Semester	**4**
Course	**Major**
Paper Code	**C2MT230411T**
Paper Title	**Analysis-3**
No. of Credits	**4**
Theory / Practical / Composite	**Theory**
Minimum No. of preparatory hours per week a student has to devote	**4**
Number of Modules	**Nil**
Syllabus	**Riemann Integration and Improper Integral [28]** Riemann Integration for bounded functions: Partition and refinement of partition of an interval.Upper Darboux sum U(P,f) & Lower Darboux sum L(P,f) and associated results. Upper Riemann(Darboux) integral and Lower Riemann (Darboux)integral (3). Darboux's theorem. Necessary and sufficient condition ofR-integrability (2).Riemann Sum:Alternative definition of integrability. Equivalence of two definitions (statement)(1).Definition of a set of measure zero (or negligible set or zero set) as a set covered by countable number of open intervals sum of whose lengths is arbitrary small).A bounded function on a closed and bounded interval is Riemann integrable if the set of points of discontinuity is a set of measure zero (Lebesgue's theorem on Riemann integrable function)(3) .Problems on Riemann integrability of functions with sets of points of discontinuity having measurezerowithspecialreferencetomonotonefunctions,continuousfunctions,piece wisecontinuousfunctionswith(i)finitenumberofpointsofdiscontinuities,(ii)infiniten umberofpointsofdiscontinuities having finite number of accumulation points(3). Integrability of sum, scalar multiple, product, quotient, modulus of Riemann integrable functions, Properties of Riemann integrable functions arising from the above results (2). Function defined by definite integral and its properties.Anti-derivative (indefinite integral).Fundamental theorem of integral calculus and its

	consequences(2).First MVT of integral calculus, second MVT of integral calculus(bothBonnet'sandWeierstrass'form)andtheirapplications(2). Differentiation under the integral sign containing an arbitrary parameter (3). Improper integrals: their convergence, μ-test, comparison test(statement only) and their applications. Convergence of Beta and Gamma functions and their properties (7). **Sequence and Series of Functions [24]** Sequence of functions (defined on a subset of R): Pointwise and uniform convergence.Cauchy criterion of uniform convergence(4).Dini's theorem on uniform convergence(statement only).Weirstrass'M-test(2).Boundedness. Repeated limits,Continuity, Integrability and Differentiability of the limit function of a sequence of functions in case of uniform convergence(6). Series of functions defined on a set:Pointwise and uniform convergence. Cauchy criterion of uniform convergence. Dini's theorem on uniform convergence (statement only)(2). Tests of uniform convergence – Weierstrass'M-test. Statement of Abel's and Dirichlet's test and their applications(5). Passage to the limit term by term. Sum function: boundedness, continuity, integrability, and differentiability of a series of functions in case of uniform convergence(5).
Learning Outcomes	On successful completion of the course a student will be able to do the following. • Will learn the theory and applications of Riemann Integration of a bounded real valued functions defined on a closed and bounded interval and learning improper integration, Beta and Gamma integrals. • Getting the idea of the concept of uniform convergence and how it helps the formation of many theorems of functional analysis, such as the Weierstrass approximation theorem and some results of Fourier analysis; and how it we can be used to construct a nowhere-differentiable continuous function. • Will understand how passage to limit under uniform convergence preserves desirable properties like continuity, integrability and (with additional hypotheses) differentiability of constituent functions and how it allows term-by-term integration and differentiation of a series of functions which has several use in application. • Understanding how concept of uniform convergence allows defining well-known functions in terms of power series and how their salient properties can be derived using term-by-term integration and differentiation.
Reading/Reference Lists	(1) K.A. Ross, Elementary Analysis, The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

	(2) R.G. Bartle D.R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002. (3) Charles G. Denlinger, Elements of Real Analysis, Jones & Bartlett (Student Edition), 2011. (4) S. Goldberg, Calculus and mathematical analysis. (5) Santi Narayan, Integral calculus. (6) T. Apostol, Calculus I, II.	
Evaluation	End Sem;70 CIA:30	
Paper Structure for Theory Semester Exam	7 questions each carrying 10 marks out of 13/14 questions.	