The Applied and Computational Mathematics (ACM) Program at the Johns Hopkins University will offer the graduate courses listed below in the fall semester (6 September 2006 to 16 December 2006) at locations in the Baltimore–Washington area (Howard and Montgomery Counties, Maryland).

Subject to meeting admission criteria, a non-degree candidate may register as a special student to take one or more courses to enhance mathematical and statistical skills. These courses are scheduled at times convenient for the working adult. Registration and general information is at http://www.epp.jhu.edu. Information specific to the ACM Program is at http://www.epp.jhu.edu/catalog/acm.html. An Open House for prospective students will be held on Thursday, 20 July 2006, at the JHU Applied Physics Laboratory (see http://www.epp.jhu.edu/misc/open_house.html). For further information related to academic requirements and course content, please contact Dr. James Spall, Program Chair, at james.spall@jhuapl.edu or 240-228-4960.

625.403 Statistical Methods and Data Analysis
Instructor: Allan McQuarrie
Time and location: Thursdays, 7:15 – 10:00PM, Applied Physics Laboratory (southern Howard County)
This course introduces commonly used statistical techniques. The intent of this course is to provide an understanding of statistical techniques and a tool box of methodologies. Statistical software is used so students can apply statistical methodology to practical problems in the workplace. Intuitive developments and practical use of the techniques are emphasized rather than theorem/proof developments. Topics include the basic laws of probability and descriptive statistics, conditional probability, random variables, expectation, discrete and continuous probability models, joint and sampling distributions, hypothesis testing, point estimation, confidence intervals, contingency tables, logistic regression, and linear and multiple regression.
Prerequisite: Multivariate calculus.

625.405 Introduction to Optimization
Instructor: David Hutchison
Time and location: Tuesdays, 7:15 – 10:00PM, Applied Physics Laboratory (southern Howard County)
This course is an introduction to the theory and practical techniques needed to solve deterministic linear and non-linear problems. The linear programming portion of the course includes a discussion of the simplex method, duality theory, sensitivity analysis, network flow, and project scheduling. Mathematical models for these and for extensions to integer programming and to certain nonlinear programs will be developed. Students will become familiar with the use of spreadsheets and an algebraic modeling language as development tools. No previous familiarity with the software is assumed. Constrained and unconstrained nonlinear optimization problems with an emphasis on gradient methods and Kuhn-Tucker conditions will also be discussed.
Prerequisite: Multivariate calculus.

625.409 Matrix Theory
Instructor: Matthew Koch
Time and location: Wednesdays, 4:30 – 7:10PM, Applied Physics Laboratory (southern Howard County)
In this course, topics include the methods of solving linear equations, Gaussian elimination, triangular factors and row exchanges, vector spaces (linear independence, basis, dimension, and linear transformations), orthogonality (inner products, projections, and Gram-Schmidt process), determinants, eigenvalues and eigenvectors (diagonal form of a matrix, similarity transformations, and matrix exponential), singular value decomposition, and the pseudoinverse. The course also covers applications to statistics (least squares fitting to linear models, covariance matrices) and to vector calculus (gradient operations and Jacobian and Hessian matrices). Matlab software will be used in some class exercises.
Prerequisite: Multivariate calculus.

625.423 Introduction to Operations Research: Probabilistic Models
Instructor: Eric Blair
Time and location: Thursdays, 4:30 – 7:10PM, Applied Physics Laboratory (southern Howard County)
This course provides an introduction to some of the more useful OR models that exploit basic concepts and principles of probability and statistics. Although the course is organized around mathematical models and methods, the focus is on practical solutions to real operational problems; sufficient theory is provided to develop understanding of fundamental results. Topics may vary, being selected from the fields of Markov chains, queueing theory, decision theory, Bayesian networks, reliability and maintenance, activity networks, Markov decision processes, and inventory theory.
Prerequisites: Multivariate calculus and a first course in probability and statistics (such as 625.403).

625.480 Cryptography
Instructor: George Nakos
Time and location: Wednesdays, 7:15 – 10:00PM, Applied Physics Laboratory (southern Howard County)
An important concern in the information age is the security, protection, and integrity of electronic information, including communications, electronic funds transfer, power system control, transportation systems, and military and law enforcement information. Modern cryptography, in applied mathematics, is concerned not only with the design and exploration of encryption schemes (classical cryptography) but with the rigorous analysis of any system that is designed to withstand malicious attempts to tamper with, disturb, or destroy it. This course introduces and surveys the field of modern cryptography. After mathematical preliminaries from probability theory, algebra, computational complexity, and number theory, we will explore the following topics in the field: foundations of cryptography, public key cryptography, probabilistic proof systems, pseudorandom generators, elliptic curve cryptography, and fundamental limits to information operations.
Prerequisites: Linear algebra and an introductory course in probability and statistics such as 625.403 Statistical Methods and Data Analysis.

