Semester	**6**
Course	**Major-2**
Paper Code	
Paper Title	**Analysis-5**
No. of Credits	**4**
Theory / Practical / Composite	**Theory**
Minimum number of preparatory hours per week a student has to devote	**4**
Number of Modules	**Nil**
Syllabus	**Vector Calculus [38]:** Differentiation of vector-valued functions of one scalar variable, velocity, speed, acceleration, parametrized curve, unit speed curve, reparameterization, length of a piecewise smooth curve **(5)**. Implication of the results $\vec{u}.d\vec{u} = 0$ and $\vec{u} \times d\vec{u} = \vec{0}$. Concepts of scalar and vector fields, physical significance. Gradient, Divergence and Curl, Laplacian, Statement and proofs of related vector identities **(4)**. Vector integration: Line integrals of vector fields along piecewise smooth curves, Application of line integrals, Mass and Work. Fundamental Theorem for line integrals, Conservative vector fields, examples: Gravitational and Electromagnetic fields, Independence of path. Circulation, Irrotational vector fields, and Conservative vector fields are irrotational. In a star-like/simply-connected domain, irrotational vector fields are conservative **(8)**. Double integrals: Double integration over a rectangular region, double integration over a non-rectangular region, Polar co-ordinates, Surface area and volume, Green's Theorem, area of a plane region bounded by a parametric curve. Integration of a vector field over a plane region **(8)**. Integration of vector fields over a surface of various form, Stokes' theorem and their applications **(7)**. Triple integrals, Triple integral over a parallelepiped and solid regions. Volume by triple integrals, cylindrical and spherical co-ordinates. Change of variables in double integrals and triple integrals. The Gauss's divergence theorem **(6)**. **Power Series [14]:** Fundamental theorem of Power series, Cauchy-Hadamard theorem,

	Determination of radius of convergence **(3)**. Uniform and absolute convergence of Power series, Properties of sum function **(2)**. Abel's limit theorems, Uniqueness of power series having the same sum function, Exponential, Logarithmic and trigonometric functions defined by Power-Series and deduction of their salient properties **(4)**. Weierstrass approximation theorem, Fourier Series, Dirichlet's theorem (statement only) and applications **(5).**
Learning Outcomes	On successful completion of the course, a student will be able to do the following: • Visualize the interrelationship between vectors, linear algebra, and functions of several variables through the concept of differentiability of vector functions. • Apply the ideas of arc-length parametrization and orientability of curves as a foundation for studying line and surface integrals. • Distinguish between irrotational and conservative vector fields and explore their connection with exact and non-exact linear differential equations. • Represent well-behaved functions in terms of series expansions involving simpler functions. • Solve application-oriented problems using classical integral theorems of vector calculus, including the Fundamental Theorem, Green's Theorem, Stokes' Theorem, and the Divergence Theorem.
Reading/Reference Lists	(1) **Basic Multivariate Calculus**: A. Weinstein, J. Marsden, A. Tromba (2) **Vector Calculus**: J. Marsden, A. Tromba (3) **Multivariate Calculus and Geometry**: Sean Dineen. (4) **Introduction to Real Analysis**: R.G. Bartle D.R. Sherbert, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002. (6) **Elements of Real Analysis**: Charles G. Denlinger, Jones & Bartlett (Student Edition), 2011. (7) **Elementary Analysis: The Theory of Calculus;** K.A. Ross, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

Evaluation	**End Sem**: 70 **CIA**:30 (20(Mid-Sem) +5(Assignment)+5(Attendance))	
Paper Structure for Theory Semester Exam	7 questions each carrying 10 marks out of 13/14 questions.	