

|                |                                                                                                                                                                                                                                                                                                                                                                                                        |                              |                       |             |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------|-------------|
| Programme      | B.Sc Mathematics Honours                                                                                                                                                                                                                                                                                                                                                                               |                              |                       |             |
| Course Code    | MAT1MN104                                                                                                                                                                                                                                                                                                                                                                                              |                              |                       |             |
| Course Title   | <b>MATHEMATICAL LOGIC, SET THEORY AND COMBINATORICS</b>                                                                                                                                                                                                                                                                                                                                                |                              |                       |             |
| Type of Course | <b>Minor</b>                                                                                                                                                                                                                                                                                                                                                                                           |                              |                       |             |
| Semester       | I                                                                                                                                                                                                                                                                                                                                                                                                      |                              |                       |             |
| Academic Level | 100 - 199                                                                                                                                                                                                                                                                                                                                                                                              |                              |                       |             |
| Course Details | Credit                                                                                                                                                                                                                                                                                                                                                                                                 | Lecture/Tutorial<br>per week | Practical<br>per week | Total Hours |
|                | 4                                                                                                                                                                                                                                                                                                                                                                                                      | 4                            | -                     | 60          |
| Pre-requisites | Higher Secondary Mathematics.                                                                                                                                                                                                                                                                                                                                                                          |                              |                       |             |
| Course Summary | This course explores mathematical logic, set theory, and combinatorics, covering fundamental ideas like propositions, logical equivalences, and quantifiers. It introduces set theory concepts such as sets, operations with sets, and cardinality. Additionally, it delves into functions and matrices, along with topics like permutations, combinations, and discrete probability in combinatorics. |                              |                       |             |

#### Course Outcomes (CO):

| CO                                                                                                                                                                                             | CO Statement                                     | Cognitive Level* | Knowledge Category# | Evaluation Tools used                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------------|---------------------|--------------------------------------------------------|
| CO1                                                                                                                                                                                            | Analyse propositional logic and equivalences     | An               | P                   | Internal Exam/Assignment/ Seminar/ Viva / End Sem Exam |
| CO2                                                                                                                                                                                            | Apply set theory and operations                  | Ap               | C                   | Internal Exam/Assignment/ Seminar/ Viva / End Sem Exam |
| CO3                                                                                                                                                                                            | Implement functions, matrices, and combinatorics | Ap               | P                   | Internal Exam/Assignment/ Seminar/ Viva / End Sem Exam |
| * - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)<br># - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M) |                                                  |                  |                     |                                                        |

**Detailed Syllabus:**

| <b>Text:</b> Discrete Mathematics with Applications, (1/e), Thomas Koshy, Academic Press (2003), ISBN: 978-0124211803. |                               |                                                                                                                                                             |                             |                                |
|------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------------|
| <b>Module</b>                                                                                                          | <b>Unit</b>                   | <b>Content</b>                                                                                                                                              | <b>Hrs<br/>(48<br/>+12)</b> | <b>Ext.<br/>Marks<br/>(70)</b> |
| <b>I</b>                                                                                                               | <b>Mathematical Logic</b>     |                                                                                                                                                             | <b>15</b>                   | <b>Min.<br/>15</b>             |
|                                                                                                                        | 1                             | 1.1 Propositions: Conjunction, Disjunction.                                                                                                                 |                             |                                |
|                                                                                                                        | 2                             | 1.1 Propositions: Converse, Inverse and Contrapositive.                                                                                                     |                             |                                |
|                                                                                                                        | 3                             | 1.1 Propositions: Biconditional Statement, Order of Precedence, Tautology, Contradiction and Contingency (Switching network and Example 1.16 are optional). |                             |                                |
|                                                                                                                        | 4                             | 1.2 Logical Equivalences (Equivalent Switching Networks, Example 1.23, Fuzzy Logic and Fuzzy Decisions are optional)                                        |                             |                                |
|                                                                                                                        | 5                             | 1.3 Quantifiers (Example 1.28, De Morgan's Laws and example 1.29 are optional)                                                                              |                             |                                |
|                                                                                                                        | 6                             | 1.4 Arguments: Valid and Invalid arguments, (Example 1.33 is optional)                                                                                      |                             |                                |
| <b>II</b>                                                                                                              | <b>Set Theory</b>             |                                                                                                                                                             | <b>12</b>                   | <b>Min.<br/>15</b>             |
|                                                                                                                        | 7                             | 2.1 The Concept of a Set - up to and including example 2.7 (Example 2.6 is optional).                                                                       |                             |                                |
|                                                                                                                        | 8                             | 2.1 The Concept of a Set - finite and infinite sets (Topics from the Hilbert Hotel paradoxes onwards are optional).                                         |                             |                                |
|                                                                                                                        | 9                             | 2.2 Operations with Sets – up to and including example 2.21.                                                                                                |                             |                                |
|                                                                                                                        | 10                            | 2.2 Operations with Sets – Cartesian product (Fuzzy sets, Fuzzy subsets and operations on fuzzy sets are optional).                                         |                             |                                |
|                                                                                                                        | 11                            | 2.4 The Cardinality of a Set (Theorem 2.2 and Algorithm subsets are optional).                                                                              |                             |                                |
| <b>III</b>                                                                                                             | <b>Functions and Matrices</b> |                                                                                                                                                             |                             |                                |

