

Mathematics

PROGRAM OBJECTIVES

The program in mathematics has three primary objectives:

- To provide a major in mathematics that develops the attitude of mind and analytical skills required for effective use and understanding of mathematics.
- To provide a major which prepares students for a variety of career choices, including graduate study, industrial and business careers, and secondary school teaching.
- Within teaching, more generally, to prepare highly qualified teachers of mathematics for elementary, middle and secondary schools.
- To provide the necessary mathematical and statistical support courses for students in other disciplines, including computer science, physical and biological sciences, social science, business and economics, and health.

LEARNING OUTCOMES

Graduates from the Mathematics Program will have demonstrated proficiency in the following four areas:

- Content Knowledge: demonstrate a broad-based knowledge of mathematical content and technique.
- Problem Solving: demonstrate problem-solving skills in the context of mathematics, and the ability to apply techniques learned in the study of specific topics in new areas.
- Inquiry and Analysis: employ the skills of independent, careful analysis of mathematical exposition.
- Communication: use written and oral communication skills appropriate to mathematical exposition.

MEANS OF ASSESSMENT

Means of outcomes assessment include midterm and comprehensive final examinations, homework exercises and quizzes, individual and group projects, classroom presentations, term papers and a capstone project. For example, students generally demonstrate their mastery of fundamental areas of mathematics through performance on examinations. Skills in logical reasoning are demonstrated by constructing rigorous proofs of mathematical theorems, or constructing counterexamples if applicable. In addition to regular course work, problem solving skills may be demonstrated by participation in the Mathematical Contest in Modeling. Classroom presentations encourage students to develop skills in communicating mathematical ideas and subtleties to an audience of their peers. Finally, every graduating senior completes a capstone project in which the student's development in multiple areas is demonstrated.

REQUIREMENTS FOR THE BACHELOR OF ARTS OR THE BACHELOR OF SCIENCE IN MATHEMATICS

1. Complete the EOU graduation requirements.
2. Completion of a minimum of 68 credit hours in Mathematics including a minimum of 40 upper division credit hours in Mathematics.
3. Complete each of the following mathematics core courses with a "C-" or better:

- MATH 251** Calculus I (4)
- MATH 252** Calculus II (4)
- MATH 253** Calculus III (4)
- MATH 254** Calculus IV (4)
- MATH 341** Linear Algebra (4)
- STAT 243** Elementary Statistics (4)
- CS 161** Foundations of CS I (4)

MATH 382 Structure of Abstract Mathematics (4)
MATH 311 Advanced Calculus (4)
MATH 344 Modern Algebra I (4)
MATH 412 Real Analysis (4) or
MATH 445 Modern Algebra II (4)
MATH 407 Capstone Seminar (4)

4. In addition to the courses above, complete a minimum of 20 hours of upper-division mathematics electives* (for a no-concentration major) or Electives designated by concentration. Grades for the electives counted toward this requirement must average to at least a "C" (2.00). (*Students may count STAT 352 as a MATH elective for this purpose.)

The Theoretical Mathematics concentration requires the following courses in addition to the mathematics core:

CS 162 Foundations of CS II (4)
MATH 321 Differential Equations (4)
MATH 338 Modern Geometry (4)
MATH 355 Advanced Discrete Mathematics (4)
MATH 412 Real Analysis (4) or
MATH 445 Modern Algebra II (4), whichever was not taken as part of the mathematics core (4) additional credit hours of upper-division MATH electives (Students may count STAT 352 as a MATH elective for this purpose)

The Applied Mathematics concentration requires the following courses in addition to the mathematics core:

CS 162 Foundations of CS II (4)
MATH 321 Differential Equations (4)
MATH 323 Mathematical Modeling (4)
MATH 483 PDEs and Engineering Mathematics (4)
STAT 352 Statistics (4)

And any two of the following

MATH 361 Probability and Statistics (4)
MATH 452 Operations Research (4)
MATH 462 Applied Regression Analysis (4)

The Mathematical Studies concentration requires the following courses in addition to the mathematics core:

MATH 323 Mathematical Modeling (4)
MATH 338 Modern Geometry (4)
MATH 355 Advanced Discrete Mathematics (4)
 (8) additional credit hours of upper-division MATH electives (Students may count STAT 352 as a MATH elective for this purpose)

TYPICAL FIRST YEAR CURRICULUM

MATHEMATICS (with no concentration, beginning with College Algebra)

