Descriptions of Courses

❒ Undergraduate Course

AM210 Introduction to Applied Mathematics
This course introduces problem-oriented mathematics with case studies for real world problems.

AM220 Matrix Computation and Numerical Methods
This course provides a basic foundation in matrix computation and related numerical methods.

AM222 Introduction to Scientific Programming
This course covers object-oriented programming, Linux system programming and web programming for solving a number of problems arising in applied mathematics and engineering. The course also includes mathematical typesetting with LaTeX.

AM241 Analysis I
This course covers basic concepts in analysis: real number system, sequence, basic topology, continuity, differentiation, integration, sequences and series of functions.

AM242 Analysis II
This course covers basic concepts of analysis: uniform continuity, differentiation and integration of sequences of functions, special functions, function spaces, implicit functions and inverse functions.

AM250 Probability· Statistics and Their Applications
Basic theory of probability is introduced with plenty of examples. Independence of events and random variables, and various probability distributions, such as Poisson, exponential and Gamma, are treated. Then expectation, conditional expectation and law of large numbers are covered.

AM311 Mathematical Logic
We symbolize the formal logic from Aristotle and study mathematical results. Also, basic concepts of mathematical logic which are needed in computer science and mathematics, are introduced. In propositional logic the syntax, deduction theorem and completeness are treated. And soundness and completeness of predicate logic, and Gödel's incompleteness are treated.

AM320 Algorithms for Scientific Computation
This course covers methodologies and applications of scientific computation using computer systems. We cover topics of numerical computation such as numerical analysis, linear algebra, and probability simulation as well as topics of efficient data manipulations such as data structure, sorting, and searching. This course includes the practice of C programming.

AM321 Numerical Analysis
This course provides elementary numerical tools for scientific computation. For example, solution of nonlinear equations, interpolation, numerical integration, and how to solve differential equations.

AM331 Ordinary Differential Equations
We study solutions to various ordinary differential equations and geometric properties. We introduce the Poincare-Bendixon theorem, modelling, dynamical systems and applications.

AM343 Applied Complex Analysis

Analytic functions, Cauchy formulas, Residue and poles, comformal mappings and applications, Schwartz-Christoffel transform, Poisson integral formula etc.

AM347 Optimization and Game Theory

This is a mathematical introduction to optimization and game theory. Convex sets, convex functions, separation theorem, Karush-Kuhn-Tucker theorem, Brouwer fixed point theorem, Ky-Fan inequality and Nash equilibrium.

AM350 Elementary Probability and Simulation

This course covers basic concepts in probability theory, conditional probability and independence, various random variables and distributions, weak law of large numbers, the central limit theorem, the Poisson process and Markov chains. The course also includes inverse transform methods and rejection methods for simulation.

AM360 Applied Statistics

This course covers basic theories for statistical methodologies and applications to engineering and applied sciences. Major topics include basic theories of probability, probability distributions and their inter-relationship, variable transformations, sampling distributions, estimation and hypothesis testing, linear models, and nonparametric methods.

AM432 Partial Differential Equations

We study the basic second order equations-Laplace equations, heat equations and wave equations. Methods for boundary value problems are introduced.

AM434 Mathematics for Mechanics

We study mathematical models for fluids and solids. Basic concepts for viscosity, elasticity and constitutive equations are introduced.

AM441 Several Variable Analysis and Geometry

This course covers the elementary theory of functions of several variables. In addition it considers elementary concepts in differential geometry such as manifolds, curvature and geodesics.

AM442 Fourier Analysis and Applications

Basic properties of Fourier series and Fourier transforms will be treated with applications to differential equations and signal processing.

AM445 Advanced Theory of Integration

Measure on Euclidean space, Lebesgue integration, space, theory of linear operators on Banach space and Hilbert space, and applications.

AM448 Transform Theories and Applications

Transform theories for continuous and discrete signals are widely applied to many engineering problems. This course covers the theories and applications of various types of transform methods. We cover topics such as complex variables, contour integrals, Laplace transforms, Fourier transforms, and Z transforms.

AM451 Elementary Stochastic Processes

This course covers the Poisson process and the memoryless property, elementary renewal theory, Markov chains, Gaussian process, basic queueing theory, and elementary reliability theory.

AM452 Random Processes and Signal Processing

This course introduces the fundamental methods of stochastic signal processing. We cover the topics of the

definition of random processes, second moment theory, special descriptions of random processes, linear transforms, signal detection and estimation, and Gaussian processes.

AM453 Stochastic Processes and Communication Systems
This course covers the Poisson process and the memoryless property, Markov chains, random walk, Gaussian process, basic queueing theory, and performance evaluation of mobile communication networks.

