School of Natural Sciences

Mathematics

Introduction:

Courses in this department can be split into three categories: pure mathematics, applied mathematics, and prerequisites for other majors.

Courses in pure mathematics cover a variety of areas, including number theory, algebra, analysis, geometry, and topology. A student of pure mathematics can enter a variety of fields, from teaching to consulting to mathematical research. The major requirements, however, are designed to prepare students to be able to continue their studies at the graduate level.

Courses in applied mathematics have a large overlap with pure mathematics courses, but stress the specific areas of linear algebra, mathematical finance, probability, and statistics. Students who take applied courses often go into the actuarial sciences as well as various areas of business and finance.

Finally, to prepare students for other majors in the sciences and engineering, the department offers basic courses in calculus, vector calculus, differential equations, linear algebra, and statistics.

Major:

(1) Students that have more than one major are required to complete 39 credits.; single majors are required to complete 48 credits.; and a teaching certificate requires the completion of at least 51 credits.

(2) All math majors are required to take MAT2110, MAT2210, MAT4110 (9 cr.).

(3) Among mathematics major course excluding above required course, 30 credits or more is required in multiple majors, 39 credits in single major, teaching course requires one course from MAT3310, MAT4310 and one course from MAT3020, MAT3410, total of 42 credits or more. However, 2 courses or more in Group A and 3 courses or more from Group B are required to be taken. (Common to multiple majors, single major and teaching certificate)
   (1) Group A : MAT2010, MAT2120, MAT2230, MAT4210
   (2) Group B : MAT2220, MAT4120, MAT4310, MAT4320, MATG210

(4) In MAT2230 and MAT2410, the contents of lectures are similar; thus, though taking 2 courses, one course is approved as major and graduation credit.

(5) Major prerequisites (Note: these credits cannot be used to fulfill the

requirements listed in (1)-(4)):

If mathematics is the primary major, students must take 16 credits from below:
MAT1050, MAT1060 (2 cr.)
(PHY1001, PHY1002), (CHM1001, CHM1002), (BIO1101, BIO1106) (choose two, 12 cr.)
(PHY1101, PHY1102), (CHM1051, CHM1052), (BIO1105, BIO1106) (choose one, 2 cr.)

If Mathematics is secondary major, students must take 11 credits below:
MAT1050, MAT1060 (2cr.)
Select three from PHY1001, PHY1002, CHM1001, CHM1002, BIO1101, BIO1102 (9 cr.)

Course Completion Roadmap

Acad. Year	1st Semester		2nd Semester	
1	CHS2001, 2002, 2003, 2004, 2009(Choose one)	3	COR1001	2
			COR1003	3
	ETS2001-2004	3	STS2006	3
	(choose one)		MAT1060	1
	STS2005	3		
	MAT1050	1	PHY1002, CHM1002, BIO1102	6
	PHY1001, CHM1001, BIO1101	6	(choose two)	
	(choose two)		PHY1102, CHM1052, BIO1106	1
	PHY1101, CHM1051, BIO1105	1	(choose one)	3
	(choose one)		Electives	19
	Electives	2	**Total**	
	Total	19		
2	HFS2001-2003 (choose one)	3	Electives	19
	SHS2001-2007 (choose one)	3		
	MAT2110	3		
	MAT2210	3		
	Electives	7		
	Total	19		
3	MAT4110	3	Electives	19
	Electives	16		
	Total	19		
4	Electives	19	Electives	19

Note: 1) Electives: major requirements, core requirements, free requirements

STS2004 College Algebra 3 cr.
This course covers Boole algebra, matrices, differentiation and its application, integration, partial differentiation and its application, and optimization.

STS2005 Analytic Geometry and Calculus I 3 cr.
This course is designed for students in the Colleges of Science and Engineering, and covers limits, continuity, differentiation and integration of algebraic functions and transcendental functions, polar coordinates, and vectors.

STS2006 Analytical Geometry and Calculus II 3 cr.
(Prereq.: STS2005)
This course focuses on improper integrals, infinite series, matrices, determinants, expansion of functions, partial differentiation, and multiple integrals.