TYPICAL FIRST YEAR CURRICULUM

Fall

MATH 111 College Algebra (4)
 General Education/Electives (8-11)

Winter

MATH 112 Precalculus (4)
CS 161 Foundations of CS I (4)
 General Education/Electives (7-11)

Spring

STAT 243 Elementary Statistics (4)
 General Education/Electives (11-14)

TYPICAL SECOND YEAR CURRICULUM

Fall

MATH 251 Calculus I (4)
 General Education/Electives (11-14)

Winter

MATH 252 Calculus II (4)
 General Education/Electives (11-14)

Spring

MATH 253 Calculus III (4)
 General Education/Electives (11-14)

TYPICAL THIRD YEAR CURRICULUM

Fall

MATH 341 Linear Algebra (4)
 MATH Elective* (4)
 General Education/Electives (5-8)

Winter

MATH 254 Calculus IV (4) or
 MATH Elective* (4)
 General Education/Electives (8-11)

Spring

MATH 382 Structures of Abstract Math (4)
 MATH Elective* (4)
 General Education/Electives (5-8)

TYPICAL FOURTH YEAR CURRICULUM

Fall

MATH 311 Advanced Calculus (4) or
MATH 344 Modern Algebra I (4)
MATH 407 Capstone Seminar (1)
 MATH Elective* (4)
 General Education/Electives (4-8)

Winter

MATH 412 Real Analysis (4) or
MATH 445 Modern Algebra (4)
MATH 254 Calculus IV (4) or
 MATH Elective* (4)
MATH 407 Capstone Seminar (1)
 General Education/Electives (0-4)

Spring

MATH 344 Modern Algebra I (4) or
MATH 311 Advanced Calculus (4)
MATH 407 Capstone Seminar (2)
 MATH Elective* (4)
 General Education/Electives (4-8)

*Math electives must include at least 20 credit hours of upper-division mathematics courses. STAT 352 counts as a mathematics course for this purpose.

CONCENTRATION IN THEORETICAL MATHEMATICS

THEORETICAL MATHEMATICS OBJECTIVES

This concentration is designed for those students who are interested in graduate study in mathematics. The designated electives – Geometry, Advanced Discrete Mathematics and Differential Equations – give students a solid undergraduate foundation. In addition, these students will complete two term sequences in both Real Analysis and Abstract Algebra, two of the pillars on which graduate-level courses are founded. To complete this concentration in four years, a student interested in this concentration must come to EOU prepared to enroll in at least MATH 251.

TYPICAL FOUR YEAR CURRICULUM: THEORETICAL MATHEMATICS

TYPICAL FIRST YEAR CURRICULUM

Fall

MATH 251 Calculus I (4)

CS 161 Foundations of CS I (4)

General Education/Electives (7-10)

Winter

MATH 252 Calculus II (4)

CS 162 Foundations of CS II (4)

General Education/ Electives (7-10)

Spring

MATH 253 Calculus III (4)

General Education/Electives (7-10)

TYPICAL SECOND YEAR CURRICULUM

Fall

MATH 321 Differential Equations (4)

MATH 341 Linear Algebra (4)

General Education/Electives (7-10)

Winter

MATH 254 Calculus IV (if available) (0-4)

STAT 243 Elementary Statistics (4)

General Education/Electives (11)

Spring

MATH 355 Advanced Discrete (4) or

MATH 338 Modern Geometry (4)

MATH 382 Structures of Abstract Math (4)

General Education/Electives (11-14)

TYPICAL THIRD YEAR CURRICULUM

Fall

MATH 311 Advanced Calculus (4) or

MATH 344 Modern Algebra I (4)

MATH elective* (4)

General Education/Elective (5-7)

Winter

MATH 412 Real Analysis (4) or

MATH 445 Modern Algebra II (4)

MATH 254 Calculus IV (4) or

MATH Elective* (4)

General Education/Elective (4-8)

Spring

MATH Elective* (4)

MATH 338 Modern Geometry (4) or

MATH 355 Advanced Discrete (4)

General Education/Electives (7 - 10)

TYPICAL FOURTH YEAR CURRICULUM

Fall

MATH 344 Modern Algebra I (4) or

MATH 311 Advanced Calculus (4)

MATH 407 Capstone Seminar (1)

MATH Electives* (4)

General Education/Elective (6-9)

Winter

MATH 445 Modern Algebra II (4) or

MATH 412 Real Analysis (4)

MATH 407 Capstone Seminar (1)

MATH Elective* (4)

General Education/Elective (6-9)

Spring

MATH 407 Capstone Seminar (2)

MATH Elective* (4)

General Education/Elective (9-12)

*Math electives must include at least 4 credit hours of upper-division mathematics courses. STAT 352 counts as a mathematics course for this purpose.

