Mathematics

Mathematics is a discipline with ancient origins in early Greek thought, and has been the indispensable language and tool of science. In our major program and in our service to other departments, the mathematics department at Covenant College seeks to provide solid grounding in the discipline of mathematics as well as providing a greater appreciation for logic and precise language. In our major program we seek to prepare students for graduate school, technical jobs or for teaching in secondary school. In our service programs we aim to prepare pre-engineering students for the dual degree program and to prepare students majoring in other disciplines which require mathematics. We also hope to impart:

1. an appreciation for the wisdom of God as it is manifested in the logic and orderliness of His creation,
2. an appreciation for the goodness of God in both structuring much of creation to be amenable to mathematical description and in structuring our thought processes to be able to understand the mathematics that describe the creation,
3. an appreciation of absolute truth in the limited context of a mathematical system and at the limited understanding of fallen man.

Requirements for a Major in Mathematics

The core requirements are the same as those listed for baccalaureate degrees (see page 22) with the exception that a course other than PHI 357. Formal Logic must be completed to fulfill the humanities distribution requirement. Mathematics courses required for the major will also satisfy the mathematics core requirement.

Core requirements ...............................................................55
Electives ..............................................................................22

Major and Supporting Course Requirements

ICS 130. Computer Programming Methodology ..............4
MAT 145-146. Calculus I, II.................................................8
MAT 247. Calculus III ..........................................................4
MAT 250. Probability ...........................................................3
MAT 258. Differential Equations .........................................4
MAT 290. Proofs and Exposition ‘W’ .................................3
MAT 310. Linear Algebra.....................................................3
MAT 350. Modern Algebra ..................................................3
MAT 460. Real Analysis .......................................................3
MAT 492. Senior Integration Paper ‘S’ .............................. 2
PHI 357. Formal Logic .........................................................3
Total hours for the major ................................................ 49
Total degree hours ................................................... 126

Requirements for Minor in Mathematics

MAT 145-146. Calculus I, II................................................ 8
MAT 247. Calculus III ......................................................... 4
MAT 258. Differential Equations ......................................... 4
Any course offered by the mathematics department that is from either the core electives of the mathematics major, or STA 251, or STA 364 ............................................... 3-4
Total hours for the minor ........................................... 19-20

Requirements for Major in Mathematics Education with Georgia Secondary School Certification in Mathematics (grades 6-12)

Students interested in secondary-level certification should consult with the Chair of the Education Department and should also refer to the Education Department’s section of this catalog.

Core Requirements

BIB 111. Old Testament Introduction ......................... 3
BIB 277-278. Christian Doctrine I, II......................... 6
COR 100. The Christian Mind .............................................2
COR 225-226. Cultural Heritage of the West I, II............... 6
COR 325. Global Trends for the Twenty-First Century ... 3
COR 337. Intercultural Experience ....................................1
ENG 111. English Composition .........................................3
HIS 325. Twentieth-Century World History ....................3
PE 151. Concepts in Physical Education ..........................2
PE 152. Personal Aerobics and General Fitness ............... 1
Fine Arts Distribution Requirement .................................1
(See the Core and Distribution Requirements section on page 24 for a list of approved courses.)
Foreign Language.................................................................8
Proficiency in one year of an elementary-level foreign language. (Note: Students who have taken two years of the same foreign language in high school and attained an average grade of 2.67 or higher on a 4.0 scale are exempted from the foreign language requirement.)

Humanities Distribution Requirement...................................3
(See the Core and Distribution Requirements section on page 24 for a list of approved courses.)

Natural Science Lab Distribution Requirement.........................4
(See the Core and Distribution Requirements section on page 24 for a list of approved courses.)

Social Science Distribution Requirement..............................3
(See the Core and Distribution Requirements section on page 24 for a list of approved courses.)