|           |                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                           |           |                    |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------|
|           | 12                                                                                                                                                                                                                                                                                                                                    | 3.1. The Concept of Functions - up to and including example 3.2                                                                           | <b>10</b> | <b>Min.<br/>15</b> |
|           | 13                                                                                                                                                                                                                                                                                                                                    | 3.1. The Concept of Functions – Piecewise definition, sum and product (Example 3.7 is optional).                                          |           |                    |
|           | 14                                                                                                                                                                                                                                                                                                                                    | 3.2 Special Functions – up to and including example 3.13 (Proof of Theorems 3.1 and 3.2 are optional).                                    |           |                    |
|           | 15                                                                                                                                                                                                                                                                                                                                    | 3.2 Special Functions- Characteristic function, Mod and Div functions (Theorem 3.3, Code dealing and The two Queens Puzzle are optional). |           |                    |
|           | 16                                                                                                                                                                                                                                                                                                                                    | 3.7 Matrices (Proof of theorem 3.12, algorithm product are optional).                                                                     |           |                    |
| <b>IV</b> | <b>Combinatorics and Discrete Probability</b>                                                                                                                                                                                                                                                                                         |                                                                                                                                           | <b>11</b> | <b>Min.<br/>15</b> |
|           | 17                                                                                                                                                                                                                                                                                                                                    | 6.1 The Fundamental Counting Principles (Example 6.7 is optional)                                                                         |           |                    |
|           | 18                                                                                                                                                                                                                                                                                                                                    | 6.2 Permutations - up to and including example 6.13 (Proof of theorem 6.4 is optional)                                                    |           |                    |
|           | 19                                                                                                                                                                                                                                                                                                                                    | 6.2 Permutations - Cyclic permutations (Theorem 6.7 and Fibonacci numbers revisited are optional)                                         |           |                    |
|           | 20                                                                                                                                                                                                                                                                                                                                    | 6.4 Combinations (Proof of theorem 6.10, example 6.22, theorem 6.12 and example 6.26 are optional)                                        |           |                    |
|           | 21                                                                                                                                                                                                                                                                                                                                    | 6.8 Discrete Probability- up to and including example 6.49 (Examples 6.45 and 6.47 are optional)                                          |           |                    |
|           | 22                                                                                                                                                                                                                                                                                                                                    | 6.8 Discrete Probability- Mutually exclusive events (Proof of theorem 6.20 is optional)                                                   |           |                    |
| <b>V</b>  | <b>Open Ended</b>                                                                                                                                                                                                                                                                                                                     |                                                                                                                                           | <b>12</b> |                    |
|           | 1. Basic calculus concepts such as limits, continuity, differentiation and integration. Relations and Digraphs, Conditional Probability, Multiplication theorem of Probability, Dependent and Independent Events, Probability Distributions, Correlation and Regression, Bisection Method, Regula-Falsie Method, Gauss-Jordan Method. |                                                                                                                                           |           |                    |

**References:**

1. Discrete Mathematics and Its Applications (7/e), Kenneth H. Rosen, McGraw-Hill, NY (2007).
2. Discrete Mathematics with Applications(4/e), Susanna S Epp, Brooks/ Cole Cengage Learning (2011).
3. Discrete Mathematics, Gary Chartrand, Ping Zhang, Waveland Press (2011).