CONCENTRATION IN MATHEMATICAL STUDIES

MATHEMATICAL STUDIES OBJECTIVES

This concentration is designed specifically for students who intend to pursue a career teaching mathematics at the high school level. The selected electives – Geometry, Advanced Discrete Mathematics, and Mathematical Modeling – are the most appropriate for a student planning to teach at this level. This concentration can be completed in four years by a student who comes to EOU prepared for at least Math 095.

TYPICAL FOUR YEAR CURRICULUM:

MATHEMATICAL STUDIES

TYPICAL FIRST YEAR CURRICULUM

Fall

MATH 111 College Algebra (4)

General Education/Electives (8-11)

Winter

MATH 112 Precalculus (4)

CS 161 Foundations of CS I (4)

General Education/Electives (7-11)

Spring

STAT 243 Elementary Statistics (4)

General Education/Electives (11-14)

TYPICAL SECOND YEAR CURRICULUM

Fall

MATH 251 Calculus I (4)

General Education/Electives (11-14)

Winter

MATH 252 Calculus II (4)

General Education/Electives (11-14)

Spring

MATH 253 Calculus III (4)
General Education/Electives (11-14)

TYPICAL THIRD YEAR CURRICULUM**Fall**

MATH 341 Linear Algebra (4)
MATH 323 Mathematical Modeling (4) or
MATH Elective* (4)
General Education/Electives (5-8)

Winter

MATH 254 Calculus IV (4) or
MATH Elective* (4)
General Education/Electives (8 - 11)

Spring

MATH 382 Structures of Abstract Math (4)
MATH 338 Modern Geometry (4) or
MATH 355 Advanced Discrete (4)
MATH Elective* (4)
General Education/Electives (0 - 4)

TYPICAL FOURTH YEAR CURRICULUM**Fall**

MATH 311 Advanced Calculus (4) or
MATH 344 Modern Algebra I (4)
MATH 407 Capstone Seminar (1)
MATH 323 Mathematical Modeling (4) or
MATH Elective* (4)
General Education/Electives (4-8)

Winter

MATH 412 Real Analysis (4) or
MATH 445 Modern Algebra (4)
MATH 254 Calculus IV (4) or
MATH Elective* (4)
MATH 407 Capstone Seminar (1)
General Education/Electives (4 - 8)

Spring

MATH 344 Modern Algebra I (4) or
MATH 311 Advanced Calculus (4)
MATH 355 Advanced Discrete (4) or
MATH 338 Modern Geometry (4)
MATH 407 Capstone Seminar (2)
MATH Elective* (4)
General Education/Electives (0 - 4)

*Math electives must include at least 8 credit hours of upper-division mathematics courses. STAT 352 counts as a mathematics course for this purpose.

CONCENTRATION IN APPLIED MATHEMATICS
APPLIED MATHEMATICS OBJECTIVES

This concentration is designed for those students who are interested in pursuing a career in business/industry after leaving EOU, or for those students who intend to pursue graduate work in Engineering, Statistics, or other fields of Applied Mathematics. The designated electives – Differential Equations, PDEs and Engineering Mathematics, Mathematical Modeling, and a second term of both Computer Programming and Statistics – give these students a solid grounding in

mathematics as a real-world problem solving tool. This concentration can be completed in four years by a student who comes to EOU prepared for at least Math 251.