625.490 Computational Complexity and Modern Computing
Instructor: Mark Fleischer
Time and location: Tuesdays, 7:15 – 10:00PM, Montgomery County Center (Rockville, MD)
This course will cover the basic issues of computational complexity, with a focus on applications that require novel computational methods. We will start with a discussion of algorithm complexity and NP-completeness. Issues related to complex and high-dimensional data, including the curse of dimensionality, will be studied in some detail. We will also look at novel computing techniques, such as quantum and molecular computing, which may be the computational tools of the future. The lectures will be enhanced through readings and homework.
Prerequisites: A graduate course in probability and statistics such as 625.403. Students should also be familiar with basic linear algebra and have a strong interest in mathematics and computation.

625.717 Advanced Differential Equations: Partial Differential Equations
Instructor: David Han
Time and location: Thursdays, 7:15 – 10:00PM, Applied Physics Laboratory (southern Howard County)
This course presents practical methods for solving partial differential equations (PDEs). The course covers solutions of hyperbolic, parabolic and elliptic equations in two or more independent variables. Topics include Fourier series, separation of variables, existence and uniqueness theory for general higher order equations, eigenfunction expansions, finite difference and finite element numerical methods, Green's functions, and transform methods. MATLAB, a high level computing language, is used throughout the course to complement the analytical approach and to introduce numerical methods.
Prerequisites: 625.404 Ordinary Differential Equations or equivalent graduate course in differential equations. Course in linear algebra would be helpful

625.725 Theory of Statistics I
Instructor: Mostafa Aminzadeh
Time and location: Mondays, 4:30 – 7:10PM, Applied Physics Laboratory (southern Howard County)
This course covers mathematical statistics and probability. Topics covered include discrete and continuous probability distributions, expected values, moment-generating functions, sampling theory, convergence concepts, and the central limit theorem. This course is a rigorous treatment of statistics that lays the foundation for 625.726 and other advanced courses in statistics.
Prerequisites: Multivariate calculus and 625.403 Statistical Methods and Data Analysis or equivalent.

625.775 Data Mining
Instructor: Peter Fitton and Peter Close
Time and location: Mondays, 7:15 – 10:00PM,, Applied Physics Laboratory (southern Howard County)
Data mining has become very important in corporate decision making, and is becoming increasingly important in government. With the advent of large data warehouses, organizations have access to huge quantities of potentially valuable data that they would like to mine in order to produce business intelligence. This course provides an advanced

introduction to the theory and practice of data mining. The emphasis of the course will be on the following topics: opportunity identification, estimating the value of a data mining solution, process standards for data mining, mathematical problem formulation, complexity control and Vapnik-Chervonenkis theory, optimization algorithms, data and dimensionality reduction techniques, regression methods, and predictive classification. Techniques referenced will include classical statistical approaches, neural networks, decision trees, and local smoothing methods. These concepts will be introduced through lectures, readings, applied problem solving, and a major project. Most of the examples to illustrate these applications will come from banking, insurance, and direct marketing.
Prerequisites: Multivariate calculus, familiarity with linear algebra and matrix theory (e.g., 625.409) and a course in statistics (such as 625.403). This course will also assume basic familiarity with multiple linear regression and basic ability to program in MATLAB, FORTRAN, or other programming language. Computer-based homework assignments will be given. Students are encouraged to contact the instructor for additional information.

The following courses provide mathematical background and review and are not offered for graduate credit

625.250 Applied Mathematics I (not for graduate credit)
Instructor: James D'Archangelo
Time and location: Wednesdays, 7:15 – 10:00PM, Applied Physics Laboratory (southern Howard County)
This course covers the fundamental mathematical tools required in applied physics and engineering. The goal is to present students with the mathematical techniques used in engineering and scientific analysis and to demonstrate these techniques by the solution of relevant problems in various disciplines. Areas include vector analysis, linear algebra, matrix theory, and complex variables.
Prerequisites: Differential and integral calculus.

625.260 Introduction to Linear Systems (not for graduate credit)
Instructor: Janet Effler
Time and location: Mondays, 7:15 – 10:00PM, Applied Physics Laboratory (southern Howard County)
This course is designed for students who do not have a bachelor's degree in electrical engineering. This course provides prerequisite material needed before entering many of the systems and telecommunications courses offered in the Master of Science in Electrical Engineering program. Topics include signal representations, linearity, time-invariance, convolution, and Fourier series and transforms. Coverage includes both continuous and discrete-time systems. Practical applications in filter design, modulation/demodulation, and sampling are introduced.
Prerequisites: Differential and integral calculus.