (Python or R); Statistics

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

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

AIT 724: *Data Analytics in Social Media*. 3 credits.

Introduce the necessary theories and the state-of-the art techniques in Web mining, network analysis, information retrieval, and predictive modeling to study emerging problems with social media. These problems include information diffusion, recommendations, behavior analysis, and event analytics in social media. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Registration Restrictions:

Required Prerequisites: AIT 664^{B-} or 664^{XS}.

^{B-} Requires minimum grade of B-.

^{XS} Requires minimum grade of XS.

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 726: *Natural Language Processing with Deep Learning*. 3 credits.

This is an advanced course in natural language processing (NLP). It explores deep learning methods in NLP. Topics covered include feedforward neural nets as applied to NLP and deep networks for NLP applications. Class reviews language structure and studies context free grammars, dependency parsing, semantic role labeling along with applications such sentiment classification and information extraction. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Python programming. Statistics or probability. Machine learning.

Registration Restrictions:

Required Prerequisite: AIT 526^B.

^B Requires minimum grade of B.

Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

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

AIT 734: *Advanced Web Analytics Using Semantics*. 3 credits.

Covers a range of current practices for metadata extraction, knowledge discovery from big complex data, as well as knowledge representation and reasoning. This course discusses Data Modeling issues in Web Information Systems and Internet of Things (IoT) Web Semantics. Current trends and open problems are also covered in this course. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: AIT 582, 624.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:

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

AIT 736: *Applied Machine Learning*. 3 credits.

Machine learning as a field is now incredibly pervasive with several applications such as homeland security face recognition, self-driving car, social media, bioinformatics, etc. This course provides a broad introduction to machine learning, deep learning, and statistical pattern recognition. It introduces interdisciplinary machine learning techniques such as statistics, linear algebra, optimization, and computer science to create automated systems able to make predictions or decisions without human intervention. This class will familiarize students with a broad cross-section of models and algorithms for machine learning, and prepare students for research or industry application of machine learning techniques. The course also provides students with opportunities to gain hands-on experience with several machine learning tools. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Basic knowledge of probability theory, statistics, linear algebra and programming.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

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

AIT 746: *Applied Deep Learning*. 3 credits.

Using machine learning in real-world problems often requires more skills than those needed to apply machine learning in academic problems. It is common, for instance, that the number of labeled samples is small but abundance of unlabeled samples is available or the number of labeled samples from different classes are extremely imbalanced. It is sometimes possible to use an already trained machine in a different domain. A machine could take advantage of external pieces of knowledge, in addition to labeled data to make more accurate predictions. In addition, not all real-world problems fit in a straightforward classification or regression problem, such as finding anomalies or outliers among data, especially streaming data. Besides aforementioned topics, this course will familiarize students with deep learning, reinforcement learning, multi-classifiers, genetic algorithms, and clustering textual documents. Among other evaluation criteria, this course entails a heavy experimental project. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May not be repeated for credit.

Recommended Prerequisite: Familiarity with Python.

Registration Restrictions:

Required Prerequisites: (AIT 636^{B-}, 636^{XS}, 736^{B-}, 736^{XS}, CS 504^{B-} or 504^{XS}).

^{B-} Requires minimum grade of B-.

^{XS} Requires minimum grade of XS.

Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

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

AIT 790: *Advanced Special Topics in Applied Information Technology*. 3 credits.

This course covers doctoral-level topics of interest not routinely covered by existing courses. Course material may be chosen from various areas of applied information technology. Students are expected to participate actively through class dialogues and the crafting of IT solutions to specific problem areas. This course may be repeated for credit when subject differs. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May be repeated within the degree for a maximum 6 credits.

Recommended Prerequisite: Permission of instructor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

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

AIT 799: Master's Thesis. 1-6 credits.

Research project chosen and completed under guidance of graduate faculty member that results in a thesis manuscript and a presentation accepted by a committee of three faculty members. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May be repeated within the degree for a maximum 6 credits.

Recommended Prerequisite: Open only to students in the MS AIT program with at least 18 credit hours of coursework prior to registration and with advisor approval.

Registration Restrictions:

Required Prerequisite: AIT 699^B.

^B Requires minimum grade of B.

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

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the Engineering Computing college.

Schedule Type: Thesis

Grading:

This course is graded on the Satisfactory/No Credit scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

800 Level Courses

AIT 800: Applied Information Technology Colloquium. 1 credit.

Students attend a series of colloquia including talks by distinguished speakers, faculty candidates and Mason faculty. Topic areas include research advances in technology, its application, and policy issues.

Notes: Students must attend a minimum of three events per semester to earn one credit in this course. PhD INFT students with a concentration in Information Science and Technology must complete at least two credits of AIT 800. Offered by Info Sciences & Technology (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>). May be repeated within the degree for a maximum 3 credits.

Recommended Prerequisite: Completion of AIT Core and at least 6 credits of AIT Field Requirements in PhD program.

Schedule Type: Seminar

Grading:

This course is graded on the Satisfactory/No Credit scale. (<http://catalog.gmu.edu/policies/academic/grading/>)