Catalog Data:

Class/Lab Schedule:
Lecture: 4 hours/week

Textbooks and other required materials:

References:

Coordinator:

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 rigor in research and engineering practice.

Course Outcomes mapped to Program Outcomes:
<table>
<thead>
<tr>
<th>Program Outcomes</th>
<th>Educational Breadth</th>
<th>Understanding</th>
<th>Communication</th>
<th>Collaboration</th>
<th>Laboratory</th>
<th>Integrated View</th>
<th>Design</th>
<th>Discovery</th>
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<td>h, f</td>
<td>a, e</td>
<td>g</td>
<td>d</td>
<td>b</td>
<td>m</td>
<td>c</td>
<td>i</td>
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Course Outcomes:

| Course Outcomes | 1-5 | 1-5 | 4   | 1-5 | 2, 3 | 3   |

Emphasis (1-5):

| 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:**
Lev B. Levitin

Percent in Final Grades:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homeworks</td>
<td>30%</td>
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<td>Mid-Term Exam</td>
<td>30%</td>
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<tr>
<td>Final Exam</td>
<td>40%</td>
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