AMERICAN GLOBAL UNIVERSITY

Committed to Excellence in Global Education

COLLEGE OF MATHEMATICS

Mission Statement

The mission of the College of Mathematics at American Global University is to offer high quality educational programs at both undergraduate and graduate levels. These programs have a wide and open range in both mathematics and applied mathematics. This means that the College of Mathematics is capable to design and offer new applied mathematics courses in accordance with the student's need. A variety of tracks in applied mathematics such as statistics and operations research are designed to develop knowledge and skills necessary for employment in business, industry, government and educational environment.

NOTE: Temporarily, all degrees in Mathematics, both undergraduate and graduate, are not being offered due to curriculum revision. Please check back periodically. You may also call or email the university (see below for more information).

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AMERICAN GLOBAL UNIVERSITY

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OBJECTIVES

The objectives of the College of Mathematics are consistent with the purpose and philosophy of the American Global University (AGU). The College is composed of two major departments: Mathematics and Computer Science. Both departments offer undergraduate and graduate degree programs with a variety of options designed to prepare students for technical profession in industry, business, government and educational environments that involve mathematics. These highly technical professions include programmer, modular, analyst, optimizer, educator, actuary and statistician.

Mathematics **"**the mother of science", Plato. The sharp growth of technology and the extensive development of science in the last quarter of the twentieth century are without any doubt due to the true applications of mathematical sciences. Applied Mathematics has filled the gap between mathematics and other disciplines which existed in the past. Today everyone who intends to enter the infinite world of science must be familiar with the language of mathematics.

DEGREES OFFERED

- Bachelor of Arts in Mathematics
- Bachelor of Arts in Mathematics Education
- Bachelor of Science in Mathematics
- Bachelor of Science in Applied Mathematics
- Bachelor of Science in Operations Research
- Master of Arts in Mathematics
- Master of Arts in Mathematics Education
- Master of Science in Mathematics
- Master of Science in Applied Mathematics
- Master of Science in Operations Research
- Doctor of Philosophy in Mathematics
- Doctor of Philosophy in Applied Mathematics
- Doctor of Philosophy in Operations Research

THE PROGRAM

This program designed for the students who intend to achieve a true liberal arts education in mathematics and excellent preparation for entrance to professional schools of law, medicine or business.

UNDERGRADUATE GENERAL EDUCATION COURSE REQUIREMENTS

The general education program is designed to ensure that all American Global University graduates have a basic understanding of certain essential areas of knowledge. General education program sets minimal requirements. Most departments of major study require additional courses in these areas, which are stated under the individual major degree requirements.

Core Courses: (45 Credit Hours)

Dept.	#	Title	Credit Hrs
ENG	100	English Grammar	3
ENG	101	English Composition I	3
MAT	101	General Mathematics	3
COM	105	Introduction to Computer Science	3
SOS	106	Introduction to Sociology	3
SOS	108	Introduction to History	3
MAT	111	College Algebra (Algebra I)	3
ENG	200	Basic Speech	3
ENG	201	English Composition II	3
SOS	109	Introduction to Geography	3
SOS	110	Introduction to Art	3
SOS	112	Religions of the World	3
SOS	206	American Government	3
SOS	208	Introduction to US History	3
PSY	400	Introduction to Psychology	3
		TOTAL	45

Electives: (15 Credit Hours)

Dept.	#	Title	Credit Hrs
CHM	101	General College Chemis try I	3
MAT	112	Pre-Calculus (Algebra II)	3
MAT	170	Introduction to Statistics	3
ACT	201	Accounting Fundamentals	3
SOS	201	Introduction to Social Sciences	3
CHM	201	General College Chemistry II	3
SOS	203	Introduction to Philosophy	3
SOS	205	Introduction to Political Science	3
ECO	206	Introduction to Economics	3
MAT	241	Calculus I (for Science & Engineering)*	3
MAT	242	Calculus II (for Science &Engineering)*	3
MAT	253	Calculus III (for Science &Engineering)*	3
SCI	201	Physics I (Mechanics of Motion)*	3
SCI	202	Physics II (Electricity/Magnetism)*	3
		TOTAL	15

***Prerequisites for a BS degree in Information Technology.**

BACHELOR OF SCIENCE DEGREE IN MATHEMATICS

This program is more technically oriented; provides solid preparation for the students who intend to work and/or pursue their education in pure or applied mathematical sciences.

I. PREREQUISITES: To be admitted to the undergraduate program of the Mathematics Department, a student must have a high school diploma or equivalent and demonstrate the ability to succeed in undergraduate study in mathematics.

II. PROGRAM REQUIREMENTS: The total semester units in general education required for graduation is dependent upon the past experience of the applicant, with a grade of at least "C" in each of the science courses. Transfer of credit from another accredited/acceptable institution is allowed subject to the approval of the Chairperson of the Mathematics Department. The student must complete a minimum of 40 credit units while enrolled at the AGU.

Core Courses: (31 Credit hours)

Dept. #	Title	Credit hours
MAT 155	Discrete Mathematics I	3
MAT 241	Calculus I	4
MAT 242	Calculus II	4
MAT 250	Linear Algebra	3
MAT 253	Calculus III	4
MAT 311	Modern Algebra I	3
PHY 201	Physics I	3
STT 270	Probability and Statistics I	3
CSC 101	Intro. to Computer Science I	3

BACHELOR OF ARTS DEGREE IN MATHEMATICS

A student may choose one of the following options:

Option 1. Mathematics:

In addition to the core requirements, the student must complete at least 6 courses at the 300-400 level including Discrete Mathematics II (MAT 355) and either Advanced Calculus I (MAT 377) or Real Analysis I (MAT 414) and Topology I (MAT 455).

