



MATHEMATICS MAJOR

Professor: M. Majerus

Associate Professors: P. Yu, L. Stumpe

Assistant Professors: J. Pichelmeyer

Visiting Assistant Professor: M. Haile

Instructor: Z. Kopeikin

Contact: Dr. Laura Stumpe

Email: laura.stumpe@westminster-mo.edu

The Department of Mathematics and Physics offers a major and a minor program of study in Mathematics as well as course work integral to the General Education Program and to programs in the physical sciences. Quantitative and analytical skills are essential for useful and effective lives. Through the study of mathematics, students acquire and enhance their problem-solving skills and learn to apply these to real world issues.

Students who are planning to major in mathematics should complete MAT 124 and CSC 104 in the freshman year. All students taking math courses are required to purchase the TI-84+ calculator.

Mathematics majors must earn a 2.3 or better cumulative GPA in courses needed to satisfy major requirements.

Mathematics minors must earn a C- or better in all mathematics courses needed to satisfy minor requirements.

You can find the course descriptions for all courses required for this major by clicking on the following links:

- [Computer Science Course Descriptions](#)
- [Mathematics Course Descriptions](#)
- [Physics Course Descriptions](#)

Major: MATHEMATICS

Student's Last Name

First Name

Middle Initial

Advisor

Date Major Declared

Course #	Title of Course	Hours Required	Semester Completed	Grade
Required Courses:				
MAT 124	Calculus I	5		
MAT 214	Calculus II	4		
MAT 215	Linear Algebra	3		
MAT 224	Calculus III	4		
MAT 313	Mathematical Probability and Statistics	3		
MAT 331	Mathematics Seminar (must be taken no later than junior year)	3		
MAT 422	Modern Algebra	3		
MAT 424	Advanced Calculus	3		
Mathematics Electives (upper-level courses) 6 hours				
	*	3		
	*	3		
Other Required Courses				
CSA 104 or	Programming Logic and Design	3		
CSA 304	Structured Programming	4		
Plus one of the following courses				
PHY 212	Physics II	4		
<u>or</u>	An Upper-Level course in Biology, Chemistry, or Economics which has a pre req in the discipline	3		
TOTAL HOURS FOR MAJOR		40-42 hrs		

If any substitutions or waivers of requirements are allowed, please list below and initial.

CSA – Computer Systems Analysis

CSA 104 Programming Logic and Design (3 hrs.) This course is an introduction to computer programming logic and design concepts that present the appropriate techniques and tools employed to clearly define and specify the functional requirements of a structured computer program. It promotes sound computer program design through a modular approach emphasizing logical reasoning and critical thinking that will enhance the design of any computer program. Students will test programming logic using a flowchart visualization tool and will explore coding examples from several different low- and high-level programming languages. This course also presents an introduction to the discipline of Systems Analysis and uses the systems development life cycle as a framework in which to introduce topics such as defining user requirements, documentation, software development methodologies, continuous quality management, and system testing strategies. Students will use general purpose software for creating program design documentation and will explore career opportunities in the discipline. It serves as a prerequisite to other programming courses offered through the department. (Previously offered as SEG 104).

CSA 250 IT Infrastructure (3 hrs.) The content of this course will present aspects of an organization's IT infrastructure, specifically networking, firewalls, servers, storage options, desktop computing, and mobile devices. Emphasis will be on advantages and disadvantages of different infrastructures and computing and storage options. Cloud computing technologies will be explored as viable options for storage, software, and computing needs of an organization. Information security considerations are included as essential component to any infrastructure decision. Prerequisites: none. Offered every fall.

CSA 304 Structured Programming (4 hrs.) This course provides students with experience in properly designing, implementing, and testing structured computer programs implemented in the C++ language using skills developed in CSA 104. The course extends the practice of problem solving, algorithm development, and program documentation forming the foundation for exploring C++ concepts in logic control structures, modular programming, functions, input, output, file processing, user defined data types, static arrays, and user defined function libraries. Programming concepts of code reuse, program interactivity, testing methods, data validation, and user interface design are incorporated throughout the course. Additional topics include proper programming techniques, strategies for debugging, interpreting design documents, and preparing documentation. Prerequisite: CSA 104. Offered every fall semester. (Previously offered as SEG 304).

