Paper I: Algebra and Topology

Subcode:MPhlMS1

Algebra

Unit I: Modules over a Principal Ideal Domain- Ring of endomorphisms of an Abelian group, Left and Right modules, Free modules and matrices, Direct sum of modules, Structure theorem for finitely generated modules over a P.I.D.

Unit II: Lattices and Boolean Algebras

Partially ordered sets and lattices, Distributivity and modularity, The theorem of Jordan-Holder, Dedekend, The lattices of subspaces of vector space, Fundamental theorem of projective geometry, Boolean Algebras

Unit III: Basic structure theory of Rings

Primitivity and semi primitivity, the Radical of a ring, Density theorem, Artinian Rings and Structure theory of Algebras.

Treatment as in 'Basic Algebra' Volume I and Volume II, by Nathan Jacobson. Hindustan Publishing Corporation (India), New Delhi

Unit I: Volume I- Chapter 3- Sections 3.1 to 3.6 and 3.8

Unit II: Volume I- Chapter 8- Sections 8.1 to 8.5

Unit III: Volume II- Chapter 4- Sections 4.1 to 4.5

Topology

Unit IV: Fundamental Group and Covering Spaces

Homotopy, Fundamental Group, Covering spaces

Unit V: Simplicial Complexes

Geometry of Simplicial complexes, Barycentric Subdivisions, Simplicial Approximation theorem

Treatment as in 'Lecture Notes on Elementary Topology and Geometry by I.M.Singer and J.A.Thorpe, Springer- Verlag, 1967

Unit IV- Chapter 3

Unit V- Chapter 4 (omit section 4.4)

Books for reference:

1) S.Lang-Algebra,Addison Wesley

2) Maclane and Birkoff-Algebra, Macmillan

3) Introduction to Commutative Algebra by M.F.Atiyah,I.G.Macdonald,Addison-Wesley,1964

4) John L.Kelley-General Topology,Springer-Verlag

Paper II: Analysis and Geometry

Sub code:MPhlMS2

Analysis

Unit I: Abstract Integration

Sigma Algebra, measure, Elementary properties of measures, Integration of positive functions, Integration of Complex functions, Monotone Convergence theorem, Fatou's lemma, Dominated Convergence theorem.

Unit II: Positive Borel Measures and Lebesgue Spaces Urysohn's lemma, Parititon of unity, Riesz Representation theorem, Regularity of Borel Measures, Lebesgue measure on R^n, Continuity property of Borel measurable functions (Luzin's theorem, Vitali Caretheodory theorem), Concept of convexity and Jensen's inequality, the Lp spaces, Approximation by continuous functions.

Treatment as in Walter Rudin, 'Real and Complex Analysis', Third Edition, McGrawHill Book Company, 1987.

Unit I:- Chapter 1- Sections 1.1 to 1.34

Unit II:- Chapter 2- Sections 2.1 to 2.24

      Chapter 3- Sections 3.1 to 3.17

Geometry

Unit III: Differential forms in R^n, Line Integrals

Unit IV: Differentiable Manifolds

Unit V: Integration on Manifolds- Integration of differential forms, Stope's theorem, Poincare's Lemma

Treatment as in 'Differential Geometry and Applications' by M.P.do Carmo, Springer- Verlag 1994

Unit III- Chapters 1 and 2

Unit IV- Chapter 3

Unit V- Chapter 4

Books for Reference:

1) E.Hewitt, K.R.Stromberg,Real and Abstract Analysis,Springer-Verlag,1975

2) G.B.Folland,Real Analysis,John Wiley and Sons,1984

3) Differential Geometry of Manifolds by Stephen Lovett, A.K.Peters, Ltd,

Natick Massachusetts,2010

4)Differential Manifolds by F.Brickell and R.S.Clark

COURSE: M.Phil., MATHEMATICS
PAPER 3: ADVANCED COMPLEX ANALYSIS
SUBJECT CODE: MPhlMSAC

Unit I:
Elementary Properties of Holomorphic Functions - power series representation, Integration over paths and index of a complex number, Cauchy's theorem for a triangle.

Unit II:
Elementary Properties of Holomorphic Functions - Homotopic closed paths, zeros of holomorphic functions, evaluation of an integral.

Unit III:
The Maximum Modulus Principle - Variants of the Schwartz lemma, Maximum Modulus theorem and its converse.

Unit IV:
Conformal Mapping - Holomorphic Extension, Area theorem, Conformal Mapping of an annulus.

Unit V:
Analytic Continuation - Function element and its analytic continuation, The Monodromy theorem and the Fundamental theorem of a group Γ.

Treatment as in

Walter Rudin, *Real and Complex Analysis*, Third Edition, McGraw Hill Book Company, 1987.

Unit I: Chapter 10-Sections 10.6, 10.7, 10.10, 10.13.

Unit II: Chapter 10-Sections 10.40,10.43,10.44.

Unit III: Chapter 12-Sections 12.4, 12.8, 12.9, 12.13.

Unit IV: Chapter 14-Sections 14.2, 14.13, 14.14, 14.22.

Unit V: Chapter 16-Sections 16.11, 16.14, 16.15. 16.19.

★★★★★