

ROWAN UNIVERSITY
Department of Mathematics

Syllabus

Math 03.400 - Applications of Mathematics

CATALOG DESCRIPTION:

Math 03.400 Applications of Mathematics, 3 s.h.

Prerequisites: one of the following two combinations of courses:

1. Math 01.230 (Calculus III) and Math 01.210 (Linear Algebra) and Math 01.231 (Ordinary Differential Equations)
2. Math 01.230 (Calculus III) and Math 01.235 (Mathematics for Engineering Analysis)

with a grade of C- or better in all prerequisites

This course studies mathematical models applicable to various fields such as biology, physics, or social science. The process of building a mathematical model to describe a real world system will be demonstrated. Emphasis will be on the value of mathematical models for solving problems and obtaining new results. Computers and graphing calculators will be used.

OBJECTIVES:

This course will introduce the student to the techniques used in the construction of mathematical models of real world systems. This will include a discussion on fitting the model to data and on model validation. Specific mathematical models and their applications to different disciplines will be studied. Emphasis will be placed on the relationship between discrete and continuous models and between deterministic and stochastic models.

CONTENT:

PART ONE:

CREATIVE MODEL CONSTRUCTION AND THE MODELING PROCESS

The discussion will center on the types of mathematical models and their classification in terms of deterministic versus stochastic and discrete versus continuous. The description of the iterative nature of model construction will be followed by examples of model construction.

PART TWO:

MODEL FITTING AND VALIDATION

The least square method of fitting a model to data will be presented. Model validation with newly acquired data is discussed and used to adjust the model in the iterative approach.

PART THREE:

SPECIFIC MATHEMATICAL MODELS AND THEIR APPLICATIONS

Models used in the physical, social, and life sciences will be introduced and the mathematics used in the analysis of these models will be discussed. The mathematics may include topics in Differential and Difference Equations, Linear Algebra, Modern Algebra, Number Theory, Probability, Complex Analysis, Graph Theory, or Numerical Analysis.

TEXT:

1. Frank R. Giordano, William P. Fox, Steven B. Horton, and Maurice D. Weir, A First Course in Mathematical Modeling, 4th ed., Brooks/Cole Publishing Co., 2009.
2. Meerschaert, M., Mathematical Modeling, 4nd Ed., Academic Press, 2013.
3. Mesterton-Gibbons, M., A Concrete Approach to Mathematical Modeling, John Wiley & Sons, Inc., 1995.

(Note: The instructor may choose to emphasize a series of individual models from a certain branch of mathematics and may find less general text more useful.)

Reviewed: 04/2021