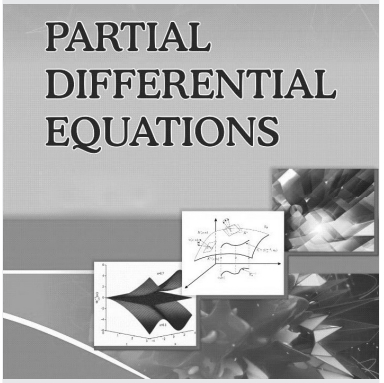
22MT112 PARTIAL DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS



Source:
https://www.google.com/

Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: Differentiation, Integration, Vectors.

COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to build an ability of understand how partial differential equations arise in the mathematical description of heat flow and vibration. The methods to explain the physical interpretations of common forms of PDEs and solution for initial and boundary value problems will be the primary focus. Students will gain deeper knowledge of multiple differentiation operations such as Gradient, Divergent and Curl.

MODULE-1

UNIT-1 **12L+8T+0P=20 Hours**

PARTIAL DIFFERENTIAL EQUATIONS:

Partial differential equations: Order and degree, Formation of partial differential equations, Lagrange linear equations, Method of multipliers.

Classification of Second Order PDE, Method Separation of variables.

UNIT-2 **12L+8T+0P=20 Hours**

APPLICATIONS AND NUMERICAL METHODS:

Solution to one dimensional wave equation, heat equation and Laplace's equation.

Numerical Methods: Numerical methods to solve Laplace's equation: Standard five-point formula, Diagonal five-point formula (Liebmenn's iteration process).

PRACTICES:

- Learn method of forming partial differential equations.
- Identify and apply different methods to solve differential equations.
- Determine the displacement of a vibrational string is initially at rest in equilibrium position.
- Evaluate the temperature distribution in insulated rods.
- Determine solutions of Laplace equation.

MODULE-2

UNIT-1 **12L+8T+0P=20 Hours**

VECTOR CALCULUS:

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

Vector Integration: Introduction to multiple integrals (Review), Line integral, Surface integral, Volume integral.

SKILLS:

- ✓ *Apply the transformation between line integral, surface integral and volume integral.*
- ✓ *Gain deeper knowledge of differential operators.*
- ✓ *Be able to use the separation of variables technique to solve partial differential equations.*

UNIT-2 **12L+8T+0P=20 Hours**

APPLICATIONS OF VECTOR CALCULUS:

Normal vector, Directional Derivate, Solenoidal and Irrotational flow.

Green's theorem for plane, Gauss divergence theorem, Stokes' theorem (without proofs).

PRACTICES:

- Compute the work done when an object moves along the path subject to a force.
- Use divergence and curl to measure the tendency of the fluid to collect or disperse at a point and the tendency of the fluid to swirl around the point.
- Compute the flux of a vector per unit time flowing across in the direction of a vector.
- Verify Green's theorem, stokes theorem and Divergence theorem for the functions over a region.
- Compute the tangent vector to a curve in space.
- Compute the directional derivative of a scalar point function at a point.
- Compute any integral which is to be evaluated over a curve, over a surface or over a volume.

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 the numerical methods to solve Laplace's equation.	Apply	1	1, 2, 9, 10, 12
2	Apply Green's theorem for plane, Gauss divergence theorem, Stokes' theorem.	Apply	2	1, 2, 9, 10, 12
3	Evaluate differential operators and the solutions of first order and some second order partial differential equations.	Evaluate	1	1, 2, 9, 10, 12
4	Evaluate the line integrals, surface integrals and volume integrals.	Evaluate	2	1, 2, 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", 44th Edition, Khanna Publishers, 2018.

REFERENCE BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons, Inc, 2015.
2. H. K. Dass and Er. Rajanish Verma, "Higher Engineering Mathematics", S. Chand and Co., Third revised edition, 2015.
3. B. V. Ramana, "Advanced Engineering Mathematics", TMH Publishers, 2020.
4. T. K.V. Iyengar et al, "Engineering Mathematics, I, II, III", S. Chand and Co., New Delhi, 2018.