Course Code	MTH2xx
Course Name	Real Analysis I
Credits	4
Course Offered to	UG
Course Description	This course covers topics in real analysis, single-variable and multivariable calculus, and vector calculus. The course starts with the real number system, then discusses sequences and series in detail. Single-variable calculus is covered in detail with emphasis on rigour and proofs. In the final section of the course, concepts and methods of multivariable calculus are covered but with less emphais on proofs.

Pre-requisites		
Pre-requisite (Mandatory)	**Pre-requisite (Desirable)**	**Pre-requisite(other)**

Post Conditions*(For suggestions on verbs please refer the second sheet)			
CO1	**CO2**	**CO3**	**CO4**
Students are familiar with the real number system, can determine convergence-divergence of sequences and series, and are able to construct epsilon-delta proofs related to limits and continuity.	Students are familiar with the concepts of differentiation and integration and are able to apply the methods of single-variable calculus.	Students are able to apply concepts of continuity, differentiability, extrema and integrability of multivariable functions and evaluate various integrals (line, double, triple and surface integrals).	

Weekly Lecture Plan			
Week Number	**Lecture Topic**	**COs Met**	**Assignment/Labs/Tutorial**
Week 1	Real Numbers: Countable and uncountable sets, Supremum, Infimum, Completeness Axiom, Archimedean Property, Density Property . (3 lectures)	CO1	HW1

Weeks 2 to 4	Sequences and Series of real numbers: Definition of a sequence, bounded sequence, convergence & divergence of a sequence, Operations on sequences, Cauchy sequence, Cauchy's criterion for convergence, Monotone sequence, Bolzano-Weierstrass theorem, limit superior and inferior, examples of some special sequences. Definition of a series, convergence and divergence of series, absolute and conditional convergence, Alternating series. Comparison, Ratio, Root, Cauchy's condensation and Leibnitz tests for convergence of series. Rearrangements, Riemann's Theorem (statement only). (9 lectures)	CO1	HW2, HW3,HW4
Week 5 to 9	Single-variable Differential & Integral Calculus: Limits of real-valued functions, continuity, Boundary value theorem, Intermediate Value Theorem, uniform continuity, differentiability, Mean Value Theorems and applications, Taylor's theorem, L' Hospital's Rule, Taylor series and applications. Definition of Riemann integral, Properties of the integral, fundamental theorems, Applications to area, arc length, volume and surface area, Improper integrals of first and second kind, Beta and Gamma functions, Differentiation under the integral sign and applications. (15 lectures)	CO2	HW5, HW6,HW7,HW8,HW9
Week 10 to 13	Multivariable Differential and Integral Calculus in several variables: Functions of several variables, limits, continuity, Partial derivatives, Mixed derivative theorem (statement only), chain rule, directional derivatives, Maxima & minima and method of Lagrange multiplies. Double & triple integrals, Fubini's Theorem for regular domains (statement only), the Jacobian & change of variables, Applications to area, volume, mass and moments. (12 lectures)	CO3	HW10,HW11,HW12

Weekly Lab Plan			
Week Number	**Laboratory Exercise**	**COs Met**	**Platform (Hardware/Software)**
Not Applicable			

Assessment Plan	
Type of Evaluation	**% Contribution in Grade**
Quiz 1	10
Midsem	20
Endsem	45
Homeworks (best 10 out of 12)	25
Remark: Subject to modification (not more than 5%)	

Resource Material	
Type	**Title**
Textbook	G. B. Thomas and R. L. Finney, Calculus, Pearson
Reference Book	R. Goldberg , Methods of Real Analysis, Oxford & Ibh
Reference Book	K. A. Ross, Elementary Analysis: The Theory of Calculus, Springer
Reference Book	Walter Rudin, Principles of Mathematical Analysis, McGraw-Hill
Reference Book	N. Piskunov, Differential and Integral Calculus, Volume I, CBS
Reference Book	James Stewart, Calculus, Brooks/Cole Cengage Learning