COURSE DESCRIPTIONS FOR COMPUTER SCIENCE

The Department of Mathematics and Computer Science requires that, prior to enrolling in any departmental course, students should earn a grade of "C" or better in all course prerequisites.

CSDP 100 Computer Science Orientation Credit 1
This course is a survey of Computer Science with special emphasis on topics of importance to computer scientists. It also provides an exploration of skills required and resources available to students majoring Computer Science. Topics include nature of problems, hardware, human factors, security, social, ethical and legal issues, familiarization of various aspects of computing and networks. This course must be taken by all Computer Science major and minor students.

CSDP 120 Introduction to Computing Credit 3
This course is for students new to Computer Science. The goal is to introduce students to different general computing aspects of the computer systems. Course topics include overview of the history of computing machines, computing codes and ethics, computing algorithms, programming languages, and mathematical software packages. Prerequisite: High school mathematics. CSDP 120 does not satisfy the General Education Area III Requirement.

CSDP 121 Microcomputer Applications Credit 3
This course is designed for non-technical majors in different applications of modern computing systems. The course surveys computing hardware and software systems and introduces students to the present state-of-the-art word processing, spreadsheet, and database software. Applications to other disciplines, such as medicine, administration, accounting, social sciences and humanities, will be considered. Prerequisite: High School Mathematics. CSDP 121 does not satisfy the General Education Area III Requirement.

CSDP 150 Office Automation Workshop Credit 1
This course is an introduction to current progress in word processing and/or office automation. The course involves considerable hands-on work with current equipment. This course may be repeated (with different topics) for a maximum of six credits. Prerequisite: Variable, depending on topic selected. CSDP 150 does NOT satisfy the General Education Area III Requirement.

CSDP 151 Special Software Workshop Credit 1
This course is an intensive introduction to various commercially available software packages, such as spreadsheet and database packages. The course involves considerable hands-on work with current software tools. The course may be repeated for a maximum of six credits. Prerequisite: Variable, depending on the topic selected. CSDP 151 does NOT satisfy the General Education Area III Requirement.

CSDP 152 Programming Techniques Workshop Credit 1
This course is an intensive introduction to special programming techniques, e.g., handling disk files on computers and writing computer-assisted instruction materials. This course involves considerable hands-on experience in the area chosen. The course may he repeated (with different topics) for a maximum of six credits. Prerequisite: Variable, depending on the topic selected. CSDP 152 does NOT satisfy the General Education Area III Requirement.

CSDP 153 Programming Language Workshop Credit 1
This course is an intensive introduction to special implementations of programming languages, e.g., hypertext and operating systems languages. The course involves considerable hands-on experience in the area chosen. This course may be repeated (with different topics) for a maximum of six credits. Prerequisite: Variable, depending on the topic selected. CSDP 153 does NOT satisfy the General Education Area III Requirement.

CSDP 154 Computer Hardware Workshop Credit 1
This course is an intensive introduction to new hardware and hardware methodology in special areas, e.g., microcomputer interaction with analogue devices, small-system data communications, etc. The course involves considerable hands-on experience in the area chosen. The course may be repeated for a maximum of six credits. Prerequisite: Variable, depending on the topic selected. CSDP 154 does NOT satisfy the General Education Area III Requirement.

CSDP 155 Computer Utilities Workshop Credit 1
This course is an intensive introduction to special computer utilities and operating systems such as OS/2, and UNIX look-alikes.

The course involves considerable hands-on experience with the utilities or systems chosen. The course may be repeated (with different topics) for a total of six credits. Prerequisite: Variable, depending on topic selected. CSDP 155 does not satisfy the General Education Requirement in Area III Requirement.

CSDP 199 Introduction to MatLab Programming Credit 3

This course introduces basic computing and programming techniques using MatLab development environment and language. This course is suitable to all STEM majors especially to students who need scientific computing. Topics covered includes: MatLab interface and environment, variables, matrices, structures and cellarrays, symbolic math ID and 2D signals, plotting, scripting and programming, standard I/O and file I/O, basic GUI. Further, the course is extended to include training on Geographical Information System-GIS. The students are trained on basic GIS skills and expected to work on read world projects. Co-requisites: Currently enrolled in or the completion of MATH 109.

