SUBJECT DESCRIPTION FORM

Subject Title: Computational Methods

Subject Code: AMA301

Credit Value: 3

Pre-requisite: Either AMA201 or AMA215 or AMA2152 or
(AMA211/AMA216/AMA280/AMA284/AMA286/AMA288 for
Minor Programme in Applied Mathematics and Free Electives)

Learning Approach:

Lecture	28 hours
Tutorial and Student Presentation	14 hours
Total	42 hours

The lectures aim to provide the students with an integrated knowledge required for the understanding and application of mathematical concepts and techniques. To develop students' ability for logical thinking and effective communication, tutorial and presentation sessions will be held.

Assessment:

Continuous Assessment	40%
Examination	60%
Total	100%

To pass this subject, students are required to obtain Grade D or above in both the Continuous Assessment and the Examination components.

Learning Outcomes:

The subject aims to introduce 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.

Upon satisfactory completion of the subject, students are expected to be able to:

(i) apply mathematical reasoning to analyse essential features of different engineering problems;

(ii) extend their knowledge of mathematical and numerical techniques and adapt known solutions to different situations;

(iii) apply appropriate numerical techniques to model and solve problems in engineering;

(iv) develop and extrapolate mathematical concepts in synthesizing and solving new problem;

(v) search for useful information in solving problems;

(vi) undertake continuous learning.

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.

Textbooks:

S.C. Chapra & R.P. Canale	Numerical Methods for Engineers: with Programming and Software Applications 5^{th} edition	McGraw Hill 2006
G.W. Recktenwald	Introduction to Numerical Methods and Matlab: Implementation and Applications	Prentice Hall 2000
C.F. Gerald	Applied Numerical Analysis 7^{th} edition	Pearson/Addison Wesley, 2004