CSA 321 Python Programming (3 hrs.) This course focuses on the essential elements of computer programming design and implementation for constructing applications using the Python programming language. Topics covered include expressions, variables, user-defined functions, logic structures, modules, and file processing. An introduction to Python libraries will include the built-in functions specifically for math, data science, graphics, and user interface applications. Additional topics include proper programming techniques, strategies for debugging, interpreting design documents, and preparing documentation. Interactive, hands-on assignments will provide the student opportunity to design software solutions to authentic problems encountered in a variety of disciplines and careers. Prerequisites: CSC 104. Offered every spring semester. (Previously offered as SEG 321)

CSA 322 Information Visualization (3 hr.) Using Excel and Python, students will explore different techniques for representing information for reporting via various media outlets. Additionally, specific Python libraries designed for working with a variety of input file types, file processing, data cleaning, and information visualization will be utilized. Students will have the opportunity to work with data files from a variety of academic disciplines. The ethical collection and use of organizational data will be discussed. This course includes a study of the transformation of organizational data into meaningful information. Students will learn how to use Python and Excel to effectively present information to a variety of audiences in a variety of formats to satisfy a research question or information need. Prerequisites: SEG 104 and SEG 321; or BUS 210. Offered every odd fall semester. (Previously offered as SEG 322)

CSA 327 Database Systems (3 hr.) This course will enable the student to translate the information needs of an organization into effective conceptual and logical data models that can be implemented in any relational database system. It utilizes a problem-based approach to learning focusing on teamwork, real-world examples, and in-class exercises allowing the student to immediately apply the knowledge gained. Students will have opportunities to create and manipulate a database from data design documents. Additional topics include dataflow diagrams, database administration, the three-tiered database architecture, data normalization, database transaction management, data security, information assurance, and SQL programming. Prerequisites: CSA 104. Offered every even fall semester. (Previously offered as SEG 327).

CSA 351 IT Project Management (3 hr.) This course presents tools and techniques for managing IT systems development projects throughout the systems development life cycle. Topics managing project integration, scope, requirements, schedule, cost, staffing, quality, communications, risk, and procurement. Emphasis is also given to stakeholder management, leading the project team, and project documentation. Students will learn to utilize software tools such as Microsoft Project and Excel to facilitate project management tasks such as cost-benefit analyses, quality metrics, and communications. While the emphasis of this course is on IT systems project management, the concepts are easily transferrable to the management of any type of project. Prerequisites: BUS 220, CSA 104, or ITY 250. (Previously offered as SEG 351)

CSA 390 Object Oriented Programming (3 hrs.) This course focuses on the object-oriented programming methodology using the C++ programming language. This methodology is often used for developing large, complex information systems. Topics covered include data abstraction, inheritance, and reusable components. The use of classes and objects is incorporated throughout the object-oriented software development processes of scenario definition, design, building, implementation, and coding. Programming concepts enforced throughout the course specifically emphasize software reliability, testing, and reusability. Additional topics include proper programming techniques, strategies for debugging, interpreting design documents, and preparing documentation. Prerequisites: CSA 104 and CSA 304.

CSA 404 Data Structures (4 hrs.) A second course in computer programming in C++ that covers multi-dimensional arrays, dynamic arrays, pointers, user defined data structures, function and operator overloading, records and structs, exception handling, memory management, and various sorting algorithms. This course focuses initially on the basic common data structures (lists, stacks, queues, trees, heaps, graphs) using modular design. Classes and data abstraction are introduced. Careful attention is given to modular architecture that promotes reliability and reusability. Additional topics include proper programming techniques, strategies for debugging, interpreting design documents, and preparing documentation. Prerequisites: CSA 104 and CSA 304. Offered even spring semester. (Previously offered as SEG 404)

CSA 470 Computer Systems Analysis Capstone I (3 hrs.) This capstone course is to be taken in the fall semester of the senior year as the first course in a two-course capstone sequence. It would cover the first phases of the systems development life cycle including project estimation and planning, feasibility analysis, cost-benefit analysis, problem analysis, requirements elicitation and definition, solution and engineering design, and quality control planning. The student will engage in a systems development project approved by the instructor to be used to demonstrate concepts presented in the course. The student should select a software development project sufficient in scope to continue through the second capstone course. The project may incorporate programming, web development, media creation, or other type of software as part of the overall project. Additional topics include professional development, career exploration, communications, and technical writing. Prerequisites: CSA 104, CSA 304, or ITY 250, and CSA 351. Offered every fall semester. (Previously offered as SEG 470).

