CIS/Busan 490. Special Studies in Computer Information Systems or Business Analytics. 1-3 credits.
An advanced course in information and/or business analytics designed to give qualified students an opportunity to complete independent study under faculty supervision. Prerequisites: Senior standing, recommendation of the instructor and written approval of the department head prior to registration.

CIS 498. Special Topics in Computer Information Systems. 3 credits.
An advanced course designed to allow exploration of current topics in computer information systems. Course content will vary. See adviser for current content. Prerequisite: Permission of the instructor.

CIS 499. Honors. 6 credits.
Year course. See catalog section “Graduation with Honors.”

Computer Science
Department of Computer Science

CS 110. Introduction to Computer Professionalism and Ethics. 1 credit.
Seminar for first year students and transfer students focusing on professional and ethical issues in computer science. Topics include computer science degree requirements, the computer science profession, ethics of computing professionals, protection of software, Internet security and privacy issues, and current issues in computer science.

CS 139. Programming Fundamentals (3, 2). 4 credits.
Students learn fundamental problem-solving techniques using a modern programming language. This course covers the same material as CS 149, but at a slower pace for students with little or no programming experience. Students may not receive credit for both CS 139 and CS 149.

CS 159. Advanced Programming. 3 credits.
Students use advanced problem-solving strategies to develop algorithms using classes and objects and techniques such as recursion, exceptions and file I/O. This course also focuses on designing small applications and effective testing strategies. Students may not receive credit for both CS 159 and CS 149. Prerequisite: A prior programming course or equivalent experience.

CS 159A. Advanced Programming. 3 credits.
Students use advanced problem-solving strategies to develop algorithms using classes and objects. Students also learn how to implement and use elementary data structures, including character strings, records, files, stacks and queues. Prerequisite: A grade of "C-" or better in CS 139 or CS 149 or equivalent.

CS 227-228. Discrete Structures I-II. 3 credits each semester.
An introduction to discrete mathematical structures including functions, relations, sets, logic, matrices, elementary number theory, proof techniques, basics of counting, graph theory, discrete probability, digital logic, finite state machines, integer and floating point representations. Prerequisite for MATH/CS 227: MATH 155 or MATH 156 or sufficient score on the Mathematics Placement Exam. Prerequisite for MATH/CS 228: MATH/CS 227.

CS 239. Advanced Computer Programming (3, 2). 4 credits.
Students use various advanced problem-solving strategies to develop algorithms using classes and objects. Students also learn how to implement and use elementary data structures, including character strings, records, files, stacks and queues. Prerequisite: A grade of "C-" or better in CS 139 or CS 149 or equivalent.

CS 240. Algorithms and Data Structures. 3 credits.
Students learn to implement and analyze elementary data structures and the basic complexity classes of algorithms that use strategies such as greedy algorithms, divide-and-conquer algorithms and backtracking algorithms. This analysis is especially applied to problems in searching, sorting and parsing. Prerequisite: Grades of "C-" or better in CS/MATH 227 or MATH 231 or equivalent and either CS 159 or CS 239.

CS 252. Discrete Structures. 3 credits.
Introduction to the mathematical structures used in computer science. Topics include logic and set theory, algebraic structures, automata theory and computability. Prerequisite: A grade of "C-" or better in CS 139 or CS 149.

CS 260. Technical Communication for Computer Scientists. 3 credits.
An introduction to the process of planning, researching, producing, and revising technical documents attuned to specific audiences in the computing industry. Document forms studied include definitions, correspondence, descriptions, specifications, instructions, proposals, reports, resumes, and plans.

CS 274. Introduction to Databases. 3 credits.
Students learn how to design and implement a normalized relational database. Emphasis is on the practical construction of an interactive database using graphical user interfaces and report generation.

CS 280. Projects in Computer Science. 1-3 credits.
Projects or topics in computer science which are of interest to the lower division student. May be repeated for credit when course content changes. Topics may vary. Prerequisite: Students should consult the instructor prior to enrolling for the course.

CS 330. Societal and Ethical Issues in Computing. 3 credits.
Overview of philosophical and professional ethics, and a survey of societal and ethical issues in computing such as privacy, intellectual property, computer security, computer crime, product liability, and the societal, environmental, and economic impact of computers. Students develop skills in assuming and defending positions on societal and ethical issues through oral presentations and written reports.

