29. Mathematics B-Course

B.A./B.Sc. Mathematics B-Course-II **Total Mark: 100**

Appendix 'A'

(Outlines of Tests)

Mathematical Methods, Group Theory and Metric Spaces **:** 100 Marks

Appendix 'B'

(Syllabi and Courses of Reading)

Mathematical Methods, Group Theory and Metric Spaces **100 Marks**

Note: Attempt six questions by selecting two questions from Section I, two questions from Section II, one question from Section III and one question from Section IV

Section-I (4/12)

Complex Numbers

- Complex Numbers and their properties
- Polar form, argand diagram, separating into real and imaginary parts
- De Moivre's theorem and its applications
- Elementary functions: circular, logarithmic, hyperbolic, exponential functions
- Series solution by using complex numbers Functions of Several Variables

Functions of two variables, Graphs of functions of two variables

- Limit and continuity of a function of two variables
- The partial derivative, Computing partial derivatives algebraically
- The second-order partial derivative, Local linearity and the differential
- Tangent planes and normal lines
- Optimization, Maxima and minima of a function of two variables
- Lagrange multipliers

Multiple Integrals

- Double integral in rectangular and polar form
- Triple integral in rectangular, Cylindrical and spherical coordinates
- Substitutions in multiple integrals
- Moments and centre of mass

Section-II (4/12)

Sequence and Series

- Sequences, Infinite series, Convergence of sequence and series
- The integral test, Comparison tests, Ratio test, Root test
- Alternative series, Absolute and conditional convergence
- Power series, Interval and radius of convergence

Elementary Number Theory

- Prime Numbers
- Theorems related to prime numbers
- Divisibility of primes, The Euclidean algorithm, The equation $ax + by = c$
- Congruences, Linear congruences, Techniques for solving $ax = b (\text{mod} m)$

Section-III (2/12)

Group Theory

- Binary operations
- Definition, Examples and formation of groups
- Subgroups
- Order of group, Order of an element
- Abelian groups
- Cyclic groups, Cosets, Lagrange's theorem
- Permutation, Even and odd permutations
- Symmetric groups
- Introduction to rings and fields

Section-IV (2/12)

Metric Spaces

- Definition and various examples of metric spaces
- Holder's inequality, Cauchy-Schwarz and Minkowski's inequality
- Open ball (or open sphere) and closed balls
- Diameter of a set
- Distance between two sets
- Neighborhoods

- Open and closed sets
- Interior, Exterior and boundary points
- Limit points, Closure of a set

Recommended Books:

1. Thomas, Calculus, 11th Edition. Addison Wesley Publishing Company, 2005
2. H.Anton, I. Bevens, S. Davis, Calculus, 8th Edition, John Wiley & Sons, In. 2005
3. Micheal, O. Searcoid, Metric Spaces, Springer, 2007
4. E. Kreyszig, Introduction to Functional Analysis with Applications, John Wiley and Sons, 1978
5. Erwin, Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 2004
6. l.N. Herstein, Topics in Algebra, Xerox Publishing Company, 1964.
7. Adler, Andrew, Coury, John E. The Theory of Numbers, Jones and Barttlet Publishers, Boston, 1995.
8. Burton, D.M. Elementary Number Theory McGraw Hill, 2000.