**Note: 1) Optional topics are exempted for end semester examination. 2) Proofs of all the results are also exempted for the end semester exam.**

**Mapping of COs with PSOs and POs :**

|      | PSO5 | PSO6 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|------|------|------|-----|-----|-----|-----|-----|-----|-----|
| CO 1 | 3    | 2    | 3   | 1   | 3   | 2   | 3   | 1   | 2   |
| CO 2 | 3    | 2    | 3   | 2   | 3   | 2   | 3   | 1   | 2   |
| CO 3 | 2    | 1    | 3   | 2   | 3   | 2   | 3   | 1   | 2   |

**Correlation Levels:**

| Level | Correlation        |
|-------|--------------------|
| -     | Nil                |
| 1     | Slightly / Low     |
| 2     | Moderate / Medium  |
| 3     | Substantial / High |

**Assessment Rubrics:**

- Assignment/ Seminar
- Internal Exam
- Viva
- Final Exam (70%)

**Mapping of COs to Assessment Rubrics:**

|      | Internal Exam | Assignment | Seminar | Viva | End Semester Examinations |
|------|---------------|------------|---------|------|---------------------------|
| CO 1 | ✓             | ✓          | ✓       | ✓    | ✓                         |
| CO 2 | ✓             | ✓          | ✓       | ✓    | ✓                         |
| CO 3 | ✓             | ✓          | ✓       | ✓    | ✓                         |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                              |                       |             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------|-------------|
| Programme      | B.Sc Mathematics Honours                                                                                                                                                                                                                                                                                                                                                                                                                                              |                              |                       |             |
| Course Code    | MAT2MN104                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                              |                       |             |
| Course Title   | <b>GRAPH THEORY AND AUTOMATA</b>                                                                                                                                                                                                                                                                                                                                                                                                                                      |                              |                       |             |
| Type of Course | <b>Minor</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                              |                       |             |
| Semester       | II                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                              |                       |             |
| Academic Level | 100 - 199                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                              |                       |             |
| Course Details | Credit                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Lecture/Tutorial<br>per week | Practical<br>per week | Total Hours |
|                | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 4                            | -                     | 60          |
| Pre-requisites | Higher Secondary Mathematics                                                                                                                                                                                                                                                                                                                                                                                                                                          |                              |                       |             |
| Course Summary | This course introduces students to Graph Theory and Automata, covering topics such as graphs, adjacency matrices, and isomorphic graphs in Module I. In Module II, it explores Eulerian and Hamiltonian graphs, including paths, cycles, and connected graphs. Module III focuses on Planar Graphs, Graph Coloring, Trees, and Spanning Trees. Finally, Module IV delves into Automata, covering concepts like formal languages, grammars, and finite state automata. |                              |                       |             |

#### Course Outcomes (CO):

| CO                                                                                                                                                                                             | CO Statement                                        | Cognitive Level* | Knowledge Category# | Evaluation Tools used                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|------------------|---------------------|--------------------------------------------------------|
| CO1                                                                                                                                                                                            | Analyse Graph Structures and Properties             | E                | C                   | Internal Exam/Assignment/ Seminar/ Viva / End Sem Exam |
| CO2                                                                                                                                                                                            | Apply Algorithms to Eulerian and Hamiltonian Graphs | Ap               | P                   | Internal Exam/Assignment/ Seminar/ Viva / End Sem Exam |
| CO3                                                                                                                                                                                            | Explore Formal Languages and Finite State Automata  | E                | C                   | Internal Exam/Assignment/ Seminar/ Viva / End Sem Exam |
| * - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)<br># - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M) |                                                     |                  |                     |                                                        |

