VECTOR CALCULUS & STATISTICAL METHODS
(Common to CHEMICAL Engg. and CIVIL Engg.)

23MA1106 **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40
End Exam : 3 Hours End Exam Marks:60

Prerequisites: Differentiation, Integration and functions.

Course Objectives:

The aim of this course is to introduce basic fundamentals of vector calculus, formulate and solve first order partial differential equations and its applications.

Course Outcomes: At the end of the course, students will be able to do

1.	Explain the characteristics of scalar and vector valued functions and provide a physical interpretation of the gradient, divergence, curl and related concepts.
2.	Transform line integral to surface integral, surface to volume integral and vice versa using Green's theorem, Stoke's theorem and Gauss's divergence theorem.
3.	Construct partial differential equation of a given equation and solve first order partial differential equations and their applications.
4.	Analyze the basic principles of statistical measures.
5.	Examine, analyze and compare probability distributions**.**

CO-PO –PSO Mapping:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1			
CO2	3	2										1			
CO3	3	2										1			
CO4	3	2										1			
CO5	3	2										1			

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

CO-PO-PSO Justification	
1	CO1 deals with finding the gradient, div and curl of a given vector point functions and these fundamental concepts in vector calculus are widely used in many areas of engineering.
2	CO2 deals with vector integration like line, surface and volume integrals and these are widely used in various fields of engineering.
3	CO3 deals with formation, finding solution and applications of PDE and there are widely used in various fields of engineering.
4	CO4 deals with knowledge of statistical central and dispersion measures.
5	CO5 deals with knowledge of probability distributions and is widely used in many areas of engineering.

SYLLABUS

UNIT I **10 Periods**

VECTOR DIFFERENTIATION

Scalar and vector point functions – Del applied to scalar point functions – Directional derivative – Del applied to vector point functions – Physical interpretation of divergence and curl – Del applied twice to point functions – Del applied to products of point functions.

UNIT II **10 Periods**

VECTOR INTEGRATION

Integration of vectors – Line integral , circulation, work done – Surface integral , flux – Green's theorem in the plane – Stoke's theorem – Volume integral – Gauss divergence theorem (all theorems without proofs) – Irrotational and solenoidal fields.

UNIT III **10 Periods**

PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS

Introduction – Formation of partial differential equations by eliminating arbitrary constants and functions – Solutions of a partial differential equations by direct Integration – Linear equations of t first order (Lagrange's linear equations).

APPLICATIONS : Method of separation of variables – Vibrations of a stretched string: Wave equation – One dimensional heat flow equation ($\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$), and two dimensional heat flow equation. (i.e. Laplace equation : $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$).

UNIT IV **10 Periods**

STATISITCS

Measures of central tendency : Mean, Median, Mode, Geometric mean, Harmonic mean.

Measures of dispersion : Quartile deviation, Mean deviation, Standard deviation, Variance.

UNIT V **10 Periods**

PROBABILITY AND DISTRIBUTIONS

Introduction – Basic terminology – Probability and set notations – Addition law of probability – Independent events – Baye's theorem – Random variable – Discrete probability distribution: Binomial distribution and Poisson distribution – Continuous probability distributions: Normal distribution (mean , variance , standard deviation and their properties without proofs).

TEXT BOOKS:

B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

2. N. P. Bali, Engineering Mathematics, Lakshmi Publications.

3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Calculus, 13/e, Pearson Publishers, 2013.

4. H. K. Dass, Advanced Engineering Mathematics, S. Chand and complany Pvt. Ltd.

5. Michael Greenberg, Advanced Engineering Mathematics, Pearson, Second Edition.

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