COURSE CODE:	MATH-331		
COURSE NAME:	Numerical Analysis		
CREDIT HOURS:	Theory = 3	Practical = 0	Total = 3
CONTACT HOURS:	Theory = 48	Practical = 0	Total = 48
PREREQUISITE:	None		
MODE OF TEACHING:	Three hours of lecture per week		

COURSE DESCRIPTION:

The course provides sound knowledge to students to investigate non-linear algebraic and differential equations numerically. Curve fitting, interpolation, forward difference, backward difference, and central difference to mention just a few are topics which are very useful for technologists/engineers. Stress is laid on applications of differentiation and integration techniques to solve differential equations regarding practical/engineering problems.

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the PLO/s:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Teamwork:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

COURSE LEARNING OUTCOMES (CLOs):

Upon successful completion of the course, the student will be able to:

S.No	CLO	Domain	Taxonomy Level	PLO
1	**Solve** algebraic and ordinary differential equations by using numerical methods.	Cognitive	3	1
2	**UTILISE** MATLAB to solve PDEs	Cognitive	3	5

PRACTICAL APPLICATIONS:

- Explain the consequence of finite precision and the inherent limits of the numerical methods considered.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of a linear and non-linear equations.

- Evaluating non-linear equations, definite integral and ODE's using numerical techniques.

TOPICS COVERED:

Week	Topic	Reading Assignment/ Homework	CLO #
1	Introduction to Numerical Analysis, Different types of errors.	Chapter 1	1
2	Iterative, Bisection and secant method	Chapter 2	1
3	Regula Falsi method, Newton Raphson method and modified Newton Raphson method	Chapter 2 Quiz 1	1
4	Least square method for curve fitting	Chapter 3	1
5	Calculus of finite difference, operators	Chapter 4	1
6	Newton forward and backward differences method	Chapter 4 Quiz 2	1
7	Newton divided difference	Chapter 4	1
8	Lagrange interpolation	Chapter 4 Quiz 3	1
9	**Mid Semester Exam**		
10	Basics of MATLAB	Assignment 1	2
11	Basics of MATLAB	Assignment 2	2
12	Numerical optimization, Golden section search method and Quadratic interpolation	Chapter 5	1
13	Numerical integration, Trapezoidal rule, Simpson's Rule	Chapter 6 Quiz 4	1
14	Numerical solution to ODE's, Power series method, Taylor series method for first and higher order differential equations	Chapter 7 Assignment 3	1,2
15	Picard's method for first and higher order differential equations	Chapter 7 Quiz 5	1
16	Euler method, Improved Euler's method, modified Euler method, Runge's method, Runge-Kutta methods, Higher order Runge-Kutta methods	Chapter 7 Assignment 4	1,2
17	Runge-Kutta methods for simultaneous first and higher order differential equations	Chapter 7 Quiz 6	
End Semester Exam			

TEXT AND MATERIAL:

Textbook (s)

1. Lectures notes
2. E. Kreyszing: Advanced Engineering Mathematics
3. Numerical Methods by V.N. Vendamurthy and S.N. Lyengar

References Material:

1. J. Gouglas Faires, Richard Burden: Numerical Methods

2. Moss, Keith J. Energy management in Buildings. Taylor and Francis, 2006.

ASSESMENT SYSTEM:

1. **CLOs Assessment**

Cognitive	**Psychomotor**	**Affective**
Spreadsheet	Rubrics	Rubrics

2. **Relative Grading**

Theoretical / Instruction			100%
	Assignments	*10 %*	
	Quizzes	*15 %*	
	Mid Semester Exams	*25 %*	
	End Semester Exam	*50 %*	
			100%