

Topics in Modeling

MATH/CSCI 4760/8766

1.0 Course Description

- 1.1 Overview of Content and Purpose:** (3 hours) Formulation and analysis of various models involving Markov chains, Markov processes (including birth and death processes), queues, cellular Automata, difference and differential equations, chaotic systems, and fractal geometries.
- 1.2 For whom Intended:** The student should be able to develop and analyze simple mathematical models arising in the physical, biological, and social sciences.
- 1.3 Prerequisite:** MATH 2350 and 4740/8746

2.0 Content and Organization

- 2.1 Topics:**
1. Markov Chains
 2. Reliability Theory
 3. Queuing Systems
 4. Difference and Differential Equations
 5. Chaotic Dynamical Systems
 6. Fractal Geometry

3.0 Teaching Methodology

- 3.1 Methods to be Used:** The course will be presented by lecture, class discussion and questions.

4.0 Evaluation

- 4.1 Basis for Evaluating Student Performance:** Evaluation will be based on examination results and outside projects including homework and/or computer projects. Approximate grading weights are 25% for the final examination, 40% for the regularly scheduled examinations, and 35% for the homework and/or computer projects. To receive graduate credit for this course, a student must do work not required of undergraduates. To meet this requirement the graduate students will be assigned more homework and/or computer projects than the undergraduate students.

Graduate students will be assigned problems at a higher level of difficulty and outside projects that are extensions and generalizations of those given to the undergraduates. The relative grading weights for the students are the same as those of the undergraduates.

5.0 Resource Material

- 5.1 Textbook(s) or Other**

**Required
Readings:**

**5.2 Current
Bibliography
of Resources:**

1. Hiller, F., and Liebermann, G., *Operations Research*, Holden Day, 1986.
2. Parzen, Emanuel, *Stochastic Processes*, Holden Day, 1962.
3. Phillips, E., Ravindran, A. and Solberg, J., *Operations Research*, John Wiley, 1976.
4. Ross, Sheldon, *Introduction to Probability Models*, Academic Press, 1980.
5. Scheinerman, Edward R., *Invitation to Dynamical Systems*, Prentice-Hall, 1996.
6. Gulick, Denny, *Encounters with Chaos*, McGraw Hill, 1992.
7. Barnsley, Michael, *Fractals Everywhere*, Academic Press, 1988.
8. Hastings, Harold M., and Sugihara, George, *Fractals, A User's Guide for the Natural Sciences*, Oxford, 1994.