

# Department of Computer Science, Mathematics and Physics

Dr. Michael Ottinger, *Chairperson*      ottinger@missouriwestern.edu      271-4376  
<http://www.missouriwestern.edu/CSMP/>

The Department of Computer Science, Mathematics and Physics contributes to the liberal arts education of all students and, in addition, provides specialized programs in computer science, computer information systems, mathematics, and physics for those students who desire a more thorough preparation for jobs in business, government, industry, and educational institutions.

## ADMISSIONS REQUIREMENTS

### Computer Science or Computer Information Systems

To gain admission into either of these degree programs, the student must be enrolled in CSC184 or have completed CSC184 with a grade of C or better, or have an ACT composite score of 25 or higher, or an ACT Science Reasoning score of 28 or higher. In addition, the student must have an overall GPA of at least 2.0.

### Mathematics

To gain admission to any degree program in Mathematics, the student must have completed MAT 167 with a grade of C or better, or have an ACT Mathematics score of 28 or higher.

## GRADUATION REQUIREMENTS

Graduation with a degree in any program offered by the Department of Computer Science, Mathematics, and Physics requires that the student receive a grade of C or better in each course in the major or minor. In addition, all other institutional requirements for graduation must be met.

## BACHELOR OF SCIENCE DEGREE REQUIREMENTS

### Major in Computer Science

CSC	184	Computing Concepts I	3
CSC	208	Discrete Structures I	3
CSC	254	Computing Concepts II	3
CSC	285	Data Structures	3
CSC	305	Database Architecture and Concepts	3
CSC	306	Object Oriented Applications and Program Development	3
CSC	318	Simulation and Modeling	3
CCS	328	Computer Graphics	3
CSC	384	Microcomputer Assembly Language	3
CSC	386	Operating Systems Concepts	3
CSC	394	Network and Telecommunications	3
CSC	410	Computer and Network Security	3
CSC	484	Compiler Theory	3
MAT	167	Calculus with Analytic Geometry I	5
MAT	177	Calculus with Analytic Geometry II	5

	CSC 289	Computational Methods for Computer Science	OR
	MAT 331	Applied Statistics	3
		<b>SUBTOTAL</b>	52
6 credits of	CSC	courses numbered 300 or higher	
		<b>TOTAL</b>	58

In addition, Computer Science majors must take PHY 110 or PHY 210 to meet the Natural Sciences portion of their General Studies program.

### Major in Computer Information Systems

Students may select among the following options as a Computer Information Systems major:

1. Major in Computer Information Systems
2. Major in Computer Information Systems with Applications of Computer Technology

The majors in Computer Information Systems require the following core of courses, totaling 30 credits:

<b>Core Requirements</b>	<i>Credits</i>
ACT 102 Introduction to Web Page Development	3
CSC 184 Computing Concepts I	3
CSC 200 Computer Systems and Architecture	3
CSC 201 Microcomputer Applications	3
CSC 305 Database Architecture and Concepts	3
ACT 301 Applied Database Systems	3
CSC 394 Networking and Telecommunications	3
CSC 400 Systems Analysis and Design	3
ACT 476 Applications of Computer Information Sciences Capstone	3
GBA 220 Business Communication	3
Statistics (3 hours) Select one of the following:	3
GBA 210 Business Statistics I	
MAT 132 Statistics	
MAT 331 Applied Statistics	
<b>TOTAL CORE</b>	<b>33</b>

### Major in Computer Information Systems

CSC 254 Computing Concepts II	3
CSC 285 Data Structures	3
CSC 306 Object Oriented Applications and Program Development	3
CSC 245 High-Level Programming Language I	3
CSC 345 High-Level Programming Language II	3
CSC 3xx CSC Elective Courses numbered 300 or higher	OR
ACT 3xx ACT Elective Courses numbered 300 or higher	3
ACC 201 Introductory Financial Accounting	3
ACC 202 Introductory Managerial Accounting	3
MGT 305 Management of Organizations	3
Quantitative Analysis (3 or 4 hours)	3 or 4
MAT 137 Business Calculus (4)	
MGT 431 Management Science (3)	
<b>TOTAL ADDITIONAL HOURS</b>	<b>33-31</b>
<b>CORE</b>	<b>33</b>
<b>TOTAL HOURS</b>	<b>63-64</b>

**Major in Computer Information Systems  
with Applications of Computer Technology**

ACT 202	Introduction to Web Graphics	3
ACT 302	Decision Support Systems	3
ACT 311	Web Development Tools	3
ACT 405	Business Intelligence	3
	*Electives (18 hours)	
	<b>TOTAL ADDITIONAL HOURS</b>	<b>30</b>
	<b>CORE</b>	<b>33</b>
	<b>TOTAL HOURS</b>	<b>63</b>

\*The requirements for the elective area may be met by one of the following methods:

1. Earned minor awarded in conjunction with the CIS-ACT major degree.
2. Earned second major in conjunction with the CIS-ACT degree.
3. A previous bachelor's degree from MWSU or other accredited 4-year college or university.
4. 12 hours of ACT or CSC courses of which at least 9 hours must be 300 level or above. Or courses with prefixes approved by the advisor and chair of the Department of Computer Science, Mathematics, and Physics.

