Gyanmanjari Innovative University

Syllabus
Gyanmanjari College Of Computer Application
Semester-I (BCA)

Subject: Basic Mathematics(BCA2XX11303)

Type of course: Core Courses

Prerequisite: Basic arithmetic operations, Understanding of graphs and coordinates, Knowledge of sets and number systems

Rationale: The syllabus of Basic Mathematics is designed to develop logical, analytical, and problem-solving skills among BCA students. Mathematics is an important foundation for computer applications, programming, data structures, algorithms, database management, networking, and software development. This subject help student to understand computational thinking and improves reasoning ability required in the field of Information Technology and Computer Science.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
CI	T	P	C	SEE	CCE	
4	0	0	4	100	50	150

Course Content:

Sr. No	Course Content	Hrs.	% Weightage
1	**Module 1:Set and Relations** Concept of sets, Representation of sets, Power Set, Subset, Superset, Operations on set, Venn diagrams, Algebra of Set, De Morgan's Law and examples. Binary Relation, Representation, Domain & Range, Universal Relation, Void Relation, Union, Intersection, Properties of Binary Relations in a Set: Reflexive, Symmetric, Transitive Relation, Matrix and Graph of a Relation. **Description of Exercise:** • Give students a flawed proof of De Morgan's Law or an incorrect classification of a relation and ask them to find and fix the mathematical error. This tests deep conceptual comprehension better than standard rote memorization.	12	20%

Sr No.	Evaluation Methods	SEE	CCE
1	The "Spot the Error" Exercise	20	
2	Assignment		10
	Total:	**20**	**10**

<table>
<tr><td></td><td>Description of Assignment:
• Solving set operations using Venn diagrams
• Preparing charts on types of relations</td><td></td><td></td></tr>
<tr><td>2</td><td>Module 2: Functions:
Introduction to functions, Domain, Co-domain, and Range. Types of functions: One-to-one (Injective), Onto (Surjective), Bijective, Constant, and Identity functions. Composition of functions and Inverse of a function and questions based on above topics.

<table>
<tr><th>Sr No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr>
<tr><td>1</td><td>1. MCQ based worksheets</td><td>10</td><td></td></tr>
<tr><td></td><td>2. Identify type of function from Venn diagram</td><td>10</td><td></td></tr>
<tr><td>2</td><td>ALA: Graph of various functions</td><td></td><td>10</td></tr>
<tr><td></td><td>Total:</td><td>20</td><td>10</td></tr>
</table></td><td>12</td><td>20%</td></tr>
<tr><td>3</td><td>Module 3: Matrices and Determinants

Definition and types of matrices, Addition and multiplication of matrices, Transpose and adjoint of a matrix, Determinants of a matrix, Inverse of a 2×2 matrix, Singular and Non-Singular matrix, Elementary operations, Definition and properties of determinants, Minors, Cofactors, Applications of determinants, solution of system of linear Equations in two variables

<table>
<tr><th>Sr No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr>
<tr><td>1</td><td>1. Solvability Test of Linear Equations
2. Matrix Property Verification & Determinant Analysis</td><td>20</td><td></td></tr>
<tr><td>2</td><td>Matrix Construction & System Evaluation</td><td></td><td>10</td></tr>
<tr><td></td><td>Total:</td><td>20</td><td>10</td></tr>
</table>
Description of ALA:</td><td>12</td><td>20%</td></tr>
</table>

4	**Module 4: Mathematical Logic and Reasoning** Propositions, Logical operations, Truth tables, Implication, Converse, Inverse, Contra-positive, Tautology, Contradiction. **Sr No. / Evaluation Methods / SEE / CCE** 1 / Truth Table & Logic Gate Mapping / 20 / 2 / Viva voce / / 10 **Total:** / **20** / **10**	**12**	**20%**
5	**Module 5: Graph Theory** Introduction to Graph, Definition: Vertices, Edges, Loops, Parallel Edges, Simple Graph, Finite Graph, Adjacent vertices, Incidence between vertex and edge, Degree of a vertex, Isolated Vertex, Pendent Vertex, Null Graph, Labeled Graph, Unlabeled Graph, Walk, Closed Walk, Open Walk, Simple Path, Circuit, Connected Graph. **Sr No. / Evaluation Methods / SEE / CCE** 1 / Structural Topology & Matrix Map Challenge / 20 / 2 / Presentation / / 10 **Total:** / **20** / **10** **Description of ALA:** • Classroom presentation on applications of graph theory in computer science. • Introduction and origin of graph theory	**12**	**20%**