MAT1050 Analytic Geometry and Calculus Recitation I 3 cr.
This course focuses on solving problems that were brought up in STS2005, as well as the application of Mathematica to these problems.

MAT1060 Analytic Geometry and Calculus Recitation II 3 cr.
This course focuses on solving problems from STS2006, and the application of Mathematica to these problems.

MAT2010 Theory of Sets 3 cr.
A survey of axioms, relations, functions, ordering, cardinal numbers, axiom of choice, and ordinal numbers.

MAT2110 Linear Algebra 3 cr.
This course covers fundamental concepts of linear algebra such as vector spaces, determinants and matrices, linear transformations, dual spaces, the characteristic equations, and Sylvester's Theorem.

MAT2120 Theory of Numbers 3 cr.
A study of number systems, number-theoretic functions, congruences, Euler's theorem, the Legendre symbol, Diophantine equations, and algebraic numbers.

MAT2210 Advanced Calculus I 3 cr.
This course looks into real number systems, limits and continuity of functions, differentiable and integrable functions of one variable, and elementary transcendental functions.

MAT2220 Advanced Calculus II 3 cr.
(Prereq.: MAT2210)
A study of vector calculus, limits, continuity, differentiability of functions of several variables, integration of functions of several variables, the inverse function theorem, line integrals, and surface integrals.

MAT2230 Differential Equations 3 cr.
A study of differential equations of the first and second order and their applications in physics and chemistry, solutions of differential equations of the higher order, and systems of differential equations.

MAT2410 Applied Mathematics I 3 cr.
A study of partial differentiation, multiple integrals, ordinary differential equations, partial differential equations, vector analysis, and the Fourier series.

MAT2420 Applied Mathematics II 3 cr.
(Prereq.: MAT2410)
A study of complex functions, Bessel functions, gamma functions, beta functions, tensor analysis, and integral transform.

MAT2510 Fourier Analysis and its Application 3 cr.
This course covers the basic nature of convolution operator and Fourier conversion in partly close group and continuity of related integral calculus. It is applied to digital audio(video) process to understand the engineering phenomenon.

MAT3010 Functions of Several Variables 3 cr.
Space curves, curvature and torsion of

space curves, gradient, directional derivatives, Lagrange multipliers, divergence, curl, line integrals, multiple integrals, Green's theorem, surface integral, Gauss's divergence theorem, and Stokes's theorem.

MAT3020 Introduction to Statistics 3 cr.
Basic concepts of descriptive and inferential statistics.

MAT3110 Discrete Mathematics 3 cr.
This course covers mathematical logics, ordered sets, lattices, algebraic lattices, conceptual lattices, algebraic structure, Boolean algebra, semi-groups, graphs, coloring, permutation and combination, recurrence relation, and generating functions.

MAT3310 Modern Geometry 3 cr.
This course looks into the significance of modern geometry, consistency, independence and completeness of a system of axioms, as well as fundamental concepts of projective geometry such as projective space, projective transformation, affine space, and affine transformation.

MAT3410 Introduction to Theory 3 cr.
(Prereq.: MAT2210, MAT3020)
This course studies basic concepts such as conditional probabilities, independence, random variables and expectation, and proves the law of large numbers and the central limit theorem, which are fundamental in modern probability theory. Also, students study elementary theories of statistical inference and stochastic processes like Poisson processes, martingales, and Brownian motions.

MAT3420 Financial Mathematics 3 cr.
An analysis of financial theory, including profit and risk, financial portfolio theory, derivatives theory, Ito's lemma, Black-Scholes formula, and stochastic processes.

MAT3430 Applied Statistics 3 cr.
(Prereq.: MAT3020)
A study of computational aspects relevant to practical statistical problems.

