Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

Autonomous

Course Structure for B.Sc. (Computer Science) Mathematics

F. Y. B. Sc. (Computer Science) Mathematics

Semester	Course Code	Title of Course	No. of Credits	No. of Lectures
I	UCSMT111	Graph Theory	2	36
	UCSMT112	Matrix Algebra	2	36
	UCSMT113	Mathematics Practical based on UCSMT111 & UCSMT112	2	48
II	UCSMT121	Discrete Mathematics	2	36
	UCSMT122	Linear Algebra	2	36
	UCSMT123	Mathematics Practical based on UCSMT121 & UCSMT122	2	48

S. Y. B. Sc. (Computer Science) Mathematics

Semester	Course Code	Title of Course	No. of Credits	No. of Lectures
I	UCSMT231	Groups and Coding Theory	3	48
	UCSMT232	Numerical Techniques	3	48
	UCSMT233	Mathematics Practical Python Programming Language I	2	48
II	UCSMT241	Computational Geometry	3	48
	UCSMT242	Operation Research	3	48
	UCSMT243	Mathematics Practical Python Programming Language II	2	48

Equivalence of the Old Syllabus with New Syllabus:

Old Course		New Course	
CSMT1201	Discrete Mathematics	UCSMT121	Discrete Mathematics
CSMT1202	Calculus	UCSMT122	Linear Algebra
CSMT1203	Mathematics Practical based on CSMT1201 & CSMT1202	UCSMT123	Mathematics Practical based on UCSMT121 & UCSMT122

SYLLABUS (CBCS) FOR F. Y. B. Sc.(COMPUTER SCIENCE)
MATHEMATICS
(w.e.f. June, 2022)

Academic Year 2022-2023

Class : F.Y. B. Sc. (Computer Science) (Semester- II)
Course Code: UCSMT121

Paper : I Title of Course: Discrete Mathematics
Credit : 2 No. of lectures: 36

A) Learning Objectives:

- Introduce concepts of mathematical logic for analyzing propositions and proving theorems.
- To understand concepts of Lattices, Boolean algebra, Recurrence relation.
- How to use and analyse recursive definitions.

B) Learning Outcome:

- Apply recursive functions and solve recurrence relations.
- Apply basic and advanced principles of counting.

TOPICS/CONTENTS

Unit 01: Logic (7 lectures)

1.1 Revision: Propositional Logic, Propositional Equivalences
1.2 Predicates and Quantifiers: Predicate, n-place Predicate or n-ary Predicate, Quantification and Quantifiers, Universal Quantifier, Existential Quantifier, Quantifiers with restricted domains, Logical Equivalences involving Quantifiers.
1.3 Rules of Inference: Argument in propositional Logic, Validity Argument (Direct and Indirect methods), Rules of Inference for Propositional Logic, Building Arguments.

Unit 02: Relation and Digraph (8 lectures)

2.1 Ordered pairs, Cartesian Product of sets
2.2 Relation, types of relation, equivalence relation, Partial Ordering relations.
2.3 Digraphs of relations ,matrix representation and composition of relations
2.4 Transitive Closure and Warshall's Algorithm

Unit 03: Lattices and Boolean Algebra (6 lectures)

3.1 Lattices, Complemented Lattice, Bounded Lattice and Distributive Lattice.
3.2 Boolean Functions: Introduction, Boolean Variable, Boolean Function of degree n, Boolean identities, Definition of Boolean Algebra.
3.3 Representation of Boolean Functions: Minterm, Maxterm, Disjunctive normal form, Conjunctive normal form.

Unit 04: Counting Principles (7 lectures)

4.1 Cardinality of Set: Cardinality of finite Sets
4.2 Basics of Counting: The Product Rule, The Sum rule, The Inclusion-Exclusion Principle.
4.3 The Pigeonhole Principle: Statement, The Generalized Pigeonhole Principle, Its Applications.
4.4 Generalized Permutations and Combinations: Permutation and Combination with Repetitions, Permutation With Indistinguishable Objects.

Unit 05: Recurrence Relations (8 lectures)

5.1 Recurrence Relations: Introduction, Formation
5.2 Linear Recurrence Relations with constant coefficients
5.3 Homogeneous solutions.
5.4 Particular solutions
5.5 Total solutions

Text Book : Kenneth Rosen, Discrete Mathematics and its applications, McGraw Hill Education Pvt. Ltd. (7^{th} Edition).