TYPICAL FOUR YEAR CURRICULUM:
APPLIED MATHEMATICS
TYPICAL FIRST YEAR CURRICULUM

Fall

MATH 251 Calculus I (4)
CS 161 Foundations of CS I (4)
General Education/Electives (7-10)

Winter

MATH 252 Calculus II (4)
CS 162 Foundations of CS II (4)
General Education/Electives (7-10)

Spring

MATH 253 Calculus III (4)
General Education/Electives (11-14)

TYPICAL SECOND YEAR CURRICULUM**Fall**

STAT 243 Elementary Statistics (4)
MATH 341 Linear Algebra (4)
General Education/Electives (7-10)

Winter

STAT 352 Statistics (4)
General Education/Electives (11-14)

Spring

MATH 382 Structures of Abstract Math (4)
General Education/Electives (11-14)

TYPICAL THIRD YEAR CURRICULUM**Fall**

MATH 323 Mathematical Modeling (4) or
MATH 361 Probability and Stat (4)
MATH 321 Differential Equations (4)
General Education/Electives (7-10)

Winter

MATH 254 Calculus IV (4) or
MATH 483 PDEs and Engineering Math (4)
General Education/Electives (11-14)

Spring

MATH 452 Operational Research (4) or
MATH 462 Regression Analysis (4)
General Education/Electives (11-14)

TYPICAL FOURTH YEAR CURRICULUM**Fall**

MATH 311 Advanced Calculus (4) or
MATH 344 Modern Algebra I (4)
MATH 323 Mathematical Modeling (4) or
MATH 361 Probability & Stat (4)
MATH 407 Capstone Seminar (1)
General Education/Electives (4-8)

Winter

MATH 412 Real Analysis (4) or
MATH 445 Modern Algebra II (4)
MATH 254 Calculus IV (4) or
MATH 483 PDEs and Engineering Math (4)
MATH 407 Capstone Seminar (1)
General Education/Electives (4-8)

Spring

MATH 344 Modern Algebra I (4) or
MATH 311 Advanced Calculus (4)
MATH 452 Operations Research (4) or
MATH 462 Regression Analysis (4)
MATH 407 Capstone Seminar (2)
General Education/Electives (4-8)

REQUIREMENTS FOR THE MINOR IN MATHEMATICS

1. Completion of a minimum of 32 credits in mathematics.
2. Complete the calculus sequence (MATH 251, 252, 253), Linear Algebra (MATH 341), and Structure of Abstract Math (MATH 382).
3. Complete an additional 12 hours of mathematics courses number 231, 254 or upper division.
4. Earn a grade of "C-" or better in MATH 251, 252, 253 and a minimum GPA of 2.00 in all other courses counting toward the minor.
5. A minimum of 10 credits applied toward the minor must be completed at Eastern.

REQUIREMENTS FOR THE MINOR IN MATHEMATICAL STUDIES

(multidisciplinary studies majors only)

1. Complete the following courses:
MATH 211 Foundations of Elementary Mathematics I (4)
MATH 251 Calculus I (4)
MATH 252 Calculus II (4)
STAT 243 Elementary Statistics (4)
MATH 338 Modern Geometry (4)
CS 161 Foundations of CS I (4)
MTHE 333 Mathematics in the Elem School (5)
One mathematics course numbered 231, 254, or upper-division (4) Total (minimum) 33 CREDITS

2. Complete each of the courses counting toward the minor with a grade of "C-" or better and an overall GPA of 2.00.

3. A minimum of 10 credits applied toward the minor must be completed at EOU.

REQUIREMENTS FOR THE MINOR IN STATISTICAL MATHEMATICS

1. Complete the following courses:
MATH 251 Calculus I (4)
MATH 252 Calculus II (4)
MATH 341 Linear Algebra (4)
STAT 243 Elementary Statistics (4) or
STAT 327/PSY 327 Stat & Exper Design (4)

STAT 352 Statistics (4)

MATH 361 Probability & Statistics (4)

MATH 462 Applied Regression Analysis (4)

One additional upper division course of at least two credits approved by the student's adviser, this course should ideally be a course in the student's major in which statistics is used. Total (minimum) 30-31 credits.

2. Complete each of the courses counting toward the minor with a grade of "C-" or better with an overall GPA of 2.00.

3. A minimum of 10 credits applied toward the minor must be completed at EOU.

MATHEMATICS COURSE DESCRIPTIONS

MATH 040- Arithmetic Skill Credits: 1.00 TO 3.00

Designed for students who need review in basic computational skills. The course will deal with whole numbers, fractions, decimals, percentages, ratios, and introductory geometry. The class will require independent student effort, and students will have to motivate themselves to attend help sessions when needed. (Not applicable toward baccalaureate degree.)

MATH 070- Elem Algebra Credits: 4.00

Fundamental concepts of algebra. This course is equivalent to first year high school algebra. Concepts include solving equations, graphing equations and inequalities, and solving systems of equations. (Not applicable toward baccalaureate degree.) Prerequisite: MATH 040 or equivalent.