CSA 480 Computer Systems Analysis Capstone II (3 hrs.) This capstone course would be taken the spring semester of the senior year as the second course in the two-course capstone sequence. It would cover the final phases of systems development including building, testing, implementation, quality control, and measures of success. The student will engage in a systems development project approved by the instructor and continued from the first capstone course. The project may incorporate programming, web development, media creation, or other type of software as part of the overall system. At the end of this course, the student will have a working prototype of some component of their project, depending on scope and project goals. Heavy emphasis will be placed on quantitative metrics use for cost-benefit analyses, resource management, and quality control. Additional topics include professional development, career readiness, communications, and technical writing. CSA 104, CSA 304, or ITY 250, and CSA 351, CSA 470.

MAT – Mathematics

MAT 110 Quantitative Reasoning for Mathematical Problem Solving (3 hrs.) This course emphasizes basic mathematical principles through problem solving. The focus is on solving problems encountered in typical college courses such as interpreting graphs, applying formulas, computing interest and percentages, understanding statistical output, and solving equations. The quantitative reasoning approach builds critical thinking skills in solving problems and analyzing the outcomes of those contextually. This course is designed for those students who will broadly use mathematics in everyday life, with less technical emphasis on skills for future math courses. This course is for those who do not intend to major in programs requiring additional mathematics. Offered every semester. Prerequisites: None

MAT 111 College Algebra (3 hrs.) The study of linear, quadratic, exponential and logarithmic equations, inequalities, functions and graphs and their applications. Prerequisites: ACT math score between 19 and 23 or SAT math score between 410 and 530 or Accuplacer Advanced Algebra and Functions score of 241 and at least 2 years of high school algebra with at least C's. Not meeting prerequisite requires the student to successfully complete MAT 110 as the Foundational Mathematics requirement. Offered every semester, one or more sections depending on demand.

MAT 114 Elementary Statistics (3 hrs.) A study of the organization and analysis of data including the normal, binomial, chi square and t distributions; estimating population parameters; hypothesis testing; random sampling; central limit theorem; and simple linear regression and correlation. A term project using technology for analysis and testing of data collected from real life is a required component of the course. Prerequisites: ACT math score 23 or SAT math score 540 and 4 years of high school math, including 2 years of algebra with at least B's. Not having prerequisite requires the student to successfully complete MAT 110 Quantitative Reasoning for Mathematical Problem Solving or MAT 111 College Algebra with a grade of C- or better. Offered every semester.

MAT 115 Fundamentals of Data Science (3 hrs.) The focus of this course is to introduce the scientific methods and processes used to analyze large data sets and predictive modeling methods. The course will use statistical methods and exploration techniques to investigate patterns and anomalies in mostly structured large data sets. Underlying theories of statistics will be utilized to explore, interpret, and visualize data in interdisciplinary fields such as health, business, education, and economics. An introduction to R programming language and R Studio will be used throughout the course. Pre-requisites: Evidence of college level statistics course with a grade of C- or better, a math ACT of 25 or higher, a math SAT score of 610 or higher, or AP stats with a score of "4" or higher. Offered spring semester.

MAT 121 Pre-Calculus (3 hrs.) The study of trigonometric, exponential, logarithmic and algebraic functions and their applications. Pre-Calculus is a course for students who plan to take Calculus I. Prerequisites: ACT math score 22 or SAT math score 540 and at least 4 years of high school math, including 2 years of algebra with at least B's. Not meeting prerequisite requires the student successfully complete MAT 111 with a grade of C- or better. Offered every semester or depending upon demand.

MAT 122 Business Calculus (3 hrs.) A terminal calculus course, including a brief review of algebra and the study of the derivatives and integrals of algebraic, exponential and logarithmic functions. Business applications of the derivative and the definite integral are also studied. Prerequisites: ACT math score 23 or SAT math score 540 and at least 4 years of high school math, including 2 years of algebra and some pre-calculus with at least B's. Students not meeting these prerequisites requires the students to successfully complete MAT 111 with a grade of C- or better. Offered every semester or depending upon demand.