CS 340. Assembly Language Programming. 3 credits.
Principles of assembly language programming. Assembly language contrasted with machine language. Assembly directives, conditional assembly and macros. Design of a two-pass assembler. The material in this course is useful for those interested in machine design, operating systems, embedded computer systems and microcontrollers, and other areas which require low-level knowledge of computer operation. Prerequisite: A grade of "C-" or better in CS 139 or CS 149.

CS/ISAT 344. Intelligent Systems. 3 credits.
In-depth introduction to current and future intelligent systems, including expert systems, neural networks, hybrid intelligent systems, and other intelligent system technologies and their development, uses and limitations. Prerequisites: CS 239, CS 159 or ISAT 340.

CS/ISAT 345. Software Engineering. 3 credits.
Study of means for the development and maintenance of high quality software products delivered on time and within budget. Topics include requirements analysis and specification, software design, implementation, testing, maintenance, project management, ethics and the responsibilities of software engineering professionals. Prerequisites: CS 139, CS 149 or ISAT 340 with sophomore standing in the ISAT major.

CS 347. Web-Based Information Systems. 3 credits.
This course covers the design and development of applications intended for deployment over the World Wide Web. Students will examine Web protocols, the architecture of Web-based applications, the languages and facilities with which they are developed, and related issues such as security and reliability. Students will also work in teams using a representative suite of development tools and languages to design and construct a simple client/server application that includes a GUI and a database interface. Prerequisites: Grades of "C-" or better in CS 345 and either CS 159 or CS 229.

CS 349. Developing Interactive Multimedia. 3 credits.
Students learn the concepts of multimedia, the issues in designing multimedia to interact effectively with users, the performance and speed issues in designing multimedia, and how to implement interactive multimedia applications. Prerequisites: A grade of "C-" or better in CS 240.

CS 350. Computer Organization. 3 credits.
Students learn how a computer works by examining hierarchical computer organization, data representation, instruction set architectures, addressing techniques, interrupt handling, and digital hardware design. Emphasis is placed on the interface between hardware and software, as well as the development of low-level software. Prerequisites: MATH 235 or equivalent, and grades of "C-" or better in CS/MATH 227 and CS 159 or CS 239.

CS 354. Introduction to Autonomous Robotics. 3 credits.
A hands-on introduction to programming autonomous mobile robots. The focus of this course is on designing robotic systems that navigate independently in complex environments. Specific topics include localization, mapping, kinematics, path planning and computer vision. Prerequisite: A grade of "C-" or better in CS 240.

CS 402. Introduction to Information System Security. 3 credits.
This course provides an introduction to the design and management of operating systems and networks, focusing on those aspects that affect information security. It provides students with the skill or ability to design, execute and evaluate information system security procedures and practices. This course does not satisfy any requirements for majors or minors in computer science. Prerequisite: A grade of "C-" or better in CS 139, CS 149 or equivalent.

CS 403. Information Systems Security Management. 1 credit.
This course covers the basic material needed to maintain an information system. Topics covered include: granting final approval to operate, accreditation of the system and verifying compliance with stated policies and procedures. This course does not satisfy any requirements for majors or minors in Computer Science. Prerequisite: A grade of "C-" or better in CS 402 or CS 457.
CS 404. Information System Security Administration. 1 credit.
This course prepares a student to ensure information systems and networks are used securely, to identify and report security incidents, to maintain configuration control of systems and software, and to identify and analyze threats to security. This course does not satisfy and requirements for majors or minors in Computer Science. Prerequisite: A grade of "C-" or better in CS 402 or CS 457.

CS 405. Information System Security Operations. 1 credit.
This course covers the basic material needed by information system security officers to protect their information systems. Topics covered include: certification, accreditation, site security policy, security policy enforcement and security reporting. This course does not satisfy any requirements for majors or minors in computer science. Prerequisite: A grade of "C-" or better in CS 402 or CS 457.

CS 406. Assessment of Secure Information Systems. 1 credit.
This course considers the assessment of the technical and non-technical security features of an information system in an operational configuration. Upon completion of the course, students should be able to identify the assurance levels achieved in meeting all applicable security policies, standards and requirements. This course does not satisfy any requirements for majors or minors in computer science. Prerequisite: A grade of "C-" or better in CS 402 or CS 457.

