School of Mathematical Sciences

☑ New ☐ Revised COURSE: COS-MATH-605 Stochastic Processes

1.0 Course Designations and Approvals:

<table>
<thead>
<tr>
<th>Required Course Approvals:</th>
<th>Approval Request Date</th>
<th>Approval Grant Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Unit Curriculum Committee</td>
<td>10-20-10</td>
<td>10-27-10</td>
</tr>
<tr>
<td>College Curriculum Committee</td>
<td>11-01-10</td>
<td>1-25-11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Optional Course Designations:</th>
<th>Yes</th>
<th>No</th>
<th>Approval Request Date</th>
<th>Approval Grant Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
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<tr>
<td>Writing Intensive</td>
<td></td>
<td>✔</td>
<td></td>
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<tr>
<td>Honors</td>
<td></td>
<td>✔</td>
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2.0 Course information:

Course Title: Stochastic Processes
Credit Hours: 3
Prerequisite(s): COS-MATH-241 and COS-MATH-251 or permission of instructor
Co-requisite(s): None
Course proposed by: School of Mathematical Sciences
Effective date: Fall 2013

<table>
<thead>
<tr>
<th>Contact Hours</th>
<th>Maximum Students/section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>3</td>
</tr>
<tr>
<td>Lab</td>
<td>25</td>
</tr>
<tr>
<td>Workshop</td>
<td></td>
</tr>
<tr>
<td>Other (specify)</td>
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</tbody>
</table>

2.1 Course Conversion Designation: (Please check which applies to this course)

☑ Semester Equivalent (SE) to: 1016-725
☐ Semester Replacement (SR) to:
☐ New

2.2 Semester(s) offered:

☐ Fall    ☑ Spring    ☐ Summer

☐ Offered every other year only    ☐ Other
2.3 Student Requirements:

Students required to take the course:
Applied and Computational Mathematics graduate students

Students who might elect to take the course:
Graduate students and advanced undergraduate students in mathematics, physics, imaging science, or engineering

3.0 Goals of the course: (including rationale for the course, when appropriate)

3.1 To introduce the theory and techniques of stochastic processes.

4.0 Course description: (as it will appear in the RIT Catalog, including pre- and co-requisites, semesters offered)

COS-MATH-605 Stochastic Processes
This course is an introduction to stochastic processes, especially those that appear in various applications. It covers basic properties and applications of Poisson processes and Markov chains in discrete and continuous time. (COS-MATH-241 and COS-MATH-251 or permission of instructor) Class 3, Credit 3 (S)

5.0 Possible resources: (texts, references, computer packages, etc.)

5.1 E. Cinlar, Introduction to Stochastic Processes, Prentice Hall, Upper Saddle River, NJ.

6.0 Topics: (outline) Topics with an asterisk(*) are at the instructor’s discretion, as time permits

6.1 Review of Elementary Probability and Random Variables

6.2 Conditioning

6.3 Discrete Time Markov Chains
   6.3.1 Examples
   6.3.2 Chapman - Kolmogorov equations
   6.3.3 Classification of states
   6.3.4 Limiting probabilities
   6.3.5 Mean time spent in transient states
   6.3.6 Gambler’s ruin and other applications

6.4 The Exponential Distribution and the Poisson Processes
   6.4.1 Properties of the exponential distribution
   6.4.2 Convolutions of exponential distributions
   6.4.3 Definition and characterizations of the Poisson process
   6.4.4 Inter-arrival and waiting time distributions
   6.4.5 Conditional distribution of arrival times
6.4.6 Generalizations of the Poisson process
6.4.7 Applications

6.5 Continuous Time Markov Chains
   6.5.1 Examples
   6.5.2 Birth and death processes
   6.5.3 The transition probability function
   6.5.4 Limiting probabilities
   6.5.5 Applications to queueing models

7.0 Intended learning outcomes and associated assessment methods of those outcomes:

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Assessment Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Homework</td>
</tr>
<tr>
<td>7.1 Develop the principles of random processes</td>
<td>✓</td>
</tr>
<tr>
<td>7.2 Analyze the properties and application of Poisson processes</td>
<td>✓</td>
</tr>
<tr>
<td>7.3 Develop the properties and applications of Markov chains in discrete and continuous time</td>
<td>✓</td>
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</tbody>
</table>

8.0 Program goals supported by this course:

8.1 To develop an understanding of the mathematical framework that supports engineering, science, and mathematics.
8.2 To develop critical and analytical thinking.
8.3 To develop an appropriate level of mathematical literacy and competency.
8.4 To provide an acquaintance with mathematical notation used to express physical and natural laws.

9.0 General education learning outcomes and/or goals supported by this course: Not applicable

10.0 Other relevant information: (such as special classroom, studio, or lab needs, special scheduling, media requirements, etc.)
    None