**Detailed Syllabus:**

**Text:** Discrete Mathematics with Applications, Thomas Koshy, Academic Press (2003), ISBN: 978-0124211803.

| <b>Module</b> | <b>Unit</b>                            | <b>Content</b>                                                                                                                                                                                    | <b>Hrs<br/>(48<br/>+12)</b> | <b>Ext.<br/>Marks<br/>(70)</b> |
|---------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------------|
| <b>I</b>      | <b>Graphs</b>                          |                                                                                                                                                                                                   | <b>14</b>                   | <b>Min.<br/>15</b>             |
|               | 1                                      | 8.1 Graphs - Graph, Simple Graph (Example 8.3 is optional).                                                                                                                                       |                             |                                |
|               | 2                                      | 8.1 Graphs - Adjacency and Incidence, Degree of a Vertex, Adjacency Matrix (Example 8.5 and proof of Theorem 8.2 are optional).                                                                   |                             |                                |
|               | 3                                      | 8.1 Graphs – Subgraph of a Graph.                                                                                                                                                                 |                             |                                |
|               | 4                                      | 8.1 Graphs - Complete Graph, Cycle and Wheel Graphs (Fibonacci and Paraffins, Lucas and Cycloparaffins are optional).                                                                             |                             |                                |
|               | 5                                      | 8.1 Graphs - Bipartite graph, Complete Bipartite Graph, Weighted Graph (Graphs and Telecommunications, Graphs and Local Area Networks and A Generalised Handshake Problem are optional).          |                             |                                |
|               | 6                                      | 8.3 Isomorphic Graphs.                                                                                                                                                                            |                             |                                |
| <b>II</b>     | <b>Eulerian and Hamiltonian graphs</b> |                                                                                                                                                                                                   | <b>10</b>                   | <b>Min.<br/>15</b>             |
|               | 7                                      | 8.4 Paths, Cycles and Circuits – Path, Independent Subsets of the Vertex set, Cycle and Circuit (Proof of theorem 8.3, 8.5, example 8.20 and example 8.21 are optional).                          |                             |                                |
|               | 8                                      | 8.4 Paths, Cycles and Circuits – Connected Graphs (Proof of theorem 8.3, 8.5, example 8.20 and example 8.21 are optional).                                                                        |                             |                                |
|               | 9                                      | 8.5 Eulerian and Hamiltonian graphs- Eulerian Graph (Proof of theorem 8.7, example 8.26, Algorithm Eulerian graph, example 8.27, Algorithm Eulerian circuit, proof of theorem 8.8, example 8.31). |                             |                                |

|            |                                                                                                             |                                                                                                                                                         |           |                    |
|------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------|
|            | 10                                                                                                          | 8.5 Eulerian and Hamiltonian graphs- Hamiltonian Graph (Knight's tour problem, example 8.34, Travelling Salesperson Problem, Example 8.35 are optional) |           |                    |
| <b>III</b> | <b>Planar Graphs and Trees</b>                                                                              |                                                                                                                                                         | <b>11</b> | <b>Min.<br/>15</b> |
|            | 11                                                                                                          | 8.6 Planar Graphs- Planar Graph (Proofs of theorems 8.11 and 8.12 are optional).                                                                        |           |                    |
|            | 12                                                                                                          | 8.6 Planar Graphs- Degree of a Region, Homeomorphic Graphs.                                                                                             |           |                    |
|            | 13                                                                                                          | 8.7 Graph Coloring- Graph Coloring, Chromatic Number, The Four-Color Problem (Example 8.27 is optional).                                                |           |                    |
|            | 14                                                                                                          | 9.1 Trees- Trees (Proof of theorem 9.1 and 9.2 are optional).                                                                                           |           |                    |
|            | 15                                                                                                          | 9.2 Spanning Trees - Spanning Trees, Kruskal's Algorithm for a Spanning Tree.                                                                           |           |                    |
| <b>IV</b>  | <b>Automata</b>                                                                                             |                                                                                                                                                         | <b>13</b> | <b>Min.<br/>15</b> |
|            | 16                                                                                                          | 2.1 The Concept of Sets – Alphabet, Length of a Word, Language, Concatenation.                                                                          |           |                    |
|            | 17                                                                                                          | 11.1 Formal Languages - Equality of Words, Concatenation of Languages (Examples 11.2, 11.3, 11.5 and Proof of Theorem 11.1 are optional).               |           |                    |
|            | 18                                                                                                          | 11.1 Formal Languages – Kleene Closure.                                                                                                                 |           |                    |
|            | 19                                                                                                          | 11.2 Grammars – Grammars, Phase Structure Grammar.                                                                                                      |           |                    |
|            | 20                                                                                                          | 11.2 Grammars – Derivation and Language.                                                                                                                |           |                    |
|            | 21                                                                                                          | 11.3 Finite State Automata – up to and including Example 11.30 (Example 11.27 is optional).                                                             |           |                    |
|            | 22                                                                                                          | 11.3 Finite State Automata – Equivalent Finite State Automata up to and including example 11.35.                                                        |           |                    |
| <b>V</b>   | <b>Open Ended Module</b>                                                                                    |                                                                                                                                                         | <b>12</b> |                    |
|            | Computer representation of graphs, minimal spanning trees, rooted trees, Digraphs and Finite state machines |                                                                                                                                                         |           |                    |