MATH 095- Algebraic Foundations Credits: 4.00

This course examines fundamental concepts of algebra and is equivalent to second year high school algebra. Concepts include polynomial expressions and factoring, rational expressions, radical expressions, and quadratic expressions. (Not applicable toward a baccalaureate degree.) Prerequisite: MATH 070 or equivalent.

MATH 102- MathExcel For 095 Credits: 1.00

In this course, students work together in a low stress environment to find workable approaches to math problems a bit more challenging than those in their current MATH 095 class. This course does not fulfill the math requirement for a BS degree. Prerequisite: Must be concurrently enrolled in MATH 095.

MATH 105- Lotteries & Loans*SMI Credits: 4.00

Gen Ed Core-Natural, Math & Info Sciences

This course is an introduction to certain areas of mathematics whose applications are important and whose study will help develop critical thinking skills. Two major topics are covered. One topic is the mathematics of finance, or "loans," which includes borrowing, saving, mortgages, leases and amortization and derivative securities. The other topic is "lotteries," which includes the elementary counting techniques including permutations and combinations, finite sample space probability theory, normal distributions and the Central Limit Theorem, and games of chance. Prerequisite: Math 095 or equivalent.

MATH 110- MATH 110 Credits: 1.00 TO 6.00

Topics of current interest to students and faculty.

MATH 111- College Algebra Credits: 4.00

Topics examined in this course include equations and inequalities in one variable, a careful treatment of the function concept, and an examination of the properties and applications of several important families of functions: polynomial, rational, exponential and logarithmic. Prerequisite: MATH 095 or equivalent.

MATH 112- Precalculus Credits: 4.00

In this course students experience a detailed treatment of exponential, logarithmic, trigonometric and inverse trigonometric functions designed to prepare them for calculus. Prerequisite: MATH 111 or equivalent.

MATH 122- MathExcel For 111 Credits: 1.00

In this course, students work together in a low stress environment to find workable approaches to math problems a bit more challenging than those in their concurrent MATH 111 class. This course does not fulfill the math requirement for a BS degree. Prerequisite: Must be concurrently enrolled in MATH 111.

MATH 202- MathExcel For 251 Credits: 1.00

In this course, students work together in a low-stress environment to find workable approaches to math problems a bit more challenging than those in their concurrent MATH 251 class. This course does not fulfill the math requirement for a BS degree. Prerequisite: Must be concurrently enrolled in MATH 251.

MATH 208- Workshop Credits: 1.00 TO 6.00

A workshop emphasizing exchange of ideas by students working in a specific area of mathematics or a related discipline. Sessions are scheduled in blocks of times where attendance is mandatory. Outside reading, papers, and/or projects may be expected as pre- and post-assignments to the workshop.

MATH 209- Field Placement Credits: 1.00 TO 15.00

A planned and supervised work experience involving mathematics at an introductory level, this course offers students an opportunity to examine career goals through a work experience with approved learning objectives.

MATH 210- Selected Topics Credits: 1.00 TO 6.00

Topics of current interest to students and faculty.

MATH 211- Found Elem Math I*SMI Credits: 4.00**Gen Ed Core-Natural, Math & Info Sciences**

Introduction to basic concepts of elementary mathematics designed to initiate the building of an understanding and appreciation of the nature, structure, philosophy, and history of mathematics. Prerequisite: MATH 095.

MATH 212- Found Elem Math II*SMI Credits: 4.00**Gen Ed Core-Natural, Math & Info Sciences**

Introduction to basic concepts of elementary mathematics designed to initiate the building of an understanding and appreciation of the nature, structure, philosophy, and history of mathematics. Prerequisite: MATH 095.

MATH 213- Found Elem Mth III*SMI Credits: 4.00**Gen Ed Core-Natural, Math & Info Sciences**

Introduction to basic concepts of elementary mathematics designed to initiate the building of an understanding and appreciation of the nature, structure, philosophy, and history of mathematics. Prerequisite: MATH 095.

MATH 231- Discrete Mathematics Credits: 4.00

This course provides an introduction to several topics from Discrete Mathematics, including mathematical induction, Boolean logic and set operations, counting theory (combinatorics), and graph theory. Prerequisite: MATH 111 or equivalent.

