C3.1 Real Analysis-II (78 Classes)

Theory Paper, Full Marks: 100, Total Credit:6=5+1(Th+Tutorial), No. of classes per week:6(=5+1)

Paper Code: HMTCR3051T

Course Objective: *Learning the concept of calculus namely the limit, continuity and differentiability of real valued functions defined on an arbitrary subset of the set of real numbers. Using the sequential method in the study of calculus. Learning the salient properties of continuous functions defined on intervals. Learning the salient properties of differentiable functions, extreme value and series expansion of differentiable functions.*

Limits of functions ($\varepsilon - \delta$ approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity **(9)**

Continuity of a function: (36)

Continuous functions, sequential criterion of continuity and discontinuity (4); Algebra of continuous functions (2); Statement and proof of properties of continuous functions on closed intervals: boundedness, attainment of bounds, Bolzano's theorem (8); Intermediate value property & allied results, fixed points of continuous functions. Set of discontinuities of monotone functions, continuous injective functions are strictly monotone, converse of IVP (5) Continuous function carries closed and bounded interval into closed and bounded interval (4); Uniform continuity, non-uniform continuity criterion, functions continuous on a closed and bounded interval is uniformly continuous, Lipschitz condition and uniform continuity (8); Continuous extension theorem, monotone and inverse functions, inverse function theorem (5).

Introduction to Derivative: **(33)**

Concept of differentiability of a function at a point and in an interval, Caratheodory's theorem, chain rule, sign of derivative (4); Algebra of differentiable functions (1); Relative extrema, interior extremum, point extremum (3); Successive derivative: Leibnitz theorem and its applications (2); Rolle's theorem, Mean value theorems, Darboux theorem, fixed points of differentiable functions (5); Cauchy's mean value theorem, Taylor's theorem with Lagrange's and Cauchy's form of reminder (5); Application of Taylor's theorem to convex functions, relative extrema (5); Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions, $\ln(1+x)$, $\frac{1}{ax+b}$, and $(1+x)^n$ (5).

Indeterminate forms: L. Hospital's rule and its applications (3).

References:

1. Introduction to Real Analysis: Bartle and Sherbert.
2. S. Goldberg, Calculus and mathematical analysis.
3. Principles of Mathematical Analysis: W. Rudin
4. Real Analysis: Shantinarayan.
5. Real Analysis: S. K. Mapa