

Subject Description Form

Subject Code	AMA301
Subject Title	Computational Methods
Credit Value	3
Level	3
Pre-requisite	Intermediate Calculus and Linear Algebra (AMA2007) or Introduction to Differential Equations (AMA2008) or Mathematics I (AMA2111) or Mathematics for Engineers (AMA2308) or Engineering Mathematics (AMA2380) or Applied Mathematics II (AMA2512) or Mathematics for Scientists and Engineers (AMA2882) or Engineering Mathematics (AMA290) or Mathematical Methods for Data Science (AMA3001) or equivalent
Objectives	The subject introduces students to some fundamental knowledge of mathematical methods for finding numerical approximations to engineering problems. The emphasis will be on application of numerical methods to solving practical problems. Computer implementation of algorithms by students is emphasized. Computer software, such as Matlab, will be used to solve practical engineering problems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: <ol style="list-style-type: none"> 1. apply mathematical reasoning to analyse essential features of different engineering problems; 2. extend their knowledge of mathematical and numerical techniques and adapt known solutions to different situations; 3. apply appropriate numerical techniques to model and solve problems in engineering; 4. develop and extrapolate mathematical concepts in synthesizing and solving new problem; 5. search for useful information in solving problems.
Subject Synopsis/ Indicative Syllabus	<p><i>Error propagation, solution of linear system and nonlinear equation:</i> Direct methods and iterative methods; Two-point methods and Fixed point iterations.</p> <p><i>Finite difference, interpolation and numerical differentiation and integration:</i> Lagrange and Newton interpolating polynomials; Aitken's interpolating formula; Composite rules; Gauss quadrature.</p> <p><i>Numerical solution of ordinary differential equation:</i> Predictor-corrector method; Runge-Kutta method.</p>

	<p><i>Unconstrained nonlinear optimization:</i> One-dimensional and multi-dimensional search methods; Gradient methods.</p>						
Teaching/Learning Methodology	<p>The subject will be delivered mainly through lectures and tutorials classes. The lectures will be conducted to introduce the concepts of various computational methods, which are reinforced by learning activities involving demonstration, example classes, assignments and exercises.</p>						
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			1	2	3	4	5
	a. Continuous Assessment	40%	✓	✓	✓	✓	✓
	b. Examination	60%	✓	✓	✓	✓	
	Total	100%					
<p>Continuous Assessment comprises of the mid-test and two assignments. A written examination is held at the end of the semester.</p>							
Student Study Effort Expected	Class contact:						
	▪ Lecture		26 Hrs.				
	▪ Tutorial		13 Hrs.				
	Other student study effort:						
	▪ assignments		20 Hrs.				
	▪ self study		58 Hrs.				
	Total student study effort		117 Hrs.				
Reading List and References	<u>Textbook:</u>						
	Chen, X. & Yamamota, T.	Numerical Analysis		Coronasha	2008		
	<u>References:</u>						
	Chapra, S.C. & Canale, R.P.	Numerical Methods for Engineers: with Programming and Software Applications 5 th edition		McGraw Hill	2006		
	Recktenwald, G.W.	Introduction to Numerical Methods and Matlab: Implementation and Applications		Prentice Hall	2000		
Gerald, C.F. & Wheatley, P.O.	Applied Numerical Analysis 7 th edition		Addison Wesley	2004			