The Hong Kong Polytechnic University

Subject Description Form

Subject Code	LGT6202
Subject Title	Stochastic Models and Decision under Uncertainty
Credit Value	3
Level	6
Normal Duration	1-semester
Pre-requisite / Co-requisite/ Exclusion	Nil
Role and Purposes	The primary objective of the module is to provide graduate students with foundational and critical knowledge on probability models and stochastic processes and to develop skills in applying these to decision-making in management and engineering.
Subject Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand important concepts such as DTMC, CTMC and Poisson Process. b. Apply stochastic processes to model some business decision problems. c. Conduct transient analysis and obtain limiting behavior of stochastic processes.
Subject Synopsis/ Indicative Syllabus	In this course, we study the basic operations research models for system performance analysis and decision making under risks that are relevant to business decision-making in the areas such as finance, operations management and supply chain management. The emphasis in this course is on model building, solution methods, and interpretation of results. Topics covered in this course may include: • Preliminaries: Probability, Random Variables, Expected Value, Moment Generating Function, Conditional Expectation, Exponential Distribution, Probability Inequalities, Limit Theorems • The Poisson Process: Definition and Properties, Nonhomogeneous Poisson Process, Compound Poisson Processes, Conditional Poisson Processes • Renewal Theory: Limit Theorems, The Key Renewal Theorem, Delayed Renewal Processes, Renewal Reward Processes • Discrete-Time Markov Chains: Limit Theorems, Transitions, Time-Reversible Markov Chains, Semi-Markov Processes

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- Continuous-Time Markov Chains: The Kolmogorov Differential Equations, Limiting Probabilities, Time Reversibility

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<tr><td>Teaching/Learning Methodology</td><td>The teaching approach will be a combination of lectures, assignments, class discussions and presentations. Basic concepts and technical knowledge of stochastic models will be covered in lectures. Students are expected to read the relevant text materials and to practice the assignment problems.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td></td><td></td><td></td></tr>
<tr><td>1. Continuous Assessment</td><td>70%</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Homework</td><td>50%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>Mid-term</td><td>20%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>2. Final Exam</td><td>30%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100%</td><td colspan="6"></td></tr>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Both the homework and examination questions are comprehensive which require students to model business decision problems as stochastic processes and to obtain the stable system performance measures based on the model.
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<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture/Tutorial</td><td>39 Hrs.</td></tr>
<tr><td>▪</td><td></td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ After-class homework</td><td>57 Hrs.</td></tr>
<tr><td>▪ Reading assignment</td><td>30 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>126 Hrs.</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>Textbook:

Ross, Sheldon M. (1996). Stochastic Processes. John Wiley, New York.

Handouts

References:

Kulkarni, Vidyadhar G. (1995). Modeling and Analysis of Stochastic Systems. Chapman & Hall, New York.</td></tr>
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	Karlin, Samuel, and Howard M. Taylor. (1975). A First Course in Stochastic Processes. Academic Press, Boston. Karlin, Samuel, and Howard M. Taylor. (1981). A Second Course in Stochastic Processes. Academic Press, New York. Ross, Sheldon M. (2000). Introduction to Probability Models. Academic Press, San Diego. E.L. Porteus (2002). Foundations of Stochastic Inventory Theory. Stanford University Press. Ross, Sheldon M. (1983). Introduction to Stochastic Dynamic Programming, Academic Press, New York.