CSDP 220 Introduction to Computer Programming Credit 4

This course is designed to introduce the student to computers and to programming in a high level language. Course topics include but are not limited to computer hardware, software algorithms, programming methodology, social and ethical implications of computing. The programming language Visual BASIC is used to learn input/output, arithmetic computation, and debugging of programs in the computer laboratory. Prerequisites: MATH 102 or MATH 109 or MATH 110. Students planning on continued study in Computer Science might well consider CSDP 221 instead.

CSDP 221 Introduction to Computer Programming Credit 4

The course, primarily for departmental majors, is designed to introduce the student to computers and to programming in a high level language. Course topics include but are not limited to computer hardware, software, algorithms, programming methodology, and social and ethical implications of computing. The programming language C++ is used to learn input/output, arithmetic computation, control structures, subroutines and functions, string manipulation, arrays, and pointers. Significant emphasis is placed on coding and debugging of programs in the computer laboratory. Prerequisites: MATH 109 or MATH 110.

CSDP 222 Advanced Programming Credit 4

This course covers advanced programming language features, including structured programming, top-down, and object-oriented techniques. Emphasis is placed on team projects and structured walk-throughs. Much of the work in this course involves the construction and debugging of programs that accomplish realistic applications. Prerequisite: CSDP 221.

CSDP 240 Principles of Data Programming Credit 3

This course is an introduction to the COBOL language and its business data processing environment. Topics include the six divisions: arithmetic, input/output, control statements, control-break logic, tables, and searching logic. The course is a computer lab-based course involving extensive coding and debugging of small to large programs. Prerequisite: CSDP 221.

CSDP 241 File Structures Credit 3

This course is an introduction to the theory of file structures and its applications. Topics include sequential direct, indexed sequential access methods, entry and updating techniques, and reports. The relationship between file structures and program structures is discussed with extensive program development and production. Prerequisites: CSDP 222 and CSDP 240.

CSDP 250 Data Structures Credit 3

This course covers the properties, implementation and analysis of data structures and object-oriented programming styles. Topics covered include linked lists, queues, stacks, binary trees, B-trees, graphs and heaps. Prerequisite: CSDP 222.

CSDP 301 Computer Organization and Assembly Language Programming Credit 3

This course covers the basics of computer organization with emphasis on the lower-level abstraction of a computer system, including digital logic, instruction set and assembly language programming. Topics include data representation; logic gates; simplification of logical expressions; design and analysis of simple combinational circuit, such as decoders and multiplexers, flip-flops and registers; design and analysis of simple synchronous sequential circuit, random-access and read-only memories; instruction set architecture; and programming in assembly language. Prerequisite: CSDP 222

CSDP 305 Software Engineering I Credit 3

This course introduces methodologies and tools that are useful in software engineering, including structured programming, software charts, sequence selection, and iteration structure charts. The course covers ethical and social implications of computing,

concepts of software design, software module structures, data flow diagrams, system dynamics, engineering system analysis, real-time data flow, and introduction to object-orientation and requires written and oral presentations. Computer Aided Software Engineering (CASE) will be introduced. Prerequisite: CSDP 250.

CSDP 332 Internet Programming Credit 3

This course introduces students to various aspects of internet programming and scripting languages. Topics include object-oriented programming, general information on Internet and World Wide Web, active server pages, HTML, DHTML, XML, JavaScript, VBScript, CSS, and databases. Prerequisite: CSDP 222.

CSDP 341 Numerical Analysis Credit 3

This course is designed to introduce fundamental aspects of numerical analysis including the basic concepts, representation of numbers, error analysis, and iterative methods. Additional topics include solution techniques for non-linear equations, interpolation and approximation, numerical differentiation and integration, and their computer applications. Prerequisites: CSDP 222 and MATH 211.

CSDP 345 Introduction to Mobile Robotics Programming Credit 3

This course provides an introduction to the basic concepts of mobile robotic systems in a hands-on oriented environment using iRobot Create platform and MatLab software development environment. Topics covered in this class include: robotic system architecture, control schemes of robotics systems, robotic communication and tele-operation, robotic sensor and robotic mobility. The course will train the students on programming mobile robots in real world and simulated virtual environments. Students will be trained and exposed to advanced GUI programming and machine learning methods. Prerequisite: CSDP 222.

