School of Engineering
Approved Courses, which satisfy the Graduate Mathematics Requirement
For Engineering Students

(Updated 5/7/14)

Below is a list of approved graduate courses which may be taken by engineering masters or doctoral students to meet the math requirements of their degree. All selections from this list must be approved by the student's advisor before it can be considered part of the student's program of study.

MTH 403 Boundary Value Problems 3 cr hrs
Introduction to the Sturm-Liouville problem. Fourier trigonometric series, Fourier integrals, Bessel functions, and Legendre polynomials. The heat equation, wave equation, and Laplace's equation with applications. Solutions by the product method.
Prerequisite(s): MTH 219.

MTH 404 Complex Variables 3 cr hrs
Functions of a complex variable, conformal mapping, integration in the complex plane. Laurent series and residue theory.
Prerequisite(s): MTH 219.

MTH 430 Real Analysis 3 cr hrs
Continuation of MTH 330. Topics include the theory of convergence of sequences and series of functions in the context of metric spaces, uniform continuity, uniform convergence, and integration.
Prerequisite(s): MTH 330.

MTH 527 Biostatistics 3 cr hrs
Introduction to statistical concepts and skills including probability theory and estimation, hypothesis tests of means and proportions for one or two samples using normal or t-distributions, regression and correlation, one- and two-way ANOVA, selected nonparametric tests.

MTH 531 Advanced Differential Equations 3 cr hrs
Existence and uniqueness theorems, linear equations and systems, self-adjoin systems, boundary value problems and basic nonlinear techniques. **Prerequisite(s):** MTH 403 or equivalent.

MTH 532 Difference Equations and Applications 3 cr hrs
The calculus of finite differences, first order equations, linear equations and systems, z-transform, stability, boundary value problems for nonlinear equations, Green's function, control theory and applications.

MTH 535 Partial Differential Equations 3 cr hrs
Classification of partial differential equations; methods of solution for the wave equation, Laplace's equation, and the heat equation; applications.
Prerequisite(s): MTH 403 or equivalent.

MTH 543 Linear Models 3 cr hrs
Least square techniques, lack of fit and pure error, correlation, matrix methods, F test, weighted least squares, examination of residuals, multiple regression, transformations and dummy variables, model building, ridge regression, stepwise regression, multiple regression applied to analysis of variance problems.
Prerequisite(s): MTH 368 or equivalent.

MTH 544 Time Series 3 cr hrs
Estimation and elimination of trend and seasonal components; stationary time series, autocovariance, autocorrelation and partial autocorrelation functions; spectral analysis; modeling and forecasting with ARMA processes; nonstationary and seasonal time series.
Prerequisite(s): Courses in single and multivariate calculus; courses in statistics and probability; courses in linear algebra.

MTH 547 Statistics for Experimenters 3 cr hrs
Covers those areas of design of experiments and analysis of quantitive data that are useful to anyone engaged in experimental work. Designed experiments using replication and blocking. Use of transformations. Applications of full and fractional factorial designs. Experimental design for developing quality into products using Taguchi methods.
Prerequisite(s): MTH 367 or equivalent.

MTH 551 Methods of Mathematical Physics 3 cr hrs
Linear transformations and matrix theory, linear integral equations, calculus of variations, eigenvalue problems.
Prerequisite(s): MTH 403 or equivalent.

MTH 552 Methods of Applied Mathematics 3 cr hrs
Dimensional analysis and scaling, regular and singular perturbation methods with boundary layer analysis, the stability and bifurcation of equilibrium solutions, other asymptotic methods.
Prerequisite(s): MTH 403 or equivalent.

MTH 555 Numerical Analysis I 3 cr hrs
Solutions of nonlinear equations, Newton's methods, fixed point methods, solutions of linear equations, LU decomposition, iterative improvement, QR decomposition, SV decomposition.
Prerequisite(s): (CPS 132 or 150) or equivalent; MTH 302 or equivalent.

MTH 556 Numerical Analysis II 3 cr hrs
Interpolating functions, numerical differentiation, numerical integration including Gaussian quadrature, numerical solutions of differential equations.
Prerequisite(s): (CPS 132 or 150) or equivalent; MTH 219 or equivalent.