**Major in Mathematics**

The mathematics major advisor can provide information on the selection of elective courses which will best prepare the student for graduate study or a career in actuarial science, applied mathematics or teaching secondary school mathematics, as well as other careers requiring a strong mathematics background.

**Core Requirements**

		<i>Credits</i>
CSC 184	Computing Concepts I	3
MAT 167	Calculus with Analytic Geometry I	5
MAT 177	Calculus with Analytic Geometry II	5
MAT 206	Mathematical Transitions	3
MAT 287	Calculus with Analytic Geometry III	5
MAT 306	Matrix Algebra	3
MAT 317	Differential Equations	3
MAT 331	Applied Statistics	3
MAT 416	Abstract Algebra	3
MAT 4xx	Numbered 400 or above	3

**Required 2-course sequence** (Select A or B) 6

- |    |         |   |           |
|----|---------|---|-----------|
| A. | MAT 332 | Probability Theory                            |           |
|    | MAT 432 | Mathematical Statistics                       | <b>OR</b> |
| B. | MAT 315 | Topics in Geometry                            |           |
|    | MAT 465 | Mathematics Teaching: Methods and Materials * |           |

*\* Only appropriate for the major in mathematics with teacher certification.*

**Additional Courses**

MAT 3xx	Numbered 300 or above	3
	Six credits selected from: (3 credits each unless otherwise noted)	6
MAT 3xx	Numbered 300 or above (1-3)	
PHY 312	University Physics III	
PHY 410	Selected Topics in Physics	
PHY 450	Independent Research/Project (1-3)	
CSC 318	Simulation and Modeling	
CSC 328	Computer Graphics	
	<b>TOTAL</b>	<b>51</b>

## Teacher Education In Mathematics

Students intending to teach mathematics at the secondary school level are required to complete the Bachelor of Science Degree program in Mathematics along with the General Studies Requirements and the Professional Sequence as specified in this Catalog under Secondary Education.

Certification for grades 9-12 requires the completion of the following courses:

<b>Core Requirements</b>			<i>Credits</i>
CSC 184	Computing Concepts I		3
MAT 167	Calculus with Analytic Geometry I		5
MAT 177	Calculus with Analytic Geometry II		5
MAT 206	Mathematical Transitions		3
MAT 287	Calculus with Analytic Geometry III		5
MAT 306	Matrix Algebra		3
MAT 317	Differential Equations		3
MAT 331	Applied Statistics		3
MAT 416	Abstract Algebra		3
MAT 4xx	Numbered 400 or above		3
 <b>Required 2-course sequence</b>			
MAT 315	Topics in Geometry		3
MAT 465	Mathematics Teaching: Methods and Materials		3
 <b>Additional Courses</b>			
MAT 462	Number Theory		3
MAT 463	History of Mathematics		3
MAT 3xx	Numbered 300 or above		3
	<b>TOTAL</b>		<b>51</b>

## MINORS

### Computer Information Systems

<b>Requirements</b>			<i>Credits</i>
ACT 102	Introduction to Web Page Development		3
CSC 184	Computing Concepts I		3
CSC 200	Computer Systems and Architecture		3
CSC/MGT 201	Microcomputer Applications		3
CSC 305	Database Architecture and Concepts		3
CSC 400	Systems Analysis and Design		3
Plus one approved course from ACT or CIS			3
	<b>TOTAL</b>		<b>21</b>

### Computer Science

<b>Requirements</b>			<i>Credits</i>
CSC 184	Computing Concepts I		3
CSC 254	Computing Concepts II		3
CSC 285	Data Structures		3
CSC 384	Microcomputer Assembly Language		3
Six credits selected from the following			6
CSC 318	Simulation and Modeling		3
CSC 328	Computer Graphics		3
CSC 394	Networking and Telecommunications		3
CSC 410	Computer and Network Security		3
	<b>TOTAL</b>		<b>18</b>

## Mathematics

### Requirements

	MAT 167	Calculus with Analytic Geometry I	<i>Credits</i>
	MAT 177	Calculus with Analytic Geometry II	5
	MAT 2xx	MAT courses numbered 200 or higher*	5
		<b>TOTAL</b>	<b>11</b>
	*MAT 132	Elementary Statistics may be included	<b>21</b>