CSDP 351 Computer Architecture Credit 3

This course covers how computer hardware works, logical aspects of system implementation as seen by the programmer and what considerations go into the design of a computer and components. Topics include processor design, instruction set design and addressing; control structures and microprogramming; memory management, caches, and memory hierarchies; interrupts and I/O structures; and advanced topics. Prerequisite: CSDP 301.

CSDP 390 Social, Ethical and legal issues in Computer Science Credit 3

The growth in computer usage and the number of networks in the information age of 21st century have placed responsibilities on computer scientists to properly use both computers and networks. Issues such as professional, social, ethical and legal responsibilities, intellectual property, piracy, hacking, Internet crimes, viruses, privacy, crime and civil liberties are addressed. Prerequisite: Students must have a junior status and have a basic understanding and awareness of computer programming.

CSDP 395 Internship Credit 3

This course is designed to encourage a student to engage in a professional discipline oriented, and supervised work place learning experience in a work setting to be approved by development chair and a faculty advisor. In all cases, approval to register for this course must be granted by the department chair and a departmental faculty advisor prior to the commencement of the work experience for which the student desires this credit. A student is eligible to enroll in this course upon attaining junior level classification. The work place supervisor must submit a confidential performance evaluation of the work done by the student to the faculty advisor. This course may be repeated for maximum of 6 credits. Prerequisites: Junior level classification, approval by faculty advisor and department chair

CSDP 398 Computer and Language Topics A Credit 3

This is a reading/research course recommended for all computer science majors. The course allows the student to gain experience in new or otherwise unavailable programming languages (e.g., JAVA, C, LISP, ADA, PROLOG). At least one section in JAVA, to satisfy major requirements will be given each year. This course may be repeated (with different topics) for a maximum of 12 credits. Prerequisite: CSDP 222

CSDP 399 Computer and Language Topics B Credit 3

This is a reading/research course recommended for all computer science majors. This course allows the student gain experience in new or otherwise unavailable programming languages (e.g., UNIX, PROLOG, XML, C#). At least one section in UNIX to satisfy major requirements will be given each year. This course may be repeated (with different topics) for a maximum of 12 credits. Prerequisite: CSDP 222.

CSDP 401 Operating Systems Credit 3

This course is an introduction to the fundamentals of operating systems. Topics may include interrupts and recovery, inter-process communication and synchronization, process scheduling, deadlock, memory management, virtual memory file systems, scheduling, and distributed systems. Formal principles are illustrated with the examples and case studies of one or more contemporary operating systems. Prerequisite: CSDP 250 and CSDP 301.

CSDP 402 Computer Networks Credit 3

This course is designed to introduce students to the basic concepts of computer network communication. Topics may include OSI model and computer network protocols (with emphasis on the TCP/IP suite of protocols), data signals and data encoding, transmission media and multiplexing, network architectures (with emphasis on the Ethernet and its various IEEE models), internetworking devices, IP addressing, and sub-netting. Prerequisite: CSDP 250.

CSDP 403 Computer Language Theory Credit 3

This course examines the principles of programming languages. Topics include criteria, formal specifications of syntax, lexical analysis, declarations binding, allocation data and control structures, imperative programming, and functional programming. Prerequisite: CSDP 301 and MATH 323.

CSDP 404 Database Management Systems Credit 3

This course covers database management and the different data models currently used to structure the logical view of databases. It provides an introduction to concepts and design principles used in database management systems, including entity-relationship data models, physical and logical database design, relational databases, query language, transaction management, reliability, and security, and considers the social and ethical implications of computing. This course has a significant writing component. Prerequisite: CSDP 250.

CSDP 405 Software Engineering II Credit 3

This course is designed to expand software engineering skills using structured programming methodologies with object-oriented design. State of the art technique in software design and development of laboratory experience in applying the techniques are covered. Topics may include structured design, structured programming, top-down design and development, segmentation and modularization techniques, iterative enhancement, design and code inspection techniques, correctness, and chief-programmer teams. Software engineering metrics, including measures of size, reuse, functionality, complexity, and quality, will be taught. Critical human factor issues involving software design, reliability, team productivity, and project management are addressed for a clearer understanding of software engineering. Prerequisite: CSDP 305.