Electives **12**

Elective courses can be selected from any available undergraduate math courses.

Option 2. Teacher Certificate in Mathematics:

In addition to the core requirements, the student must complete at least 6 courses at the 300-400 level including Applied Number Theory (MAT 305), Principles of Teaching Mathematics (MAT 315), college Geometry (MAT 325), and either Advanced Calculus I (MAT 377) or Real Analysis I (MAT 414).

Electives **12**

Elective courses can be selected from any available undergraduate math courses.

BACHELOR OF SCIENCE DEGREE IN MATHEMATICS

A student may choose one of the following options:

Option 1. Mathematics:

In addition to the core requirements, the student must complete at least 7 courses at the 300-400 level including Real Analysis I & II (MAT 414 & MAT 415).

Option 2. Applied Mathematics:

In addition to the core requirements, the student must complete at least 7 courses at the 300-400 level including Advanced Calculus I & II (MAT 377 & MAT 378).

Option 3. Operations Research:

In addition to the core requirements, the student must complete at least 7 courses at the 300-400 level including Advanced Calculus I (MAT 377) and Operations Research (MAT 380).

Option 4. Statistics:

In addition to the core requirements, the student must complete at least 7 courses at the 300-400 level including Probability and Statistics II (MAT 370) and Advanced Calculus I (MAT 377).

Minor in Mathematics

A minor in mathematics requires 17 credit units in mathematics including Calculus I & II (MAT 241 & 242), Linear Algebra (MAT 250) and 6 credit units at 300-400 level with a grade of "C" or higher.

THE GRADUATE PROGRAMS
MASTER OF ARTS IN MATHEMATICS

Is a graduate degree track including an option designed for secondary and community college teachers, and an option for those who intend to pursue their graduate studies towards a Ph.D. degree in mathematical sciences.

MASTER OF SCIENCE IN MATHEMATICS

Is a graduate degree track including an option designed to prepare students for careers in business, industry or government as well as further study in mathematical sciences? Applications from the sciences, industry and management are stressed in course work from the areas of classical applied mathematics, operations research, statistics, and computer science.

I. PREREQUISITES: To be admitted to the master's degree program of the Mathematics Department, after meeting the University admission requirements, a student must have a bachelor degree or equivalent in mathematical sciences with a grade average of at least "C" in each of major courses.

II. PROGRAM REQUIREMENTS: To obtain a master's degree in mathematics, a student must have completed a minimum of 33 credit units for the M.A. degree and 36 credit units for the M.S. degree with an average of at least "B". A minimum of 21 credit units for the M.A. and M.S. must be earned at AGU. Optional master's thesis for a total of 6 credit hours must be completed and approved by the thesis committee composed of the thesis' advisor, department's chairman and the dean of the College.

MASTER OF ARTS IN MATHEMATICS

A student may choose one of the following options.

Option 1. Secondary and Community College Teaching
Core Courses

Dept #	Title	Credit hours
MAT 503	Adv. Discrete Structures	3
MAT 514	Real Analysis I	3
MAT 532	Number Theory I	3
MAT 547	Abstract Algebra I	3

And 7 courses at the 500-600 level.

Option 2. Preparation for Further Graduate Study
Core Courses:

Dept	#	Title	Credit hours
MAT	514	Real Analysis I	3
MAT	541	Matrix Algebra I	3
MAT	547	Abstract Algebra I	3
MAT	555	Topology I	3

And 7 courses at the 500-600 level.

MASTER OF SCIENCE IN MATHEMATICS

A student may choose one of the following options:

Option 1. Mathematics Core Courses

Dept.	#	Title	Credit hours
MAT	514	Real Analysis I	3
MAT	515	Real Analysis II	3
MAT	516	Measure And Integration	3
MAT	547	Abstract Algebra I	3

And 8 courses at the 500-600 level.

Option 2. Applied Mathematics Core Courses

Dept	#	Title	Credit hours
MAT	514	Real Analysis I	3
MAT	541	Matrix Algebra I	3
MAT	524	Applied Mathematics I	3
MAT	573	Stoch. Proc. in Applied Math.	3

And 8 courses at the 500-600 level.

Option 3. Operations Research
Core Courses

Dept	#	Title	Credit hours
MAT	514	Real Analysis I	3
MAT	541	Matrix Algebra I	3
MAT	543	Linear Programming	3
MAT	574	Stoch. Proc. in Operations Research	3

And 8 courses at the 500-600 level.

Option 4. Statistics Core Courses

Dept	#	Title	Credit hours
MAT	514	Real Analysis I	3
MAT	541	Matrix Algebra I	3
MAT	570	Applied Probability I	3
MAT	575	Simulation	3

And 8 courses at the 500-600 level.

It is recommended that each student take an independent study of two course sequences, or a group of three related courses. This sequence or group may be follow-up courses to some of the core courses. Every applied major is required to choose s ome direction in applied mathematics such as differential equations, numerical analysis, operations research, statistics, or any other areas of mathematical sciences.

DOCTOR OF PHILOSOPHY IN MATHEMATICS

The Department of Mathematics offers Ph.D. degrees in mathematics and applied mathematics. The degree programs are intended for students with superior mathematical ability and are designed to ensure that the student acquires a fairly broad background in mathematical sciences with a deep concentration in some specific area of his/her interest. Both are 48 credit programs with a minimum of 30 credits earned at AGU.

I. PREREQUISITES: A master degree is not required for entering the Ph.D. program. Instead students must take enough graduate courses to get prepared for the Ph.D. qualifying exam.

II. PROGRAM REQUIREMENTS:

a) Ph.D. Qualifying Exam: Ph.D. candidates are required to take a qualifying exam. The exam covers three subjects including Real Analysis (MAT 514 & MAT 515). The student will choose two other subjects and take one sequence of two courses in each subject from the following list.