MAT 124 Calculus I (5 hrs.) A formal introduction to calculus, including limits, derivatives, techniques of differentiation, optimization, anti-derivatives, definite integrals, and the fundamental theorem of calculus. Applications in science and engineering are included. Prerequisites: ACT math score of 25 (27 preferred) or SAT math score of 600 (630 preferred) and at least 4 years of high school math, including a pre-calculus or trigonometry course with a grade of at least B. Not having prerequisite requires the student to successfully complete MAT 121, Pre-calculus with a grade of C- or better. Offered every semester.

NOTE: A course **leading to the fulfillment** of the Breakthrough math requirement (MAT 114 or MAT 124) must be taken in the first year (MAT 090 Intermediate Algebra, MAT 111 College Algebra, MAT 114 Elementary Statistics, MAT 121 Pre-Calculus, or MAT 124 Calculus I).

MAT 214 Calculus II (4 hrs.) A continuation of MAT 124. This course includes integration of standard forms (integration by parts, trigonometric substitution, etc.), the definite integral, applications of integration and the study of sequences and series. Prerequisites: Completion of MAT 124 with a C- or better, or permission of the instructor. Offered every semester or depending upon demand.

MAT 215 Linear Algebra (3 hrs.) An introduction to the concepts of linear transformations and matrices, determinants, vector spaces, eigenvalues, and selected applications. Prerequisites: Completion of MAT 124 with a C- or better. Offered every fall semester.

MAT 224 Calculus III (4 hrs.) A continuation of MAT 214. This course includes solid analytic geometry, an introduction to vector analysis and differential geometry, partial differentiation and multiple integration. Prerequisites: Completion of MAT 214 with a C- or better. Offered every semester or depending upon demand.

MAT 231 Mathematics for Elementary & Middle School Teachers (3 hrs.) This is the first part of a two-part integrated methods and content course for elementary teachers. This part focuses on the "why" along with the "how" of such topics as problem solving, deductive and inductive reasoning, beginning number concepts, operations with whole numbers, elementary number theory and other appropriate topics such as learning theory and assessment. Prerequisites: Completion of the Tier I mathematics or Foundational math requirement in Breakthrough requirement with a C- or better. Offered every fall semester.

MAT 305 Heart of Mathematics (3 hrs.) A semester-long discussion of the big ideas of mathematics in cultural and applications contexts. Evolution of mathematical ideas in art, the sciences, computing, literature and other disciplines. An introduction to mathematical thinking and problem-solving in many contexts. Prerequisites: MAT 214 with a C- or better, or permission of instructor. Offered in the spring semester of even years.

MAT 310 History of Mathematics (3 hrs.) This course is taught from the viewpoint that mathematics has been a major cultural force in many civilizations. The course will trace the evolution of mathematics and its impact on the human endeavor as civilizations rose and fell throughout history to modern times. Prerequisites: Completion of MAT 124 with a C- or better. Offered in the fall semester of odd years.

MAT 312 Differential Equations (3 hrs.) A study of ordinary differential equations (ODEs). This course is focused on the analytical, geometrical, and numerical aspects of differential equations. First and second order ODEs are studied using various analytical techniques. The Laplace transform is utilized to solve initial value problems of higher-order ODEs. Particular attention is paid to systems of ODEs using phase portraits and numerical analyses. Offered spring semester of odd years. Prerequisites: Completion of CSC 104 and MAT 224 with a C- or better, or by permission of instructor.

MAT 313 Mathematical Probability and Statistics (3 hrs.) This course introduces the student to the mathematics of probability and statistics. The concepts of discrete and continuous probability distributions are studied in detail. The material is applied to the areas of statistical inference, including estimation and hypothesis testing. Offered every spring semester. Prerequisites: Completion of MAT 214 with a C- or better or concurrent enrollment in MAT 214.

MAT 314 Higher Geometry (3 hrs.) A study of various geometric axiomatic systems from both the synthetic and analytic approach, including finite and non-Euclidean geometries. Offered every fall semester or depending upon demand. Prerequisites: Completion of MAT 331 with a C- or better.