CSDP 406 Introduction to Artificial Intelligence Credit 3

This course is designed to provide an introduction to the different topics of Artificial Intelligence as well as the basic principles that Artificial Intelligence application areas are based on. Topics covered include automated reasoning, knowledge representation, automated interpretation systems and automated behavior. Prerequisite: CSDP 250

CSDP 407 Advanced Database Credit 3

This course is intended for computer science students and professionals who have already acquired a basic background on databases. The objective of the course is to introduce the students to the most advanced concepts and recent issues in several areas of database technology, including the following: advanced database design and implementation, transaction management and concurrency control, distributed database management systems, object-oriented databases, and client/server systems. The course includes lab work and individual database application projects. Prerequisites: CSDP404

CSDP 425 Computer and Network Forensics Credit 3

This course provides an introduction to the basic knowledge of network forensics process, incident response and response after detection, data collection, handling and analysis in different operating system environments. It also provides competence in using established forensic methods to investigate electronic evidence and offers a rigorous audit/logging and data archival practices. It further provides hands-on experiencers throughout the semester with a number of laboratories using a variety of forensics tools like FTK, Encase and others. Prerequisites: Reasonable experience with programming and operating systems and permission of the instructor.

CSDP 431 Data Warehousing and Data Mining Credit 3

This course introduces students to concepts and techniques of data mining and data warehousing. Concepts, principles, architecture, design, implementation, application of data warehousing and data mining are taught. The course also introduces several systems for data warehousing and/or data mining. Prerequisite: CSDP 222, MATH 232, and MATH 210.

CSDP 442 Numerical Analysis II Credit 3

This course extracts numerical solutions of systems of equations by direct and iterative methods, ordinary differential equations, optimization, evaluation of determinants, matrix inversion, and calculation of eigenvalues and eigenvectors, and partial differential equations. This course makes use of the powerful MATLAB software utilizing a more practical approach to link every method to real engineering and/or science problems without deriving theoretical concepts. Prerequisite: CSDP 341 and MATH 212.

CSDP 450 Algorithms and Data Structures Credit 3

This course will focus on the design and analysis of algorithms. Topics include: review of data structures, analysis of algorithms, brute force algorithms, searching techniques, divide-and-conquer, sorting and selection, dynamic programming, graph algorithms, greedy algorithms, P and NP, and coping with NP-completeness. Prerequisites: CSDP250 and MATH 323.

CSDP 490-I Senior Design Project Business Track Credit 3

This course deals with formal software development techniques applied to the definition, design, coding, testing and documentation of a computer programming project. Each student completes an individual project. Prerequisite: CSDP 305, CSDP 390, CSDP 402, CSDP 404 as either prerequisites or corequisites.

CSDP 490-S Senior Design Project Science Track Credit 3

This course deals with formal software development techniques applied to the definition, design, coding, testing and documentation of a computer programming project. Each student completes an individual project. CSDP 305, CSDP 390, CSDP 399, CSDP 401, CSDP 402, CSDP 404, CSDP 450 as either prerequisites or corequisites.

CSDP 498 Selected Topics in Computer Science A Credit 3

This is a reading/research course recommended for all computer science majors. The grade for this course will be based primarily on a research project in an area of computer science chosen together by the student and the instructor. This course may be repeated (with different topics) for a maximum of 12 credits. Advanced undergraduate students may also enroll in graduate-level computer science courses below CSDP 610 with permission of the Department.

CSDP 499 Undergraduate Research Credit 3

This course is designed to provide a student an active experience in research methodology while working closely with a faculty research advisor. It will generally require literature search and review, problem selection, and the student's approach to addressing the problem. A written final report of the student's work is required and an oral presentation is encouraged. The credit hours for this course are arranged with a research faculty advisor whose approval is needed prior to registration for the course. Prerequisites: permission of a departmental faculty advisor and the department chair.

COURSE DESCRIPTIONS FOR MATHEMATICS

The Department of Mathematics and Computer Science requires that, prior to enrolling in any departmental course, students should earn a grade of "C" or better in all course prerequisites.

