



MATHEMATICAL DATA SCIENCE MAJOR

Professor: M. Majerus

Associate Professors: P. Yu, L. Stumpe (Chair)

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 offers a major program of study leading to a Bachelor of Arts in Mathematical Data Science. This major explores the volume of data available in a variety of fields, including but not limited to biology, business, and education. This program supports a deep understanding of statistics, programming skills, and communication skills. By studying large data sets in applicable fields, students who major in Mathematical Data Science will learn to access data, ask critical questions, glean patterns and insights from the data, and communicate results to answer real-world problems. The results will be technologically uncovered, researched in literature, and communicated clearly for their intended audiences. A major in this area of study provides a solid foundation for continued work and graduate study in data science surrounding business, science, or social science fields.

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

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

Major: MATHEMATICAL DATA SCIENCE

Student's Last Name

First Name

Middle Initial

Advisor

Date Major Declared

Course #	Title of Course	Hours Required	Semester Completed	Grade
Required Courses				
MAT 115	Fundamentals of Data Science	3		
MAT 124	Calculus I	5		
MAT 214	Calculus II	4		
MAT 215	Linear Algebra	3		
MAT 313	Mathematical Probability and Statistics	3		
MAT 321	Discrete Mathematics & Graph Theory	3		
MAT 340	Statistical Computing in R	3		
MAT 411	Data Science Seminar	3		
Mathematics elective (upper-level course)				
MAT 3xx/4xx	Upper-Level Elective	3		
Other Required Courses				
CSA 104	Programming Logic and Design	3		
CSA 321	Python Programming	3		
CSA 327	Database Management Systems	3		
ECN 355	Research Methods for Business and Social Sciences Applications	3		
One Upper-Level Elective				
	An advisor approved upper-level course in Biology, Chemistry, Business, Physics, Psychology, Computer Science, Environmental Science, or Economics which has a pre-req in the discipline.	3		
TOTAL MAJOR HOURS		45 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.

ECN – Economics

ECN 110 Introduction to Economics (3 hrs.) This introductory course will briefly explore the historical foundations of economics systems including the foundation of private property rights, the emergence of capitalism and market-based economy, and its rise in different forms in the US and around the world. The course will then move to the study of microeconomic topics such as scarcity, theory of markets and effects of the market structures on the resource allocation and social welfare. After exploring markets and market structures, the course will move into topics from macroeconomic such as measurements of an economy, basic classical and Keynesian theory and the macroeconomic tools of fiscal and monetary policy. Finally, this course will conclude with a look at the economics of international trade, and exchange rates. This is an excellent course to explore subject matter of economics for those who have not done any economics before and would like to get an introduction to its subject matter or to pursue further study in business and economics.

ECN 211 Principles of Macroeconomics (3 hrs.) An introductory course that examines, in an international context, the causes and consequences of economic growth, inflation and unemployment, and how government fiscal and monetary policies affect macroeconomic outcomes. Prerequisite: MAT 114 or MAT 122 or MAT 124.

ECN 212 Principles of Microeconomics (3 hrs.) An introductory course to acquaint the student with consumer choice, the market system, resource allocation, and the decisions of firms in markets with varying degrees of competition with applications relating to public policy. Prerequisite: MAT 114 or higher.

ECN 308 Economics of Industrial Organization (3 hrs.) In this course students will study business firms' behavior under different market structures. The course studies behavior of firms: their strategy, performance, and interactions under various market conditions and levels of competition. It explains and studies reasons behind business practices such as mergers, acquisition, price discrimination, advertising, product selections, innovations vertical restraints, cartels and exclusionary conducts. It also explains why there are economic regulations, such as antitrust and other industrial regulations. This course will introduce game theory as a tool of economic analysis. Prerequisites: ECN 212 and either MAT 122 or MAT 124 or permission from instructor. Basic understanding of principles of microeconomics, algebra, and calculus is necessary and these will not be reviewed in the class.

ECN 310 International Trade and Finance (3 hrs.) Studies international movements of goods and services and monetary flows. Covers international trade theory, trade policy, institutional evolution of the world economy, balance of payments and exchange rates. Prerequisite: ECN 211 and ECN 212.

ECN 316 Public Finance (3 hrs.) Examines the role of government in a market system and develops the tools necessary to evaluate government policies. Explores the development and growth of the public sector of the economy, the theory and character of public revenue, expenditure, and debt; studies the use of public finance to achieve economic stability, promote economic growth, and effect other social goals; and examines federal, state, and local taxes, expenditure, and administration. Offered every other spring semester. Prerequisites: ECN 211 and 212.

ECN 325 Money, Banking, and Financial Markets (3 hrs.) A study of the roles of the financial sector and of monetary policy on the economy. Explores essential features of financial markets; discusses concerns of bank managers in making investment choices; examines the roles of the Federal Reserve and banks in the money supply process; explores the importance of money in the economy; and examines the importance of exchange rate movements in international investing. Prerequisite: ECN 211.

ECN 331 Intermediate Macroeconomic Theory (3 hrs.) This course provides a working understanding of the economy as a whole in an international context. It examines the relationship between such measures of aggregate economic activity as income, unemployment, inflation and interest rates. It develops models of economic activity and uses them to analyze the effects of changes in the economic environment, private behavior and government policy. It also evaluates the potential for government fiscal and monetary policies to affect economic activities. Prerequisite: ECN 211, ECN 212 & MAT 114 or MAT 122 or higher.