## Physics

### Requirements

	Select A or B		<i>Credits</i>
	A. PHY 110	College Physics I (4)	13
	PHY 111	College Physics II (4)	
	MAT 147	Applied Calculus (5)	OR
	MAT 167	Calculus with Analytic Geometry I (5)	
	B. PHY 210	University Physics I (5)	
	PHY 211	University Physics II (5)	
	PHY 312	University Physics III (3)	
	Select from the following		7
	PHY 313	Modern Physics Laboratory (1)	
	PHY 320	History of Physics (3)	
	PHY 410	Selected Topics in Physics (3)	
	PHY 450	Independent Research/Project (1-3)	
	CHE 383	Physical Chemistry: Thermodynamics (3)	
	MAT 317	Differential Equations (3)	
		<b>TOTAL</b>	<b>20</b>

Students seeking a minor in Physics for Secondary Teacher Certification must also complete PHY465, the General Studies requirements for Secondary Education, and the Professional Sequence for Secondary Education.

## Semester Designation

- F -- the course is offered in the fall semester
- Sp -- the course is offered in the spring semester
- Su -- the course is offered in the summer semester
- DD -- the course is offered at the discretion of the department

## APPLIED COMPUTER TECHNOLOGY COURSES

Waiving of any course prerequisites requires prior departmental authorization.

**ACT 102 Introduction to Web Page Development (3) F, Sp.** This course is an introduction to the design, creation, and maintenance of web pages and websites. Students learn how to critically evaluate website quality, create and maintain quality web pages, investigate web design standards, and create and manipulate images. The course progresses through web design tools HTML, XHTML, Cascading Style Sheets, and concludes with PHP using MySQL. Each student will develop a fictitious organization website.

**ACT 202 Introduction to Web Graphics (3) Sp.** This course provides a comprehensive introduction to the Adobe Design Suite exploring the design applications Illustrator, InDesign and Photoshop CS. With the use of exercises and projects, the student will develop an extensive understanding of the tools and methods associated with the software. Real-world issues will be addressed to build problem-solving and critical thinking skills necessary for advanced course work. Prerequisite: A grade of C or better in ACT102.

**ACT 301 Applied Database Systems (3) F.** Emphasis is placed upon the core concepts of database application development, data warehousing and data mining. Students will gain proficiency in Microsoft Access; the concepts learned will allow the students to apply database application development concepts to a real world type application. Students will then take this further by gaining an understanding of the value of data warehouses and data mining for use by decision support and business intelligence systems. Prerequisite: A grade of C or better in CSC201.

**ACT 302 Decision Support Systems (3) F.** This course uses statistics to help solve business problems, examines case examples of statistical analysis in areas such as marketing, finance and management, and teaches descriptive and inferential techniques using a statistical computer software application - Excel. Topics to be covered include Creating Charts, Working with Charts, Using List Features and Templates, Working with Advanced Functions, Analyzing Data, Using PivotTables, and Working with Data Analysis Tools. Prerequisite: A grade of C or better in CSC201.

**ACT 311 Web Development Tools (3) Sp.** This course uses Adobe Design Suite tools to lead the student through the process of web-application development. Students will gain knowledge and hands-on practice in building and maintaining web applications using Dreamweaver, Flash, Contribute, and Photoshop. Students will use Java, PHP and MySQL to interact with external databases. Prerequisites: A grade of C or better in both CSC184 and ACT102.

**ACT 405 Business Intelligence (3) F.** Students learn how to make better business decisions, use fewer resources, and improve the company's bottom line by developing and using a data warehouse. This course provides an overview of business intelligence and data warehousing and gives students a look at all the major facets of developing and using a data warehouse to make effective business decisions. Students work on a single project that allows them to develop a project plan and business case for a data warehouse, develop a dimensional model, develop a data staging process, and develop a data access process. Prerequisite: A grade of C or better in ACT301, ACT302, and an approved statistics course.

**ACT 476 Applications of Computer Information Sciences Capstone (3) DD.** The capstone course will encompass and consolidate all of the concepts covered in the ACT curriculum. In this course, students will manage an Information Systems project, design an appropriate database and incorporate both LAN and Web-based distributed information solutions to support a business process, effectively document the system and incorporate elements of the general education into a successfully implemented information systems solution. Prerequisite: Course must be completed after ACT core.

## COMPUTER SCIENCE COURSES

Waiving of any course prerequisites requires prior departmental authorization.

**CSC 174 Introduction to Unix/Linux (3) DD.** An introductory course on UNIX/Linux and its applications. Topics covered include: basic commands and system structures; system tools; output redirection; command line text editing, e-mail and system calls; file system basics; and, basic shell scripting. Basic security issues will also be discussed. The course material is intended to prepare students for versatile use of any UNIX/Linux system and as a foundation for numerous UNIX/Linux certification programs.

**CSC 184 Computing Concepts I (3) F, Sp.** Introduction to problem solving utilizing the Java programming language. Topics include algorithm and program development, syntax of java in input/output, assignment operations, program control structures, character data manipulation, functions, and single dimension arrays. Emphasis is placed on object oriented program design techniques and program modularity. Prerequisite: A grade of C or better in either ACT102 or EGT102, or an ACT math score of 20 or higher or the equivalent. LAS Computer Literacy.