**References:**

1. Discrete Mathematics and Its Applications (7/e), Kenneth H. Rosen, McGraw-Hill, NY (2007).
2. Discrete Mathematics with Applications (4/e), Susanna S Epp, Brooks/ Cole Cengage Learning (2011).
3. A First Look at Graph Theory, John Clark and Allan Holton, Allied Publishers (1991).

**Note: 1) Optional topics are exempted for end semester examination. 2) Proofs of all the results are also exempted for the end semester exam.**

**Mapping of COs with PSOs and POs :**

|      | PSO5 | PSO6 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|------|------|------|-----|-----|-----|-----|-----|-----|-----|
| CO 1 | 2    | 1    | 2   | 1   | 1   | 0   | 3   | 0   | 0   |
| CO 2 | 2    | 1    | 2   | 0   | 1   | 1   | 2   | 0   | 0   |
| CO 3 | 2    | 1    | 2   | 0   | 1   | 1   | 3   | 0   | 0   |

**Correlation Levels:**

| Level | Correlation        |
|-------|--------------------|
| -     | Nil                |
| 1     | Slightly / Low     |
| 2     | Moderate / Medium  |
| 3     | Substantial / High |

**Assessment Rubrics:**

- Assignment/ Seminar
- Internal Exam
- Viva
- Final Exam (70%)

**Mapping of COs to Assessment Rubrics:**

|      | Internal Exam | Assignment | Seminar | Viva | End Semester Examinations |
|------|---------------|------------|---------|------|---------------------------|
| CO 1 | ✓             | ✓          | ✓       | ✓    | ✓                         |
| CO 2 | ✓             | ✓          | ✓       | ✓    | ✓                         |
| CO 3 | ✓             | ✓          | ✓       | ✓    | ✓                         |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                              |                       |             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------|-------------|
| Programme      | B. Sc. Mathematics Honours                                                                                                                                                                                                                                                                                                                                                                                                                                              |                              |                       |             |
| Course Code    | MAT3MN204                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                              |                       |             |
| Course Title   | <b>BOOLEAN ALGEBRA AND SYSTEM OF EQUATIONS</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                              |                       |             |
| Type of Course | <b>Minor</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                              |                       |             |
| Semester       | III                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                              |                       |             |
| Academic Level | 200-299                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                              |                       |             |
| Course Details | Credit                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Lecture/Tutorial<br>per week | Practical<br>per week | Total Hours |
|                | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4                            | -                     | 60          |
| Pre-requisites | MAT1MN203 and MAT2MN203                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                              |                       |             |
| Course Summary | This course comprises four main modules: Lattice, Boolean Algebra, System of Equations, and Eigenvalue and Eigenvectors. Module I introduce concepts like ordered sets and lattices, while Module II explores Boolean Algebra and its applications. Module III covers linear systems of equations, including Gauss elimination and determinants. Finally, Module IV delves into Eigenvalue and Eigenvectors, offering insights into matrix properties and applications. |                              |                       |             |