General education core subtotal........................................55

Teaching Field
ICS 210. Computer Programming Methodology ..................4
MAT 145-146. Calculus I, II..................................................8
MAT 247. Calculus with Analytic Geometry III...................4
MAT 258. Differential Equations...........................................4
MAT 310. Linear Algebra.....................................................3
MAT 350. Modern Algebra..................................................3
MAT 360. Modern Geometry I.............................................3
MAT 361. Modern Geometry II............................................3
MAT 492. Senior Integration Paper ‘S’.................................2
STA 251. Elementary Statistical Methods.............................4
Teaching field subtotal....................................................38

Professional Education
EDU 215. Technology for Educators.................................3
EDU 221. Introduction to Teaching......................................3
EDU 222. Educational Psychology......................................3
EDU 234. Teaching in a Pluralistic Society..........................3
EDU 322. Nature and Needs of the Early Adolescent Learner.....3
EDU 340. Curriculum and Methods in the Secondary School....4
EDU 361. Education of Exceptional Children......................3
EDU 370. History and Philosophy of American Education ‘W’ ..................................................3
EDU 411. Educational Assessment......................................1
EDU 491. Student Teaching Seminar.................................1
EDU 497-498. Teaching Practicums I & II, Secondary ‘S’ 15
Total professional education subtotal...............................42
Total degree hours ................................................................135

Note: COR 337. Intercultural Experience may be taken for 0-3 credit units. In addition, it is possible to be exempt from taking foreign language and/or math and/or English composition courses. One or more elective courses may need to be taken in order to bring the total number of credit units up to the 126 units required for graduation.

Mathematics Courses
Placement in mathematics courses for those with no previous college mathematics credit is determined on the basis of high school mathematics credit, high school mathematics GPA, mathematics scores on the SAT or ACT and scores on the mathematics placement test given at registration time each semester.

040. Intermediate Algebra
A review of elementary and intermediate algebra designed to assist students in developing the skills necessary for taking MAT 122. Fundamentals of Mathematics or MAT 141. College Algebra. Prerequisite: placement level 0 (zero). Four units institutional credit (institutional credit is not applicable to the 126 units required for graduation). Only offered on a credit/no credit basis.

111-112. Mathematics for Elementary Teachers: I, II
These courses are a two-course sequence of mathematics courses designed to fulfill the general education core mathematics requirement for students preparing to be early grade teachers and candidates for teaching mathematics in the middle grades. It is designed to provide the mathematical content needed to enable them to teach mathematics at their level of instruction as described by the National Council of Teachers of Mathematics in Principles and Standards for School Mathematics (2000). Prerequisite: MAT 040 or placement level 2; open only to majors in elementary education. MAT 111 is three units, MAT 112 is three units for early grade majors; middle grade majors with a concentration in mathematics take MAT 112 for four units of credit. (Note: If a student takes this course and subsequently changes majors, that student will also need to take either MAT 122. Concepts in Mathematics or MAT 141. College Algebra to fulfill the College core math requirement. Conversely, if a student has taken MAT 122 before changing to an education major, that student is exempt from MAT 111 and may proceed directly to taking MAT 112.)

122. Concepts in Mathematics
The course will cover problem solving, elementary set theory, mathematical logic, systems of numeration, the real number system, mathematical systems, geometry, counting methods, and elementary probability and statistics. The course is designed to fulfill the general education core mathematics requirement. Prerequisite: MAT 040 or placement level 1; not open to students with credit for any mathematics course (or equivalent) numbered 142 or higher unless special permission is granted by the instructor. Three units.
141. College Algebra
The course will cover complex numbers, solution of equations and inequalities, techniques of graphing, and the study of various functions: linear, quadratic, polynomial, rational, exponential, and logarithmic. Designed for those who have had two years of high school algebra, but need more depth in algebraic topics to prepare for enrollment in MAT 142, 144 or STA 251. Prerequisite: MAT 040 or placement level 2; not open to students with credit for any mathematics course (or equivalent) numbered 142 or higher unless special permission is granted by the instructor. Four units.

142. Pre-Calculus Mathematics
The course will cover analytical trigonometry, systems of equations, matrices and determinants, linear programming, solution of polynomial equations, conic sections, mathematical induction, the binomial theorem, permutations and combinations, and introductory probability. Designed to meet the requirements of various major programs (including biology, business and elementary education/middle grades certification), and to provide preparation for the calculus sequence. Prerequisite: MAT 141 or placement level 3; not open to students with credit for any mathematics course (or equivalent) numbered 145 or higher unless special permission is granted by the instructor. Four units.

144. Finite Mathematics
The course will cover systems of linear equations, matrices, linear programming, mathematics of finance and elementary differential and integral calculus. Emphasis will be placed on applications to finance and management problems. Prerequisite: MAT 141 or placement level 3. Four units.