MTH 558 Financial Mathematics I, Discrete Model 3 cr hrs
Discrete methods in financial mathematics. Topics include introduction to financial derivatives, discrete probability theory, discrete stochastic processes (Markov chain, random walk, and Martingale), binomial tree models for derivative pricing and computational methods (European and American options), forward and futures, and interest rate derivatives.
Prerequisite(s): MTH 411 or equivalent.

MTH 559 Financial Mathematics II, Continuous Model 3 cr hrs
Discrete methods in financial mathematics. Continuous methods in financial mathematics. Topics include review of continuous probability theory, Ito's Lemma, the Black-Scholes partial differential equation, option pricing via partial differential equations, analysis of exotic options, local and stochastic volatility models, American options, fixed income and stopping time. Computational methods are introduced.
Prerequisite(s): MTH 558.

MTH 563 Computational Finance 3 cr hrs
The purpose of this course is to introduce students to numerical methods and various financial problems that include portfolio optimization and derivatives valuation that can be tackled by numerical methods. Students will learn the basics of numerical analysis, optimization methods, Monte Carlo simulations and finite difference methods for solving PDEs.
Prerequisite(s): MBA 621 or permission of instructor.

MTH 565 Linear Algebra 3 cr hrs
Vector spaces, linear transformations and matrices; determinants, inner product spaces, invariant direct-sum decomposition and the Jordan canonical form.

MTH 571 Topology I 3 cr hrs
An axiomatic treatment of the concept of a topological space; bases and subbases; connectedness, compactness; continuity, homeomorphisms, separation axioms and countability axioms; convergence in topological spaces.

MTH 590 Topics in Mathematics 3 cr hrs
This course, given upon appropriate occasions, deals with specialized material not covered in the regular courses. May be taken more than once as topics change.
Prerequisite(s): Permission of advisor.

CME 581 Advanced Chemical Engineering Calculations I 3 cr hrs
Applications of ordinary and partial differential equations to engineering problems. Classical methods of solution.
Prerequisite(s): MTH 219 or permission of instructor.

CME 582 Advanced Chemical Engineering Calculations II 3 cr hrs
Analyses and solutions of engineering problems described by differential equations. Numerical methods of solution.

CME 583 Process Modeling 3 cr hrs
Mathematical description of physical and chemical processes, solution methods, and prediction interpretation. Engineering applications.
Prerequisite(s): CME 582 or equivalent.

ECE 503 Random Processes 3 cr hrs
Random variables as applied to system theory, communications, signal processing and controls. Topics include advanced engineering probability, random variables, random vectors and an introduction to random processes.
Prerequisite(s): ECE 340 or equivalent.

ENM 500 Probability & Statistics for Engineers 3 cr hrs
This is an introductory course in the concepts and applications of probability and statistics. Emphasis is on applications and examples that an engineer or analyst would encounter in practice. Probability is presented as the fundamental tool for modeling uncertainty as well as the logical connection between a population of data and its samples. Descriptive statistics are introduced to describe and characterize data. Inferential statistics provide the means of generalizing to a population from a sample, thus enabling solutions and conclusions that otherwise would not be obtained. Modern software provides the leverage to tackle problems of realistic size and complexity. The concepts and methods covered have direct application to forecasting, queuing, inventory, production, scheduling, equipment replacement, reliability, availability, quality control, experimental design, robust engineering, six sigma, and more.
Prerequisite(s): an undergraduate course sequence in calculus.

ENM 561 Design & Analysis of Experiments 3 cr hrs
This course introduces advanced topics in experimental design and analysis, including full and fractional factorial designs, response surface analysis, multiple and partial regression, and correlation.
Prerequisite(s): ENM 500 or equivalent.

MEE 522 Geometric Methods in Kinematics 3 cr hrs
Trajectories and velocities of moving bodies are designed and analyzed via the principles of classical differential and algebraic geometry. Fundamentals include centrodes, instantaneous invariants, resultants and center point design curves. Curves, surfaces, metrics, manifolds and geodesics in spaces of more than three dimensions are analyzed to study multi-parameter systems.