Program: **Diploma** Class: **UG**	Year: **Second**	Semester: **III**
Subject: **Mathematics**		
Course Code: **MJ-4**	Course Title: **Real Analysis**	

Course Learning Outcomes: This course will enable the students to:

a) Understand many properties of the real line $\mathbb{R}$ and learn to define sequence in terms of functions from $\mathbb{R}$ to a subset of $\mathbb{R}$.

b) Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.

c) Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

d) Learn some of the properties of Riemann integrable functions, and the applications of the fundamental theorems of integration.

Credit: **4 (Theory)**	**Compulsory**
Full Marks: **75**	Time: **3 Hours**

Unit	Content	Hours
I	**Real Number System** Axioms in $\mathbb{R}$, Absolute value of a real number; Bounds of a sets, Supremum and infimum of a nonempty subset of $\mathbb{R}$, The completeness property of $\mathbb{R}$, Archimedean property, Definition and types of intervals, Neighborhood of a point in $\mathbb{R}$, Open, closed and perfect sets in $\mathbb{R}$	**15 h**
II	**Sequences of Real Numbers:** Convergent sequence, Limit of a sequence, Bounded sequence, Limit theorems, Monotone sequences, Weierstrass' theorem for sequences, Monotone convergence theorem, Subsequences, Bolzano sequences, Limit superior and limit inferior of a sequence of real numbers, Cauchy sequence, Cauchy's first theorem on limit, Cauchy's convergence criterion. Completeness property of set of real number.	**15 h**
III	**Infinite Series** Convergence and divergence of infinite series of positive real numbers, Necessary condition for convergence, Cauchy criterion for convergence; Tests for convergence of positive term series; Basic comparison test, Limit comparison test, D'Alembert's ratio test, Raabe's test, Logarithmic test, Cauchy's condensation Test, De Morgan & Bertrand's test, Higher logarithmic test, Gauss's test, Cauchy's root test, Integral test;	**20 h**
IV	**Alternating series**: Alternating series, Leibniz test, Absolute and conditional convergence. Properties of absolutely convergent series.	**10 h**

Sessional Internal Assessment (SIA) Full Marks . 25 Marks
A Internal written Examination . 20 Marks (1 Hr)
B Over All Performance including Regularity . 05 Marks

Books Recommended:

1. Real Analysis: Dasgupta & Prasad
2. Real Analysis: Lalji Prasad
3. Real Analysis: K.K. Jha
4. Principle of Real Analysis: S. C. Malik

Program: **Diploma** Class: **UG**	Year: **Second**	Semester: **III**
Subject: **Mathematics**		
Course Code: **MJ-5**	Course Title: **Vectors**	

Course Learning Outcomes: This course will enable the students to:

a) Understand the concepts of scalar & vector products of three and four vectors.
b) Understand the concept of vector function of scalar variable t, Scalar point functions, vector point functions, Grad, Curl and Divergence.
c) Inter-relationship amongst the line integral, double and triple integral formulations
d) Realize importance of Green, Gauss and Stokes' theorems in other branches of mathematics.

Credit: **4 (Theory)**	**Compulsory**
Full Marks: **75**	Time: **3 Hours**

Unit	Content	Hours
I	**Product of three & four vectors:** Product of 3 & 4 vectors, Reciprocal system of vectors, Lami's theorem. $\lambda - \mu$ theorem, work done, Moment of force. Couple.	**15 h**
II	**Vector Differentiation:** Vector function of scalar variable t, it's derivative and geometrical meaning, Derivative of product of two and three vectors	**15 h**
III	**Grad, Divergence & Curl:** Scalar point function and vector point function, grad, divergence and curl, their expansion formulae and properties.	**15 h**
IV	**Green's, Stoke's & Gauss's Divergence theorem:** Line integrals, Applications of line integrals: Mass and Work, Fundamental theorem for line integrals, Conservative vector fields, Green's theorem, Area as a line integral, Surface integrals, Stokes' theorem, The Gauss divergence theorem.	**15 h**

Sessional Internal Assessment (SIA) Full Marks . 25 Marks
A Internal written Examination . 20 Marks (1 Hr)
B Over All Performance including Regularity . 05 Marks

Books Recommended:

1. *Advanced Engineering Mathematics* (10th edition). Erwin Kreyszig, Wiley
2. Vector Analysis: Lalji Prasad, Paramount