**CSC 200 Computer Systems and Architectures (3) F, Sp.** This course is an introduction to microcomputer systems including Windows™ operating system and microcomputer architecture. IT infrastructures including database, networking, and systems development as well as basic hardware/software concepts will be emphasized. Security and ethical issues are considered throughout the course. This course will not be accepted as a Computer Science elective for CSC degree programs.

**CSC 201 Microcomputer Applications (3) F, Sp.** Applications of productivity software such as Microsoft Office® Word, Excel, Access, and PowerPoint for careers, school, and home. Impact of technology on society by computer information systems, networks, e-commerce, and the Internet is included. Same as MGT201. Previous computer experience recommended.

**CSC 208 Discrete Structures I (3) F.** This course is a study of mathematical reasoning including the nature and methods of proof, relations and functions, combinatorics and graph theory, Boolean algebra, and applications of these topics. Attention will be given to the direct applications to computer science. Prerequisites: Credit with a grade of C or better or concurrent enrollment in both MAT167 and CSC184.

**CSC 245 High-Level Programming Language I (3) F.** This course explores the structure of a high-level programming language other than java. This course typically includes coverage of topics such as data types, flow control structures, record or class structures, input/output commands, and basic user interface design. Majors enrolling in this course must also complete CSC345 during the following spring semester. Prerequisite: A grade of C or better in CSC184.

**CSC 254 Computing Concepts II (3) F, Sp.** This course is a continuation of CSC184. Topics include multidimensional arrays and array processing, elementary sorting and searching techniques, classes, dynamic memory allocation, linked lists, data abstraction, and GUI interface creating. Prerequisites: A grade of C or better in CSC184 and credit or concurrent enrollment in MAT112, MAT116, or higher.

**CSC 283 Introduction to Research Methods in Computer Science (1-2) DD.** Introduction to basic research methods in Computer Science. Individual and team projects involving methods for solving computer science-related research problems. Prerequisite: Departmental approval.

**CSC 285 Data Structures (3) Sp.** Topics include algorithm analysis and the implementation of stacks, queues, linked lists, trees, and other data structures. Principles of data abstraction are emphasized throughout the course. Prerequisites: A grade of C or better in both CSC254 and MAT112, MAT116, or higher.

**CSC 289 Computational Methods for Computer Science (3) Sp.** This course provides the underlying mathematical foundations and applied algorithms that are used across the basic fields in Computer Science. The course will focus on the computational algorithms in the fields of semantic search, data encryption and computer security, computer graphics, gaming and simulation. Further the course will consider the impact/computational limitations of current hardware on the application of these algorithms. Prerequisites: Credit with a grade of C or better in MAT167, CSC254, and CSC208.

**CSC 305 Database Architecture and Concepts (3) Sp.** An introduction to Database Concepts and Architecture, with an emphasis on the Relational Database Model. Prerequisite: A grade of C or better In both CSC184 and CSC201.

**CSC 306 Object Oriented Applications and Program Development (3) F.** This course emphasizes the application of Object Oriented Programming (OOP) concepts in the C++ programming language to large-scale programming problems. The course includes application of techniques such as the Unified Modeling Language (UML). Prerequisites: A grade of C or better in CSC254, and credit or concurrent enrollment in CSC285. LAS Writing.

**CSC 318 Simulation and Modeling (3) F.** An introduction to computerized simulations. Focus is on the architecture and development of time-step and event-sequenced models used extensively by industry and government. Other topics include process generators for random events, the development of computerized games for management training, and current simulation research. Prerequisites: CSC285 and either MAT137 or MAT167.

**CSC 328 Computer Graphics (3) Sp.** A course in the techniques for picture transformation, curve and surface approximation; study and implementation of graphical languages and data structure; organization of graphical systems; use of the microcomputer as tools for displaying graphical data. Prerequisites: CSC285 and either MAT137 or MAT167.

**CSC 345 High-Level Programming Language II (3) Sp.** This course explores the advanced features of a high-level programming language other than Java. Topics typically include database access, network programming, advances GUI interface design and management of large-scale program development. Students will produce an application demonstrating mastery of advanced topics of the selected language. This is a continuation of CSC245. Students must take CSC245 and CSC345 in the same language. Prerequisite: A grade of C or better in CSC245.

**CSC 384 Microcomputer Assembly Language (3) F DD.** Assembler language level programming for the Intel 8088 microprocessor. Symbolic machine instruction, assembly instruction, segmentation, addressing modes, subprograms, and modular programming will be the major topics covered. Prerequisite: A grade of C or better in either CSC245 or CSC254.

