COURSE OUTLINE

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PRE-REQUISITE	**:**	**SCSJ 2273**
EQUIVALENCE	**:**	
LECTURE HOURS	**:**	**3 Hour Lecture**

Lecturers	E-Mail	Room No.	Phone No.
1. Mohsin Mohd Sies	mohsin@utm.my	N01-324	
2.			
3.			
4.			

SYNOPSIS

This course formally introduces the steps involved in engineering analysis (mathematical modeling, solving the governing equation, and interpretation of the results). Example of case studies in applied mechanics, strength of materials, themal science, and fluid mechanics are presented. Methods for solving the nonlinear equations, simultaneous linear algebraic equations, eigenvalue problem, interpolation, numerical differentiation, numerical integration, initial value problems, and boundary value problem are introduced. Students will be required to use computing tools such as Matlab or Octave to implement the solutions for the problems.

PREPARED BY :	**CERTIFIED BY :**
Name : Mohsin Mohd Sies	**Name** :
Signature :	**Signature** :
Date : 17 January 2017	**Date** :

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COURSE LEARNING OUTCOMES

By the end of the course, students should be able to :

No.	Course Learning Outcomes	Programme Learning Outcome(s) Addressed	Learning Taxonomy & Generic Skill Assessed	Weightage	Assessment Methods
1.	Construct mathematical models or the governing equations for the complex physical systems under investigation.	PO1	C5	30	T, PR, Q, HW
2.	Solve the governing equations using appropriate numerical methods.	PO1	C3	30	T, PR, Q, HW
3.	Develop a well-structured and reliable Matlab or Octave computer program for the chosen numerical method.	PO5	C5	30	PR, HW
4.	Analyze the validity and accuracy of the numerical solutions.	P011	C5	10	T, PR, HW

Note :
(T – Test ; PR – Project ; Q – Quiz; HW – Homework ; Pr – Presentation; F – Final Exam)

Program Outcomes (PO) related to the course:

PO1 Ability to apply knowledge of mathematics, Natural science, engineering fundamentals**,** nuclear engineering principles to the solution of complex engineering problems.

PO5 Ability to inculcate modern computational techniques and tools which include prediction and modelling to solve complex engineering problem with an understanding of the limitations.

PO11 Ability to acquire knowledge and engage in independent and life-long learning.

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STUDENT LEARNING TIME

No.	Teaching and Learning Activities	Student Learning Time (hours)
1.	Face to face learning Lecture Practical SCL activities	 42 0 0
2.	Independent Study Non-face to face learning Revision Preparing for assessments	 28 38 9
3.	Formal Assessement Continuous assessment Final exam	 3 0
Total		**120**

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WEEKLY SCHEDULE

Week	Lecture	Topic / Content
1	1-3	**Introduction to engineering analysis** a) Course requirement b) Course overview
2	4-6	**Solution of nonlinear equations** a) Incremental search, Bisection, Newton-Ralphson, and secant methods. b) Engineering applications
3	7-9	**Simultaneous linear algebraic equations** a) Elimination Methods - Gauss Jordan elimination, LU decomposition, Jacobi iteration, Gauss-Seidel iteration b) Engineering applications
4	10-12	**Simultaneous linear algebraic equations** a) Iterative Methods - Jacobi iteration, Gauss-Seidel iteration b) Engineering applications
5	13-15	**Eigenvalue-eigenvector problem** a) Faddeev-Leverrier and Power methods b) Engineering applications
6	16-18	**Curve fitting and interpolation** a) Collocation-polynomial fit b) Engineering applications
7	19-21	**Curve fitting and interpolation** a) Least-squares regression b) Interpolation c) Engineering applications
8		**MID SEMESTER BREAK**
9	22-24	**Numerical Differentiation** a) Finite-difference, Taylor's series expansion b) Engineering applications

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10	25-27	**Numerical integration** a) Newton-Cotes Formulas, Simpson's rule, Romberg integration, Gauss quadrature b) Engineering applications
11	28-30	**ODE : Initial-value problem** a) Euler's and Runge-Kutta methods
12	31-33	**ODE : Initial-value problem** a) Simultaneous differential equation b) Engineering applications
13	34-36	**ODE : Boundary-value problem** a) Shooting and finite-difference methods b) Engineering applications
14	37-39	**Project Submission week (Group and Individual Project)**
16-18		**REVISION WEEK AND FINAL EXAMINATION**

REFERENCES

1. MATLAB® Programming with Applications for Engineers (First Edition), Stephen J. Chapman
2. Numerical methods for engineers, Steven C. Chapra, Raymond P. Canale. — 6th ed
3. Rao, S. S. 2002. *Applied Numerical Methods for Engineers and Scientists.* New Jersey: Prentice Hall.
4. Pao, Y. C. 1999. *Engineering Analysis, Interactive Methods and Programs, with FORTRAN, Qbasic, and MATLAB.* New York: CRC
5. Habib, S. I. 1975. *Engineering Analysis Method.* Lexington Books

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GRADING

No.	Assessment	Number	% each	% total	Dates
1.	Assignment		10	10	
2.	Test	2	25	50	
3.	Project	2	20	40	
Overall Total				**100**	

ATTENDANCE

The student should adhere to the rules of attendance as stated in the University Academic Regulation :-

1. Student must attend not less than 80% of lecture hours as required for the subject.

2. The student will be prohibited from attending any lecture and assessment activities upon failure to comply the above requirement. Zero mark will be given for the subject.