Subject Description Form

Subject Code	AMA528
Subject Title	Probability and Stochastic Models
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To enable students to have a thorough understanding of basic probability theory and some families of distributions, and their applications.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Apply the concepts of probability, conditional probability and conditional expectations. (b) Identify the distribution of random variable under various discrete and continuous distributions. (c) Calculate probabilities, moments and other related quantities based on given distributions. (d) Determine the probability distribution after transformation. (e) Apply stochastic models in mathematical modelling.
Subject Synopsis/ Indicative Syllabus	Fundamental probability: set function, sample space, events, set operation, probability, independence, conditional probability, three basic probability axioms: multiplication rules, law of total probability, and Bayes Theorem. Random variables: discrete and continuous, distribution functions, expectation, variance, and higher order moments, moment generating functions, probability generating functions, cumulant generating functions and cumulants. Identify applications for which each distribution may be used, explain the reasons why, and apply the distribution to the application, given the parameters. Multiple random variables: Independence, jointly distributed, conditional distributions, marginal distributions. Conditional expectation, variance, and compound distributions; concept of Bayesian statistics; Apply techniques for creating new distributions: multiplication by a constant, raising to a power, exponentiation, mixing. Central limit theorem. Stochastic processes: time index, ensemble average, autocorrelation, classification, stationary increment, independent increment. Markov property, Markov process, transition probability, multiple state Markov chain, application of Markov process models.
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The teaching and learning approach is mainly problem-solving oriented. The approach aims at the development of probabilistic techniques and how the techniques can be applied to solving problems. Students are encouraged to

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<tr><td></td><td>adopt a deep study approach by employing high level cognitive strategies, such as critical and evaluative thinking, relating, integrating and applying theories to practice.</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="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td></tr>
<tr><td>1. Assignments</td><td>16%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Mid-term test</td><td>24%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>3. Examination</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="5"></td></tr>
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Continuous Assessment comprises of assignments and a mid-term test. A written examination is held at the end of the semester.
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<tr><td>Student Study Effort Required</td><td>
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<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>26 Hrs.</td></tr>
<tr><td>▪ Tutorial</td><td>13 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Assignment/Mini-project</td><td>35 Hrs.</td></tr>
<tr><td>▪ Self-study</td><td>63 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>137 Hrs.</td></tr>
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<tr><td>Reading List and References</td><td>
<table>
<tr><td>Ross, S.M.</td><td>A First Course In Probability, 9th Edition</td><td>Pearson Education</td></tr>
<tr><td>Ross, S.M.</td><td>Introduction To Probability Models, 11th Edition</td><td>Academic Press</td></tr>
<tr><td>Richard Durrett</td><td>Essentials of Stochastic Processes</td><td>Springer, 2016</td></tr>
<tr><td>Grimmett, G. and Stirzaker, D.</td><td>Probability and Random Processes, 3rd Edition</td><td>Oxford University</td></tr>
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