VECTOR CALCULUS, PARTIAL DIFFERENTIAL EQUATIONS and TESTING OF HYPOTHESIS

ENGINEERING MATHEMATICS – IV

II/IV B.Tech. II - Semester

[R-19 Regulation]

(ECE)

	Credits:3
Instruction: 3 Periods & 1 E/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Pre-requisites: Basic concepts of Vector Algebra, differentiation, Partial differentiation, Integration and Probability.

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

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.	Explain analytical methods for solving PDEs like applying separation of variables to solve elementary problems in linear second order partial differential equations (Heat and Wave equations).
4.	Find numerical solution of ordinary differential equations.
5.	Analyze the statistical data by using statistical tests and to draw valid inferences about the population parameters.

CO – PO Mapping :

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	3	2										1
CO-2	3	2										1
CO-3	3	2										1
CO-4	3	2										1
CO-5	3	2										1

SYLLABUS

UNIT – I: VECTOR DIFFERENTIATION [12 Periods]

Scalar and vector point functions – Del applied to scalar point functions: Gradient, 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.

Sections: 8.4, 8.5, 8.6, 8.7, 8.8 and 8.9.

UNIT – II: VECTOR INTEGRATION [12 Periods]

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

Sections: 8.10, 8.11, 8.12, 8.13, 8.14, 8.15, 8.16 and 8.18.

UNIT – III: PARTIAL DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS [12 Periods]

Introduction – Formation of partial differential equations by eliminating arbitrary constants and functions – Solutions of a partial differential equations by direct Integration – Linear equations of the 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 : $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0.$).

Sections: 17.1, 17.2, 17.4, 17.5, 18.2, 18.4, 18.5, 18.6 and 18.7.

UNIT – IV: NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS [12 Periods]

Numerical solution of Ordinary Differential equations: Picard's Method – Taylor's series method – Euler's method – Runge-Kutta method – Predictor-Corrector methods – Milne's Method.

Sections: 32.1,32.2,32.3,32.4,32.7,32.8 and 32.9

UNIT-V: TESTING OF HYPOTHESIS [12 Periods]

Introduction – Sampling distribution – Testing a hypothesis – Level of significance – Confidence limits – Test of Significance of Large samples (Test of significance of single mean, difference of means.) – Confidence limits for unknown mean – Small samples – Students t-distribution – Significance test of a sample mean – Significance test of difference between sample means – $\chi^2 -$ test – Goodness of fit.

Sections:27.1, 27.2, 27.3, 27.4, 27.5, 27.7, 27.11, 27.12,27.13, 27.14, 27.15, 26.16, 27.17 and 27.18.

TEXTBOOK:

1. **B. S. Grewal**, "*Higher Engineering Mathematics*", 43rd edition, Khanna publishers, 2017.

REFERENCE BOOKS

1. **N P. Bali and Manish Goyal**, "*A text book of Engineering mathematics*", Laxmi publications, latest edition.
2. **Erwin Kreyszig**, "*Advanced Engineering Mathematics*", 10th edition, John Wiley & Sons,2011.
3. **R. K. Jain and S. R. K. Iyengar**, "*Advanced Engineering Mathematics*", 3rdedition, Alpha Science International Ltd., 2002.
4. **George B. Thomas, Maurice D. Weir and Joel Hass, "***Thomas Calculus*", 13thedition, Pearson Publishers.