MATH 101 Intermediate Algebra Credit 3

Topics in this intermediate algebra course include the algebra of signed numbers, solving linear equations and inequalities, quadratic equations, operations on algebraic expressions, and graphing. This course requires the successful completion of the Arithmetic Basic Skills Test administered by the Department. Students not receiving a satisfactory grade on this examination at entrance are required to attend special arithmetic skills laboratory sessions, in addition to their regular class work, until they do pass this test with a satisfactory score. This course does not satisfy the General Education Requirement in Mathematics and does not count towards graduation requirements.

MATH 102 Applications of College Mathematics Credit 3

This course reviews sets and logic, functions and graphing, and solution of sets of linear equalities and inequalities. It includes an introduction to linear programming, combinatorial principles, and counting, with applications in the development of probability theory and statistics, numeration systems, and computer mathematics. All topics are covered making use of current educational technology, both from the point of view of their significance within mathematics and of their applicability in modeling the world using mathematics. In addition to regular class work, this course requires the successful completion of the Arithmetic Basic Skills Test administered by the Department. Students not receiving a satisfactory grade on this examination at entrance are required to attend special arithmetic skills laboratory sessions, in addition to their regular class work, until they do pass this test with a satisfactory score. Prerequisites: MATH 101 with a grade of at least "C" or permission of the Department (obtained by receiving a satisfactory score on the placement test).

MATH 109 College Algebra Credit 3

The purpose of this course is twofold: for students requiring quantitative mathematical skills but not trigonometry or calculus, it may be viewed as a terminal course; it also provides the algebraic and graphing skills necessary for satisfactory performance involving relations and functions, graphing, solving systems of linear equations, and the logarithmic and exponential functions. Prerequisites: MATH 101 with a grade of at least "C" or permission of the Department (obtained by receiving a satisfactory score on the placement test).

MATH 110 Trigonometry and Analytic Geometry Credit 3

This course is intended for students majoring in mathematics, computer science, science, technology, or engineering, or for students preparing to take calculus. Topics covered include the unit circle and graphs of the trigonometric functions, trigonometric identities, trigonometric equations, inverse trigonometric functions, complex numbers, and polar coordinates. Prerequisites: MATH 109 with a grade of at least "C" or permission of the Department (obtained by receiving a satisfactory score on the placement test).

MATH 111H Honors Elementary - Mathematical Analysis Credit 4

This course covers the content of both MATH 109 and MATH 110 in one semester Prerequisites: Permission of the Department (obtained by receiving a satisfactory score on the placement test).

MATH 112 Calculus I Credit 4

This course covers differential calculus of functions of one variable, graphing, and differentiating algebraic and transcendental functions. It also covers limits, continuity, and Mean Value Theorem and applications, as well as maximizing and minimizing functions, related rate, and approximation applications. An introduction to integration is also included. Prerequisites: MATH 110 or MATH 111H with a grade of a least "C" or better.

MATH 210 Elementary Statistics Credit 3

The course covers frequency and graphs of distributions; calculation of averages from raw data and grouped data; the standard deviation; the Binomial, Poisson, and normal distribution and their properties; Bayes Theorem and Bayesian inference; Regression and correlation in two variables; and Times Series Analysis and applications. Prerequisite: MATH 102 or MATH 109 or MATH 110 or MATH 111H.

MATH 211 Calculus II Credit 4

This course covers Integral calculus of functions of one variable; techniques and theory of the Riemann integral, including the fundamental theorem and its application; applications to area, volume, surface area work, centroids, arc length, and polar coordinates; advanced work with transcendental functions; and an introduction to series and sequences. Prerequisite: MATH 112.

MATH 212 Calculus III Credit 4

This course covers multivariable differential and integral calculus, which includes the chain rule and inverse function theorems for several variables, with applications to maxima and minima; integration in polar, cylindrical, and spherical coordinate systems; Taylor's Theorem, infinite series; convergence tests; and applications. Prerequisite: MATH 211.

MATH 232 Introduction to Linear Algebra Credit 3

This course covers vector spaces, matrices, and their algebra; linear transformations; and normal forms. Also, systems of linear equations using the Gaussian Elimination method, Cramer's rule, LU decomposition, and the inverse matrix are studied. The reduction of a matrix to row-echelon form and the use of the reduced matrix to calculate the rank of the matrix, determine the

solvability of a system of linear equations and the dependence and independence of rows and/or columns of the original matrix are also included. Prerequisite: MATH 112.

