Engineering Mathematics-I

Subject Code : 14MAT11  IA Marks : 25
Hours/Week : 04  Exam. Hours : 03
Total Hours : 50  Exam. Marks : 100

Course Objectives
To enable students to apply knowledge of Mathematics in various engineering fields by making them to learn the following:

- \( n^{\text{th}} \) derivatives of product of two functions and polar curves.
- Partial derivatives, indeterminate form and jacobian.
- Vectors and Curve tracing.
- Reduction formulae; First order differential equations.
- Solution of system of equations and quadratic forms.

Module –1

Differential Calculus -1:
Determination of \( n^{\text{th}} \) order derivatives of Standard functions - Problems. Leibnitz’s theorem (without proof) - problems.

Polar Curves - angle between the radius vector and tangent, angle between two curves, Pedal equation for polar curves. Derivative of arc length - Cartesian, Parametric and Polar forms (without proof) - problems. Curvature and Radius of Curvature – Cartesian, Parametric, Polar and Pedal forms and problems.  

10hrs

Module –2

Differential Calculus -2
Taylor’s and Maclaurin’s theorems for function of one variable(statement only)- problems. Evaluation of Indeterminate forms.

Partial derivatives – Definition and simple problems, Euler’s theorem – problems, total derivatives, partial differentiation of composite functions, Jacobians-definition and problems, extreme values of functions of two variables.  

10hrs
Module –3

Vector Calculus:
Derivative of vector valued functions, Velocity, Acceleration and related problems, Scalar and Vector point functions, Gradient, Divergence, Curl, Solenoidal and Irrotational vector fields. Vector identities - div \( (\Phi A) \), curl \( (\Phi A) \), curl \( (\nabla \Phi) \), div (curl \( A \)). Differentiation under integral sign using Leibnitz rule with constant and variable limits.

Curve Tracing - General rules to trace Cartesian, polar and parametric curves. 10hrs

Module- 4

Integral Calculus:
Reduction formulae \( \int x^n dx, \int \cos^n x dx, \int \sin^n x \cos^n x dx \) \( (m \text{ and } n \text{ are positive integers}) \), evaluation of these integrals with standard limits \((0 \text{ to } \pi/2)\) and problems.

Differential Equations:
Solution of first order and first degree differential equations – Exact, reducible to exact and Bernoulli’s differential equations. Applications- orthogonal trajectories, Newton’s law of cooling, flow of electricity, laws of decay and growth. 10hrs

Module –5

Linear Algebra
Linear transformation, diagonalisation of a square matrix, Quadratic forms, reduction to Canonical form by orthogonal transformation, Rayleigh’s power method to find the largest Eigenvalue and the corresponding Eigen vector. 10hrs

Course Outcomes:
On completion of this course, students are able to

- Use partial derivatives to calculate rates of change of multivariate functions.
- Analyze position, velocity, and acceleration in two or three dimensions using the calculus of vector valued functions.
- Trace the curves which are useful in applications of integration in finding the length, area and volume.
• Recognize and solve first-order ordinary differential equations, model simple electrical circuits, projectile motion and Newton’s law of cooling and laws of decay and growth, and
• Use matrices, determinants and techniques for solving systems of linear equations in the different areas of Linear Algebra.

Scheme of examination:
• Two full questions (with a maximum of four sub questions) of twenty marks each to be set from each module. Each question should cover all contents of the respective module.
• Students have to answer five full questions choosing one full question from each module.

Text Books:

Reference Books: