Subject Description Form

Subject Code	AMA523
Subject Title	Optimal Control with Management Science Applications
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject aims to introduce the basic theoretical concepts of calculus of variations and optimal control theory with applications to management sciences.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Formulate simple problems in calculus of variations and optimal control. (b) Apply theory and techniques of calculus of variations and optimal control to solve certain control problems. (c) Synthesize mathematical knowledge in modeling simple optimal control problems.
Subject Synopsis/ Indicative Syllabus	Introduction Introduction of calculus of variations and optimal control theory – a brief historical account for the theory, standard notations and simple formulations. Analytical techniques Calculus of variations, dynamic programming, the maximum principle, Kalman filter, stochastic differential equations. Applications to Finance The simple cash balance problem; Optimal financing problem considering external equity financing, distribution of dividends per share, and maximizing present value of future dividend. Applications to Production and Inventory A production inventory system; Continuous Wheat Trading Model; Planning horizons and forecast horizons. Numerical optimal control software package Introduction to the optimal control computation software --- Matlab
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 mathematical techniques and how the techniques can be applied to solving problems. Students are encouraged to adopt a deep study approach by employing high level cognitive strategies, such

<table>
<tr><td></td><td>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>
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<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="3">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td></tr>
<tr><td>1. Assignments</td><td>20%</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Mid-term test</td><td>20%</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>3. Examination</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="3"></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</td><td>20 Hrs.</td></tr>
<tr><td>▪ Case study/Mini-project</td><td>38 Hrs.</td></tr>
<tr><td>▪ Self-study</td><td>40 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>Stephen Boyd and Lieven Vandenberghe</td><td>Convex Optimization</td><td>Cambridge University Press, 2004</td></tr>
<tr><td>Mike, Mesterton-Gibbons</td><td>A primer on the calculus of variations and optimal control theory</td><td>American Mathematical Society, c2009</td></tr>
<tr><td>Sethi, S.P. and Thompson, G.L.</td><td>Optimal Control Theory: Applications to Management Science and Economics, 2nd Edition</td><td>Kluwer Academic, 2000</td></tr>
<tr><td>P. E. Kloeden and E. Platen</td><td>Numerical solution of stochastic differential equations</td><td>Springer, New York, 2000.</td></tr>
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