**CSC 386 Operating Systems Concepts (3) Sp.** This course is an introduction to operating system principles. Topics include processor management, real and virtual storage management, device management and scheduling, multiprocessing, concurrent programming, and other topics related to operating systems. The course also includes a survey of major operating systems. Prerequisite: A grade of C or better in both CSC284 and CSC285 and CSC384.

**CSC 394 Networking and Telecommunications (3) F.** An examination of current computer communication technologies and their protocol structures as applied to computer networks and telecommunication systems. Topics include the physical layers, architectural elements, and information layers of a communication network; protocols; switching; routing; LANs; and WANs. Prerequisite: A grade of C or better in CSC200.

**CSC 400 Systems Analysis and Design (3) F.** Study of structured systems development. Emphasis on strategies and techniques of structured analysis and object oriented design for producing logical methodologies for dealing with the development of information systems. Prerequisites: Credit or concurrent enrollment in CSC305. LAS Writing.

**CSC 410 Computer and Network Security (3) F (even-numbered years).** This course covers various facets of network security and the tools that are available to secure and monitor networks. Topics include commercial and open source security tools, public-key cryptography, firewalls, authentication, intrusion detection, control of malicious code, OS hardening fundamentals, and security assessment. Prerequisites: Completion of at least six credit hours of CSC courses numbered 300 or above, or completion of CIS minor core.

**CSC 450 Independent Research/Project (1-3) F, Sp.** Investigation of a research problem, project, or topic on an individual conference basis. Prerequisites: Declared Computer Information Systems or Computer Science major, a minimum of 2.5 GPA in major field, and departmental approval.

**CSC 451 Internship in Computer Science (1-3) F, Sp, Su.** An academic program which offers Computer Science majors an opportunity to integrate theory with practice. Students work full-time or part-time for a company in a position related to the Computer Science major. Anticipated learning objectives are established in a contract agreed to by the student, the company supervisor, and the departmental faculty sponsor. May be repeated for credit, but at most 3 hours may count towards the total number of hours required for the major. Prerequisites: Declared Computer Science or Computer Information Systems major or declared CIS minor, a minimum of 2.5 GPA, and permission of the faculty sponsor.

**CSC 484 Compiler Theory (3) Sp.** An introduction to the basic structures of compilers and their design. Course topics include computer language structure, translation/recognition techniques of lexical analysis, parsing and syntax-directed translation. The course will also consider the impact of run-time environments on the design of computer languages and the constraints of code optimization on code generation. A small compiler will be developed. Prerequisite: A grade of C or better in CSC384.

**CSC 487 Digital Animation and Production (3) Sp.** This class will concentrate on the methods used to build digital animated characters. Subjects will include character design and development, animation of characters, lighting, camera shots, sound and production editing. Prerequisites: Junior standing and declared Computer Information Systems, Computer Science, or Communications Studies and Theatre major.

**CSC 488 Gaming and Simulation Architecture (3) F.** This class will concentrate on classic gaming architectures such as first person, single shooter games and strategy games. Distributed simulation architectures and net-based distributed gaming architectures will also be considered. Prerequisites: CSC318, CSC328 and either MAT137 or MAT167.

**CSC 489 Mathematics and Physics of Simulation and Gaming (3) F.** This class will focus on current math/physics techniques for character collisions and pathfinding used in gaming and animation. AI techniques for game character learning and personality will be considered. Also considered will be the topics of the physics of special effects (i.e., fires, explosions, crashes, etc.) Prerequisite: CSC318, CSC328 and either MAT137 or MAT167.

## MATHEMATICS COURSES

Waiving of any course prerequisites requires prior departmental authorization.

Students enrolling in developmental mathematics for the first time should enroll in MAT081. Developmental math courses do not count toward graduation credits.

**MAT 081 Foundations for University Mathematics I (3) F, Sp, Su.** A study of the fundamental arithmetic and algebraic concepts prerequisite to university level mathematics. The specific topics studied are determined by assessment of the individual student's mathematical background.

**MAT 082 Foundations for University Mathematics II (3) F, Sp, Su.** A continuing study of the fundamental arithmetic and algebraic concepts prerequisite to university level mathematics initiated in MAT081. The specific topics studied are determined by assessment of the individual student's mathematical background. Prerequisite: A grade of C or better in MAT081 or the equivalent.

**MAT 083 Foundations for University Mathematics III (3) F, Sp, Su.** A continuing study of the fundamental arithmetic and algebraic concepts prerequisite to university level mathematics initiated in MAT082. The specific topics studied are determined by assessment of the individual student's mathematical background. Prerequisite: A grade of C or better in MAT082 or the equivalent.

**MAT 110 Contemporary Problem Solving (3) F, Sp, Su.** Mathematics for solving selected real-world problems using elementary graph theory, data analysis, techniques of decision making, and the mathematics of finance. Prerequisite: ACT math score of 20 or higher or the equivalent.

