ENG EC534 Discrete Stochastic Models

2008-2009 Catalog Data:
Discrete Stochastic Models Prereq: ENG EC 381 or ENG EK 500. Markov chains, Chapman-Kolmogorov equation. Classification of states, limiting probabilities, branching processes, time-reversible processes. Poisson process and its generalization, continuous-time Markov chains, birth and death processes, embedded Markov chains, applications to queuing systems, renewal processes. 4cr.

Status in the Curriculum: Elective

Class/Lab Schedule:
Lecture: 4 hours/week

Textbooks and other required materials:
Ross, S.M., "Introduction to Probability Models," 9th edition, Elsevier Books, 2006.

References:
1. Wolfe, R.W., "Stochastic Modeling and the Theory of Queues," Prentice Hall, 1989.
2. Taylor, H.M. and S. Karlin, "An Introduction to Stochastic Modeling," Academic Press, 1984.
3. Asmussen, S., "Applied Probability and Queues," J. Wiley & Sons, 1987.

Coordinator: Lev Levitin

Prerequisites by topic:
EK300 or EK500, Probability Theory

Goals:
Presentation of discrete-time Markov chains, Poisson and related processes, continuous-time Markov chains, renewal processes, and their applications to queuing systems.

Course Outcomes:
As an outcome of completing this course, students should be able to:

1. *Understand and be able to use* discrete-time Markov chains, Poisson and related processes, continuous-time Markov chains, and renewal processes.
2. *Apply* probabilistic models to various problem of engineering and bioengineering practice.
3. *Be able to design* mathematical models for queuing systems, reliability, communication, etc. using the probabilistic processes.
4. *Communicate* in written and orally, using mathematical concepts and models learned.
5. *Know, understand, and appreciate* the importance of mathematical literacy and mathematical rigour in research and engineering practice.

Course Outcomes mapped to Program Outcomes:

Program Outcomes	**h, f**	**a, e**	**g**	**d**	**b**	**m**	**c**	**i**
Course Outcomes	**1-5**	**1-5**	**4**			**1-5**	**2, 3**	**3**
Emphasis (1-5)	**5**	**5**	**4**			**3**	**5**	**4**

1=not at all; 5=a great deal;

Topics in Project Assignments:
1) Markov Chains, Chapman-Kolmogorov Equation. 2) Classification of States, Limiting Probabilities. 3) Branching Processes. 4) The Poisson Process and its Generalization. 5) Continuous-Time Markov Chains. 6) Birth and Death Processes. 7) Queuing Systems; Exponential Models. 8) The Systems M/M/s, M/G/1, G/M/1, and its Variations. 9) Renewal Processes.

Contribution of Course to Meeting the Professional Component:
Engineering topics: 30%
Math & Basic Science: 65%
General Education: 5%

Prepared by: **Date:** June 12, 2009
Lev B. Levitin