- Functional Analysis (MAT 518-618)
- Complex Analysis (MAT 520-620)
- Differential Geometry (MAT 530-630)
- Numerical Analysis (MAT 535-635)
- Matrix Algebra (MAT 541-641)
- Abstract Algebra (MAT 547-647)
- Topology (MAT 555-655)
- Ordinary Differential Equations (MAT 565-665)
- Partial Differential Equations (MAT 566-666)
- Probability and Statistics (MAT 570-670).

b) The three sequences may be the follow-ups of the core courses. The student is given three chances to pass the qualifying exam.

c) Ph.D. Dissertation: After passing the qualifying exam, the student chooses a research advisor among the College faculty who supervises the student's independent research work through the completion of his /her dissertation. The dissertation must be original and unique in the field of mathematical sciences. Finally, the student will defend his/her dissertation before the Defense Committee which is composed of research advisor (committee's chair), Department's Chair and the Dean of the College.

PH.D. IN MATHEMATICS

Core Courses: (18 Credit Hours)

Dept.	#	Title	Credit hours
MAT	515	Real Analysis II	3
MAT	647	Abstract Algebra II	3
Three (3) courses from:			
MAT	518	Functional Analysis I	3
MAT	520	Complex Analysis I	3
MAT	530	Differential Geometry	3
MAT	641	Matrix Algebra II	3
MAT	655	Topology II	3
One (1) course from:			
MAT	535	Numerical Analysis I	3
MAT	565	Ordinary Differential Equations I	3
MAT	566	Partial Differential Equations I	3

And at least ten (10) more courses (electives) at the 500-600 level.

PH.D. APPLIED MATHEMATICS

Core Courses: (18 Credit Hours)

Dept #	Title	Credit hours
MAT 515	Real Analysis II	3
MAT 641	Matrix Algebra II	3
Three (3) courses from:		
MAT 625	Adv. Applied Mathematics	3
MAT 635	Numerical Analysis II	3
MAT 543	Linear programming	3
MAT 665	Ordinary Differential Equations II	3
MAT 566	Partial Differential Equations I	3
One (1) course from:		
MAT 520	Complex Analysis I	3
MAT 518	Functional Analysis I	3
MAT 547	Abstract Algebra I	3

And at least ten (10) more courses (electives) at the 500-600 level.

Students must pass all courses with a grade of at least B. A student who completed all the Ph.D. course works but declined to present an acceptable dissertation will receive a Master of Philosophy Degree in Mathematics or Applied Mathematics.

COURSE DESCRIPTIONS

GENERAL EDUCATION

ACT 201 Accounting Fundamentals 3 Credit hours
Theory and application of accounting principles for recording, summarizing, and reporting business transactions designed mostly for external uses. It includes valuation of asset items and handling liability and capital accounts of the balance sheet, as well as, revenue and expense recognition in preparation of the income statement. The emphasis in this course is on the financial aspect of accounting. (Prerequisite: General Mathematics or approval of academic advisor.)

CHM 101 General College Chemistry I 3 Credit hours
This course presents an intensive technical program in general and inorganic chemistry for those in various professional curricula demanding competence in utilization of basic chemical principles and information. Emphasized are the relationships between structure and properties of matter. Chemical principles are presented both qualitatively and quantitatively.

CHM 201 General College Chemistry II 3 Credit hours
This course presents kinetic theory and thermodynamics of gas phase, thermo-chemistry, molecular interactions in liquids and solids, acid-base and solubility equilabria, free energy and reactivity. (Four hours of video lab is a requirement.)

COM 105 Introduction to Computer Science
3 Credit hours
This course familiarizes the student with foundations of algorithmic problem solving, problem specification, program design, and subsequent implementation using a high-level, structured, modern programming language. Also presented are computer hardware and software (including user view of operating systems), history of computing, computers in society and ethics. The student is introduced to the basic components of programming languages, although a specific programming language (e.g. C++, Java, Modula 3) is used for program implementations.

ECO 206 Introduction to Economics 3 Credit hours
This course provides an introduction to the principles, tools and models governing economics analysis with an overview of micro and macroeconomics, emphasizing terminology and methods of micro and macroeconomics. Includes a study of contemporary economics issues and problems.

ENG 100 English Grammar 3 Credit hours
This course is intended to function as an introduction to college level composition. The course will emphasize composition, developing a personal style and gaining a sense of purpose and audience. The student will demonstrate an understanding of the writing process through completion of business letters, resumes and a research paper.

ENG 101 English Composition I 3 Credit hours
The course is an introduction to the principles and methods of composition in the development of writing skills. Important components are reading skills, critical thinking, synthesis and the correct use of grammar and vocabulary.

ENG 200 Basic Speech 3 Credit hours
Designed as an introduction to the principles of speech and communication, the student will become familiar with the basic principles involved in speech writing and public speaking.

ENG 201 English Composition II 3 Credit hours
An analysis and application of methods of composition in the enhancement of writing skills.

MAT 101 General Mathematics 3 Credit hours
Set, system of numeration, problem solving, real number system, consumer mathematics, mathematical system, probability, and statistics.
Prerequisite: one year of high school algebra and geometry.

MAT 111 Algebra I 3 Credit hours
Cartesian coordinate, graphing, lines, parabolas, functions, inverse functions, rational functions, exponential and logarithmic functions, roots of polynomials, system of linear equations, matrices, determinants, counting rules, mathematical induction, binomials.
Prerequisite: three semesters of high school algebra and one year of high school geometry.

MAT 112 Pre-calculus (Algebra II) 3 Credit hours
Trigonometric functions and their applications, inverse trigonometric functions, trigonometric identities, trigonometric equations, law of sines and cosines, complex numbers and DeMoivre's formula.
Prerequisite: six semesters of high school algebra or college algebra.