**MAT 112 Finite Mathematics (3) F, Sp.** Linear and quadratic equations, graphs, and functions including exponential and logarithmic functions; mathematics of finance, annuities, sinking funds and mortgages; linear programming; counting methods, probability, expectation; descriptive statistics. Not open to the student with credit in MAT167. Prerequisite: ACT math score of 20 or higher or the equivalent.

**MAT 116 College Algebra (3) F, Sp, Su.** Linear, quadratic, and miscellaneous equations and inequalities; relations and functions including polynomial, exponential, and logarithmic functions; graphing; systems of equations; and matrices. Not open to the student with credit in MAT130 or MAT167. Prerequisite: ACT math score of 20 or higher or the equivalent.

**MAT 119 Trigonometry (2) F, Sp.** Trigonometric functions, trigonometric identities, trigonometric equations, logarithms, solution of triangles, inverse trigonometric functions. Not open to the student with credit in MAT130 or MAT167. Prerequisite: ACT math score of 20 or higher or the equivalent.

**MAT 127 Applied Mathematics for Engineering Technology (3) Sp.** An applied course in algebra, trigonometry, analytic geometry, and statistics; applications primarily from the technological fields; also includes an introduction to basic concepts in calculus. Satisfies Associate Degree requirements in Engineering Technology only. Does not satisfy general studies mathematics requirement. Prerequisites: A grade of C or better in both MAT116 and MAT119.

**MAT 130 Pre-Calculus (5) F.** Algebraic, trigonometric, exponential and logarithmic equations and inequalities; relations and functions in algebra and trigonometry; systems of equations and inequalities; matrices and determinants; introduction to discrete algebra; solutions of triangles; inverses of algebraic and trigonometric functions, trigonometric identities; introduction to analytic geometry. Not open to any student with credit in MAT147 or MAT167. Prerequisite: ACT math score of 20 or higher or the equivalent.

**MAT 132 Elementary Statistics (3) F, Sp, Su.** A basic course for students in natural sciences, behavioral sciences, and social sciences; tabulation of data, graphic representation, measures of central tendency and dispersion, probability, types of distributions, estimations, sampling, hypothesis testing, elementary aspects of correlation. Prerequisite: A grade of C or better in MAT112 or MAT116,

**MAT 137 Calculus in Business and the Non-Physical Sciences (4) Sp.** Differential and integral calculus applications in Business, life sciences and social science. Not open to the student with credit in MAT147 or MAT167. Prerequisite: ACT math score of 25 or higher or a grade of C or better in MAT112, MAT116, or equivalent.

**MAT 147 Applied Calculus (5) F.** An applied course in techniques of differentiation and integration; applications primarily from the technological fields; analytic geometry, functions, differential and integral calculus. Prerequisite: ACT math score of 25 or higher or a grade of C or better in either MAT116 or MAT130.

**MAT 167 Calculus with Analytic Geometry I (5) F, Sp, Su.** The first of three sequenced courses in calculus. Includes the study of limits and continuity of real functions, the derivative and its applications, the integral, and the integration and differentiation of trigonometric, exponential and logarithmic functions. Prerequisite: ACT math score of 25 or higher or a grade of C or better in MAT130.

**MAT 177 Calculus with Analytic Geometry II (5) F, Sp.** The second of three sequenced courses in calculus. Includes the study of applications of integration, integration techniques, L'Hopital's Rule, improper integrals, infinite series, conic sections, plane curves, parametric equations, and polar coordinates. Prerequisite: A grade of C or better in MAT167.

**MAT 206 Mathematical Transitions (3) Sp.** This course is designed to prepare students thoroughly for the transition into university level mathematics. Its main content is the development of formal proof, concise logical reasoning and the ability to write mathematically. Topics include but not limited to proof techniques, induction, number systems, function and sets, complex numbers, series and sequences, matrices. Prerequisite: Credit or concurrent enrollment in MAT177.

**MAT 283 Introduction to Research Methods in Mathematics (1-2) DD.** Introduction to basic research methods in Mathematics. Individual and team projects involving methods for solving mathematics-related research problems. Prerequisite: Departmental approval.

**MAT 287 Calculus with Analytic Geometry III (5) F, Sp.** The third of three sequenced courses in calculus. Includes the study of solid analytic geometry, vectors and vector calculus, partial differentiation, and multiple integrals. Prerequisite: A grade of C or better in MAT177.

**MAT 301 Mathematical Modeling (3) S.** An introduction to the modeling process including creative and empirical model construction, model analysis, and model research. Prerequisite: A grade of C or better in MAT137, MAT147, or MAT167.

**MAT 306 Matrix Algebra (3) F.** Vector spaces, linear transformations, matrix operations, determinants, matrix inversion, linear systems, eigenvalues, canonical forms. Prerequisite: A grade of C or better in MAT206.

