Subject Description Form

Subject Code	AMA3201
Subject Title	Computational Methods
Credit Value	3
Level	3
Pre-requisite	▪ Intermediate Calculus and Linear Algebra (AMA2007/AMA2707) or ▪ Mathematics I (AMA2111) or ▪ Mathematics for Engineers (AMA2131/AMA2308) or ▪ Applied Mathematics II (AMA2512) or ▪ Mathematics for Scientists and Engineers (AMA2882) or ▪ Engineering Mathematics (AMA290) or ▪ Mathematical Methods for Data Science (AMA3001/AMA3701) or ▪ **Both** Basic Mathematics II –Calculus and Linear algebra (AMA1120) **and** ▪ Engineering Mathematics (AMA2380) or ▪ **Both** Multivariable Calculus (AMA2702) **and** Further Mathematical Methods (AMA3724) [Students are expected to have some basic knowledge of ODE]
Exclusion	Computational Methods (AMA301)
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: 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	*Error propagation, solution of linear system and nonlinear equation:* Direct methods and iterative methods; Two-point methods and Fixed point iterations. *Finite difference, interpolation and numerical differentiation and integration:* Lagrange and Newton interpolating polynomials; Aitken's interpolating formula;

	Composite rules; Gauss quadrature. *Numerical solution of ordinary differential equation:* Predictor-corrector method; Runge-Kutta method. *Unconstrained nonlinear optimization:* One-dimensional and multi-dimensional search methods; Gradient methods.
Teaching/Learning Methodology	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.

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%					

Continuous Assessment comprises of the mid-test and two assignments. A written examination is held at the end of the semester.

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

Textbook:

Chen, X. & Yamamota, T.	Numerical Analysis	Coronasha 2008

References:

Chapra, S.C. & Canale, R.P.	Numerical Methods for Engineers: with Programming and Software Applications 5th edition	McGraw Hill 2006
Recktenwald, G.W.	Introduction to Numerical Methods and Matlab: Implementation and Applications	Prentice Hall 2000
Gerald, C.F. &	Applied Numerical Analysis	Addison Wesley

	Wheatley, P.O. 7th edition	2004