COMPUTATIONAL AND APPLIED MATHEMATICS (CAM)

CAM 597 Problems in Computational and Applied Mathematics (1 Credit)
Supervised projects selected to suit the needs of the graduate student, including those wishing to perform an internship as part of the Curricular Practical Training Program. Projects to be chosen in consultation with the student's advisor. Acceptable research outlines and project reports are required. Students may count credits received in only one offering of this course toward the number of credits required for their degree.

CAM 606 Computing Methods (3 Credits)
Prerequisite: a course in a high-level programming language. This course introduces students to a number of computing topics. Topics include LINUX operating system and its editors, C programming language, R programming language, LaTeX and Beamer, as well as William and Mary's high performance computing network.

CAM 608 Decision Theory (3 Credits)
Prerequisite(s): Equivalent of MATH 351. Development and use of systematic procedures for assisting decision makers in evaluating alternative choices. Emphasis is on problem formulation, uncertainty and risk assessment, Bayes, minimax and other decision rules and applications. Problems will be solved using appropriate software tools.

CAM 616 Design of Experiments (3 Credits)
Prerequisite: equivalent of MATH 351. Topics covered in this course include the theory, design, conduct, and statistical analysis of experiments. Special emphasis is placed upon factorials and fractional factorials to optimize experimental resources.

CAM 618 Models and Applications in OR (3 Credits)
A study of realistic and diverse Operations Research problems with emphasis upon model formulation, interpretation of results and implementation of solutions. Topics include applications of linear programming, goal programming, decomposition of large-scale problems, and job scheduling algorithms. Problems will be solved using appropriate software tools.
Prerequisite(s): CAM 628 or CSCI 628

CAM 626 Linear Regression (3 Credits)
Prerequisite: equivalent of MATH 351. Topics covered in this course include the theory, mechanics, and application of simple and multiple linear regression.

CAM 628 Linear Programming (3 Credits)
Prerequisite(s): equivalent of MATH 211. Theory and applications of linear programming. Topics include the simplex method, duality theory, sensitivity analysis and interior point methods. Problems will be solved using appropriate software tools.

CAM 638 Nonlinear Programming (3 Credits)
Topics include unconstrained optimization, nonlinear least-squares, feasible-point methods, and penalty and barrier methods, with an emphasis on effective computational techniques.
Prerequisite(s): CAM 628 or CSCI 628

CAM 646 Business Analytics (3 Credits)
Business analytics (BA) refer to the use of data by organizations, including businesses, non-profits, and government entities, to extract insights and enhance decision-making processes. It finds application in various areas such as operations, marketing, finance, and strategic planning, among others. This course underscores that BA is not a theoretical field; its methodologies only hold significance when they can translate into practical insights that enhance the speed, dependability, and quality of decisions.
Prerequisite(s): CAM 628 or CSCI 628

CAM 648 Integer Programming (3 Credits)
This course emphasizes coding of Mixed Integer Programming (MIP) models, interpreting solver results, and deepening the understanding of solving techniques. Solver techniques include Lagrangian relaxation, Benders decomposition, column generation, as well as branch and bound, polyhedral theory and cutting planes.
Prerequisite(s): CAM 628 or CSCI 628

CAM 656 Reliability (3 Credits)
Prerequisite(s): equivalent of courses MATH 451/551 and CAM 606. Introduction to probabilistic models and statistical methods used in analysis of reliability problems. Topics include models for the lifetime of a system of components and statistical analysis of survival times data. Problems will be solved using appropriate software tools.

CAM 658 Discrete Optimization (3 Credits)
Discrete optimization problems are those problems with decisions that are logical (yes/no) or countable. Both exact and heuristic methods for discrete optimization models will be presented in the course. Topics include relaxation techniques, constructive heuristics, improving search techniques (simplex method, simulated annealing, tabu search and genetic algorithms), branch and bound schemes, and valid inequalities for branch and cut methods.
Prerequisite(s): CAM 628 or CSCI 628

CAM 666 Directed Studies (1-3 Credits)
Graded Pass/Fail. No credits earned in this course may be applied to the number of credits required to satisfy graduate degree requirements. This course may be repeated.

CAM 668 Supply Chain Optimization (3 Credits)
Prerequisite: CAM 628 and equivalent of MATH 451/551. This course provides a deeper understanding of the optimization principles that underpin modern machine learning and data science. Topics include regularized regression, support vector machines, and reinforcement learning models. Students will explore real-world applications and gain hands-on experience, formulate and solve data-driven optimization problems efficiently.
Prerequisite(s): CAM 628 or CSCI 628

CAM 676 Statistical Analysis of Simulation Models (3 Credits)
Prerequisite(s): equivalent of courses MATH 451/551 and CAM 606. This course introduces statistical techniques used in the analysis of simulation models. The first half of the course develops techniques for determining appropriate inputs to a simulation model, and the last half develops analysis techniques that are applied to the output of a simulation model.

CAM 678 Network Location Theory (3 Credits)
Network location problems arise in many diverse applications. Examples include locating facilities, sensors, components, vehicles, people, services, and actuators. The course will include topics from classical location theory (covering, center and median problems) as well as more recent topics in the literature.
Prerequisite(s): CAM 628 or CSCI 628

CAM 685 Colloquium (0-2 Credits)
Graded Pass/Fail. Students must attend at least seven research talks. No credits earned in this course may be applied to the number of credits required for a degree. This course may be repeated.

CAM 686 Optimization in Machine Learning (3 Credits)
This course provides a deeper understanding of the optimization principles that underpin modern machine learning and data science. Topics include regularized regression, support vector machines, and reinforcement learning models. Students will explore real-world applications and gain hands-on experience, formulate and solve data-driven optimization problems efficiently.
Prerequisite(s): (CAM 628 or CSCI 628) and MATH 551

CAM 688 Topics in CAM (1-3 Credits)
A treatment of Master's level topics of interest not routinely covered by existing courses. Material may be chosen from various areas of computational operations research. May be repeated for different topics. This course may be repeated for credit.

CAM 690 Readings in CAM (1-3 Credits)
Graded Pass/Fail. Permission of the instructor and the Graduate Director required. A description of the intended contents of the readings course must be approved by the Graduate Director before the student may register for the course. Only one offering of this course may count towards meeting the M.S. degree requirements.

CAM 696 Simulation and Modeling Project in CAM (3 Credits)
Prerequisite(s): equivalent of courses MATH 451/551 and CAM 606. Simulation model building in a high-level simulation language. Topics include network, discrete-event, and continuous modeling approaches. Interfaces between the three modeling approaches are presented. Familiarity with univariate and multivariate probability distributions is required for input modeling and simulation output analysis. Course culminates in a semester project.

CAM 699 Research Project in CAM (2 Credits)
Graded Pass/Fail. Permission of Graduate Director required. Students will select a faculty advisor and committee in their area of specialization within computational and applied mathematics, prepare a research proposal abstract for approval by the Graduate Director, undertake a research project, and write a paper describing their research.