**MAT 315 Topics in Geometry (3) F (odd-numbered years).** Synthetic projective geometry; basic symbolic logic; mathematical systems and finite geometries; algebraic geometry; non-Euclidean geometry. Prerequisite: Credit or concurrent enrollment in MAT306.

**MAT 317 Differential Equations (3) Sp.** Common types of ordinary differential equations; differential operators, Laplace transforms; systems of differential equations; partial differential equations; Fourier series; applications. Prerequisite: A grade of C or better in both MAT287 and MAT306. LAS Computer Literacy.

**MAT 331 Applied Statistics (3) Sp.** Fundamental principles and techniques of statistical investigations and data analysis from a calculus-based perspective including discrete and continuous random variables, estimation and hypothesis testing. Prerequisite: A grade of C or better in MAT137, MAT147, or MAT167.

**MAT 332 Probability Theory (3) F.** The study of discrete and continuous probability distributions. Prerequisites: MAT206 and MAT287.

**MAT 351 Mathematics Methods for Early Childhood and Elementary Education (3) F, Sp.** Mathematical methodologies, strategies, materials, and curriculum development in early childhood and elementary education. Prerequisite: A grade of C or better in MAT112 or MAT116.

**MAT 352 Mathematics for Elementary and Middle School Teachers I (3) F, Sp.** Problem solving; set theory; logical reasoning; numeration systems; addition, subtraction, multiplication, and division algorithms; number theory; mathematical applications. Not applicable to the major or minor in mathematics. Elementary and Middle School education majors may not take the course until officially admitted to teacher education. Prerequisite: A grade of C or better or concurrent enrollment in MAT351.

**MAT 353 Mathematics for Elementary and Middle School Teachers II (3) F, Sp.** Introductory geometry; geometric constructions; measurement geometry; motion geometry; introductory probability and statistics. Not applicable to the major or minor in mathematics. Prerequisite: A grade of C or better in MAT352.

**MAT 407 Advanced Calculus I (3) F.** Elementary topological aspects of the real numbers, sequences, limits and continuity, differentiation, integration, and infinite series. Prerequisite: A grade of C or better in MAT306.

**MAT 416 Abstract Algebra (3) Sp.** Groups, rings, and fields; definitions and fundamental theorems; homomorphisms and isomorphisms; polynomials and field extensions. Prerequisite: A grade of C or better in MAT306. LAS Writing.

**MAT 417 Numerical Analysis (3) Sp (odd-numbered years).** The solution of algebraic and transcendental equations; finite differences; interpolation, numerical differentiation, and integration; numerical solutions of ordinary differential equations. Prerequisite: A grade of C or better in MAT306.

**MAT 432 Mathematical Statistics (3) Sp (even-numbered years).** A continuation of MAT 332 to include the theory and applications of estimation, hypothesis testing, regression and correlation, analysis of variance and nonparametric statistics. Prerequisite: A grade of C or better in MAT332.

**MAT 440 Advanced Topics for Middle School Teachers (5) F.** Number theory, sets and logic, algebraic systems, trigonometry, geometry, problem-solving techniques, graph theory, combinatorics, probability and statistics, and the use of technology in the learning of mathematics. Not applicable to the major or minor in mathematics. Prerequisite: A grade of C or better in MAT353.

**MAT 441 Mathematics Methods in the Middle School (3) Sp.** Techniques, materials, and resources used in the teaching of middle school mathematics. Not applicable to the major or minor in mathematics. Prerequisite: A grade of C or better in MAT440.

**MAT 447 Advanced Calculus II (3) Sp.** A continuation of MAT407. Includes vectors and curves, functions of several variables, limits and continuity; differentiable functions, the inversion theorem, multiple integrals; line and surface integrals. Prerequisite: A grade of C or better in MAT407.

**MAT 450 Independent Research/Project (1-3) F, Sp.** Investigation of a research problem, project, or topic on an individual conference basis. Prerequisites: Declared Mathematics major, a minimum of 2.5 GPA in major field, a grade of C or better in MAT287, and departmental approval.

**MAT 451 Internship in Mathematics (1-3) F, Sp, Su.** An academic program which offers mathematics majors an opportunity to integrate theory with practice. Students work full-time or part-time for a company in a position related to the mathematics major. Anticipated learning objectives are established in a contract agreed to by the student, the company supervisor, and the departmental faculty sponsor. May be repeated for a total of 6 credits. Prerequisite: Declared Mathematics major, a minimum of 2.5 GPA, MAT287, and permission of the faculty sponsor.

**MAT 462 Number Theory (3) F (even-numbered years).** Study of divisibility, primes, congruencies, Diophantine equations, arithmetic functions, partitions, Fibonacci numbers, and continued fractions. An independent method of study will be used. Prerequisite: A grade of C or better in MAT206.

**MAT 463 History of Mathematics (3) F (even-numbered years).** Study of the origins, philosophy and development of mathematics. Prerequisite: A grade of C or better in MAT206.