ECN 334 Economic Development (3 hrs.) This course examines the concept and measurement of development, the main factors that prevent development from taking place, alternative approaches to guiding development, and how development can be made sustainable. It investigates how human resources are transformed in the process of economic development and how that transformation contributes to the development process itself. It discusses how capital is mobilized and allocated for development purposes. It also explores the importance of agriculture, primary production, and industrial development, and analyzes the macroeconomic management of a developing economy open to world markets. Offered every other fall semester. Prerequisites: ECN 211.

ECN 337 Open Economy Macroeconomics (3 hrs.) This is an applied macroeconomics course, where students will be exposed to the theories of open market international aspects of finance and macroeconomics. The course will investigate modern monetary and exchange rate relationships between countries. We will analyze the balance of payments of countries, understand the issues related to international capital flows, and explain how exchange rates are determined. In addition, the standard aggregate supply and demand and the IS-LM models will be expanded to open market economies. Prerequisites: ECN 211, ECN 212.

ECN 351 Price theory and Managerial Decisions (3 hrs.) An intensive study of the tools which economists use to analyze the allocation resources among alternative uses. Topics discussed include consumer demand (consumer's choice); the determinants of price, output, and employment in various market situations (production and markets); the effects of imperfect competition on resource allocation; and it will then use the concepts to examine business decision techniques. Special emphasis will be placed on the statistical derivation and interpretation of demand and cost curves, and decision making under uncertainty. Prerequisites: ECN 212, MAT 114 and MAT 122.

ECN 355 Research Methods for Business and Social Sciences Applications (3 hrs.) This course provides the students with an overview of research methods that are commonly used to support economic, business, public policy research and decision-making. The course emphasizes business and social sciences applications. This course will enhance students understanding of quantitative, statistical and qualitative methods used in business, economics and other social sciences. Students will learn survey methods, sampling and probability distribution, statistical inference, multiple regression technique, time-series analysis and forecasting, and analysis of multivariate system using matrices such as input-output model, activity analysis, and simple linear programming. This course is writing intensive. Prerequisite: MAT 114, BUS 210, ECN 211, ECN 212, or Permission from instructor.

ECN 360 Mathematical Economics (3 hrs.) This course gives students majoring in economics and business a sound grounding in mathematical economics that has become indispensable for proper understanding of the current economics and business literatures. The course provides an introduction to a wide array of mathematical techniques used in solving economic problems and developing economic theories. Students will learn and apply integral and differential calculus, differential equations, linear algebra to study and explore economic optimization, static equilibrium analysis, linear economic models, and economic dynamics. The course will provide students an excellent grounding to work in applied and theoretical economics, econometrics and economic modeling. Prerequisites: MAT 124, MAT 215, and ECN 331, or permission from the instructor for students with strong mathematics background (such as seniors with Math majors or Economics majors who have combined GPA above 3.5 in MAT 122 and ECN 355).

ECN 362 Sports Economics (3 hrs.) This course introduces students to how economic concepts apply to the business and practice of sports. The sports world is filled with empirical evidence that illustrates economics in action and allows for testing economic theories. Basic economic models will be applied to evaluate professional and amateur sports. We will investigate topics such as the league structure, labor-relations, incentive structures, salary caps, stadium financing, etc. In addition to our attention to professional sports, we will also spend a portion of our time on college athletic programs. By the end of the course, students should be able to distinguish the sports industry from most other types of business industries. Prerequisites: MAT 114, MAT 122 or higher, and ECN 212.

ECN 364 Labor Economics (3 hrs.) This is an applied microeconomics course, where students will be exposed to the theories of the labor market and the effects of various government policies on the labor market in the U.S. Socioeconomic issues such as legal and illegal immigration, race and gender discrimination will be investigated in the course. Essentially, students will be using microeconomic economic theories to analyze the determinants of labor demand, labor supply, the causes and effects of wage differential, unemployment and labor unions. Complex topic of worker's compensation and wage structure will also be explored. Prerequisites: ECN 212 and MAT 124 or higher.

ECN 367 Econometrics (3 hrs.) An intensive study of the use of multivariate linear regression techniques applied to the estimation of economic relationships. This study will include the assumptions of the statistical model, how to recognize when these assumptions have been violated by the economic model or the data, and what corrective procedures are appropriate. Also discussed will be methods for checking forecast accuracy in advance of the forecast period and simultaneous equation estimation procedures. Prerequisites: ECN 355 or MAT 313 and ECN 110 or both ECN 212 & 211 or permission of instructor.

ECN/ENV 377 Environmental and Resource Economics (3 hrs.) This course will introduce students to the theories and methods used to understand and evaluate environmental problems and policies. The class will provide students the much-needed exposure to the non-competitive markets, the methods to analyze such markets, and the effects of these markets on economic institutions. The objective of this course is to introduce students to theories and methods used to understand and evaluate the environmental problems and policies. We will start with concepts of externalities, public goods, property rights and why markets could fail in these cases. Policies to correct market failure in domestic and international situations will be examined. Students will explore the common property problem in case of renewable resources and the public policies used to correct the problem. Prerequisites: MAT 122 or MAT 124, and ECN 212.

ECN 425 Senior Seminar (3 hrs.) This course provides the capstone experience in economics. Students will learn how to apply knowledge gained in economics courses to further their understanding of contemporary economic issues. The course provides a review of intermediate macroeconomics, price theory and econometrics. Students will complete a senior thesis which provides an opportunity to conduct original research on an economic or interdisciplinary issue. Students will present and discuss their research results in class throughout the semester. Prerequisites: Senior standing, ECN 331, (ECN 367 or ECN 355), and at least two economics electives or consent of instructor.

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.