

# MATHEMATICS (MAT)

## **MAT-096 PRE-ALGEBRA (3 Credits)**

An individualized review of applied arithmetic and pre-algebra. Patterns leading to operations with fractions, decimals, percents and proportions. Review of multiplication facts 0-15. This course does not count toward a major or a minor in mathematics. This course does not fulfill the core mathematics requirement. This course has a no-calculator policy.

*Prerequisite:* None

## **MAT-107 ALGEBRA (3 Credits)**

A study of number properties, variation, graphs and equations involving linear, quadratic and exponential functions. This course introduces the use of calculators and/or spreadsheets for the study of functions and data. It does not count toward a major or minor in mathematics. MAT-107 is designed to review the necessary foundations in algebra for MAT-110. *Prerequisite:* Qualifying score on math placement test; this course does not fulfill the core mathematics requirement.

*Prerequisite:* Requires qualifying placement score or MAT-096. C or higher

## **MAT-108 MATH FOR NURSING (3 Credits)**

This class examines the structure of mathematical expressions, equations and functions, along with their connection to practical applications. Topics include the evaluation and manipulation of expressions, equations and functions, as well as the structure and applications of linear, quadratic, rational and exponential functions.

*Prerequisite:* Qualifying placement score or MAT-096, C or higher

## **MAT-109 MATH FOR ELEM TEACHERS (4 Credits)**

This course is intended for teacher candidates. Its purpose is to give candidates broad exposure to a variety of applications of mathematics in the real world as well as enhance their basic math skills to help prepare them for teaching math in the classroom. Topics include problem solving, fraction/decimals/percents, numeration systems, equations, geometry, functions, finance, probability, and statistics. This course satisfies the core requirement in Mathematics for elementary students.

*Prerequisite:* Take MAT-096 (C or higher) or qualifying placement score.

## **MAT-110 COLLEGE MATHEMATICS (3 Credits)**

College Mathematics is intended for students majoring in liberal arts or other fields that do not have a specific mathematics requirement. Its purpose is to give students a broad exposure to a variety of applications of mathematics in the real world and to understand related spiritual foundations. Topics include reasoning, voting methods, apportionment, mathematics of finance, logic, shapes and patterns in geometry, networks and directed graphs, probability and statistics. Computational skill, spatial reasoning, calculator usage, and logical analysis abilities are developed. This course satisfies the core requirement in mathematics. *Prerequisite:* Qualifying score on SAT or CU Math Placement Exam or MAT-107 or MAT-096, C or higher. \*Warning: Math, Science, Engineering & Exercise Science Majors check with your advisor for the correct math course.

*Prerequisite:* Take MAT-096 (C or higher), or qualifying placement score

## **MAT-120 CONTEMPORARY MATH FOR BUSINESS (3 Credits)**

by permission only

*Prerequisite:* None

## **MAT-121 COLLEGE ALGEBRA (3 Credits)**

College Algebra introduces the study of polynomial, rational, exponential, and logarithmic functions, in addition to the quadratic formula, geometric series, binomial series, systems of equations and probability. A graphing calculator is required (TI-83/84 recommended). This course satisfies the core requirement in mathematics.

*Prerequisite:* Take MAT-107 or qualifying placement score

## **MAT-122 PRE-CALCULUS (4 Credits)**

This course serves as a collection of topics relevant to calculus based courses. Focus will be given on exponential and logarithmic functions in addition to properties, graphs and applications of the sine, cosine and tangent functions, along with their reciprocals and inverse functions. Connections are made with right and oblique triangles, polar coordinates and equations concerning polar coordinates and conic sections. This course satisfies the core requirement in mathematics.

*Prerequisite:* Take MAT-121 or qualifying placement score

## **MAT-131 CALCULUS I (5 Credits)**

The study of rates of change for polynomial, exponential, logarithmic, and trigonometric functions, tangent lines, graphs, maximum values, and areas. Applications of calculus will be modeled with graphing calculators. Computer software and/or graphing calculator (TI-84 recommended) is a required tool for this course. This course satisfies the core requirement in mathematics.