MATH 241 Elements of Differential Equations for Engineers Credit 3
This course is an introduction to ordinary differential equations which presents basic techniques for solving first and second order differential equations, both linear and non-linear, and systems of differential equations. Emphasis is placed on qualitative and numerical methods, as well as on formula solutions. Prerequisite: MATH 211.

MATH 300 Foundations of Mathematics Credit 3
This course covers sets, relations, prepositional calculus, first order theory and its model theory, completeness, incompleteness and independence theorems. Also, applications to axiomatic systems, number theory, geometry, set theory or computer science are included. Prerequisite: MATH 211.

MATH 301 College Geometry Credit 3
This course covers basic concepts of Euclidean geometry, such as distance congruence, similarity, triangles, parallelism, Pythagorean Theorem, axiomatic geometry, Non-Euclidean geometry, and comparison with Euclidean geometry. This course is also essential as a part of the training of prospective teachers of secondary school mathematics. Prerequisite: MATH 110 or MATH 111H and MATH 300.

MATH 302 Number Theory Credit 3
This course covers integers, divisibility, the Euclidean algorithm and its application, solution of Diophantine equations, prime numbers, congruencies, quadratic residues, number theoretic functions, and Mobius inversion and its applications. Prerequisite: MATH 110 or MATH 111H and MATH 300.

MATH 304 History of Mathematics and Computer Science Credit 3
This course covers the historical and cultural development of mathematics and computer science from ancient times to the present. Emphasis is placed on the development of mathematical reasoning, style, philosophy, and techniques within cultural settings, growth of computer hardware and software; and developmental styles of applications. Prerequisite: MATH 109 or MATH 110 or MATH 111H.

MATH 309 Introduction to Probability Credit 3
This course covers sample spaces, axioms, and elementary theorems of probability; it also covers combinatorics, dependence, conditional probability, random variables, probability distributions which include the Binomial, Geometric, Poisson, Negative Binomial, Hypogeometric, Uniform, Normal, Gamma, and Chi-Square, expectation, mean variance, and moment generating functions, Chebychev's inequality; examples of stochastic processes are also studied. Prerequisite: MATH 211.

MATH 310 Mathematical Statistics I Credit 3
This course covers bivariate and multi-variate distributions of random variables and their properties, limit theorems (law of large numbers and the central limit theorem) transformation of variables for the discrete and continuous types, and T and F distributions; point and interval estimation; the maximum likelihood; unbiasedness; efficiency; sufficiency; MVU of estimators and other characteristics of point estimators; Cramer and Rao Blackwell Theorems, testing of hypotheses, and Neyman Pearson Lemma. Prerequisite: MATH 309.

MATH 321 Differential Equations Credit 4
This course covers first-order equations for which exact solutions are obtainable with applications. Higher order linear differential equations, systems of linear differential equations, Laplace transforms, non-linear differential equations, and numerical applications are also included. Prerequisite: MATH 211.

MATH 323 Introduction to Discrete Structures Credit 3
Topics covered in this course include group, graph, Boolean, prepositional, and other algebraic structures through detailed study of automata and their relationship to formal languages. This course requires teams creating relatively large application programs. Prerequisites: CSDP 222.

MATH 342 Advanced Calculus Credit 3

This course includes a review of the real numbers, topology of Cartesian spaces, limits, convergence, continuity, differentiability, integration, infinite series and products, Fourier series, and Laplace transforms. Prerequisite: MATH 212 and MATH 300.

MATH 350 Linear Programming Credit 3

This course introduces the concepts of Models, model-building and operations research methods. It includes a review of linear algebra and convexity, mathematical background; graphic method, simplex computation procedures, special cases, degeneracy, duality and its applications; transportation, production, scheduling and inventory control problems; PERT Network Analysis Techniques and game theory and software application to the solution of linear programming problems. (LINDO and MATHLAB). Prerequisites: MATH 232

MATH 360 Statistics for Scientists Credit 3

This course, available for departmental majors and intermediate between MATH 210 and the three-semester probability and statistics sequence, is a one-semester introduction to the methodology and application of statistics. Emphasis is placed on statistical methods commonly used in scientific and technical applications and their theoretical justification and limitations. Prerequisite: MATH 309.

