Semester - 1

PC 1 **MT01C01**

LINEAR ALGEBRA

Text Book: **Kenneth Hoffman / Ray Kunze (Second Edition),** ***Linear Algebra*****,** **Prentice-Hall of India Pvt. Ltd., New Delhi, 1992.**

Module 1: Vector spaces, subspaces, basis and dimension
(Chapter 2, 2.1, 2.2, 2.3 of the text)
(Proof of theorems excluded)

Co-ordinates, summary of row-equivalence

(Chapter 2- 2.4 & 2.5 of the text) (15 hours.)

Module 2: Linear transformations, the algebra of linear transformations, isomorphism, representation of transformations by matrices, linear functionals, double dual, transpose of a linear transformation.

(Chapter 3 - 3.1, 3.2, 3.3, 3.4, 3.5, 3.6 & 3.7 of the text) (30 hours.)

Module 3: Determinants: Commutative Rings, Determinant functions, Permutation and uniqueness of determinants, Additional properties of determinants.

(Chapter 5 - 5.1, 5.2, 5.3 & 5.4 of the text) (18 hours.)

Module 4: Introduction to elementary canonical forms, characteristic values, annihilatory polynomials, invariant subspaces, simultaneous triangulations, simultaneous diagonalisation, direct sum decompositions, invariant direct sums

(Chapter 6 - 6.1, 6.2, 6.3, 6.4, 6.5 & 6.6 of the text) (27 hours.)

Question paper Pattern

	Part A Short questions	Part B Short essays	Part C Long essays
Module I	2	1	1
Module II	2	3	2
Module III	2	1	1
Module IV	2	3	2
Total	8	8	6

References:

1. Klaus Jonich. Linear Algebra, Springer Verlag.
2. Paul R. Halmos, Linear Algebra Problem Book, The Mathematical Association of America.
3. S. Lang, Algebra, 3rd edition, Addison-Wesley, 1993.
4. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.
5. S. Kumaresan, Linear Algebra A Geometrical Approach, Prentice Hall of India, 2000.

PC 2 **MT01C02**

BASIC TOPOLOGY

Text Book: **K.D. Joshi, Introduction to General Topology, Wiley Eastern Ltd,1984.**

Module 1: Definition of a topological space – examples of topological spaces, bases and sub bases – sub spaces.

Basic concepts: closed sets and closure – neighborhood, interior and accumulation points

(Chapter 4 Section – 1, 2, 3, 4 - Chapter 5 Section -. 1 and 2 of the text.

5.2.11 & 5.2.12 excluded.) (24 hours)

Module 2: Continuity and related concepts: making functions continuous, quotient spaces.

Spaces with special properties: Smallness condition on a space

(Chapter 5. Section. 3 and 4 of the text, 5.3.2(4) excluded)

(Chapter 6 Sec. 1 of the text) (22 hours)

Module 3: Connectedness: Local connectedness and paths

(Chapter 6 Section. 2 & 3 of the text) (22 hours)

Module 4: Separation axioms: Hierarchy of separation axioms – compactness and separation axioms

(Chapter – 7 Section 1 & 2 of the text)

(2.13 to 2.16 of section.2 excluded) (22 hours)

Question paper Pattern

<table>
<tr><th></th><th>Part A
Short questions</th><th>Part B
Short essays</th><th colspan="2">Part C
Long essays</th></tr>
<tr><td>Module I</td><td>2</td><td>2</td><td>1</td><td rowspan="2">1</td></tr>
<tr><td>Module II</td><td>2</td><td>2</td><td>1</td></tr>
<tr><td>Module III</td><td>2</td><td>2</td><td>1</td><td rowspan="2">1</td></tr>
<tr><td>Module IV</td><td>2</td><td>2</td><td>1</td></tr>
<tr><td>Total</td><td>8</td><td>8</td><td colspan="2">6</td></tr>
</table>

References:-

1. Munkres J.R, Topology-A First Course, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.

2. J.L Kelley, General Topology, Van Nostrand, Reinhold Co., New York, 1995.
3. Stephen Willard, General Topology, Addison-Wesley.
4. Dugundji, Topology, Universal Book Stall, New Delhi.
5. George F Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Company, 1963.