MAT 155 Discrete Mathematics I 3 Credit hours
Topics include: mathematical logic and proof techniques, predicate calculus with applications in computer programming, Boolean algebra and computer hardware. Set

theory, combinatrics, finite state machines, and complexity of algorithms.

MAT 170 Introduction to Statistics 3 Credit hours
The course will cover the following areas: percentiles, arithmetic mean, histograms, random numbers, normal curve, dichotomous curve, population, dispersion, correlation factor, error factor, standard deviation, regression, variance, covariance, chi-square tests, sequential analysis, binomial distribution, up and down method, discrete distribution.

MAT 241 Calculus I 3 Credit hours
Topics include: Calculus of functions of single variable; Limits and continuity; Differential and integral of polynomial; Rational, and trigonometric functions; Applications of derivatives; Definite integral and its application in calculation of area.

MAT 242 Calculus II 3 Credit hours
Prerequisite: MAT 241
Topic include: Transcendental functions and their derivative and integrals; Applications and different techniques of integration; Infinite series and sequences; Conic sections; Parameterized curves; Polar coordinates and graphs.

MAT 253 Calculus III 3 Credit hours
Prerequisite: MAT 242
Topics include: vectors and solid analytic geometry, vector valued functions; partial differentiation; gradients and directional derivatives; multiple integrals; integration in vector fields; path independence, potential functions, and conservative fields.

PSY 400 Introduction to Psychology 3 Credit hours
This course is designed to provide a basic framework for understanding fundamental theories regarding human behavior and psychology. The student is expected to gain an understanding and basic knowledge of the primary issues, concepts and tenets of human psychology and behavior in relation to consciousness, learning, cognition, memory, thinking, human development, abnormal behavior and cultural diversity.

SOS 106 Introduction to Sociology 3 Credit hours
This course is designed to familiarize the student with the science of evaluation, structure and functioning of human society, characteristics of social life and process of social interaction. Included are systematic studies of human institutions and social relationships as well as the principles underlying their function.

SOS 108 Introduction to History 3 Credit hours
This course is an introduction to the history of the modern world. Since no single memory or accounting can relay what has happened in the past, the student is asked to open his/her mind and explore the possibilities of what might have been.

SOS 109 Introduction to Geography 3 Credit hours
The regional geography of the world, population agglomerations, scale, culture, physical geography, site and situations, super nationalism, federations, irredentism, isolated states, geography of languages, nomadism, urban dominance, ecological trilogy, boundaries, feudalism, pluralism, physiological density measure, industrial locations, exchange economy, modernization, buffer states, heartland theory, developed vs. underdeveloped regions, Pleistocene cycles, regions of the world: Europe, North America, Central and South America, North Africa and Southeast Asia, Africa, India, China.

SOS 110 Introduction to Art 3 Credit hours
This course will concentrate on introducing the student to the art of the ages. In an attempt to provide insight to the layman, the course will view works of art in the context of time and circumstance. The course will explore personal taste as a part of art history and the continuous process in which established values are discarded and neglected ones are rediscovered.

SOS 112 Religions of the World 3 Credit hours
This course is designed to familiarize the student with the movements and themes of the major religions of the world.

SOS 201 Introduction to Social Sciences 3 Credit hours
This course will attempt to develop an overall comprehensive understanding of human society and culture in all forms by emphasizing interdisciplinary themes in anthropology, history, economics, geography, psychology, sociology and political science.

SOS 203 Introduction to Philosophy 3 Credit hours
Philosophy is defined as the love and pursuit of wisdom by intellectual means. This course was designed to familiarize the student with the basic elements of ethics, social philosophy, political philosophy, philosophy of art, philosophy of religion, the theory of knowledge and metaphysics. The course will include the origin of Greek cosmology and philosophy and the beginning of systematic thought and scientific investigation concerning origin and nature of the material world, metaphysics and the theory of knowledge.

SOS 205 Introduction to Political Science 3 Credit hours
This course will introduce the student to the basic ideologies of politics, political theories and structure.

SOS 206 American Government 3 Credit hours
This course is designed to familiarize the student with the leading areas of American political thought from the founding days of our country to the present. The course covers the route of American government and characteristics of American democracy and the American people. It also explains the major political philosophies, their political themes and questions of political theory. The course will also emphasize the role of the U.S. Constitution and offer a glimpse into human personality and the unique conditions that created such a strong desire for democracy.

SOS 208 Introduction to U.S. History 3 Credit hours
This course presents an introductory study of the history of the United States by focusing on the colonial origins, cultural heritages, political institutions, economic development and social interaction that created our contemporary society.

BACHELOR'S COURSES

MAT 101-102 General Mathematics 3 Credit hours
Covers a variety of basic concepts in mathematics and its applications. Not intended as preparation for further mathematics courses. Topics include: A survey of mathematical ways of thinking, logic, number systems, number theory, algebra, graph sketching, geometry, probability, statistics, and a brief history of mathematics.

MAT 111 College Algebra I 3 Credit hours
This is a preparatory course for further mathematics courses. Topics include: a review of factoring, operations on: algebraic fractions, rational exponents, radicals, linear and quadratic equations and inequalities, graphs, relations and functions.