MAT3440 Mathematics of Communication 3 cr.
(Prereq.: MAT2110, MAT2120, MAT2210, MAT2220, MAT4210)
In one year, this course covers binary symmetric channels, error-correcting code, Hamming distance and Hamming weight, maximum-likelihood decoding, linear code, generator and parity-check matrices, dual code, the MacWilliams identity, structure of a finite field, cyclic code, BCH and RS code, secret and public key cryptosystem, RSA and the ElGamal cryptosystem, and elliptic curve cryptosystems; in another year, this course covers mathematical understanding of digital images, convolution, Laplace's equation and mean value theorem, discrete Fourier transform, discrete cosine transform, approximation of matrices by compression, sampling theory, and the Gibbs phenomenon.

MAT3450 Computational Mathematics 3 cr.
(Prereq.: MAT2110, MAT2210, MAT2220, MAT4210)
This course focuses on solving mathematical problems in differential equations, optimization problems, integration problems and applied sciences with computer language such as MATLAB, Mathematica, and C language.

MAT4110 Introduction to Abstract Algebra I 3 cr.
(Prereq.: MAT2110)
This course looks into Legendre's theorem, isomorphism theorems, quotient groups, ideals, quotient rings, and maximal and prime ideals.

MAT4120 Introduction to Abstract Algebra II 3 cr.
(Prereq.: MAT4110)
Polynomial rings, Eisenstein's criterion, integral domains, fields, quotient fields, extensions of a field, the root field of an equation, the Galois group, and Abel's

theorem.

MAT4210 Theory of Functions of a Complex Variable I 3 cr.
(Prereq.: MAT2210)
Real and complex number systems, domain and curves in the complex plane, analytic functions, power series, and conformal mappings.

MAT4220 Theory of Functions of a Complex Variable II 3 cr.
(Prereq.: MAT4210)
Properties of elementary functions, analytic extensions, the maximum modulus principle, the Laurent expansion, residues, and integration.

MAT4310 Differential Geometry 3 cr.
(Prereq.: MAT2110, MAT2210)
Theory of curves in space with the use of vector analysis: curvature and torsion, the Frenet formula, intrinsic equations of a curve, and parametric equations of a surface.

MAT4320 Introduction to Topology I 3 cr.
(Prereq.: MAT2010, MAT2210)
A study of topology, neighborhoods, bases, limits, continuity, relative topology, connectedness, compactness and continuity, separation axioms, and axioms of countability.

MAT4330 Introduction to Topology II 3 cr.
(Prereq: MAT4320)
A study of topological spaces and new spaces obtained from old spaces, as well as various related topics such as connectivity, compactness, separation axioms, countability axioms and the metrization theorem, complete metric spaces, and function spaces.

MATG110 Advanced Linear Algebra 3 cr.
(Prereq.: MAT2110)
A study of diagonalization, invariant subspace, inner product space, normal transformation and normal matrices, unitary transformation and unitary matrices, orthogonal transformation and orthogonal matrices, canonical form, symmetric form, skew-symmetric forms, classical linear groups, and Lie algebra.

MATG210 Introduction to Real Analysis I 3 cr.
(Prereq.: MAT2220)
This course examines the topology of sets of real numbers, Borel sets, Lebesgue measures and their properties, measureable functions, Riemann integrals, Lebesgue integrals, and convergence theorems for integrals.

MATG220 Introduction to Real Analysis II 3 cr.
(Prereq.: MAT5210)
A study of the differentiation of functions, functions of bounded variation, absolute continuity, spaces, the Riesz theorem, signed measures, the Radon-Nikodym theorem, multiple integrals, Tonelli's theorem, and Fubini's theorem.

MATQ981 Mathematics Teaching Methods 3 cr.
This course takes a look at the development course and theoretical background of mathematics education. It covers the theory of teaching education, education course development principle, problem solving, teacher's professionalism, utilizing teaching engineering and evaluation.

MATQ982 Logical Thinking and Wiriting in Mathematics Education 3 cr.
The goal of mathematics education is to improve the logical thought and ability to express. This course takes a look at various theories and teaching method along with systematical and academical understanding regarding logical thinking of mathematics.

MATQ983 Foundation of Instructional Design in Mathematics 3 cr.

This course looks at and develop the mathematics teaching method focusing on students by applying various theories and teaching methods which are found through systematical analysis of mid-level mathematics course curriculum and textbooks and mathematics curriculum.