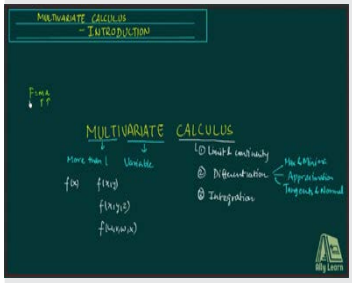
22MT111 MULTI VARIATE CALCULUS



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Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: Basic set theory and determinants.

COURSE DESCRIPTION AND OBJECTIVES:

The course covers the fundamental concept of vector and multivariate calculus. The primary focus of the course will be to study the basic concepts of limit, continuity and differentiability. Students will learn some important theorems (Mean value theorem, Taylor's theorem, Green's theorem, Gauss divergence theorem, Stokes' theorem), multiple integrals and convergence of sequence and series which will be helpful to understand the optimization problems, the motion of race cars, the mass of a wire or a spring and various applications arise on science and engineering.

MODULE-1

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

SEQUENCE, SERIES AND DIFFERENTIABILITY:

Real number system, Sequence, Convergence of a sequence, Monotone sequence Infinite series, Convergence of series, Testing of convergence by ratio test, nth root test, p-test Real functions of one variable, Limits, Continuity, Differentiability Functions of several variables, Partial differentiation.

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

APPLICATIONS:

Mean value theorems, Bolzano-Weierstrass theorem (without proof), Taylor's theorem, Leibnitz theorem. Maxima and Minima of a function of two variables, Conditions for extreme values, Lagrange method of undetermined multipliers.

PRACTICES:

- Calculate whether the sequence or series is convergent or not.
- Derive the partial differentiation of a function.
- Apply mean value theorem.
- Approximation of function by Taylor's series.
- Find extreme value.

MODULE-2

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

VECTOR CALCULUS:

Introduction to vectors, Vector algebra (review), Scalar and vector point functions, Gradient, Divergence and Curl.

Introduction to Multiple integrals (review), Line integral, Surface integral, Volume integral

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

APPLICATIONS OF VECTOR CALCULUS:

Normal vector, Directional Derivate, Solenoidal and Irrotational vectors, Scalar potential Green's theorem for plane, Gauss divergence theorem, Stokes' theorem.

SKILLS:

- ✓ *Understanding of sequence and series of real numbers.*
- ✓ *Ability to compute the maximum and minimum of a function.*
- ✓ *Approximation of Taylor series of a function.*
- ✓ *Fluency in vector operation and understanding of gradient, divergence and curl.*
- ✓ *Ability to compute multiple integrals and to change variables in multiple integrals.*

PRACTICES:

- Apply Gradient, Divergence and Curl.
- Calculate Line, Surface and Volume integral.
- Find Directional derivative.
- Check whether a vector is Solenoidal or Irrotational.
- Apply Green's theorem, Gauss divergence theorem, Stokes' theorem.

COURSEOUTCOMES:

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 concepts of convergence, continuity and differentiability.	Apply	1	1, 2, 9, 10, 12
2	Apply vector integration to find areas and volumes.	Apply	2	1, 2, 9, 10, 12
3	Evaluate the extreme values	Evaluate	1	1, 2, 9, 10, 12
4	Evaluate the gradient, curl and directional derivatives	Evaluate	2	1, 2, 9, 10, 12

TEXT BOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", 44 Edition, Khanna Publishers, 2018.
2. E. Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons, Inc, 2015.

REFERENCE BOOKS:

1. H. K. Dass and Er. Rajanish Verma, "Higher Engineering Mathematics", Third revised edition, S. Chand and Co., 2015
2. B. V. Ramana, "Engineering Mathematics", TMH Publishers, 2015.
3. N. P. Bali, K. L. Sai Prasad, "A Textbook of Engineering Mathematics I, II, III", Universal Science Press, New Delhi, 2018
4. E. Herman, G. Strang, "Calculus Volume 3", Openstax, 2016.