MAT 112 College Algebra II 3 Credit hours
This course is the continuation of MAT 111, which includes: algebra of polynomials, fundamental theory of algebra, combinations of functions, inverse functions, special functions such as: polynomial, rational, exponential, and logarithmic. General graphing techniques and conic sections. *(Prerequisite: MAT 111.)*

MAT 113 Trigonometry 3 Credit hours
This is a pre-calculus course. Topics include trigonometric functions and their inverses, identities, solutions of trigonometric equations and triangles. Graphs of trigonometric functions. Also included are zeros of polynomials; sequences and series and mathematical induction. *(Prerequisite: MAT 112.)*

MAT 151 Applied Calculus 3 Credit hours
This course is intended for students from other disciplines who do not need mathematics beyond calculus. Greater emphasis is placed on techniques and applications than on theory and derivations. The course will cover differentiation and integration of algebraic and certain transcendental functions, partial differentiation, sequences and series. *(Prerequisite: MAT 112.)*

MAT 155 Discrete Mathematics I 3 Credit hours
Topics include: mathematical logic and proof techniques, predicate calculus with applications in computer programming, Boolean Algebra and computer hardware. Set theory, combinatrics, finite state machines, and complexity of algorithms. *(Prerequisite: MAT 112.)*

MAT 170 Elementary Probability and Statistics (STT) 3 Credit hours
This is the first course in statistics which shows how to use statistics as a tool in the decision making process. Topics include: common statistical measures; charts and graph techniques; probability; the binomial distribution; the standard normal distribution; t-test; correlation and prediction; chi-square and analysis of variance. (*Prerequisite: MAT 111.)*

MAT 241 Calculus I 4 Credit hours
Calculus of functions of single variable intended for the students in the mathematical and natural sciences. Topics include: limits and continuity; differential and integral of polynomial, rational, and trigonometric functions; applications of derivatives; definite integral and its application in calculation of area. *(Prerequisite: MAT 113.)*

MAT 242 Calculus II 4 Credit hours
A continuation of Calculus I. Topics include: transcendental functions and their derivative and integrals; applications and different techniques of integration; infinite series and sequences; conic sections; parametrized curves; polar coordinates and graphs. *(Prerequisite: MAT 241.)*

MAT 250 Linear Algebra 3 Credit hours
Topics include: systems of linear equations; algebra of matrices; determinants; vector spaces; linear transformations and their matrix representatives; eigenvalues and eigenvectors and some other applications. *(Prerequisite: MAT 242.)*

MAT 253 Calculus III 4 Credit hours
Topics include: vectors and solid analytic geometry, vector valued functions; partial differentiation; gradients and directional derivatives; multiple integrals; integration in vector fields; path independence, potential functions, and conservative fields. *(Prerequisite: MAT 250.)*

MAT 270 Probability and Statistics I (STT) 3 Credit hours
This course includes: an introduction to set and probability and statistics theory; conditional probability; independent events; discrete and continuous random variables; some distribution functions of each type with their probability and moment generating functions. *(Prerequisite: MAT 155 and MAT 241.)*

MAT 305 Applied Number Theory 3 Credit hours
Topics covered in this course include primes and divisibility, Euclidean algorithm, Linear congruence and the Chinese Remainder Theorem; Diophantine equations and primitive roots; Fermat's Little Theorem, Continued fractions and Farey Sequences. Applications to cryptology, computer random number generators and primality testing. *(Prerequisite: MAT 155.)*

MAT 311 Modern Algebra I 3 Credit hours
Topics include: study of group theory and introduction to rings. Groups; subgroups, normal subgroups, quotient groups, homomorphism. Permutation groups, matrix groups, symmetry groups. Definition and examples of rings. *(Prerequisite: MAT 155 and MAT 250.)*

MAT 312 Modern Algebra II 3 Credit hours
Topics include: properties of rings, integral domains, ideals, homomorphism, quotient rings and fields. Rings and factorization of polynomials over a field; unique factorization domains; Eisenstein's irreducibility criterion; field extensions; the isomorphism extension theorem; the primitive element theorem; introduction and illustrations of Galois theory. *(Prerequisite: MAT 311.)*

MAT 315 Principles of Teaching Mathematics 3 Credit hours
This course is designed for students preparing to teach secondary and middle school mathematics. Innovative techniques to be used in teaching of mathematics and

assessment procedures will be discussed and developed. *(Prerequisite: MAT 155.)*

MAT 325 College Geometry 3 Credit hours
Use of elementary methods in advanced study of the triangle and circle, special emphasis on solving original examples, comparison of Euclidean and non-Euclidean and projective geometries. *(Prerequisite: MAT 155 or consent of instructor.)*

MAT333 History of Mathematics 3 Credit hours
Development of mathematics from earliest systems to present century. Personalities involved with the contributions of each. A problem-study approach to give the students some training in research. *(Prerequisite: MAT 155 or consent of instructor.)*

MAT 355 Discrete Mathematics II 3 Credit hours
Techniques for counting configurations of objects. Recurrence relations, principle of inclusion-exclusion, graphs, trees, and circuits. Additional topics chosen from Polya's Theorem, generating functions, and network fellows. *(Prerequisite: MAT 155.)*

MAT 365 Elementary Differential Equations
3 Credit hours
Theory and methods of solutions. Applications of ordinary differential equations with emphasis on first order linear equations. Additional topics include: power series solutions, Laplace transforms, linear systems, and numerical methods. *(Prerequisite: MAT 253.)*

M**AT 370 Probability and Statistics II (STT)** 3 Credit hours
This course is a continuation of Probability and Statistics I. Topics include Random sampling and classical statistical inference, especially point and interval estimation, tests of hypothesis, general linear models, Bayesian methods, and an introduction to least squares. *(Prerequisite: MAT 270.)*

MAT 377-378 Advanced Calculus I & II 3 Credit hours
Further topics in analysis and their applications. Infinite series, power series, uniform convergence; Fourier series and orthogonal functions; Fourier and Laplace transforms; Lementary applications to differential equations and boundary value problems. *(Prerequisite: MAT 253.)*

