NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B.Tech (Mechanical Engineering)
Course Code:	2ME801
Course Title:	Mathematics for Mechanical Engineering
Course Type:	Core
Year of introduction:	2023-24

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Course Learning Outcomes (CLOs):

After successful completion of the course, student will be able to –

1 infer concepts related to Fourier series, vector calculus and its applications, (BL2)

2 solve engineering problems of higher order linear differential equations, (BL3)

3 apply the concepts of Laplace transforms for mechanical engineering problems, (BL3)

4 make use of various numerical methods for engineering applications. (BL3)

Syllabus: **Total Teaching Hours: 30**

Unit	**Syllabus**	**Teaching Hours**
Unit I	**Vector Calculus and Fourier Series** Differentiation of scalars and vectors, Gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, applications of Gauss, Stokes and Green's theorems, Fourier series and its applications.	**10**
Unit II	**Differential Equations** Higher order linear differential equations with constant coefficients; method of separation of variables, similarity solutions, Euler-Cauchy equation; initial and boundary value problems; Laplace transforms of elementary functions; application of Laplace transforms in solving differential equations, solutions of heat, wave and Laplace's equations.	**10**

Unit III	**Numerical Methods**	**10**

Numerical solutions of linear and non-linear algebraic equations (bracketing and open methods), solution of the system of linear algebraic equations, integration by trapezoidal and Simpson's rules; single and multi-step methods for ordinary differential equations (Euler's and Runge-Kutta higher order methods). Finite difference methods to solve partial differential equations. Use of software tools for solving mathematical problems pertaining to mechanical engineering.

Self – Study: The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings /References:

1. Michael D Greenberg, Advanced Engineering Mathematics, Prentice Hall, Inc.
2. William Ames et al., Mathematics for Mechanical Engineers, CRC Press
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc.
4. Chapra and Canale, Numerical Methods for Engineers, McGraw Hill

Suggested list of Tutorials:

1. Solution of problems using Fourier series
2. Application of gradient, divergence and curl
3. Estimation of surface and volume integrals
4. Euler- Cauchy formulations
5. Solution of Initial and Boundary value problems
6. Problem solving using Laplace transforms
7. Estimation of roots of algebraic equations using numerical methods
8. Interpolation using numerical methods
9. Solution of ordinary differential equations using numerical methods
10. Application of finite difference methods in problem solving.