Suggested Specification table with Marks:

Distribution of Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage%	10%	20%	30%	20%	10%	10%

Course Outcomes:

After learning the course, the students should be able to:

CO1	**Perform** foundational set operations and map complex binary relations using visual Venn diagrams and coordinate graphs.
CO2	**Determine** the domain, range, and classification of a function while graphically plotting its algebraic behavior.
CO3	**Compute** matrix products, inverses, and determinants to systematically solve multi-variable systems of linear equations.
CO4	**Evaluate** the truth value of compound propositions and construct corresponding hardware logic gate schematics.
CO5	**Analyze** network configurations using graph elements and translate visual topologies into computational data matrices.

Instructional Method:

The course will be delivered using classroom teaching supported by active learning, structured problem-solving, and computing-oriented mathematical applications. In addition to blackboard teaching, the instructor may use:

- Diagram-based teaching for sets, Venn diagrams, graphs, and trees
- Guided practice sessions for functions, counting principles, and recurrence relations
- Algorithm-based demonstrations for graph traversal, shortest path, and minimum spanning tree methods
- Tree-structure demonstrations for preorder, inorder, and postorder traversal
- Boolean reasoning exercises using truth tables and algebraic simplification
- Peer-teaching and short presentations for graph models, tree structures, and logic simplification
- Internal evaluation through ALA, class tests, audits, visual mapping exercises, and oral explanation of solutions

Reference Books:

[1]Discrete Mathematics and Its Applications by Kenneth H. Rosen
[2] Discrete Mathematical Structures by Kolman, Busby, and Ross
[3] Elements of Discrete Mathematics by C.L. Liu and D.P. Mohapatra
[4] Graph Theory with Applications by J.A. Bondy and U.S.R. Murty
[5] Boolean Algebra and Its Applications by J. Eldon Whitesitt
[6] Discrete Mathematics for Computer Scientists by J.L. Hein

Suggestive Rubrics:

Suggestive Assessment Guidelines:
Module 1: ALA: Assignment (10 Marks) **10 Marks:** Flawless Venn diagrams and relation matrices; **8 Marks:** Minor labeling errors;

5 Marks: Overlap calculation mistakes; **2 Marks:** Messy/incorrect logic; **0 Marks:** Not submitted.
Module 2: **ALA: Graph of various functions (10 Marks)** **10 Marks: Marks:** Perfect function classification and exact domain/range grid graphs; **8 Marks:** Minor scaling gaps; **5 Marks:** Inaccurate range tracking; **2 Marks:** Wrong function types; **0 Marks:** Not submitted.
Module 3:Matrix Construction & System Evaluation (10 Marks) **10 Marks:**Flawless matrix algebra, determinants, and Cramer's rule steps; **8 Marks:** Minor sign/arithmetic slips; **5 Marks:** Incomplete system solving; **2 Marks:** Wrong calculation logic; **0 Marks:** Not submitted.
Module 4: **ALA: Viva voice(10 Marks)** **10 Marks:**Flawless truth tables, perfect logic gate circuits, and confident viva; **8 Marks:** Minor notation gaps; **5 Marks:** Weak circuit mapping; **2 Marks:** Fails basic viva definitions; **0 Marks:** Not submitted.
Module 5: **ALA: Presentation(10 Marks)** **10 Marks:** Correct node-degree layouts, flawless adjacency matrices, and clear path tracing; **8 Marks:** Minor presentation gaps; **5 Marks:** Matrix tracking errors; **2 Marks:** Violates Handshaking Lemma; **0 Marks:** Not submitted.