MAT 380 Operations Research (OPR) 3 Credit hours
This course develops some standard operation research techniques including mathematical model formulations, Linear programming and simplex method, pert problems, transportation problems, integer and dynamic programming. *(Prerequisite: MAT 250 and MAT 270.)*

MAT 414-415 (514-515) Real Analysis I & II Each
3 Credit hours
Advanced study of convergence, continuity, differentiation, and integration in Euclidean space. The real number system, basic topology of Euclidean spaces; sequences and series; continuity, differentiation of vector-valued functions, uniform continuity; theory of integration; implicit and inverse function theorems, Stokes' Theorem.
(*Prerequisite: MAT 253.)*

MAT 419 (519) Introduction to Complex Variables
3 Credit hours
A thorough treatment of the solution of functions of a complex variable. Algebra of complex numbers, elementary functions with their mapping properties; analytical functions; power series; integration, Cauchy's Theorem, Laurent series and residue calculus; elementary conformal mappings and boundary value problems. (*Prerequisite: MAT 378 or 414.)*

MAT 424-425 (524-525) Applied Mathematics I & II
3 Credit hours
A thorough treatment of the solution of initial and boundary value problems of partial differential equations, the method of transforms, generalized functions, Green's functions, Sturm-Liouville theory, approximations, numerical methods. (*Prerequisite: MAT 365 and 378.)*

MAT 432 (532) Number Theory I 3 Credit hours
Use of algebraic techniques to study arithmetic properties of the integers and their generalizations. Primes, divisibility and unique factorization in integral domains; congruence, residues and quadratic reciprocity; Diophantine equations and additional topics in algebraic number theory. (*Prerequisite: MAT 305.*)

MAT 435 (535) Numerical Analysis I (CSC)
3 Credit hours
Introduction to the theoretical foundations of numerical algorithms. Solutions of linear systems by direct methods; least squares, minimax, and spline approximations; polynomial interpolation; numerical integration and differentiation; solution of nonlinear equations; initial value problems in ordinary differential equations.
(*Prerequisite: MAT 250 and MAT 365.)*

MAT 443 (543) Linear Programming (OPR)
3 Credit hours
Methods and applications of optimizing a linear function subject to linear constraints. Theory of the simplex method and duality; parametric linear programming; sensitivity analysis; modeling and computer implementation.
(*Prerequisite: CSC 101 and MAT 250.)*

MAT 444 (544) Discrete Optimization (OPR)
3 Credit hours
Theory and application of discrete optimization algorithms. Transportation problems and network flow problems; integer programming; computer implementation. (*Prerequisite: MAT 443.)*

MAT 455 (555) Topology I 3 Credit hours
A study of the basic concepts of general topology. Metric spaces, continuity, completeness, compactness, connectness, separation axioms, product and quotient spaces; additional topics in point-set topology. *(Prerequisite: MAT 155 and MAT 311.)*

MAT 465 (565) Ordinary Differential Equations I
3 Credit hours
Advanced study of ordinary differential equations. Existence and uniqueness; systems of linear equations, fundamental matrices, matrix exponential; series solutions,

regular singular points; plane autonomous systems, stability and perturbation theory; Sturm-Liouville theory and expansion in eigenfunctions.
(*Prerequisite: MAT 250 and 365.)*

MAT 470 (570) Applied Probability (STT) 3 Credit hours
The formulation, analysis and interpretation of probabilistic models. Selected topics in probability theory. Conditioning, Markov chains, and Poisson processes. Additional topics chosen from renewal theory, queuing theory, Gaussian processes, Brownian motion, and elementary stochastic differential equations. (*Prerequisite: MAT 370.)*

MAT 477 Project in Mathematics/Applied Mathematics 3 Credit hours
Techniques or problem recognition and formulation, and mathematical solution and interpretation of results. Construction of a mathematical model under the supervision of an applied mathematician and report of the investigation in written form.
(*Prerequisite: MAT 443 or MAT 370.)*

MAT 488 (588) Topics in Mathematics/Applied Mathematics 3 Credit hours
Topics of current interest in mathematics not covered in existing courses.
(*Prerequisite: Junior or senior standing.)*

MASTER'S COURSES

MAT 503 (503) Advanced Discrete Structures 3 Credit hours
Survey of the mathematical foundations of computer science. Mathematical logic, set theory, algebraic structures, lattices and Boolean algebra, graph theory, introduction to computability theory.
(*Prerequisite: MAT 355 or consent of instructor.)*

MAT 514-515 (414-415) Real Analysis 3 Credit hours
Advanced study of convergence, continuity, differentiation and integration in Euclidean space. The real number system, basic topology of Euclidean spaces; sequences and series; continuity, differentiation of vector- valued functions, uniform continuity; theory of integration; implicit and inverse function theorems, Stokes' Theorem.
(*Prerequisite: Permission of department.)*

MAT 516 Measure and Integration 3 Credit hours
Abstract measure theory. Lebesgue measure, integration, convergence theorems, absolute continuity, differentiation, Radon-Nikodym Theorem, product measures, Fubini's Theorem, Lebesgue spaces, convolution.
(*Prerequisite: MAT 515.)*

MAT 518 Functional Analysis I 3 Credit hours
Introduction to functional analysis and applications to areas such as linear and non-linear differential equations, integral equations and control theory. Topics selected from Banach spaces, operators, the Hahn-Banach Theorem, open mapping and closed graph theorems, Sobolev spaces, operators in Hilbert spaces and operational calculus.
(*Prerequisite: MAT 515.)*

MAT 519 (419) Introduction to Complex Variables 3 Credit hours
A first study of functions of a complex variable. Algebra of complex numbers, elementary functions with their mapping properties; analytic functions; power series; integration, Cauchy's Theorem, Laurent series and residue calculus; elementary conformal mappings and boundary value problems. *(Prerequisite: MAT 378 or MAT 514.)*