Unit 1: Section 1.1to 1.5
Unit 4: Section 6.1 to 6.6
Unit 5: Section 8.2

Text Book : Bernard Kolman, Robert Busby, Sharon Culter Ross, Nadeem-ur-Rehman, Discrete Mathematics Structure, Pearson Education, 5^{th} Edition.

Unit 2: Section 4.2, 4.4, 4.5, 4.8
Unit 3: Section 7.3 to 7.6

Reference Books:

1. C. L. Liu., Elements of Discrete Mathematics, Tata McGraw Hill.

Class : F.Y. B. Sc. (Computer Science) (Semester-II)
Course Code: UCSMT122

Paper : II Title of Course: Linear Algebra
Credit : 2 No. of lectures: 36

A) Learning Objectives:

- To understand properties and operations on System of Linear Equations.
- To understand basic concepts of Determinants.
- Understanding of how to translate a linear equation into a matrix.

B) Learning Outcome:

- Improves problem solving ability and understanding of different algebraic structures in Mathematics
- Students are able to define determinants and understand their relation to matrices.

TOPICS/CONTENTS

Unit 01: Vector Spaces (10 lectures)

1.1 Vector Spaces and Subspaces
1.2 Solving $Ax = 0$ and $Ax = b$
1.3 Linearly Independence, Basis and Dimensions
1.4 The Four Fundamental subspaces
1.5 Graphs and Networks
1.6 Linear Transformations

Unit 02: Orthogonality (06 lectures)

2.1 Orthogonal Vectors and subspaces
2.2 Cosines and projections onto Lines
2.3 Projections and least squares
2.4 Orthogonal Bases and Gram-Schmidt
2.5 The Fast Fourier Transform

Unit 03: Eigen Values and Eigen Vectors (10 lectures)

3.1 Introduction
3.2 Diagonalization of a Matrix
3.3 Difference Equations and Powers A^k
3.4 Differential Equations and e^{At}
3.5 Complex Matrices

3.6 Similarity Transformations

Unit 04: Symmetric Matrices (04 lectures)

4.1 Diagonalization of Symmetric Matrices
4.2 Quadratic Forms

Unit 05: The Geometry of Vector Spaces (06 lectures)

5.1 Affine Combinations
5.2 Affine Independence
5.3 Convex Combinations

Text Book: Gilbert Strang, Linear Algebra and its applications (4^{th} Edition).

Unit 1: Section 2.1 to 2.6
Unit 2: Section 3.1 to 3.5
Unit 3: Section 5.1 to 5.6

Text Book: David C. Lay, Linear Algebra and its Applications, MacDonald Pearson Publication Fourth Edition.

Unit 4: Section 7.1, 7.2
Unit 5: Section 8.1 to 8.3

Reference Books:

1. Howard Anton and others , Elementary Linear Algebra with supplemental Applications , Wiley Student Edition.
2. KantiBhushan Datta , Matrix and Linear Algebra (aided with MATLAB) , Eastern Economic Edition.
3. Devi Prasad , Elementary Linear Algebra , Narosa , Third Edition.

Class : F.Y. B. Sc. (Computer Science) (Semester- II)
Course Code: UCSMT123

Paper : III
Title of Course: Practical based on UCSMT121 & UCSMT122
Credit : 2 No. of lectures: 48

A) Learning Objectives:

- Problem solving ability and understanding applications of discrete mathematics.
- Solve system of linear equation using multiple methods.
- To build the necessary skill set and analytical abilities for developing computer based solutions using mathematical concepts.

B) Learning Outcome:

- Lead students to apply these mathematical concepts in the study of computer science
- Students are able to apply logical reasoning to solve a variety of problems.

Title of Experiments:

Discrete Mathematics:

1. Problems on Logic.
2. Problems on Lattices and Relation.
3. Problems on Counting Principles.
4. Problems on Recurrence Relation.
5. Problems on Logic and Lattices using maxima software.
6. Problems on Counting Principles and Recurrence Relations using maxima software.

Linear Algebra:

1. Problems on Vector Spaces
2. Problems on Eigen Values and Eigen Vectors
3. Problems on Orthogonality and Symmetric Matrices
4. Problems on The Geometry of vector spaces
5. Problems on Vector Spaces, Eigen Values and Eigen Vectors on Maxima Software.
6. Problems on Orthogonality, Symmetric Matrices and Geometry of Vector Spaces using Maxima Software.