**MATHEMATICS (MATH)**

**MATH 106. Mathematics for the Benefit of Mission and Society. (4 Credits)**  
An overview of how mathematics benefits the mission of the Church and society worldwide, with special regard for those who are suffering and/or marginalized. Examples will be drawn both from history and our contemporary world.  
Tags: AAQR

**MATH 107. Finite Mathematics and Applications. (4 Credits)**  
Designed to provide the mathematical tools that a college graduate is likely to encounter in his or her work. Core topics include systems of linear equations, mathematics of finance, and basic probability and statistics. Additional topics may include game theory for decision making, linear programming, iterated processes, or networks. Extensive use of spreadsheet programs. The course illustrates the relevance of mathematics to life applications by taking real or realistic examples from business, economics, social sciences, and life sciences.  
Tags: AAQR

**MATH 125. Mathematics for Elementary and Middle Grade Education. (4 Credits)**  
Numeration systems, set theory, the whole number, integer number, and rational number systems with associated axioms, operations, relations, and counting principles. Topics from geometry, measurement, logic, and probability and statistics. For elementary education majors only.

**MATH 131. Precalculus. (4 Credits)**  
A course in elementary functions intended to prepare students for MATH 221 or MATH 231. Topics include the properties of the real number system, inequalities and absolute values, functions and their graphs, solutions of equations, polynomial functions, trigonometric functions, exponential, and logarithm functions. Emphasis on using functions to model physical or social systems.  
Tags: AAQR

**MATH 221. Applied Calculus. (4 Credits)**  
This course covers the ideas of calculus, emphasizing applications to business and the social sciences. It includes a wider range of topics than MATH 231 but with less depth of coverage. Topics include limits, definitions and applications of the derivative and integral, and functions of one or more variables. Prerequisite: MATH 131 or Precalculus competence. This course does not count towards the mathematics major. Only one of MATH 221 or MATH 231 may be taken for credit.  
Tags: AAQR

**MATH 231. Calculus I. (4 Credits)**  
This course covers differential and integral calculus of functions of a single real variable, including trigonometric, exponential, and logarithmic functions. Derivatives and integrals are studied symbolically, graphically, and numerically. Applications of calculus are emphasized throughout the course. Three lectures, two hours drill. Prerequisite: MATH 131 or Precalculus (see Calculus Readiness Assessment).  
Tags: AAQR

**MATH 232. Calculus II. (4 Credits)**  
Infinite series, polar coordinates and parametric curves. Three-dimensional geometry and vector algebra, functions of two variables, partial differentiation, double integration. Applications of these topics are emphasized throughout the course. Three lectures, two hours drill. Prerequisite: MATH 231 or 233 with a minimum grade of C-, or AP Calculus AB score of 4 or 5, or BC score of 3.

**MATH 233. Calculus I B. (2 Credits)**  
This is a 2-hour course that covers the B-Quad material of MATH 231. It meets concurrently with MATH 231 in B-Quad. Three lectures, two hours drill. Prerequisite: AP Calculus AB score of 3 or BC score of 2.  
Tags: AAQR

**MATH 234. Calculus II B. (2 Credits)**  
This is a 2-hour course that covers the B-Quad material of MATH 232. Prerequisite: AP Calculus BC score of 4 or 5.

**MATH 241. Introduction to Proofs. (2 Credits)**  
Propositional logic, quantifiers, elementary proof techniques and strategies. An introduction to set theory, including operations on sets, definition of functions, relations. Basic number theory including divisibility, primes, greatest common divider, Euclidean Algorithm. Induction and well-ordering. Permutations and combinations. Axiomatic systems. Prerequisite: MATH 232.

**MATH 243. Discrete Mathematics and Functional Programming. (4 Credits)**  
Sets, logic, the nature of proof, induction, algorithms, algorithm correctness, relations, lattices, functions, and graphs. Functional programming and recursion using the ML programming language. May not be taken after MATH 341 or MATH 351.  
Tags: AAQR

**MATH 245. Linear Algebra. (4 Credits)**  
Starting with solving systems of linear equations, matrix algebra is used to explore vector spaces and linear transformations. Emphasis is given to bases, dimension, eigenvectors, and orthogonality. Prerequisite: MATH 231 or 233.