*Prerequisite:* Take MAT-122 or qualifying placement score

## **MAT-132 CALCULUS II (5 Credits)**

Applications of differentiation and integration will include techniques of integration, transcendental functions, infinite series and sequences, parametric equations, polar forms and vectors. Graphing calculator (TI-84 recommended) required. This course satisfies the core requirement in Mathematics.

*Prerequisite:* MAT-131

## **MAT-151 STATISTICS (3 Credits)**

Descriptive statistics including measures of central tendency and standard deviation, statistical inference with emphasis upon testing of hypotheses and measures of association, and application of these techniques to decision-making and planning. Computer software and/or graphing calculator is required (TI-83/84 preferred).

*Prerequisite:* Complete math core

## **MAT-209 TEACHING MATH I & CLINICAL EXP (4 Credits)**

This course is designed to merge mathematical content knowledge and pedagogical knowledge to design mathematical pedagogical knowledge that focuses on the whole learner with specific attention to PK-3 students' needs (cognitive, physical, behavioral, social, and emotional). Teacher candidates will be introduced to reflective thinking to understand how their own biases, content knowledge, and past experiences will impact their instruction. Topics include counting and cardinality; operations (addition, subtraction, and foundational ideas for multiplication); initial place value and regrouping concepts; measurement and data (time, money, relative positions, lengths in metric and standard); and geometry (naming shapes, shape composition, shapes in the real world, composition/decompositions of shapes, 2D and 3D shapes). This course will expose teacher candidates to various curricular resources, assessment tools, and instructional technology to promote active engagement and give direction to instruction. Clinical experience in an appropriate early education setting provides teacher candidates an opportunity to apply their developing mathematical instructional knowledge and skills.

*Prerequisite:* MAT-109 and conditional acceptance into TE division

**MAT-233 DIFFERENTIAL EQUATIONS (3 Credits)**

The study of equations involving derivatives by methods of analytic algebra or numeric solutions. Priority is given to first-order differential equations and their applications as well as linear higher-order equations and Laplace transformations. Maple software required.

*Prerequisite:* MAT-132

**MAT-234 MULTIVARIATE CALCULUS (3 Credits)**

This course explores differentiation and integration of functions of several variables, limits, differentials, optimization, volumes and surface area. Students will also study change of variables and methods of multivariate integration. Maple software required.

*Prerequisite:* MAT-132

**MAT-235 DIFFER EQUAT & LINEAR ALG - ENGINEERS (3 Credits)**

Introduction to the theory of first and higher order differential equations by analytical and numerical methods as well as computer-based approaches. This course also introduces concepts in linear algebra such as systems of equations, determinants, vector spaces and eigenvectors. Maple software required.

*Prerequisite:* MAT-234

**MAT-241 APPLIED LINEAR ALGEBRA (3 Credits)**

The algebra of matrices, determinants, vectors, inverting matrices, diagonalizing matrices, eigenvalues and their applications. Maple software and graphing calculator (TI-89/92/200) required for calculations and applications to dynamic systems.

*Prerequisite:* None

**MAT-243 DISCRETE MATHEMATICS (3 Credits)**

A basic study of fundamental principles of discrete mathematics. Topics include combinatorics, probability and algorithms.

*Prerequisite:* MAT-121 or MAT-131

**MAT-244 METHODS OF MATHEMATICAL RESEARCH (3 Credits)**

Students in this course will be introduced to the typesetting language of L<sup>A</sup>T<sub>E</sub>X, solving mathematical problems with Maple, understanding mathematical articles, locating and researching mathematical topics, and preparing mathematical presentations. Maple software required.

