Subject Description Form

Subject Code	AMA 612
Subject Title	Numerical methods for Partial Differential Equations
Credit Value	3
Level	6
Expected background knowledge	A course in Differential Equations and a course in Advanced Calculus
Objectives	This subject is to introduce students to numerical techniques for solving partial differential equations, with applications in physics, engineering, finance and economics.
Intended Learning Outcomes	Upon satisfactory completion of the subject, students should be able to: a. Gain a deep understanding of algorithms of finite difference and finite element methods for solving partial differential equations; b. Solve simple partial differential equations numerically; c. Gain a basic knowledge of theories of finite difference and finite element methods; d. Apply finite difference or finite element methods to solve problems arising in physics, engineering, finance and economics numerically.
Subject Synopsis/ Indicative Syllabus	*Finite difference methods:* Finite difference methods for model problems, Stability, Consistency, Convergence, Lax equivalent theorem, Error estimates. *Finite element methods:* Finite element methods for model problems, Interpolation theory in Sobolev Spaces, Conforming finite elements, Error estimates. *Time discretization of evolution equations:* Parabolic equations and BDF methods, Subdiffusion equations and convolution quadrature, Approximation to nonsmooth solutions.

<table>
<tr><td>Teaching/ Learning Methodology</td><td>The subject will be delivered mainly through lectures and tutorials. The lectures will be conducted to introduce numerical methods for partial differential equations in the syllabus, which are then reinforced by learning activities involving demonstration, tutorial exercise and assignments.</td></tr>
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<table>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods</td><td rowspan="2">% weighting</td><td colspan="4">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></tr>
<tr><td>1. CA</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Exam</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="4"></td></tr>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The subject focuses on knowledge, skill and understanding of <u>Numerical methods for Partial Differential equations</u>, <u>thus, Exam-based assessment</u> is the most appropriate assessment method, including 25% test and 60% examination. Moreover, 15% worth of assignments are included as a component of continuous assessment so as to keep the students in progress.

Continuous Assessment comprises of assignments and tests. A written examination is held at the end of the semester.
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<tr><td rowspan="2">Student Study Effort Expected</td><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>26 Hrs.</td></tr>
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	▪ Tutorial	13 Hrs.
	Other student study effort:	
	▪ Assignment	36 Hrs.
	▪ Self-study	27 Hrs.
	Total student study effort	102 Hrs.
Reading List and References	J.W. Thomas, Numerical partial differential equations—Finite Difference Methods, Springer, 1995. Randall J. LeVeque, Finite Difference Methods for Ordinary and Partial Differential Equations--Steady State and Time Dependent Problems, SIAM: Society for Industrial and Applied Mathematics, 2007. Philippe G. Ciarlet, The Finite Element Method for Elliptic Problems, SIAM: Society for Industrial and Applied Mathematics; 2nd edition, 2002. O.C. Zienkiewicz and K. Morgan, Finite Element Method, John Wiley, 1983.	