MATH 239- Surv Calculus Part I*SMI Credits: 2.00**Gen Ed Core-Natural, Math & Info Sciences**

This course is the first of a two part course sequence to be offered. The two course sequence will be equivalent in credit and content to MATH 241, Survey of Calculus. Topics cover an introductory look at the calculus of a small family of functions, primarily those encountered in high school algebra. Both differentiation and integration will be discussed together with applications of each. This course, only when combined with MATH 240, will meet the math competency requirement. Prerequisite: MATH 111 or equivalent.

MATH 240- Surv Calculus Part II*SMI Credits: 2.00**Gen Ed Core-Natural, Math & Info Sciences**

This course is the second of a two course sequence to be offered. The two course sequence will be equivalent in credit and content to MATH 241, Survey of Calculus. Topics cover an introductory look at the calculus of a small family of functions, primarily those encountered in high school algebra. Both differentiation and integration will be discussed together with applications of each. This course, only when combined with MATH 239, will meet the math competency requirement. Prerequisite: MATH 239 or equivalent.

MATH 241- Survey Calculus*SMI Credits: 4.00**Gen Ed Core-Natural, Math & Info Sciences**

An introductory look at the calculus of a small family of functions primarily those encountered in high school algebra. Both differentiation and integration will be discussed together with applications of each. Prerequisite: MATH 111 or equivalent.

MATH 251- Calculus I*SMI Credits: 4.00**Gen Ed Core-Natural, Math & Info Sciences**

Differential Calculus including functions, limits, continuity, differentiation formulas, implicit differentiation, higher order derivatives, related rates, differentials, optimization problems, how the derivative affects the shape of a graph and an introduction to antiderivatives. Prerequisite: MATH 112.

MATH 252- Calculus II*SMI Credits: 4.00**Gen Ed Core-Natural, Math & Info Sciences**

Integral Calculus including the definite integral, the fundamental theorem of Calculus, area between curves, volumes by slicing, L'Hospital's Rule, the Calculus of the exponential and logarithmic functions, techniques of integration, improper integrals and arc length. Prerequisite: MATH 251.

MATH 253- Calculus III*SMI Credits: 4.00**Gen Ed Core-Natural, Math & Info Sciences**

Parametric equations and curves, Calculus with parametric curves, polar coordinates, conic sections, sequences, series, convergence tests for series, power series, Taylor and Maclaurin series, three dimensional coordinate system, vectors, dot product and cross product. Prerequisite: MATH 252.

MATH 254- Calculus IV*SMI Credits: 4.00**Gen Ed Core-Natural, Math & Info Sciences**

Multivariable Calculus including equations of lines and planes, cylinders and quadric surfaces, vector functions, Calculus of vector functions, functions of several variables, partial derivatives, the gradient vector, maximum and minimum values, iterated integrals, multiple integrals, cylindrical and spherical coordinates, triple integrals in cylindrical and spherical coordinates. Prerequisite: MATH 253.

MATH 310- Selected Topics Credits: 1.00 TO 6.00

Topics of current interest to students and faculty. Student must have at least sophomore standing to register for this course.

MATH 311- Advanced Calculus Credits: 4.00

A careful examination of the calculus of single variable functions. Topics include limits, completeness and compactness, sequences and series, continuity and convergence of functions. Prerequisite: MATH 382. Student must have at least sophomore standing to register for this course.

MATH 321- Differential Equations Credits: 4.00

This course examines techniques of solution for ordinary differential equations including first order differential equations, linear differential equations of higher order, Euler's method, linear systems of differential equations and applications. Prerequisite: MATH 252. Student must have at least sophomore standing to register for this course.

MATH 323- Intro Math Modelings Credits: 4.00

An introduction to the techniques of building and analyzing mathematical models. Discrete and continuous models in both scalar and vector systems are examined. Prerequisites: MATH 252 required, STAT 243 and MATH 341 recommended. Student must have at least sophomore standing to register for this course.

MATH 338- Modern Geometry Credits: 4.00

A consideration of Euclid's parallel postulate and an introduction to non-Euclidean geometry. Prerequisite: MATH 252 or consent of instructor. Student must have at least sophomore standing to register for this course.

MATH 341 – Linear Algebra Credits: 4.00

An introduction to linear algebra including systems of linear equations, vector and matrix algebra, determinants, linear transformations, eigenvalues and eigenvectors, and the concepts of basis and dimension. Prerequisite: MATH 252 or consent of instructor. Student must have at least sophomore standing to register for this course.