*Prerequisite:* ENG-212 and MAT-245

**MAT-245 MATHEMATICAL PROOFS (4 Credits)**

A course in reading and constructing mathematical proofs. How to start proofs (direct proofs, proofs by cases, proofs by contrapositive, proofs by contradiction); proofs about sets, functions, numbers, inequalities, and equivalence relations; proofs by mathematical induction; understanding the theorems of calculus and linear algebra; and preparing to do proofs in Modern Algebra and Real Analysis.

*Prerequisite:* ENG-212

**MAT-251 PROBABILITY & STATISTICS (3 Credits)**

This is a Calculus-based course in probability and statistics which includes discrete and continuous random variable probability models. Topics include the central limit theorem, sampling distributions, estimation, confidence intervals, hypotheses testing, analysis of variance, and regression analysis. Emphasis will be placed on statistical software to create probability models and run statistical procedures, specific to applications in economics and science.

*Prerequisite:* MAT-131 and MAT-132

**MAT-312 ELEM MATH METHODS & FIELD EXPERIENCE (4 Credits)**

This course is designed to merge mathematical content knowledge and pedagogical knowledge to design mathematical pedagogical knowledge that focuses on the whole learner with specific attention to the 3rd through 6th grade students' needs (cognitive, physical, behavioral, social, and emotional). Teacher candidates will be introduced to reflective thinking to understand how their own biases, content knowledge, and past experiences will impact their instruction. Topics include place value (multi-digit operations, base 10, and other bases); multiplication and division (factors, multiples, area model, distributive property, commutative property, order of operations, and inverse operations); fractions (unit fractions, equivalent fractions, relationship to perimeter, volume, angle measure, shapes, and attributes); and arithmetic patterns (setting up for algebraic thinking). This course will also expose students to various curricular resources, assessment tools, and instructional technology to promote age-appropriate active engagement and give direction to instruction. Clinical experience in an appropriate upper elementary setting provides teacher candidates an opportunity to apply their developing mathematical instructional knowledge and skills.

*Prerequisite:* Professional Status and MAT 209

*Prerequisite:* Complete math core and have full acceptance into teacher ed program

**MAT-315 TEACHING MATHEMATICS II (4 Credits)**

This course is designed to merge mathematical content knowledge and pedagogical knowledge to design mathematical pedagogical knowledge that focuses on the whole learner with specific attention to the 3rd through 6th grade students' needs (cognitive, physical, behavioral, social, and emotional). Teacher candidates will be introduced to reflective thinking to understand how their own biases, content knowledge, and past experiences will impact their instruction. Topics include place value (multi-digit operations, base 10, and other bases); multiplication and division (factors, multiples, area model, distributive property, commutative property, order of operations, and inverse operations); fractions (unit fractions, equivalent fractions, relationship to perimeter, volume, angle measure, shapes, and attributes); and arithmetic patterns (setting up for algebraic thinking). This course will also expose students to various curricular resources, assessment tools, and instructional technology to promote age-appropriate active engagement and give direction to instruction. Clinical experience in an appropriate upper elementary setting provides teacher candidates an opportunity to apply their developing mathematical instructional knowledge and skills.

*Prerequisite:* Take MAT-209 and have full acceptance into teacher ed program

**MAT-333 REAL ANALYSIS (3 Credits)**

A first course in the theory of the calculus of a single real variable. Students will study the real number system as a complete ordered field, convergence of sequences and series, continuity and differentiability of functions of a real variable, theory of the Riemann integral and integrable functions.

*Prerequisite:* MAT-132, 241, 233 or 234 and MAT-245

**MAT-341 MODERN ALGEBRA (3 Credits)**

A first course in group theory with a focus on binary operations, isomorphisms, cyclic groups, permutations, abelian groups, orbits of equivalence relations, cosets, normal subgroups, homomorphisms and related theorems, factor groups, group actions and Sylow's Theorems.

*Prerequisite:* MAT-245 & MAT-241

**MAT-380 INTERNSHIP (1-3 Credits)**

An individualized assignment arranged with an agency, business or other organization to provide guided practical experience in a mathematical sciences related career/ministry activity.