### Course Outcome

| CO                                                                                                                                                                                             | CO Statement                                    | Cognitive Level* | Knowledge Category# | Evaluation Tools used                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------------|---------------------|--------------------------------------------------------|
| CO1                                                                                                                                                                                            | Analyse Lattices and Boolean Algebra            | E                | C                   | Internal Exam/Assignment/ Seminar/ Viva / End Sem Exam |
| CO2                                                                                                                                                                                            | Apply Matrix Operations and Linear Systems      | Ap               | P                   | Internal Exam/Assignment/ Seminar/ Viva / End Sem Exam |
| CO3                                                                                                                                                                                            | Investigate Eigenvalue and Eigenvector Problems | An               | P                   | Internal Exam/Assignment/ Seminar/ Viva / End Sem Exam |
| * - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)<br># - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M) |                                                 |                  |                     |                                                        |

Detailed Syllabus:

| Textbook | 1. Theory and Problems of Discrete mathematics (3/e), Seymour Lipschutz, Marc Lipson, Schaum's Outline Series.<br>2. Advanced Engineering Mathematics (10/e), Erwin Kreyzsig, Wiley India. |                                                                                       |                    |                    |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------|--------------------|
| Module   | Unit                                                                                                                                                                                       | Content                                                                               | Hrs<br>(48<br>+12) | Ext. Marks<br>(70) |
| I        | <b>Lattice (Text 1)</b>                                                                                                                                                                    |                                                                                       | 12                 | Min 15             |
|          | 1                                                                                                                                                                                          | 14.2 Ordered set                                                                      |                    |                    |
|          | 2                                                                                                                                                                                          | 14.3 Hasse diagrams of partially ordered sets                                         |                    |                    |
|          | 3                                                                                                                                                                                          | 14.5 Supremum and Infimum                                                             |                    |                    |
|          | 4                                                                                                                                                                                          | 14.8 Lattices                                                                         |                    |                    |
|          | 5                                                                                                                                                                                          | 14.9 Bounded lattices, 14.10 Distributive lattices                                    |                    |                    |
|          | 6                                                                                                                                                                                          | 14.11 Complements, Complemented lattices                                              |                    |                    |
| II       | <b>Boolean Algebra (Text 1)</b>                                                                                                                                                            |                                                                                       | 10                 | Min 15             |
|          | 7                                                                                                                                                                                          | 15.2 Basic definitions                                                                |                    |                    |
|          | 8                                                                                                                                                                                          | 15.3 Duality                                                                          |                    |                    |
|          | 9                                                                                                                                                                                          | 15.4 Basic theorems                                                                   |                    |                    |
|          | 10                                                                                                                                                                                         | 15.5 Boolean algebra as lattices                                                      |                    |                    |
|          | 11                                                                                                                                                                                         | 15.8 Sum and Product form for Boolean algebras                                        |                    |                    |
|          | 12                                                                                                                                                                                         | 15.8 Sum and Product form for Boolean algebras - Complete Sum and Product forms       |                    |                    |
| III      | <b>System of Equations (Text 2)</b>                                                                                                                                                        |                                                                                       | 14                 | Min 15             |
|          | 13                                                                                                                                                                                         | 7.1 Matrices, Vectors: Addition and Scalar Multiplication                             |                    |                    |
|          | 14                                                                                                                                                                                         | 7.2 Matrix Multiplication (Example 13 is optional)                                    |                    |                    |
|          | 15                                                                                                                                                                                         | 7.3 Linear System of Equations- Gauss Elimination                                     |                    |                    |
|          | 16                                                                                                                                                                                         | 7.4 Linear Independence- Rank of a matrix- Vector Space (Proof Theorem 3 is optional) |                    |                    |