AM455 Statistics and Artificial Intelligence
This course covers issues of substantiating probabilistic reasoning in artificial intelligence by applying probability theory and statistical models. Major topics of the course include uncertainty in AI, Bayes inference, Markov networks, Bayes Networks, belief updating, decision and control, uncertain probability, network building, and logic and probability.

AM461 Linear Model
This course covers methods of linear regression analysis, and major topics include simple linear regression analysis, multiple regression analysis, goodness-of-fit test, model building and model selection methods, regression analysis with incomplete data, and non-least-squares estimation.

AM462 Statistical Methods with Computer
This course introduces data analysis methods using computer statistical program packages (Minitab, SAS, SPLUS, etc), and the main goal of the course is to teach and train students for effective analysis methods over a variety of data types and analysis purposes.

AM465 Introduction to Financial Mathematics
We introduce stochastic methods that are useful for financial markets. The concepts of financial terms will be explained and stochastic methods on how the financial market products are priced will also be introduced. Through this course, students are expected to learn how probability, statistics, and applied mathematics are used in financial markets.

AM470 Mathematical Modeling
We study mathematical modeling and mathematical analysis of various problems arising in industry. Diffusion, coagulation, conduction, transport phenomena in polymers, stochastic process, bio-medical science, crystallization, flow, heat transfer are dealt with.

AM480 Topics in Applied Mathematics
Selected topics in current trends in applied mathematics will be treated.

AM490 B.S. Thesis Research

AM495 Individual Study
AM496 Seminar

❒ Graduate Program

AM501 Analysis for Engineers
The topics of this course include Basic theory and application of Analysis, Topological space, Differential Calculus of one and several variable functions, sequences and series of functions.

AM502 Functional Analysis for Engineers

Topics of this course include topological, metric, and vector spaces, linear operators on Banach and Hilbert spaces, Green's formula, applications to boundary value problems, and spectral theory of linear operators.

AM503 Complex Variable Techniques for Engineers

Complex variable techniques for engineering problems will be treated. Residue theorems and applications of conformal mappings, special functions, transform methods, asymptotic methods, Wiener-Hopf methods, etc.

AM504 Applied Matrix Computation

This course covers the graduate-level matrix computation and related numerical methods that are frequently used in science and engineering.

AM511 Methods of Applied Mathematics

We study the mathematical theory of differential and integral equations. We introduce Fourier series theory and eigenvalue problems.

AM520 Advanced Numerical Analysis

The goal of this course is to provide a basic foundation in numerical methods for scientific computation. The course introduces interpolation theory, the approximation of functions, root-finding for nonlinear equations, numerical differentiation and integration, and numerical methods for matrix computation.

AM521 Machine Learning Theories and Applications

Machine Learning is concerned with computer programs that automatically improve their performance through experience. This course covers the theories and applications of machine learning in variety of perspectives. We cover topics such as decision trees, neural networks, Bayesian learning methods, evaluation of learning systems, computational learning theory, and genetic algorithms.

AM523 Knowledge Discovery and Data Mining

This course will introduce various methods of data mining in a database environment. We cover topics of database perspectives on data mining, associations and rule generation, classification and clustering algorithms, genetic algorithms, time-series clustering, latent semantic analysis, visualization of data mining results, and various case studies.

AM530 Partial Differential Equations

We study first and second-order partial differential equations. Laplace, heat and wave equations are introduced. Applications to engineering are emphasized.

AM531 Mathematical Fluid Mechanics

We study the mathematical foundations of Navier-Stokes equations and Euler equations. Especially we study the steady state theory for Stokes equations.

AM541 Applied Real Analysis

Properties and applications of real variables functions are treated. Integration in R^n, basics of functional analysis, L^p space, Radon measure and its applications, application to probability theory are major topics.

AM542 Applicable Complex Analysis

Applicable complex analytic theories will be treated. Cauchy formulas, Poisson formulas, reflection principles, infinite products and series, entire functions, Riemann ζ-functions, conformal mappings Schwarz-Christoffel transform, Dirichlet problems, analytic continuations, etc.

AM546 Wavelets and Applications

The basic theory of wavelets and their applications will be treated. Fourier analysis, Wavelet transforms, Cardinal splines, wavelets and MRA, wavelet packets, applications to signal analysis and image analysis.

AM547 Applied Approximation Theory

Topics of this course include Polynomial Approximation in various function spaces, Interpolation, Mechanical quadrature, Approximation Algorithms, Error Analysis.

AM548 Special Functions

This course covers analytic properties of various special functions such as orthogonal polynomials, hypergeometric functions, gamma functions etc. Topics also include applications to Physics and engineering.

AM550 Probability with Applications

In this course, one treats advanced probability theory which is essential in applications. It includes independent events, conditional probability, martingale processes, stopping times, laws of large numbers, characteristic functions, the central limit theorem and Gaussian processes.

AM551 Applied Stochastic Processes

General theory of stochastic processes and its applications are treated. The course covers Markov chains and processes, Gaussian processes, diffusion processes, stationary processes, ergodic theory, spectral theory and prediction theory.