MATH 344 – Modern Algebra I Credits: 4.00

An introduction to group theory. Topics covered include

construction of examples, normal subgroups, factor groups, the homomorphism theorem, and group actions. Prerequisite: MATH 382. Student must have at least sophomore standing to register for this course.

MATH 355- Adv Top Discrete Math Credits: 4.00

This course examines topics in discrete mathematics at an advanced level. Topics include set theory, relations, graph theory, analysis of algorithms, and enumeration. Prerequisite: MATH 252 or consent of instructor. Student must have at least sophomore standing to register for this course

MATH 358- Numerical Analysis Credits: 3.00

In this course students examine numerical techniques for solutions of equations, series, integration, differentiation and matrices. Error analysis. Prerequisite: MATH 253. Student must have at least sophomore standing to register for this course.

MATH 361 - Probability & Statistics Credits: 4.00

In this course, students examine the foundation of elementary probability theory and statistics in both the discrete and continuous cases. Topics include probability density functions, moments and moment generating functions, random variables, samples and sampling distributions, estimation of parameters, and applications. Prerequisite: MATH 252 and STAT 243. Student must have at least sophomore standing to register for this course.

MATH 382- Structures Abstract Math Credits: 4.00

This course provides an introduction to many topics used frequently in advanced courses, as well as a thorough introduction to proof techniques. The context includes elementary logic, naive set theory, number theory, and topology. Prerequisite: MATH 341 or consent of instructor. Student must have at least sophomore standing to register for this course.

MATH 405- Reading and Conf. (Arranged) Credits: 1.00 TO 15.00

Student must have at least junior standing to register for this course.

MATH 407- Seminar/Capstone (arranged) Credits: 1.00 TO 15.00

Student must have at least junior standing to register for this course.

MATH 408- Workshop Credits: 1.00 TO 6.00

Student must have at least junior standing to register for this course.

MATH 409- Field Placement Credits: 1.00 TO 15.00

A planned and supervised work experience involving mathematics at an advanced level, this course offers students an opportunity to examine career goals through a work experience with approved learning objectives. Student must have at least junior standing to register for this course.

MATH 410- Selected Topics Credits: 1.00 TO 6.00

Student must have at least junior standing to register for this course.

MATH 412 – Real Analysis Credits: 4.00

A second term of advanced calculus covering the theory of derivatives and the Riemann integral. Prerequisite: MATH 311. Student must have at least junior standing to register for this course.

MATH 445 – Modern Algebra II Credits: 4.00

Continues the studies begun in MATH 344, extended by an introduction to rings and fields. Prerequisite: MATH 344. Student must have at least junior standing to register for this course.

MATH 452- Operations Research Credits: 4.00

In this course, students examine linear optimization methods in mathematics. Topics include linear programming models, solution techniques, and sensitivity analysis. Prerequisite: MATH 252 and 341. Student must have at least junior standing to register for this course.

MATH 453- Operations Research Credits: 4.00

In this course, students examine nonlinear optimization methods in mathematics. Topics include dynamic programming, integer programming, nonlinear programming, queuing models, and inventory models. Prerequisite: STAT 243 and Math 254. Student must have at least junior standing to register for this course.

MATH 462- Applied Regression Analysis Credits: 4.00

An introduction to statistical methods in regression and analysis of variance through the unifying theme of the general

linear model Prerequisite: STAT 243 and MATH 341 required; STAT 352 recommended. Student must have at least junior standing to register for this course.

MATH 483 – PDEs & Engineering Math Credits: 4.00

A course covering advanced multi-variable and complex calculus together with partial differential equations. Topics include Fourier series, the heat and wave equations, analytic mappings of the complex plane, and other advanced mathematics commonly used in the fields of physics and engineering. Prerequisite: MATH 321 required and MATH 254 recommended. Student must have at least junior standing to register for this course.

MATH 501- Research (arranged) Credits: 1.00 TO 15.00

Student must have graduate standing to register for this course.

MATH 505- Reading and Conf (arranged) Credits: 1.00 TO 15.00

Student must have graduate standing to register for this course.

MATH 507- Seminar Credits: 1.00 TO 15.00

Student must have graduate standing to register for this course.

MATH 708- Workshop Credits: 1.00 TO 6.00

Student must have graduate standing to register for this course.