MATHEMATICS-I

(Common to all Branches)

Course Code: 13BM1101

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Pre requisites:

- Basic formulae of differentiation, product rule, and quotient rule.
- Basic Integration formulae, integration by parts, definite integrals and properties.
- Basic concept of partial differentiation.

Course Educational Objectives:

- The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
- The skills derived from the course will help the student from a necessary base to develop analytic and design concepts.

Course Outcomes:

Upon successful completion of the course, the students should be able to

- Solve ordinary differential equations of first, second and higher order.
- Learn the technique of Laplace transform and apply it to solve differential equations.
- Understand the concept of Double and Triple integrals and their applications to calculation of areas, volumes .
- Extend the concept of integration to vector functions, understand the significance of the operators, gradient, divergence and curl.
- Find surface areas and volumes of certain solids using Green, Stokes and Gauss divergence theorems.

UNIT-I (12 Lectures)

ORDINARY DIFFERENTIAL EQUATIONS:

Linear equations of first order, Bernoulli differential equation, Linear differential equations of higher order with constant coefficients, Method of Variation of parameters, Linear differential equations with variable coefficients (Cauchy's homogeneous linear equation, Legendre's linear equation).

APPLICATIONS OF LINEAR DIFFERENTIAL EQUATIONS:

Orthogonal trajectories, Models on R-L-C circuits, Newton's law of cooling.
(11.9, 11.10, 13.1—13.7, 13.8(1), 13.9, 12.3, 12.5, 12.6)

UNIT-II (12 Lectures)

LAPLACE TRANSFORMS:

Laplace transform of elementary functions, properties, Transforms of periodic functions, Transforms of derivatives and integrals, Multiplication by t^n, division by t, evolution of integrals by Laplace transforms.

INVERSE TRANSFORM:

Introduction, Finding inverse transforms by the method of partial fractions, other methods of finding Inverse Transform, Convolution theorem, Unit step function, and Unit impulse function.

APPLICATION OF LAPLACE TRANSFORMS:

Initial and Boundary Value Problems.
(21.1-21.5, 21.7-21.15, 21.17, 21.18

UNIT-III (12 Lectures)

PARTIAL DIFFERENTIATION:

Total derivative, change of variables, Jacobians, Tangent Plane and Normal to the Surface, Taylor's theorem for functions of two variables.

APPLICATIONS OF PARTIAL DIFFERENTIATION:

Maxima and Minima of functions of two variables, Lagrange method of undetermined multipliers.
(5.5 – 5.9, 5.11, 5.12)

UNIT-IV (12 Lectures)

MULTIPLE INTEGRALS:

Introduction to Non-Cartesian Coordinates, Double integrals, Change of order of integration, Double integral in polar co-ordinates, Triple integrals, Change of variables in double integrals, Change of variables in triple integrals. Simple Applications of Multiple Integrals**:** Area enclosed by plane curves, Volumes of solids.
(8.19, 8.21, 7.1, 7.7,)

UNIT-V (12 Lectures)

VECTOR DIFFERENTIATION:

Differentiation of vectors, curves in space, velocity, acceleration, Scalar and Vector point functions. Gradient of a scalar field and directional derivatives- Divergence and curl of a Vector field and it's physical interpretation.

VECTOR INTEGRATION:

Line integral, Circulation, work done, surface and volume integrals.

Vector integral theorems: Green's, Stoke's and Gauss Divergence theorems (without proofs) and related problems.
(8.1- 8.16)

TEXT BOOK:

Dr.B.S.Grewal *"Higher Engineering Mathematics"*, 42nd Edition, Khanna Publishers, 2012.

REFERENCES:

1. Kreyszig E, "*Advanced Engineering Mathematics*", 8th Edition, John Wiley, Singapore, 2001.
2. Greenberg M D, "*Advanced Engineering Mathematics*", 2nd Edition, Pearson Education, Singapore, Indian Print, 2003.
3. Peter V. O'Neil, "*Advanced Engineering Mathematics*", 7th Edition, Cengage Learning, 2011.