CS 430. Programming Languages. 3 credits.
Several actual programming languages are studied in terms of the fundamental principles of computer programming language design, including object-oriented programming, functional programming, concurrent programming and logical programming. Prerequisites: Grades of "C-" or better in CS 240 and CS 350.

CS 442. Logic in Computer Science. 3 credits.
An exploration of some of the many connections between logic and computing, such as the application of classical and temporal logic in program verification, logic and logic programming, decidability, computability, automatic theorem proving, the computational complexity of logic algorithms, and applications of logic in artificial intelligence. A course in discrete mathematics or logic is recommended as preparation for this course. Prerequisite: Junior or senior standing.

CS 444. Artificial Intelligence. 3 credits.
Students will study the history, premises, goals, social impact and philosophical implications of artificial intelligence. Students will study heuristic algorithms for large state spaces and learn to develop recursive and non-deterministic algorithms. Prerequisite: A grade of "C-" or better in CS 240.

CS 446. Software Analysis and Design. 3 credits.
Contemporary software analysis and design methods, tools, notations, techniques, processes, principles and practices. Students solve analysis and design problems alone or in teams and present their work to their peers and the instructor. Prerequisites: Grades of "C-" or better in CS 240 and CS 346.

CS/ISAT 447. Interaction Design. 3 credits.
Study of and practice with processes, principles, tools, models and techniques for designing interactions between humans and digital products and systems. Topics include physiological and psychological factors affecting interaction design, interaction design processes, interaction models, styles, and paradigms, design notations and representations, prototyping, and interaction design evaluation. Prerequisite: Junior standing.

3 credits each semester.
Numerical solutions and error analysis of typical problems such as finding zeros of nonlinear functions, solving systems of linear and nonlinear equations, interpolation, approximation, integration, solving ordinary differential equations, optimization, and Monte Carlo methods. Prerequisites for CS/MATH 448: MATH 237, MATH 238 and MATH 249. Prerequisites for CS/MATH 449: CS/MATH 448 and MATH 338.

CS 450. Operating Systems. 3 credits.
Introduction to the design and implementation of modern operating systems. Explores fundamental concepts of operating systems, concurrency and synchronization, memory management, file systems, and system protection mechanisms. Course work includes a significant programming component. Prerequisites: Grades of "C-" or better in CS 240 and CS 350.

CS/MATH 452. Design and Analysis of Algorithms. 3 credits.
An introduction to the analysis, design and theory of algorithms. Algorithms studied will be selected from searching, sorting and graph theory. Included are elements of counting, recurrence relations, direct and indirect proofs, recursion, complexity classes, language theory, decidability and undecidability. Prerequisites: CS/MATH 228 and CS 240.

CS 454. Internship in Computer Science. 1-3 credits.
An advanced course to give supervised practical experience in a professional computing environment. May be taken multiple times for credit, but no more than three credits may be used in the computer science program graduation requirements. Prerequisites: Junior standing, major in computer science and permission of the instructor.

CS 457. Information Security. 3 credits.
This course covers the basic issues of information system security. The roles of planning, management, policies, procedures, and personnel in protecting the confidentiality, integrity and availability of information are described. Specific threats (malicious code, network attacks and hostile content) and widely used countermeasures (access control, mechanisms, firewalls, intrusion detection systems) are also discussed. Corequisite: A grade of "C-" or better in CS 450.

CS 458. Cyber Defense. 3 credits.
A hands-on, lab-based learning experience in which the students engage in a series of mini projects to perform security assessment, penetration testing and hardening of networked systems. Students also participate in a cyber defense exercise. Prerequisites: Grades of "C-" or better in CS 457 and CS 460.

CS/ISAT 460. TCP/IP Networks. 3 credits.
An overview of Local Network hardware, LAN topology and design, and LAN protocols. Includes installation and management of network operating systems and TCP/IP services (address management, name management, file and print sharing, account management). Prerequisite: CS 350 or CS/ CIS 320 or equivalent.

CS/ISAT 461. Internetworking. 3 credits.
Wide Area Network (WAN) and Metropolitan Area Network (MAN) design. Audio, voice, data and TV transmission over ATM/B-ISDN networks. The SONET signal hierarchy and Q3 standard interface model. Network security. Performance analysis of a given network. Prerequisite: CS/ISAT 460.

CS/ISAT 462. Network Applications Development. 3 credits.
Design and implementation of network-based applications using languages and architectures such as sockets, JAVA, TAI and CORBA. Concepts in distributed processing, including synchronization of interprocess communication and management of replicated data. Analysis of performance issues related to distributed applications. Prerequisites: CS/ ISAT 460 and either CS 159, CS 239 or CIS 344.

CS/ISAT 463. Network Analysis and Design. 3 credits.
In-depth introduction to the techniques and tools used to design and analyze computer and telecommunications networks. Overview of issues related to network performance, including the impact on cost, reliability and security. Addresses complex business concepts and issues in the telecommunications industry. Explores the interrelation of the economics of the telecommunications industry with ensuing social, ethical and security issues. Discusses topics in product and service creation, marketing, customer service and billing, and electronic commerce. Prerequisites: CIS 320, SMAD 356, and ISAT 340 or equivalent.

CS 474. Database Design and Application. 3 credits.
Students study database design and management with emphasis placed on data definition languages, data manipulation languages, query languages and management of the database environment. Prerequisite: Grades of "C-" or better in CS 345 and either CS 159 or CS 239 or equivalent.

CS 475. Distributed Database Management. 3 credits.
Students learn the concepts of client-server architectures and other aspects that arise in the design of distributed database systems. Prerequisite: A grade of "C-" or better in CS 474.

CS 476. Database Administration. 3 credits.
Students learn to administer a database by manipulating physical and logical components of a database management system. Topics include creation of an instance, managing of tables, indexes, privileges, profiles and roles. Prerequisite: A grade of "C-" or better in CS 474.

CS 490. Selected Topics in Computer Science. 1-3 credits.
Topics in computer science which are of interest but not otherwise covered in the regular computer science offerings of the department. Offered only with the approval of the department head; may be repeated for credit when course content changes. Prerequisite: A grade of "C-" or better in CS 159 or CS 239. Topics selected may dictate further prerequisites; students should consult the instructor prior to enrolling for credit.
CS 482. Selected Topics in Information Security. 1-3 credits.
Topics in information security. Offered only with the approval of the department head; may be repeated for credit when course content changes. Prerequisites: Grades of "C-" or better in CS 240 and CS 350. Topics selected may dictate further prerequisites; students should consult the instructor prior to enrolling for the course.

This course develops a computer graphics application package based on standard graphics functions as well as attributes of a graphical user interface. It includes experience in applying interactive computer graphics techniques to industrial problems. Prerequisites: Grades of "C-" or better in CS 240 and CS 350.

CS 497. Independent Study. 1-3 credits.
An advanced course to give independent study experience under faculty supervision. May be taken multiple times for credit, but no more than three credits may be used in the computer science program graduation requirements. Prerequisites: Junior standing, major in computer science and permission of the program coordinator.

CS 499. Honors. 6 credits.
Year course. See catalog section “Graduation with Honors.”

Continuing Education

Outreach and Engagement

CE 485. Conversational Spanish. 3 credits.
This intensive introductory course aims to develop elementary Spanish skills in a conversational environment using Rosetta Stone Software. It is an online only course which is not available to JMU undergraduate students.

CE 490. Special Studies in Continuing Education. 1-3 credits.
This course is designed to allow exploration of current topics of interest including various trends and issues in a given field of study.

Criminal Justice

Department of Justice Studies

CRJU 215. Introduction to Criminal Justice. 3 credits.
An introduction to the development of the American criminal justice system from early English beginnings to the present in its three dimensions: police, courts and corrections.

CRJU 225. Ethics in Criminal Justice. 3 credits.
This class offers an overview of ethical issues in the various branches of the criminal justice system, and reviews approaches to establishing and using ethical practices. Prerequisite: CRJU 215.

CRJU 301. Special Topics in Criminal Justice. 3 credits.
This course provides an examination of topics that are of current interest in the field of criminal justice. The class may be repeated for credit when course content changes. Prerequisite: CRJU 215.

CRJU 321. Criminalistics. 3 credits.
This course introduces student to crime scene investigation and the major disciplines of modern forensic science. Topics include an examination of the historical background of forensic science in the criminal justice system, an assessment of general principles of the current practice of forensic science, examination of the role of expert testimony and likelihood interaction(s) of the forensic scientist with other individuals and components of the criminal justice system. Prerequisite: CRJU 215.