MATH 410 Mathematical Statistics II Credit 3

Correlation, linear and multiple regression techniques are covered mathematically as well as using available statistical software. In addition, design of experiments, analysis of covariance techniques; analysis of categorical data including the chi-square and goodness-of-fit tests, contingency tables and non-parametric statistics are covered. Prerequisites: MATH 212, MATH 232 and MATH 310.

MATH 411 Modern Algebra I Credit 3

This course takes an axiomatic approach to studying the structures: groups, rings, and fields. Quotient structures, sub-structures, homomorphism and isomorphism are also included. In addition to abstract structures, numerous examples of well-known structures are investigated from the axiomatic point of view. Prerequisite: MATH 211 and MATH 300.

MATH 412 Linear Algebra Credit 3

This course covers matrix algebra and determinants, vector spaces, subspaces, basis and dimension, inner product, orthogonal and orthonormal vectors and sets, Gram-Schmidt orthogonalization process, linear transformations, eigenvalues and eigenvectors, kernel and range, diagonalization of matrices, and quadratic forms. Also, application of linear algebra to Error-Correcting Codes and linear programming are covered. Prerequisites: MATH 211, MATH 232, and MATH 411.

MATH 413 Modern Algebra II Credit 3

This course is a continuation of Math 411. Specific topics include Sylow's Theorems and Free Abelian Groups from Group Theory; Fundamental Homomorphisms/Isomorphisms Theorems and Ideals (Maximal) from Ring Theory; and Extension Fields leading to the study of Galois Theory. Prerequisite: Math 411.

MATH 440 Topology Credit 3

This is a beginning course in topology with emphasis on the development of mathematical maturity in the area. Open and closed sets, connectedness, compactness, continuous functions and homomorphisms, separation properties, and pathologies are included. Prerequisite: MATH 300 and either MATH 212 or MATH 411 or permission of instructor.

MATH 442 Complex Analysis Credit 3

This course extracts numerical solutions of systems of equation by direct and iterative methods, ordinary differential equations, optimization, evaluate of determinants, matrix inversions, and calculation of eigenvalues and eigenvectors, and partial differential equations. This course makes use of the powerful MATLAB software utilizing a more practical approach and links every method to real engineering and/or science problems without deriving theoretical concepts. Prerequisites: Math 212 and MATH 300.

MATH 443 Real Analysis I Credit 3

This course covers the analysis on the real line and n-space from the abstract point of view. Point sets, completeness, convergence, differentiability, Riemann integration, measurable sets and functions, Lebesque integration, differentiation vs. integration, interchange of order, Lebesque-Stieltjes integrals, dominated and other convergence theorems are included. Prerequisites: MATH 300 and either MATH 212 or permission of instructor.

MATH 444 Real Analysis II Credit 3

This course is a continuation of MATH 443. Emphasis is placed on uniform convergence of sequences and series of functions, improper integrals, differentiation and integration in higher dimensions, inverse and implicit function theorems, introductory metric spaces, and metric space topologies. Prerequisite: MATH 443.

MATH 455 Mathematical Models Credit 3

This course covers construction, development, and study of mathematical models for real applications; Markov chain models; models for linear optimization; and selected case studies. Prerequisites: MATH 212 and MATH 443.

MATH 490 Senior Seminar Credit 1

This course is designed for graduating seniors to acquaint them with research information and sources in the field of mathematics. The student develops and presents reports on current research problems from various fields of mathematics.

MATH 498 Selected Topics in Mathematics Credit 3

This is a reading course recommended for all mathematics majors. The grade for this course is based primarily on a research project in an area of mathematics chosen by the student and the instructor. This course may be repeated (with different topics) for a maximum of 12 credits.

MATH 499 Selected Topics in Mathematics Credit 3

This is a reading course recommended for all mathematics majors. The grade for this course is based primarily on a research project in an area of mathematics chosen together by the student and the instructor. This course may be repeated (with different topics) for a maximum of 12 credits.