MAT 321 Discrete Mathematics and Graph Theory (3 hrs.) This course provides an introduction to an area of mathematics focusing on discrete rather than continuous mathematical structures. Topics explored in this course include number theory, functions and sequences, graph theory, combinatorics, and set theory. Basic definitions and concepts of the field as well as some major results in the area will be discussed. This course prepares students for further study in mathematics, business, or computer-related fields. Pre-requisite: MAT 214 with a grade of C- or better. Offered in even fall semesters.

MAT 331 Mathematics Seminar (3 hrs.) A study of the foundations of mathematics, logical deductive reasoning and proof. Emphasis is on sets and number theory. This course prepares the mathematics major for success in other 300- and 400-level mathematics courses. Prerequisites: Completion of CSC 104 with a C- or better; and MAT 224 with a C- or better or permission of the instructor. Offered every spring semester.

MAT 340 Statistical Computer in R Studio (3 hrs.) A projects-based introduction to R and R Studio with applications in relevant fields. The focus of this course is to work with pre-processed data and flat files, access and format large data from the web, analyze data by methods such as conditional means, regression analysis, and cross-validation techniques, with the focus on statistically analyzing and presenting the data.

MAT 351 Methods of Teaching Elementary & Middle School Mathematics (3 hrs.) This course is the second part of an integrated methods and content course for elementary teachers. Topics include fractions, decimals, geometry, probability and statistics, measurement and other appropriate topics. Offered every spring semester. Prerequisites: C- or better in MAT 231 or permission of the instructor.

MAT 398 Independent Study (1-4 hrs.) Individual study and/or research under the supervision of staff members on a particular topic agreed upon by both the student and the instructor. Enrollment by permission of the instructor and department chair.

MAT 411 Data Science Seminar (3 hrs.) This is a capstone course for majors. Each individual in the class carries out research under the supervision of the instructor in large-scale data analysis using statistical knowledge and computational techniques learned in previous courses. Literature review, regular meetings, progress reports, and a final paper and presentation are required. Topics may be chosen from interdisciplinary fields including, but not limited to, computer science, biology, psychology, engineering, and business. Offered every other spring semester. Prerequisites: MAT 340, ECN 355, and CSC 211 with a grade of C- or better.

MAT 422 Modern Algebra (3 hrs.) A study of the axiomatic development of algebraic structures, including groups, rings, and fields, with selected introductions to topics which may include symmetry groups, factorization, and integral domains. Offered every spring semester. Prerequisites: Completion of CSC 104 and MAT 331 with a C- or better.

MAT 424 Advanced Calculus (3 hrs.) This course is a rigorous study of the foundations of Calculus with emphasis on limits, continuity, differentiation, and Riemann integration. Through the reexamination of those topics, students learn proof techniques which are fundamental to the mathematical field of analysis. Prerequisites: Completion of CSC 104, MAT 331, and MAT 224 with grades of C- or better. Offered every fall semester.

PHY – Physics

PHY/EGR 101 Introduction to Engineering and Design (3 hrs.) This course introduces students to the engineering profession. Emphasis is placed on engineering design, project management skills, software applications, teamwork, and communication. An engineering term project including a written technical report is required for this course. Offered every spring semester.

PHY 105 Introduction to Physics (3 hrs.) An introductory study of the foundations and concepts of modern physical theory. The course stresses the historical significance and philosophic implications of classical mechanics, the special and general theories of relativity and quantum theory. This course is intended for non-science majors. However, students who plan to enroll in PHY 201, but who have not taken high school physics, are encouraged to take this course first. Not open to students with credit in PHY 201. This course is typically offered once per academic year in the spring semester. Prerequisites: MAT 111 or one year of high school algebra.

PHY 201 Physics I (4 hrs.) A study of the science of physics covering topics in mechanics, gravitation and rudimentary quantum physics. Lecture, three hours; laboratory, three hours. This course is offered once per academic year in the Fall semester. Prerequisites: PHY 105 or one year of high school physics and previous or concurrent enrollment in MAT 124 or one year of high school calculus.