|                                                                                                                              |                                                                                                                                                                                                                                      |                                                                                                                             |    |        |
|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|----|--------|
|                                                                                                                              | 17                                                                                                                                                                                                                                   | 7.5 Solutions of Linear Systems- Existence, Uniqueness (Proof of Theorem 1, Theorem 2 and Theorem 4 are optional)           |    |        |
| IV                                                                                                                           | Eigen Value and Eigen Vectors (Text 2)                                                                                                                                                                                               |                                                                                                                             | 12 | Min 15 |
|                                                                                                                              | 18                                                                                                                                                                                                                                   | 7.6 Second and Third Order Determinants- up to and including Example 1                                                      |    |        |
|                                                                                                                              | 19                                                                                                                                                                                                                                   | 7.6 Second and Third Order Determinants- Third order determinants                                                           |    |        |
|                                                                                                                              | 20                                                                                                                                                                                                                                   | 7.7 Determinants- Cramer's Rule (Proof of Theorem 1, Theorem 2, Theorem 3 and Theorem 4 are optional)                       |    |        |
|                                                                                                                              | 21                                                                                                                                                                                                                                   | 7.8 Inverse of a Matrix- Gauss- Jordan Elimination (Proof Theorem 1, Theorem 2, Theorem 3 and Theorem 4 are optional)       |    |        |
|                                                                                                                              | 22                                                                                                                                                                                                                                   | 8.1 The Matrix Eigenvalue Problem- Determining Eigenvalues and Eigenvectors (Proof of Theorem 1 and Theorem 2 are optional) |    |        |
| V                                                                                                                            | Open Ended Module                                                                                                                                                                                                                    |                                                                                                                             | 12 |        |
|                                                                                                                              | Relation on a set, Equivalence relation and partition, Isomorphic ordered sets, Well-ordered sets, Representation theorem of Boolean algebra, Logic gates, Symmetric, Skew-symmetric and Orthogonal matrices, Linear Transformation. |                                                                                                                             |    |        |
| References:                                                                                                                  |                                                                                                                                                                                                                                      |                                                                                                                             |    |        |
| 1. Howard Anton & Chris Rorres, Elementary Linear Algebra: Application (11/e) : Wiley                                        |                                                                                                                                                                                                                                      |                                                                                                                             |    |        |
| 2. Ron Larson, Edwards, David C Falvo : Elementary Linear Algebra (6/e), Houghton Mifflin Harcourt Publishing Company (2009) |                                                                                                                                                                                                                                      |                                                                                                                             |    |        |
| 3. Thomas Koshy - Discrete Mathematics with Applications-Academic Press (2003)                                               |                                                                                                                                                                                                                                      |                                                                                                                             |    |        |
| 4. George Gratzner, Lattice theory: First concepts and distributive lattices. Courier Corporation (2009)                     |                                                                                                                                                                                                                                      |                                                                                                                             |    |        |

**Note: 1) Optional topics are exempted for end semester examination. 2) Proofs of all the results are also exempted for the end semester exam.**

**Mapping of COs with PSOs and POs :**

|      | PSO5 | PSO6 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|------|------|------|-----|-----|-----|-----|-----|-----|-----|
| CO 1 | 3    | 1    | 3   | 2   | 3   | 1   | 3   | 1   | 2   |
| CO 2 | 3    | 2    | 3   | 2   | 3   | 2   | 3   | 1   | 2   |
| CO 3 | 3    | 2    | 3   | 2   | 3   | 2   | 3   | 1   | 2   |

**Correlation Levels:**

| Level | Correlation        |
|-------|--------------------|
| -     | Nil                |
| 1     | Slightly / Low     |
| 2     | Moderate / Medium  |
| 3     | Substantial / High |

**Assessment Rubrics:**

- Assignment/ Seminar
- Internal Exam
- Viva
- Final Exam (70%)

**Mapping of COs to Assessment Rubrics:**

|      | Internal Exam | Assignment | Seminar | Viva | End Semester Examinations |
|------|---------------|------------|---------|------|---------------------------|
| CO 1 | ✓             | ✓          | ✓       | ✓    | ✓                         |
| CO 2 | ✓             | ✓          | ✓       | ✓    | ✓                         |
| CO 3 | ✓             | ✓          | ✓       | ✓    | ✓                         |