MAT 520 Complex Analysis I 3 Credit hours
Advanced study of complex-valued functions. Holomorphic and harmonic functions, Cauchy's Integral Theorem, Poisson's kernel and the Dirichlet problem, conformally, the Riemann Mapping Theorem, analytic continuation. Additional topics chosen from univalent, entire, meromorphic functions; Riemann surfaces; asymptotic methods; Mittaq-Leffler, Runge and Weierstrass factorization theorems.
(*Prerequisite: MAT 514 and 519.)*

MAT 524-525 (424-425) Applied Mathematics I & II Each 3 Credit hours
A thorough treatment of the solution of initial and boundary value problems of partial differential equations. Topics include classification of partial differential equations, the method of characteristics, separation of variables, Fourier analysis, integral equations and integral transforms, generalized functions, Green's functions, integral equations and integral transforms, generalized functions, Green's functions, Sturm-Liouville theory, approximations, numerical methods.
(*Prerequisite: MAT 365 and MAT 378.)*

MAT 530 Differential Geometry 3 Credit hours
Theory of curves and surfaces in Euclidean space. Frenet formulas, curvature and torsion, arc length; first and second fundamental forms; Gaussian curvature, equations of Gauss and Codazzi, differential forms, Cartan's equations and global theorems.
(*Prerequisite: MAT 377 or MAT 414.)*

MAT 532 (432) Number Theory I 3 Credit hours
Use of algebraic techniques to study arithmetic properties of the integers and their generalizations. Primes, divisibility and unique factorization in integral domains; congruence, residues and quadratic reciprocity; Diophantine approximation and the geometry of numbers; additional topics in algebraic number theory.
(*Prerequisite: Permission of department.)*

MAT 533 Number Theory II 3 Credit hours
A continuation of number theory using analytic methods. Number theoretic functions; distribution of primes and the primary number theorem; the Riemann zeta function; Diophantine approximation and the geometry of numbers; additional topics in analytical number theory.
(*Prerequisite: MAT 532.)*

MAT 535 (435) Numerical Analysis I (CSC)
3 Credit hours
Introduction to the theoretical foundations of numerical algorithms. Solution of linear systems by direct methods; least squares, minimax, and spline approximations; polynomial interpolation; problems in ordinary differential equations. Error analysis. Certain algorithms are selected for programming. (*Prerequisite: Undergraduate linear algebra, differential equations, and numerical analysis.)*

MAT 541 Matrix Algebra I 3 Credit hours
Theory of vector spaces, linear mapping and matrices. Determinants, eigenvalues, canonical forms, the Cayley-Hamilton Theorem, inner product spaces and positive definite matrices.
(*Prerequisite: Permission of department.)*

MAT 543 (443) Linear Programming 3 Credit hours
Methods and applications of optimizing a linear function subject to linear constraints. Theory of the simplex method and duality; parametric linear programs; sensitivity analysis; modeling and computer implementation.
(*Prerequisite: Undergraduate linear algebra and computing experience.)*

MAT 544 (444) Discrete Optimization 3 Credit hours
Theory and applications of discrete optimization algorithms. Transportation problems and network flow problems; integer programming; computer implementation.
(*Prerequisite: MAT 543.)*

MAT 547 Abstract Algebra I 3 Credit hours
Introduction to group theory. Binary structures including semi groups and lattices; finite groups, structure theorems, Sylow theorems and applications; group actions; free groups and presentations; structure of abelian groups.
(*Prerequisite: Permission of department.)*

MAT 555 (455) Topology I 3 Credit hours
A study of the basic concepts of general topology. Metric spaces, continuity, completeness, compactness, connectedness, separation axioms, product and quotient spaces; additional topics in point-set topology.
(*Prerequisite: Permission of department.)*

MAT 557 Advanced Geometry 3 Credit hours
A survey of modern geometry from several perspectives. Euclidean and non-Euclidean axiomatic geometries; finite geometries; projective geometry; transformations and invariants. Additional topics include introductions to algebraic geometry, combinatorial geometry or differential geometry. (*Prerequisite: MAT 547.)*

MAT 565 (465) Ordinary Differential Equations I
3 Credit hours
Advanced study of ordinary differential equations. Existence and uniqueness; systems of linear equations, fundamental matrices, matrix exponential; series solutions, regular singular points; plane autonomous systems, stability and perturbation theory; Sturm-Liouville theory and expansion in eigenfunctions. (*Prerequisite: Undergraduate linear algebra and differential equations.)*

MAT 566 Partial Differential Equations I 3 Credit hours
First order equations, constant coefficient second order equations (wave equation, heat equation, Laplace's equation) appropriate boundary value problems, representation formulas, for solutions and applications, including Duhamel's principle, Huyghen's principle and maximum principle. (*Prerequisite: linear algebra, complex variable, and MAT 565.)*

MAT 570 (470) Applied Probability and Statistics (STT)
3 Credit hours
The formulation, analysis and interpretation of probabilistic models. Selected topics in probability theory. Conditioning, Markov chains, and Poisson processes. Additional topics chosen from renewal theory, queuing theory, Gaussian processes, Brownian motion, and elementary stochastic differential equations. (*Prerequisite: STT 370.)*

MAT 573 Stochastic Processes in Applied Mathematics
3 Credit hours
Probabilistic models with applications in the sciences and engineering. Markov processes, diffusion, stochastic differential equations. (*Prerequisite: MAT 570.)*

MAT 574 Stochastic Processes in Operations Research
3 Credit hours
Probabilistic models with applications in operations research. Queuing theory, birth-death processes, embedded Markov chains, finite and infinite waiting room systems, single and multi-server queues, general service distributions; Markov decision processes; reliability.
(*Prerequisite: MAT 570.)*

MAT 575 Simulation 3 Credit hours
Study of computer simulation of discrete and continuous random processes. Generation of pseudo-random variables, discrete event simulation, simulation design, simulation languages, statistical analysis of simulations output. Applications to modeling stochastic systems in computer science, engineering and operations research.
(*Prerequisite: MAT 570.)*

MAT 577 Project in Mathematics/Applied Mathematics
3 Credit hours
Under faculty supervision, a student presents a written exposition of the history, current knowledge, future directions, and bibliography of a mathematical topic.