PHY 202 Algebra-Based Physics I (4 hrs.) Algebra-based Physics I is an introductory physics course which covers the topics of Newtonian mechanics, conservation laws, and fluid statics and dynamics. The course includes a laboratory. Prerequisite: MAT 111 or one year of high school Algebra.

PHY 212 Physics II (4 hrs.) A continuation of Physics I covering topics in electromagnetism, electric circuits, waves, optics, atomic physics, nuclear physics and particle physics. Lecture three hours; laboratory three hours. This course is offered once per academic year in the spring semester. Prerequisites: Completion of PHY 201 with a C- or better.

PHY 213 Algebra-Based Physics II (4 hrs.) Algebra-based Physics II is a continuation of Algebra-based Physics I and covers the topics of oscillatory motion, waves, electricity and magnetism, optics, and selected topics in modern physics. This course includes a laboratory. Prerequisite: C- or better in Algebra-based Physics I.

PHY 223 Physics III (3 hrs.) A continuation of Physics II covering topics that require a command of calculus and more abstract concepts than those presented in PHY 201 or 212. The course is a study of selected topics in relativity, quantum mechanics and modern physics (including elementary particles). This course is typically offered once per academic year in the fall semester. Prerequisites: PHY 212 and previous or concurrent enrollment in MAT 214.

PHY/EGR 230 Engineering Mechanics & Statics (3 hrs.) Statics is the study of rigid-body mechanics which deals with the equilibrium of bodies. Covered topics include the principles of statics, force systems, internal forces, structural analysis, friction, center of gravity, and moments of inertia. Prerequisites: MAT 224 and PHY 201 with a C- or better.

PHY 314 Thermodynamics (4 hrs.) Study of the general laws of thermodynamics, the kinetic theory of gases and statistical mechanics. Lecture three hours; laboratory three hours. Prerequisites: PHY 223 and MAT 224.

PHY 315 Modern Physics (4 hrs.) The course covers applications of quantum theory and relativity theory to atoms, molecules and subatomic particles. Lecture three hours; laboratory three hours. Prerequisites: PHY 223 and MAT 224.

PHY 324 Light (4 hrs.) A study of topics in geometrical and physical optics and in spectroscopy, including an examination of optical instruments and light sources such as lasers. Lecture three hours; laboratory three hours. This course is typically offered every other academic year in the spring semester and alternates with PHY 325. Prerequisites: PHY 223.

PHY 325 Electronics (4 hrs.) The theory of semiconductor devices and applications of these devices in circuits. The course emphasizes electronic instrumentation and experimental technique. Lecture three hours; laboratory three hours. This course typically is offered every other academic year during the spring semester and alternates with PHY 324. Prerequisites: PHY 212.

PHY 328 Analog Circuits (4 hrs.) We will investigate the theory and experimental procedures of modern electronic analog circuits. There are two main classes of electronics: analog and digital. Analog circuits, covered this semester, deals with electrical signals that can have a continuous range of values, while digital circuits, covered during the second semester of the circuits sequence, involves digital signals that can have only a small number of discrete values. Prerequisites: PHY 212 and MAT 214.

PHY 398 Independent Study (1-4 hrs.) On topics from the major areas of physics, chosen according to the background, requirements, or interests of the individual student. Course work will consist of readings, problem solving, laboratory research, practicums, reports or conferences, as appropriate.

PHY 415 Introduction to Theoretical Physics I (4 hrs.) Vector analysis is developed as a working tool and applied to problems in mechanics and electromagnetic theory. The topics covered include statics, kinematics and dynamics of particles and rigid bodies, moments of inertia and inertia tensors, work and energy, gravitational theory, oscillations and electric and magnetic fields in vacuo and in material substances. Four lectures per week. This course is offered as needed. Prerequisites: PHY 223, MAT 224 and previous or concurrent enrollment in MAT 312.

PHY 416 Introduction to Theoretical Physics II (4 hrs.) Vector analysis is developed as a working tool and applied to problems in electromagnetic theory and quantum mechanics. The topics covered include Maxwell's equations and time-dependent fields, energy and forces associated with these fields, wave propagation and the postulates of quantum mechanics, wave functions, expectation values and the quantization of angular momentum in atoms. Four lectures per week. This course is offered as needed. Prerequisites: PHY 223, MAT 224 and previous or concurrent enrollment in MAT 312.