*Prerequisite:* Junior or Senior status required

**MAT-400 CAPSTONE SEM: GEOM & HIST/MATH SCIENCES (3 Credits)**

For Math Education majors, this course studies the history of mathematical ideas, notation and processes from ancient Egypt and Mesopotamia through the modern era. Students will study individual mathematicians as well as cultural and abstract ideas. Attention will be given to geometrical concepts, including constructions and geometrical proofs.

*Prerequisite:* MAT-241 and 245

**MAT-401 CAPSTONE SEMINAR FOR MATHEMATICS (3 Credits)**

Students will research and present an important topic in mathematics using both library research and personal preparation.

*Prerequisite:* Fifteen credits of upper level MAT courses

**MAT-402 MATHEMATICAL SCIENCE SEMINAR I (3 Credits)**

Exploration of selected advanced topics in mathematical modeling, set theory, number theory; topology, complex variables; differential geometry, set theory, number theory; topology, complex variables; differential geometry, modern geometries; abstract linear algebra, advanced matrix algebra, vector analysis, numerical analysis, graph theory, combinatorics, computer programming. Advanced project topics in physics may be selected from Fourier series, transform calculus, partial differential equations, boundary value problems, complex variables, and vector calculus. Designed for mathematical sciences majors' current needs and for students planning graduate study in the physical sciences or applied mathematics.

*Prerequisite:* None

**MAT-403 MATHEMATICAL SCIENCE SEMINAR II (3 Credits)**

Exploration of selected advanced topics in mathematical modeling, set theory, number theory; topology, complex variables; differential geometry, set theory, number theory; topology, complex variables; differential geometry, modern geometries; abstract linear algebra, advanced matrix algebra, vector analysis, numerical analysis, graph theory, combinatorics, computer programming. Advanced project topics in physics may be selected from Fourier series, transform calculus, partial differential equations, boundary value problems, complex variables, and vector calculus. Designed for mathematical sciences majors' current needs and for students planning graduate study in the physical sciences or applied mathematics.

*Prerequisite:* Take MAT-402

**MAT-470 READINGS IN MATHEMATICAL SCIENCES (1-3 Credits)**

Readings in specific mathematical sciences or mathematics education topics in areas of student need and interest. Required periodic reports with related discussions, labs, or creative/classroom activities. May be repeated.

*Prerequisite:* None

**MAT-471 SECONDARY MATH METHODS (3 Credits)**

Prospective teachers implement a secondary mathematics curriculum that models NCTM and State of Michigan standards. They will examine educational philosophy and history, learning theory and curriculum development. They will also plan, implement and evaluate unit and lesson plans in developmental math, algebra, geometry, probability and statistics and pre-calculus. Exploration with use manipulatives, computers, multimedia technologies, activity projects and construction tools. Computer and TI-84 graphing calculator required.

*Prerequisite:* MAT-132, MAT-151 or MAT-251 and acceptance into teacher ed program

**MAT-480 ADVANCED TOPICS (1-3 Credits)**

Selected topics in mathematical modeling, set theory, number theory; topology, complex variables; differential geometry, set theory, number theory; topology, complex variables; differential geometry, modern geometries; abstract linear algebra, advanced matrix algebra, vector analysis, numerical analysis, graph theory, combinatorics, computer programming. Advanced project topics in physics may be selected from Fourier series, transform calculus, partial differential equations, boundary value problems, complex variables, and vector calculus. Designed for mathematical sciences majors' current needs and for students planning graduate study in the physical sciences or applied mathematics. May be repeated. *Prerequisite:* Permission of instructor.

*Prerequisite:* None

**MAT-490 INDEPENDENT STUDY (1-3 Credits)**

An opportunity to perform independent study/research/creative activity in the various branches of mathematical sciences and allied fields of application. Submission and approval of a research proposal must precede registration. May be repeated.

*Prerequisite:* None