**MATH 263. Introduction to Statistics. (4 Credits)**  
Topics chosen from discrete and continuous distributions, moments, hypothesis testing, correlation and multiple correlation, regression of linear equations, mathematics of finance, and basic probability and statistics. Students will use selected software packages for data processing and analysis. Prerequisite: MATH 131 or Precalculus knowledge.

**MATH 314. Problem Solving Seminar. (2 Credits)**  
Mathematical problem solving aimed at students who enjoy solving problems in a variety of areas of mathematics, and who would like to strengthen their creative mathematical thinking. Students are required to take the William Lowell Putnam Undergraduate Mathematics Competition. Prerequisites: MATH 232 or 234, and 245.
MATH 324. Methods of Teaching Mathematics. (2 Credits)
Theories and methods for teaching mathematics at the secondary level. Topics include cooperative learning, classroom management, and creative teaching ideas. Consideration of current math technology and curriculum standards. Required of mathematics majors in WheTEP prior to student teaching. Prerequisite: Acceptance to WheTEP

MATH 325. Methods of Teaching Middle Grade Mathematics. (2 Credits)
Theories and methods for teaching mathematics at the middle grade level. Topics include effective teaching strategies, planning, and assessment of math content. Based on the Common Core State Standards for Mathematics and the Illinois Professional Teaching Standards. Prerequisite: Acceptance to WheTEP

MATH 331. Vector Calculus. (2 Credits)
Vector algebra, properties of transformations, curves and surfaces, line, surface, and volume integrals, Green's, Stokes', and the divergence theorems. Prerequisite: MATH 232 or 234.

MATH 333. Differential Equations. (4 Credits)
An introduction into the theory, methods of solution, and selected applications of ordinary differential equations. Topics include first order equations, second order linear equations with constant coefficients, numerical analysis of ordinary differential equations, Laplace Transforms, series solutions, and systems of differential equations. Prerequisite: MATH 232 or 234.

MATH 341. Modern Algebra. (4 Credits)
An introduction to the theory of groups, rings, and fields. Topics in group theory include Lagrange's theorem, quotient groups, applications to geometry, public key cryptography, and finitely generated abelian groups. Topics in ring theory include ideals, quotient rings, and polynomial rings. Topics in field theory include field extensions, Euclidean construction problems, cubic and quartic equations. Prerequisite: MATH 245 or consent of instructor.

MATH 343. Discrete Mathematics. (4 Credits)
Basic and advanced topics selected from sets and logic, Boolean algebra, functions, algorithms, relations and recursion, combinatorics, graph theory, nature of proof, number theory and cryptography. Prerequisite: MATH 231, 233 or consent of instructor. Offered spring of even-numbered years.

MATH 351. Analysis I. (4 Credits)
Derivation of the properties of continuity, differentiability, integrability, and convergence by use of the limit concept and basic axioms of the real number field. Prerequisites: MATH 232 (or MATH 234) and MATH 245, or consent of instructor.

MATH 352. Complex Analysis. (4 Credits)
An introduction to functions of a complex variable. Topics include the algebra and geometry of complex numbers, mappings of the complex plane, elementary analytic functions, complex functions defined by power series, and differentiation and integration of complex functions. Prerequisite: MATH 331 (MATH 351 recommended). Offered spring of odd-numbered years.

MATH 362. Geometry. (4 Credits)
Selected topics from finite, affine, projective, Euclidean and non-Euclidean geometry from both the axiomatic and transformation approaches. Prerequisite: MATH 245. Offered spring of odd-numbered years.

MATH 363. Probability and Statistics I. (4 Credits)
An introduction to probability theory, including discrete and continuous distributions. Topics covered include independence, conditional probability, expectation, variance and covariance, random vectors, and the central limit theorem. Prerequisites: MATH 232 (or MATH 234) and MATH 245.

MATH 364. Mathematical Modeling. (4 Credits)
A course designed to develop an appreciation for, an understanding of, and a facility in the use of mathematics in the social and life sciences. Particularly important in political science, ecology, psychology, sociology, economics, anthropology, epidemiology, and business management provide the motivation for the development of tools and techniques employed throughout applied mathematics. Prerequisites: MATH 232 (or MATH 234) and MATH 245.