AM552 Queueing Theory with Applications

Stochastic processes and queueing theory for the analysis of telecommunication systems and manufacturing systems are treated. This course covers Poisson processes, renewal theory, discrete time and continuous time Markov chains, the M/G/1 queue and the G/M/1 queue, random walks, the GI/GI/1 queue, Brownian motion and its application to queueing systems, diffusion processes and stochastic order relations.

AM560 Advanced Statistics

This course covers the theoretical background of statistical methods. Major topics of the course include basics of probability theory, characteristics of some probability distributions, laws of large numbers, central limit theorem, sufficiency, completeness, estimation, hypotheses testing, sequential analysis, analysis of variance, and non-parametric inference.

AM580 Recent Progress in Applied Mathematics

Special topics and/or recent progress in Applied Mathematics are introduced through this intensive course.

AM620 Numerical Partial Differential Equations

The goal of this course is to provide a basic foundation in numerical methods for partial differential equations. The course introduces the methods for some model partial differential equations, then goes into more depth for each method as it applies to other types of equations.

AM621 Computational Models of Neural Networks

This course covers the models of biological and artificial neural networks in variety of perspectives. We cover topics such as models of neurons, neural coding, dynamics of neural networks, feed-forward neural networks, sample complexity, generalization bounds, optimization, and application to engineering problems.

AM641 Applied Functional Analysis

Topics of this course include Banach space, Hilbert space, Linear operators, Banach fixed point theorem, Schauder theorem, Spectral theory and Applications, Variational methods, Differential calculus of operators and Applications.

AM643 Harmonic Analysis and Applications

The methods of Fourier series and integrals will be treated. Fourier transforms, Hardy space method, Conjugate functions, Maximal functions, the Hilbert transform method, Wavelet transform methods, etc.

AM644 Generalized Functions and Applications

This course introduces basic properties of distributions and other generalized functions, Integral transforms, Sobolev spaces, Applications to partial differential equations, Physics, and Engineering.

AM650 Stochastic Differential Equations

Markov processes, Poisson processes, Brownian motions, Ito integrals, Solutions of linear stochastic differential equations, and their asymptotic analysis, boundary value problems, filtering theory and applications to optimal control theory are treated.

AM662 Graphical Models in Statistics

A statistical model from which we can represent the stochastic relationship among variables via a graph is called a graphical model. This model is easy to analyze with and draws much attention for its availability to the research fields of expert systems and artificial intelligence. Major topics include stochastic independence, independence graphs, information theory, the inverse of the variance-covariance matrix, the graphical Gauss model, the graphical log-linear model, the graph chain model, the mixed-variable model, and decomposition.

AM663 Statistical Analysis of Incomplete Data

This course covers statistical methods for various types of incomplete data that are applications or extensions of the statistical methods for complete data. Major topics of the course include least squares analysis with missing data, imputation methods, randomization, weighting methods, likelihood-based estimation for incomplete data, missing-data mechanisms, the EM algorithm, and robust estimation.

AM664 Multivariate Statistical Analysis

This course covers statistical analysis methods for data with multiple random variables. Major topics of the course include multivariate normal distribution, properties of variance-covariance matrices of random vectors, distributions of sample variance- covariance matrices, T-square statistics, statistical classification, multivariate analysis of variance, independence of random vectors, testing hypotheses on variance-covariance matrices, principal component analysis, canonical correlation analysis, and factor analysis.

AM665 Bayesian Statistics

This course covers statistical analysis methods based on Bayes theory, and major topics include utility and loss, prior information, subjective probability, Bayes inference, decision theory, Bayes analysis, Bayes robustness, and Bayes sequential analysis.

AM670 Numerical Fluid Mechanics

Here we will study numerical methods for the Navier-Stokes equations. Numerical algorithms using the method of finite elements, and convergence tests and stability will be treated.

AM671 Hyperbolic Differential Equations
This course presents computational methods for gas dynamics and Euler equations. We introduce a theoretical background for finite difference methods.

AM675 High Speed Computation
Here, parallel processing, multi-grid, domain decomposition for large scale computations are treated. We introduce parallel processing algorithms for super-computing.

AM730 Mathematical Methods for Mechanics
We study basic mathematical theory for continuum mechanics. Frechet derivative, equilibrium point, Cauchy stress principle hyperelasticity, 3-dimensional elasticity and existence theory are introduced.

AM801 Topics in Applied Mathematics
Selected topics in current trends in applied and industrial mathematics will be treated.

AM960 M.S. Thesis Research

AM965 Independent Study in M.S.
Students choose topics and carry out research individually under the supervision of a chosen advisor.

AM966 M.S. Seminar

AM980 Ph.D. Thesis Research

AM986 Ph.D. Seminar