

Course Outline for MATH 4464, Senior Project Applied Seminar

MATH 4464 Senior Project Applied Seminar (3 units)

Prerequisite: One of the following: CSC 101, [CSC 1001](#), MATH 350, or [MATH 3681](#); and MATH 306 or [MATH 3152](#); and MATH 344 or [MATH 3351](#).

Written and oral analysis and presentation of topics in applied mathematics and mathematical modeling. Construct and analyze mathematical models using a range of mathematical fields, including linear algebra, differential equations, numerical analysis, dynamical systems, and data analytics. Not open to students with credit in MATH 459 or [MATH 4463](#). 3 seminars. Formerly MATH 460.

Course Learning Objectives	
1	Apply mathematics skills and knowledge to the analysis of problems in applied mathematics.
2	Construct and analyze mathematical models and their solutions, including model creation, analysis of model assumptions, parameter estimation, sensitivity analysis, model validation, and interpretation of solutions.
3	Present written and oral solutions to open-ended problems in applied mathematics.
4	Explore open-ended problems in applied mathematics using standard modes of mathematical investigation, including rigorous mathematical proof and numerical simulations and computations.

Expanded Course Content

Textbooks, materials, and/or other resources
Instructors can choose from a variety of textbooks and/or additional readings. This sample course outline is based on the following text: F. Giordano et al., A First Course in Mathematical Modeling

Week	Readings	Topics of Discussion
1	Ch. 1: Modeling Change	Modeling change with difference equations; solutions to dynamical systems; systems of difference equations
2	Ch. 3: Model Fitting	Fitting models to data graphically and analytically; applying the least-squares criteria; parameter estimation
3	Ch. 4: Experimental Modeling	Polynomial models, cubic spline models
4	Ch. 6: Discrete Probabilistic Modeling	Probabilistic modeling with discrete systems
5	Ch. 7: Optimization of Discrete Models	Linear programming: geometric and algebraic solutions
6	Ch. 7: Optimization of Discrete Models	Linear programming: the simplex method and sensitivity analysis; numerical search methods
7	Ch. 8: Modeling Using Graph Theory	Graphs as models; connections to mathematical programming
8	Ch. 9: Modeling with Decision Theory	Probability and expected value; decision trees
9	Ch. 11: Modeling with Differential Equations	Construction of differential equations models of physical and biological problems; analyzing numerical and/or exact solutions of differential equations models
10	Ch. 12: Modeling with Systems of Differential Equations	Construction of systems of differential equations to model problems in physics, biology, and engineering. Analysis and interpretation of numerical solutions of models.
11	Ch. 12: Modeling with Systems of Differential Equations	Construction of systems of differential equations to model problems in physics, biology, and engineering. Analysis and interpretation of numerical solutions of models.
12	Ch. 14: Dimensional Analysis and Similitude	The process of dimensional analysis
13	Problems from the Mathematical Contest in Modeling	Construction and analysis of mathematical models for open-ended problems in applied mathematics.

Week	Readings	Topics of Discussion
14	Problems from the Mathematical Contest in Modeling	Construction and analysis of mathematical models for open-ended problems in applied mathematics.
15	Problems from the Mathematical Contest in Modeling	Construction and analysis of mathematical models for open-ended problems in applied mathematics.

Method of Assessment

The possible methods of assessment are written individual examinations, quizzes, in-class worksheets and presentations, projects, and homework. The final assessment for this course will be a final project

Instructional Mode

The instructional mode for this class is face-to-face. This designation means that the essential academic standards of the course require in-class student engagement, and thus remote instruction is not appropriate.