**MAT 465 Mathematics Teaching: Methods and Materials (3) F (even-numbered years).** Techniques, materials, and resources used in the mathematics curriculum in secondary schools. Not appropriate for the major in mathematics without teacher certification. Prerequisite: A grade of C or better in both MAT206 and EDU203.

**MAT 470 Seminar in Mathematics (3) Sp (odd-numbered years).** Selected topics in mathematics. May be repeated for credit. Prerequisite: Departmental approval.

**MAT 480 Mathematical Connections from an Advanced Perspective (3) F, Sp, Su.** A senior-level capstone experience for the student majoring in mathematics or mathematics with teacher certification. Students will formalize connections between mathematical theory and applications. Students will be expected to effectively communicate these mathematical connections in a written senior project and an oral presentation. Prerequisite: Departmental approval.

## PHYSICS COURSES

Waiving of any course prerequisites requires prior departmental authorization.

**PHY 101 Physics for the Liberal Arts (4) F.** A comprehensive, descriptive study of the scientific principles of the physical world, including the history of science, motion, energy, cosmology, geophysics, etc. Designed to provide students without significant previous coursework in the physical sciences with a solid introduction to the terminology and concepts required for further study. Three hours lecture, two hours lab. Not open to the student with credit in PHY107, PHY110, or PHY210.

**PHY 104 Introduction to Astronomy (4) F, Sp.** Basic course in astronomy, mostly descriptive in nature; solar system, stellar astronomy, structure of galaxy and universe. Three hours lecture, two hours lab.

**PHY 107 Introduction to Physics (4) Sp.** A comprehensive, quantitative study of the concepts and laws of physics. Designed for students majoring in fields other than the physical sciences, mathematics, or engineering. Topics include motion, gravity, electromagnetism, atomic and nuclear physics, optics, and relativity. Three hours of lecture, two hours lab. Not open to the student with credit in PHY110 or PHY210. Prerequisite: ACT math score of 20 or higher or the equivalent.

**PHY 110 College Physics I (4) F, Sp.** Classical treatment of mechanics, energy, waves, and heat. Three hours lecture, three hours lab. Not open to students with credit in PHY210. Prerequisite: MAT116.

**PHY 111 College Physics II (4) Sp.** Electricity, magnetism, optics, relativity, atomic physics and nuclear physics. Three hours lecture, three hours lab. Not open to students with credit in PHY211. Prerequisite: PHY110 or PHY210.

**PHY 210 University Physics I (5) F.** This course is a comprehensive study of mechanics, relativity, oscillations, waves, and thermodynamics involving simulations, applications, and experimentation. Course assignments require the student to have a thorough knowledge of college algebra, trigonometry, and calculus. Three hours lecture, two hours computer aided instruction lab, two hours experimentation lab. Prerequisite: MAT167.

**PHY 211 University Physics II (5) Sp.** This course is a comprehensive study of electricity, magnetism, optics, and introductory quantum physics involving simulations, applications, and experimentation. Course assignments require the student to have a thorough knowledge of college algebra, trigonometry, and calculus. Three hours lecture, two hours computer aided instruction laboratory, two hours experimentation laboratory. Prerequisites: PHY210 and MAT177. MAT287 recommended.

**PHY 283 Introduction to Research Methods in Physics (1-2) DD.** Introduction to basic research methods in Physics. Individual and team projects involving methods for solving physics-related research problems. Prerequisite: Departmental approval.

**PHY 312 University Physics III (3) F.** Calculus-level modern physics. Three hours lecture. Prerequisite: PHY211.

**PHY 313 Modern Physics Laboratory (1) F (odd-numbered years).** Selected experiments in modern physics. Three hours laboratory. Prerequisite: Credit or concurrent enrollment in PHY111 or PHY312.

**PHY 320 History of Physics (3) Sp (even-numbered years).** Comprehensive discussion of chronological development of concepts in classical and modern physics. Prerequisite: PHY111 or PHY312.

**PHY 410 Selected Topics in Physics (3) Sp (odd-numbered years).** Presentation of one of the following topics: 01-mathematical physics; 02-classical mechanics; 03-thermodynamics; 04-electricity and magnetism; 05-optics; 06-quantum mechanics; 07-astrophysics; 08-solid state physics; 09-nuclear and particle physics; 10-computational physics. Prerequisite: Departmental approval.

**PHY 450 Independent Research/Project (1-3) F, Sp.** Investigation of a research problem, project, or topic on an individual conference basis. Prerequisite: Declared Physics minor, a minimum of 2.5 GPA in minor field, and departmental approval.

**PHY 465 Physics Teaching: Methods and Materials (2) F (even-numbered years).** Techniques, materials, and equipment used in teaching physics in secondary schools. Prerequisite: PHY111 or PHY312.