MATH 385. Topics in Applied Mathematics. (4 Credits)
A topic selected for each semester in which the course is offered that focuses upon a particular applied mathematics discipline in a way that brings important mathematical theory and methods to practice. Possibilities include Numerical Analysis, Dynamical Systems, Applied Linear Algebra, Operations Research, Cryptography, or Applied Discrete Math. Prerequisites: MATH 232 (or MATH 234) and MATH 245 or consent of instructor.

MATH 386. Topics in Statistics. (4 Credits)
A topic selected for each semester in which the course is offered that focuses upon a particular application in depth and goes beyond methods covered in MATH 363. Some possible topics include Bayesian Analysis, Machine Learning, Nonparametric Methods, Regression, or Structural Equation Modeling. Prerequisite: MATH 363.

MATH 394. Seminar. (2 Credits)
Study of a topic of mathematics not covered in the other courses. May be retaken when different topics are offered. Prerequisite: Consent of instructor. Offered on demand. Last offering was Topology.

MATH 433. Partial Differential Equations. (4 Credits)
Partial differential equations (PDE's) are differential equations involving functions of multiple independent variables and partial derivatives. PDEs are ubiquitous in the natural sciences, especially physics and engineering, appearing in mathematical models that vary in time and space such as diffusion, fluid flow, vibrating strings and membranes, waves (sound, electromagnetic), transport phenomena, and quantum mechanics. The course focuses on analytical methods for solving PDEs with extensions into Fourier theory, L2 theory, and Sturm-Liouville theory. Prerequisites: MATH 245 and 333.

MATH 441. Algebra II. (4 Credits)
Advanced group theory, including group actions and Sylow topics. Module theory with selected applications. Galois theory of field extensions. Multivariable polynomial rings with applications of Groebner bases. Introduction to the concept of categories. Prerequisite: MATH 341. Offered fall of even-numbered years.

MATH 451. Analysis II. (2 or 4 Credits)
Study of topics from real analysis. Prerequisite: MATH 351. Alternate years.

MATH 463. Probability & Statistics II. (4 Credits)
Starting from a review of probability distributions and their underlying assumptions and features, this course focuses upon statistical inference and data analysis. Topics will be chosen from parametric hypothesis testing, ANOVA, contingency tables and tests for independence, regression techniques and some Bayesian/non-parametric methodology. Prerequisite: MATH 363.
MATH 485. Advanced Topics in Mathematics. (4 Credits)
Selected topics from advanced mathematics, such as Number Theory, Partial Differential Equations, or Differential Geometry. Prerequisite: MATH 245.

MATH 493. Mentored Research Seminar. (2 or 4 Credits)
Faculty and student collaboration on a project of mutual interest. Limited enrollment - faculty approval required.

MATH 494. Senior Seminar. (2 Credits)
494-1. (Section 1) "Mathematics and Its Foundations". A study of the historical development of the main ideas in mathematics, with an emphasis on the nineteenth-century developments in axiomatics, logic, number and set theory which led to the twentieth-century developments in the philosophy and foundations of mathematics. As a Christ at the Core Capstone course, students will actively participate in this learning experience by extensive reading, group discussions and several written assignments. Prerequisites: Senior standing in the mathematics major, MATH 341 and 351.; 494-2. (Section 2) "Applied Mathematics Senior Seminar". Christ at the Core Capstone course integrating the applied math program with liberal arts learning. Historical survey and current applications of important mathematical equations and models. Applied project work and oral presentations connecting applied mathematics with other disciplines, humanitarian organizations, and/or faith-based mission in under-served communities, and also with Christ at the Core learning. Reflection on diverse and distinctive callings of Christian mathematicians and the Christ at the Core student calling to grow in knowledge, wisdom and Christian character. Prerequisites: Senior standing in the applied math major including MATH 302, or consent of instructor.

MATH 495. Problems In Mathematics. (1 to 4 Credits)
Independent study for senior majors. A maximum of two hours can be applied to the major.

MATH 496. Internship. (1 to 4 Credits)
Graded pass/fail. Prerequisite: junior or senior standing with Mathematics or Applied Mathematics major.