CRJU/SOCI 325. Criminology. 3 credits.
Study of the extent, causes and possible deterrents to crime including murder, assault, white-collar offenses and organized crime with attention to the role of the victim and policy implications.

CRJU 328. Criminal Procedure. 3 credits.
Study of the criminal justice process from arrest through appeal with emphasis upon the rights of the accused including due process, the right to counsel, search and seizure, and the privilege against self-incrimination. Prerequisite: CRJU 215.

CRJU 329. Criminal Investigation and Evidence. 3 credits.
Characteristics, legal aspects, organizational aspects, theories and systematic procedure of criminal investigation. Includes a survey of the investigative function, interviewing witnesses, interrogation, physical evidence, the investigation of common serious offenses and the principles of evidence, including the legal rules controlling the presentation of evidence in court.

CRJU 335. Law Enforcement. 3 credits.
This course provides students with an overview of the practice of law enforcement, the legal and social issues associated with this work in the United States. Prerequisite: CRJU 215.

CRJU 337. Courts and the Judiciary. 3 credits.
This class offers students an in depth introduction to the workings of the Court system in the United States. Prerequisite: CRJU 215.

CRJU 340. Administration of Justice. 3 credits.
This course is designed to identify unique challenges to administrators of criminal justice organizations. The structures, functions, and processes in the administration of criminal justice organizations is examined. Topics of interest include a variety of public management theories, the role of leadership, and communication as it relates to criminal justice organization. Prerequisite: CRJU 215.

CRJU 401. Internship in Criminal Justice. 3 credits.
This course allows students to receive academic credit for work experienced in an agency or organization related to the criminal justice minor. Students should consult the director of the criminal justice minor for assistance in arranging approved internships. Prerequisites: CRJU 215 and permission of the instructor.

Cross Disciplinary Studies

Office of Cross Disciplinary Studies

CDS 301. Special Topics. 1-3 credits.
This course allows instructors working through recognized university centers or institutes to offer an examination of current topics that are cross disciplinary in nature and not covered elsewhere in the curriculum. The course may be repeated for credit when course content changes.

CDS 401. Internship. 1-3 credits.
This course allows students to receive academic credit for work experienced in a recognized JMU center or institute. Internships must be approved in advance by the center director and follow the guidelines established by the participating center or institute. Internship is granted at the discretion of the center director. Prerequisites: Junior or senior standing and permission of the director.

Dance

School of Theatre and Dance

DANC/THEA 100. Theatre and Dance Colloquium. 0 credits.
Weekly department colloquium; work in progress presented, viewed and discussed by student body, faculty, and guests. Professionals in the field frequently hold master classes. All majors in the School of Theatre and Dance are required to enroll in and pass six semesters in order to meet program graduation requirements. Prerequisite: Admission to the School of Theatre and Dance.

DANC 110. Associate Group Dance Repertory I (0, 4). 1 credit.
Introduction to group dance experiences through rehearsal, performance, dance technique training and technical theatre practice. Prerequisites: Permission of the instructor and concurrent enrollment in a dance technique course.

DANC 142. Elementary Ballet (0, 4). 2 credits.
Emphasis on modern dance technique and fundamentals of improvisation and choreography. May be repeated for credit.

DANC 143. International Folk Dance (0, 4). 2 credits.
Traditional folk dance steps and international folk dances. Emphasis on dances from eastern and western Europe, Mexico and Israel. May be repeated for credit.

DANC 144. Ballroom Dance (0, 4). 2 credits.
Ballroom dance skills including steps, styling and leading, and following for American and Latin ballroom dance forms. May be repeated for credit.

DANC 146. Jazz Dance (0, 4). 2 credits.
Fundamentals of jazz technique, basic vocabulary and combinations. May be repeated for credit.

DANC 147. Tap Dance (0, 4). 2 credits.
Fundamentals of tap dance, basic vocabulary and combinations. May be repeated for credit.

DANC/THEA 171. Performance Production. 3 credits.
An introduction to the methods of the production of scenery, properties, costumes, lighting, sound and performance management for theatre and dance performance. Instruction in the skills required for the operation of associated tools and equipment and instruction in the skills required for the operation of