

## UNIT - V

Convergence of improper integrals - various tests and their applications, Evaluation of such integrals.

Real line  $R$ -Interior points and limit points of a subset of  $R$ , open sets and closed sets in  $R$  and their properties, Bolzano - Weierstrass theorem, Heine Boral theorem, Nested interval property, Compactness and connectedness Properties in the real line.

### References :

- T.M.Apostol : Mathematical Analysis.  
R.R.Golbegg : Real Analysis  
Walter Rudin : Principles of Mathematical Analysis  
P.K. Jain & S.K. Kaushik : An introduction to Real Analysis.  
D.Somasundaram & B.Chaudhary : A First Course of Mathematical Analysis.  
G.F. Simmon : Introduction to Topology.  
Bhargava & Goyal : Real Analysis.  
Gokhroo & others : Real Analysis.  
Sharma & Purohit : Elements of Real Analysis.

## PAPER - II ABSTRACT ALGEBRA

**Note :** The question paper will be divided into three section A, B and C as follows:

**Section A :** In this section, questions will be set taking two questions from each unit. Each question will be of short answer type not exceeding 20 words and will carry 3/4 mark. The candidate will be required to attempt all the questions (aggregating 7.5 marks).

**Section B :** In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 250 words or two and a half page. Each question will be of 7.5 marks. The candidate will be required to attempt five questions in all, taking one question from each unit (aggregating 37.5 marks).

**Section C :** In this section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each. Each question may have sub-parts in it and will carry 15 marks. The candidate will be required to attempt any two questions (aggregating 30 marks).

## UNIT - I

The three isomorphism theorems of group, simple group, centre of group, Automorphisms and inner automorphisms, Normalizer of an element and that of a subgroup, conjugacy relation, class equation for finite groups, Burnside theorem and nature of groups of order  $p$  &  $p^2$ , ( $p$  being prime number).



## UNIT -II

maximal, prime and Principal ideals in Commutative rings and their theorems, The three isomorphism theorems in rings, Embedding of a ring into a ring of integers and also into a ring of endomorphism of an abelian group, Quotient field of an integral domain.

## UNIT - III

Definition and various examples of vector spaces, Subspaces and examples, Intersection, sum and direct sum of two subspaces, Linear span, Linear dependence, independence and their basic properties and theorems.

## UNIT - IV

Dimension and examples, Finite dimensional vector spaces, Existence theorem for a basis, Extension theorem, Invariance of the number of elements of a basis, Existence of complementary subspaces of a space of a finite dimensional vector space, Dimension of sum (and direct sum) of two subspaces, Dual space and its dimension.

## UNIT - V

Linear transformations, Rank and Nullity of a linear transformation, Sylvester law of nullity, To obtain a matrix from a linear transformation and vice-versa, Similarity problems relating to the same and different matrices. The algebra of linear transformations, dual

space and dual basis and dimension of dual space, bidual space and natural isomorphism (Reflexivity).

## References

1. Surjeet Singh and Quazi Zarneeruddin : Modern Algebra
2. I.N.Herstein : Topics in Algebra
3. R.S.Agrawal : Algebra
4. Gokhroo, Saini : Advance Abstract Algebra
5. Shanti Narayan : A Text-Book of Modern Abstract Algebra
6. Hoffman and Kunze : Linear Algebra, (Second Edition)
7. Purohit, Pareek, Sharma : Linear Algebra
8. Halmos, Paul R : Finite - Dimensional Vector spaces.