PC 3 **MT01C03**

MEASURE THEORY AND INTEGRATION

Text 1: **H.L. Royden, Real Analysis, Third edition, Prentice Hall of India Private Limited.**

Text 2: **G. de Barra, Measure Theory and Integration, New Age International (P) Linnilect Publishers.**

Pre-requisites: Algebras of sets, the axiom of choice and infinite direct products, open and closed sets of real numbers.

(Chapter 1 - section 4, 5

Chapter 2 - section 5 of Text 1). (5 hours)

(No questions shall be asked from this section)

Module 1: Lebesgue measure: introduction, outer measure, measurable sets and Lebesgue measure, & non-measurable sets, measurable functions.

(Chapter 3 - Sec. 1 to 5. of Text 1) (20 hours)

Module 2: Lebesgue integral: the Riemann integral, he Lebesgue integral of a bounded function over a set of finite measures, the integral of a non-negative function, the general Lebesgue integral, differentiation of monotone functions.

(Chapter 4 - Sec. 1 – 4. of Text 1

Chapter 5 - Sec. 1. of Text 1) (20 hours)

Module 3: Measure and integration: measure spaces, measurable functions, Integration, general convergence theorems, signed measures, the Radon-Nikodym theorem, outer measure and measurability, the extension theorem.

(Chapter 11 - Sec. 1 to 6 of Text 1

Chapter 12 - Sec. 1& 2 of Text 1) (20 hours)

Module 4: Convergence: convergence in measure, almost uniform convergence, measurability in a product space, the product measure and Fubini's theorem.

(Chapter 8 - Sec. 7.1 & 7.2 of Text 2

Chapter 10 - Sec. 10.1& 10.2 of Text 2) (25 hours)

Question paper pattern

	Part A Short questions	Part B Short essays	Part C Long essays
Module I	2	2	1
Module II	2	2	2
Module III	2	2	2
Module IV	2	2	1
Total	8	8	6

References:-

1. Halmos P.R, Measure Theory, D.van Nostrand Co.
2. P.K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age International (P) Ltd., New Delhi, 1986(Reprint 2000).
3. R.G. Bartle, The Elements of Integration, John Wiley & Sons, Inc New York, 1966.
4. Inder K Rana, An Introduction to Measure and Integration, Narosa Publishing House, 1997.

PC 4 **MT01C04**

GRAPH THEORY

Text : R.Balakrishnan and K. Ranganathan, A Text book of Graph Theory, Springer

Module: -1 Basic results and directed graphs

Basic concepts. sub graphs. degrees of vertices. Paths and connectedness

automorphism of a simple graph, line graphs, basic concepts and tournaments.

Connectivity

Vertex cuts and edge cuts. connectivity and edge connectivity, blocks.

(Chapter 1 Sections 1.1 to 1.5 and 1.6 (Up to 1.6.3)

Chapter 2 Sections 2.1 and 2.2

Chapter 3 Sections 3.1 to 3.3 of the text) (20 hours)

Module:- 2 Trees:

Definition, characterization and simple properties, centres and cenroids, counting the number of spanning trees, Cayley's formula, applications

(Chapter 4 Sections 4.1 to 4.4

Chapter 10 Sections 10.1 to 10.4 of the text) (20 hours)

Module:- 3

Independent Sets, Eulerian Graphs; Hamiltonian Graphs and Vertex Colouring, Vertex independent sets and vertex coverings. edge independent sets, Eulerian graphs, Hamiltonian graphs, vertex colourings, critical graphs, triangle free graphs.