MAT 588 Topics in Mathematics/Applied Mathematics
3 Credit hours
Advanced topics of current interest in pure or applied mathematics not covered in existing courses.
(*Prerequisite: Consent of instructor.)*

MAT 598-599 Master's Thesis Each 3 Credit hours
This is the capstone of the master's program in which the student who has decided to write a thesis works on a problem in mathematics or applied mathematics under the guidance of the thesis advisor. A written report of the thesis is required at

the completion of the work. See the master's degree requirements.

DOCTORAL COURSES

MAT 618 Functional Analysis II 3 Credit hours
Integration: Lebesgue measure and integration. Lebesgue dominated convergence and monotone convergence theorems, Fubini's theorem, extension of the fundamental theorem of calculus. Banach spaces: Lp spaces, weak convergence, adjoint operators, compact linear operators, Fredholm-Riesz-Schauder theory and spectral theorem. (*Prerequisite: MAT 518.)*

MAT 620 Complex Analysis II 3 Credit hours
This is the continuation of complex analysis I. Topics chosen from univalent, entire, meromorphic functions, Riemann surfaces, asymptotic methods, Mittag-Lefller, Runge and Weierstrass factorization theorems. (*Prerequisite: MAT 520.)*

MAT 625 Advanced Applied Mathematics 3 Credit hours
Topics include Composite materials, modeling of turbulent flow, nonlinear waves in the atmosphere and ocean verticity and the mathematical theory of incompressible flow, urbulent diffusion, and the PDE of atmosphere and ocean.

MAT 630 Differentiable Manifolds 3 Credit hours
A study of differentiable manifolds. .Functions of several variables and mappings, implicit and inverse function and derivatives and connections; Riemannian metrics, torsion and curvature tensors, Cartan's equations; Lie groups; sub-manifolds. (*Prerequisite: MAT 558.)*

MAT 635 Numerical Analysis II (CSC) 3 Credit hours
Continuation of MAT 525. Rational and trigonometric interpolation, numerical integration, iterative techniques, eigenvalue problems. Numerical solution of initial and boundary value of problems for ordinary differential equations, large linear systems, and partial differential equations. (*Prerequisite: MAT 535.)*

MAT 641 Matrix Algebra II 3 Credit hours
Matrix theory and numerical techniques in linear algebra. Topics include elimination, iteration and factorization methods for systems of linear equations; minimal polynomials, eigenvalue approximations, norms and error estimates, spectral theorem, symmetric and unitary bilinear forms. (*Prerequisite: Undergraduate linear algebra and computing experience.)*

MAT 643 Nonlinear Programming 3 Credit hours
Theory and applications for constrained and unconstrained nonlinear optimization. Theory of convex sets, convex and concave functions, Kuhn-Tucker conditions, duality, algorithm convergence; computational methods including penalty and barrier functions, gradient projection, and quadratic programming.
(*Prerequisite: Advanced calculus and MAT 543.)*

MAT 647 Abstract Algebra II 3 Credit hours
Introduction to rings and fields. Modules, integral domains, vector spaces. Structure of polynomial rings and their relation to linear algebra. Field extension and Galois theory. (*Prerequisite: MAT 547.)*

MAT 650 Group Theory 3 Credit hours
Theory of groups. Isomorphism theorems; permutation groups and representation theorems; finite direct products and the fundamental theorem of abelian groups; the Sylow theorems and generalizations; normal series and solvable groups; extensions and semi-direct products; theory of simple groups. (*Prerequisite: MAT 547.)*

MAT 655 Topology II 3 Credit hours
An introduction to the concepts of algebraic topology. Classification of surfaces, manifolds, the fundamental group, covering spaces; additional topics in algebraic topology. (*Prerequisite: MAT 555 and knowledge of elementary group theory.)*

MAT 665 Ordinary Differential Equations II 3 Credit hours
Existence-uniqueness theory, periodic solutions, invariant manifolds, bifurcations, and Fredholm's alternative. (*Prerequisite: MAT 565.)*

MAT 666 Partial Differential Equations II 3 Credit hours
Topics include: Linear second order parabolic, elliptic and hyperbolic equations. Initial value problems and boundary value problems. Iterative and variational methods. Existence, uniqueness and regularity. Nonlinear equations and systems. (*Prerequisite: MAT 566.)*

MAT 667 Advanced Applied Mathematics 3 Credit hours
Topics in applied analysis of current interest. Topics may include tensor analysis and relativity, quantum mechanics, control theory, fluid mechanics, waves, ocean circulation, and mathematical models in biology or economics. (*Prerequisite: MAT 525.)*

MAT 670 Advanced Probability and Statistics (STT) 3 Credit hours
Probability spaces and sigma algebra. Conditional sigma fields, stochastic processes, Brownian motion, Markov property, infinitely divisible distributions. Stochastic integral and differentials. Stochastic approximations. (*Prerequisite: MAT 570.*)

MAT 675- 699 Dissertations 24 Credit hours
This most important requirement of the Ph. D. degree is the completion of a dissertation, which must be an original scholarly investigation. See the Ph. D. requirements.

NOTE: Any and all information in this publication is subject to change without notice. This information may include, but is not limited to, available courses, course values, and program requirements.