22BEAS110 ADVANCED CALCULUS AND PARTIAL DIFFERENTIAL EQUATIONS

Hours Per Week :

L	T	P	C
1	2	2	3

PREREQUISITE KNOWLEDGE: Basics of differential equations.

COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to understand the concept of complex geometry which is very useful in constructing machines. Complex analysis has a great role in many circuits. To understand about Fourier series which represents periodic functions. It is used in the resolution of partial differential equations, which appears in many engineering problems such as heat diffusion, wave propagation and fluid mechanics problem.

MODULE-1

UNIT-1   **4L+8T+8P=20 Hours**

CALCULUS: Partial differentiation: Partial derivatives of higher order, Homogeneous functions, Euler's theorem, Total differential coefficient.

Multiple Integrals: Double and triple integrals, change of order of integration,

Vector Differentiation: Scalar and vector point functions, Differentiation of vector functions, Gradient, Divergence, Curl.

UNIT-2   **4L+8T+8P=20 Hours**

APPLICATIONS: Applications of Partial differentiation: Maxima and Minima of a function of two variables, Conditions for extreme values, Lagrange method of undetermined multipliers.

Jacobians: Definition, Properties, determining functional dependency and independency.

Application of multiple integrals: to find Area and Volume

Applications of Vector Calculus: Normal vector, Angle between surfaces, Directional Derivate, Solenoidal and Irrotational flow.

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PRACTICES:

- Determine extreme values of a function.
- Calculate area and volume.
- Determine the directional derivative of scalar at any point in the direction of the tangent to the curve.
- Determine scalar potential function.
- Identify field is solenoidal vector and irrational.

MODULE-2

UNIT-1   **4L+8T+8P=20 Hours**

PARTIAL DIFFERENTIAL EQUATIONS AND SERIES SOLUTIONS: Partial differential equation: Order and degree, Formation of partial differential equations, Higher order linear partial differential equations with constant co efficients, Solution of first order nonlinear PDE.

Series Solution Techniques: Frobeneous Series solution (Singular point only).

UNIT-2   **4L+8T+8P=20 Hours**

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS AND SERIES SOLUTIONS: Solutions of One dimensional wave equation, Heat equation and Laplace's equation,

PRACTICES:

- Learn method of forming partial differential equations.
- Identify and apply different methods to solve differential equations.
- Learn Series Solution Techniques like Frobeneous Series solution.
- Determine the displacement of a vibrational string is initially at rest in equilibrium position.
- Evaluate the temperature distribution in insulated rods.
- Determine solutions of Bessel's and Legendre's differential equations.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply partial differentiation to estimate extreme values.	Apply	1	1, 2, 4, 9, 10, 12
2	Apply series solution methods to solve Bessel's and Legendre's differential equations.	Apply	2	1, 2, 4, 9, 10, 12
3	Evaluate the line integral, surface integral and volume integral.	Evaluate	1	1, 2, 4, 9, 10, 12
4	Evaluate the one dimensional wave equation, heat equation and Laplace's equation.	Evaluate	2	1, 2, 4, 9, 10, 12

TEXT BOOKS:

1. N. P. Bali, K. L. Sai Prasad, "A Textbook of Engineering Mathematics I, II, III", 2nd Edition Universal Science Press, New Delhi, 2018.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2018

REFERENCE BOOKS:

1. H. K. Dass and Er. Rajinish Verma, "Higher Engineering Mathematics", S. Chand and Co., Third revised edition, 2015.
2. B. V. Ramana, "Advanced Engineering Mathematics", TMH Publishers, 2014.
3. T. K.V. Iyengar et al, "Engineering Mathematics, I, II, III", S. Chand and Co., New Delhi, 2018

SKILLS:

- ✓ *Apply the transformation between line integral, surface integral and volume integral.*
- ✓ *Gain deeper knowledge of multivariate differentiation operations such as Gradient, Divergent and Curl.*
- ✓ *Recognize characteristic curves and canonical forms for second-order partial differential equations.*
- ✓ *Solve PDE problems.*