145-146. Calculus I, II
The course will cover analytic geometry, functions and limits, the derivative and its applications, antiderivatives, indefinite integrals, transcendental functions, the definite integral and its application, methods of integration, polar coordinates and infinite series. These courses are prerequisites to all courses numbered above 200. Prerequisite: MAT 142 or placement level 4 for MAT 145; MAT 145 or placement level 5 for MAT 146. Four units each.

247. Calculus III
A continuation of MAT 145-146. The course will cover vectors, parametric equations, solid analytic geometry, partial differentiation, multiple integration, line and surface integrals. Prerequisite: MAT 146. Four units.

250. Probability
An introduction to the theory of probability. The course will cover combinatorics, laws of probability, discrete and continuous random variables and distributions, expectation, variance, and if time permits, other topics. Prerequisite: MAT 146. Three units.

258. Differential Equations
The course will cover first order differential equations, second and higher order linear equations, series solutions, the Laplace transform, systems of first order equations, linear second order boundary value problems. Both analytic and numerical techniques are studied. Prerequisite: MAT 146. Four units.

270. Discrete Mathematics
The course will cover counting, permutations, combinations, discrete probability distributions, generating functions, Ramsey Theory, the pigeonhole principle, induction, various algorithms, topics in graph theory including: connectivity, trees, Euler tours, Hamilton cycles, edge and vertex coloring, planar graphs and graph algorithms. Prerequisite: MAT 145. Three units.

290. Proofs and Exposition
Proofs in mathematics are both intimidating and mysterious to most people. This course hopes to dispel some of that mystery as well as equip students to both read and write mathematical proofs. Besides a review of logic and mathematical nomenclature, students will be required to tackle proofs from a variety of different fields of mathematics. Prerequisite: MAT 146. Three units. ‘S’ ‘W’

310. Linear Algebra
This course will develop the algebra of vectors and matrices, including finding the inverse of a matrix, subspaces, basis and dimension of vector spaces, linear transformations, isomorphisms. Inner and cross products will be treated. Special types of matrices will be discussed, such as the Jordan Normal form. Eigenvalues and eigenvectors will be treated. Prerequisite: MAT 146. Three units.

350. Modern Algebra
The course will cover integral domains, rings, fields, groups, elementary number theory, and other selected topics. Prerequisite: MAT 290 or permission of instructor for Math Edu majors. Three units.

360-361. Modern Geometry I, II
The objective of this course is to teach students axiomatic reasoning without the aid of diagrams, explore what can be deduced from neutral geometry (without the Euclidean Fifth Postulate, or, equivalently, the Hilbert Parallel Axiom for Euclidean Geometry), explore aspects of Euclidean Geometry, then, replace the Euclidean Fifth Postulate with the Hyperbolic Parallel Postulate, and show that Hyperbolic Geometry is as self-consistent as Euclidean Geometry. The historical developments, philosophical implications and Hyperbolic Trigonometry should be of particular use to future secondary education mathematics instructors.
Prerequisite: MAT 290 or permission of instructor for Math Edu majors for MAT 360; MAT 360 for MAT 361. Three units each.

410. Mathematical Logic
The course will cover truth functions and tables, rules of logic, predicate calculus, first order arithmetic, formal set theory, consistency, completeness, recursive functions, and if time permits, Godel Numbers, Godel’s Incompleteness Theorem, algorithms, computability, Church’s Thesis, Turing machines, undecidability of formal systems and the halting problem. Prerequisite: MAT 290. Three units.

460. Real Analysis
The course will cover set theory, the real number system, functions, sequences, limits, convergence, uniform convergence, Bolzano-Wierstrass Theorem, functions of a real variable, open and closed sets, continuity, uniform continuity, connectivity of the real numbers, the intermediate value theorem, completeness, compactness, the mean value theorem, differentiation, Riemann integration, and if time permits, other topics. Prerequisite: MAT 290 and 258. Three units.

470. Topology
Review of set theory and logic, defining axioms of topological spaces, bases for topological spaces, order, product and subspace topology, closed sets and limit points, continuous functions, metric topology, connectivity, compactness, the Tychonoff Theorem, and if time permits, other topics. Prerequisite: MAT 290. Three units.

480. Advanced Topics in Mathematics
Topics are considered in number theory, operations research, mathematical statistics, or advanced calculus, depending on student demand. Prerequisite: MAT 290. Four units per semester. ‘S’ ‘W’

492. Senior Integration Paper
See page 25. ‘S’