(Chapter 5 Sections 5.1 and 5.2

Chapter 6 Sections 6.1 and 6.2

Chapter 7 Sections 7.1 to 7.3 of the text) (25 hours)

Module:- 4 :

Edge colouring and planarity- Edge colouring of graphs, planar and non planar graphs, Euler formula and its consequences, K5 and K3,3 are non planar graphs, dual of a plane graph. the four colour theorem and Heawood five colour theorem.

(Chapter 7 Section 7.4

Chapter 8 Sections 8.1 to 8.5 of the text) (25 hours)

Question Paper Pattern

<table>
<tr><th></th><th>Part A
Short questions</th><th>Part B
Short essays</th><th colspan="2">Part C
Long essays</th></tr>
<tr><td>Module I</td><td>2</td><td>2</td><td>1</td><td rowspan="2">1</td></tr>
<tr><td>Module II</td><td>2</td><td>2</td><td>1</td></tr>
<tr><td>Module III</td><td>2</td><td>2</td><td>1</td><td rowspan="2">1</td></tr>
<tr><td>Module IV</td><td>2</td><td>2</td><td>1</td></tr>
<tr><td>Total</td><td>8</td><td>8</td><td colspan="2">6</td></tr>
</table>

References:

1. John Clark and Derek Allan Holton, A First Look at Graph Theory, Allied Publishers.
2. Douglas B West, Introduction to Graph Theory, Prentice Hall of India
3. F.Harary, Graph Theory, Addison-Wesley, 1969.

PC 5 **MT01C05**

COMPLEX ANALYSIS

Text: **Lars V. Ahlfors, Complex Analysis, Third edition, McGraw Hill Internationals**

Module 1: Analytic functions as mappings.

Conformality: arcs and closed curves, analytic functions in regions, conformal mapping, length and area.

Linear transformations: linear group, the cross ratio, symmetry, oriented circles, family of circles.

Elementary conformal mappings: the use of level curves, a survey of elementary mappings, elementary Riemann surfaces.

(Chapter 3 – sections 2, 3 and 4. of the text) (20 hours.)

Module 2: Complex Integration

Fundamental theorem: line integrals, rectifiable arcs, line integrals as functions of arcs, Cauchy's theorem for a rectangle, Cauchy's theorem in a disk

Cauchy's integral formula: the index of a point with respect to a cloud curve, the integral formula, higher derivatives.

(Chapter 4 – Sections 1 and 2. of the text.) (20 hours.)

Module 3: Local properties of analytical functions: removable singularities, Taylor's theorem, zeroes and poles, the local mapping, the maximum principle.

The general form of Cauchy's theorem: chains and cycles, simple connectivity, homology, general statement of Cauchy's theorem, proof of Cauchy's theorem, locally exact differentiation, multiply connected regions.

(Chapter 4 – Sections 3 and 4. of the text) (25 hours.)

Module 4: Calculus of Residues: the residue theorem, the argument principle, evaluation of definite integrals.

Harmonic functions: definition and basic properties, the mean value property, Poisson's formula, Schwarz theorem, the reflection principle.

(Chapter 4 – Sections 5 and 6 of the text) (25 hours.)

Question paper Pattern

	Part A Short questions	Part B Short essays	Part C Long essays	
Module I	2	2	1	

<table>
<tr><td>Module II</td><td>2</td><td>2</td><td>1</td><td>1</td></tr>
<tr><td>Module III</td><td>2</td><td>2</td><td>1</td><td rowspan="2">1</td></tr>
<tr><td>Module IV</td><td>2</td><td>2</td><td>1</td></tr>
<tr><td>Total</td><td>8</td><td>8</td><td colspan="2">6</td></tr>
</table>

.

References:

1. Chaudhary. B, The elements of Complex Analysis, Wiley Eastern.
2. Cartan. H (1973), Elementary theory of Analytic functions of one or several variable, Addison Wesley.
3. Conway .J.B, Functions of one Complex variable, Narosa publishing.
4. Lang. S, Complex Analysis, Springer.
5. H.A. Priestly, Introduction to Complex Analysis, Clarendon press, Oxford, 1990.