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	Paper Code	Title of Paper	No. of Credits
I	CSMT1101	Graph Theory	2
	CSMT1102	Algebra	2
	CSMT1103	Mathematics Practical based on CSMT1101 & CSMT1102	2
II	CSMT1201	Discrete Mathematics	2
	CSMT1202	Calculus	2
	CSMT1203	Mathematics Practical based on CSMT1201 & CSMT1202	2

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

Semester	Paper Code	Title of Paper	No. of Credits
III	CSMT2301	Linear Algebra	3
	CSMT2302	Numerical Analysis	3
	CSMT2303	Mathematics Practical I	2
IV	CSMT2401	Computational Geometry	3
	CSMT2402	Operations Research	3
	CSMT2403	Mathematics Practical II	2

SYLLABUS (CBCS) FOR F. Y. B. Sc.(COMPUTER SCIENCE)
MATHEMATICS
(w.e.f. June, 2019)

Academic Year 2019-2020

Class : F.Y. B. Sc.(Computer Science) (Semester- I)
Paper Code: CSMT1101

Paper : I **Title of Paper** : Graph Theory
Credit : 2 **No. of lectures:** 36

A) Learning Objectives:

- To introduce graphs, their types and properties
- To understand applications of graph theory in Computer science
- To build the necessary skill set and analytical abilities for developing computer based solutions using mathematical concepts

B) Learning Outcome:
Understanding of algorithms and applications to computer science

TOPICS/CONTENTS:

Unit 01: An Introduction to Graphs (12 lectures)

1.1 Definition of a Graph.
1.2 Graphs as a model
1.3 More definitions
1.4 Vertex Degrees
1.5 Subgraphs
1.6 Paths and Cycles
1.7 The Matrix Representation of Graphs
1.8 Fusion

Unit 02: Trees and Connectivity (12 lectures)

2.1 Definitions and Simple Properties
2.2 Bridges
2.3 Spanning Trees
2.4 Connector Problems
2.5 Shortest Path Problems
2.6 Cut Vertices and Connectivity

Unit 03: Euler Tours and Hamiltonian Cycles (7 lectures)

3.1 Euler Tours
3.2 The Chinese Postman Problem
3.3 Hamiltonian Graphs
3.4 Travelling Salesman Problem

Unit 04: Directed Graphs and Networks (5 lectures)

4.1 Definitions
4.2 Indegree and Outdegree
4.3 Flow and Cuts
4.4 Applications to Computer Science

Text Book:

John Clark and Derek Holtan , A First Look at Graph Theory, Allied Publishers
(Chapters: 1, 2, 3, 7 and 8)

Reference Books:

1. Kenneth Rosen, Discrete Mathematics and It's Applications,Tata McGraw Hill.
2. Narsingh Deo, Graph Theory with Application to Computer Science and Engineerng,Prentice Hall.

Class **:** F.Y. B. Sc.(Computer Science) (Semester- I)

Paper Code: CSMT1102

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

A) Learning Objectives:

- To understand properties and operations on sets and functions
- To understand basic concepts of groups, integers, matrices

B) Learning Outcome:

Improves problem solving ability and understanding of different algebraic structures in Mathematics

TOPICS/CONTENTS:

Unit 01:Set and Functions (5 lectures)

1.1 Definition of set, operations on sets, power set, Cartesian product of sets.

1.2 Definition of Function, Domain, Co-domain and the range of function, Injective, surjective and bijective functions, Composite function, invertible function.

Unit 02: Binary Operations and Groups (13 lectures)

2.1 Definition of binary operation, examples, properties of binary operation.

2.2 Definition of Monoid, semi group, examples.

2.3 Definition of Group and examples, subgroups, finite and infinite groups, cyclic groups.

2.4 Applications to Computer Science.

Unit 03: Integers (9 lectures)

3.1 Well ordering principle.

3.2 First and Second Principle of Mathematical Induction ,Examples.

3.3 Division Algorithm (Without Proof)

3.4 Divisibility and its Properties, prime numbers.

3.5 Definition G.C.D and L.C.M , Expressing G.C.D. of two integers as a linear combination of the two integers.

3.6 Euclidean Algorithm (Without Proof)

3.7 Relatively prime integers , Euclid Lemma and its generalization.

3.8 Congruence relations and its properties, Residue Classes: Definition, Examples, addition and multiplication modulo n and composition tables.

3.9 Euler's and Fermat's Theorems.(Without Proof). Examples.

3.10 Applications to Computer Science.

Unit 04: Matrices and System of linear Equations (9 lectures)

4.1 Revision: Elementary operations on matrices.

4.2 Echelon form of matrix.

4.3 System of linear Equations:

4.4 Gauss Elimination Method,
Gauss Jordan Elimination Method,
L.U. Decompositions Method.

4.5 Rank of matrix, Row rank, Column rank.

4.6 Applications to Computer Science.

Text Books: Unit 01: Set & Functions (Kenneth Rosen, Discrete Mathematics and It's Applications,Tata McGraw Hill).**Section : 2.1 to 2.3**

Unit 02: Binary Operations and Groups(J. B. Fraleigh, A. First Course in Abstract . Algebra,Third Ed., Narasa, New Delhi 1990).**Chapter 1 .Section : 1,2,4,5,6.**

Unit 03: Integers (David M. Burton,Elementary Number Theory**) Section: 1.1,2.1 to 2.4 , . 4.2,5.2,7.2,7.3**

Unit 04: Matrices and System of linear Equations(Kwak & Hong ,Linear Algebra**) . .. Section: 1.1 to 1.4 ,1.6 to 1.9** .

Reference Books:

1. 1. Discrete Mathematics Structure- Bernard Kolman, Robert Busby, Sharon Culter Ross, Nadeem-ur-Rehman , Pearson Education, 5th Edition.
2. Elements of Discrete Mathematics – C. L. Liu, Tata McGraw Hill.
3. J. B. Fraleigh, A. First Course in Abstract Algebra, 7th Edition,Pearson
4. H. Anton, C. Rorres, Elementary linear algebra with applications, Wiley 7th
   i. Edition,1994.

Class : F.Y. B. Sc.(Computer Science) (Semester- I)

Paper Code: CSMT1103

Paper : III **Title of Paper :** Practical based on CSMT1101 & CSMT1102

Credit : 2 **No. of lectures:** 48

A) Learning Objectives:

- Problem solving ability and understanding applications of Graph Theory
- Improve skills to handle abstract algebraic structures such as integers, groups

B) Learning Outcome:

Lead students to apply these mathematical concepts in the study of computer science

Title of Experiments:

Graph Theory:

1. Graphs and Operations on Graphs.
2. Connected Graphs.
3. Eulerian and Hamiltonian Graphs.
4. Trees.

5. Directed Graphs.
6. Miscellaneous

Algebra:

1. Relations and functions.
2. Binary Operations
3. Groups
4. Divisibility and Congruence
5. Matrices and System of linear Equations
6. Miscellaneous

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

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	CSMT2402	Operations Research	3
	CSMT2403	Mathematics Practical II	2

SYLLABUS (CBCS) FOR F. Y. B. Sc.(COMPUTER SCIENCE)
MATHEMATICS
(w.e.f. June, 2019)

Academic Year 2019-2020

Class : F.Y. B. Sc.(Computer Science) (Semester- II)
Paper Code: CSMT1201

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

A) Learning Objectives:

- To understand concepts of Lattices, Boolean algebra, Recurrence relation
- Use of discrete mathematics in computer science

B) Learning Outcome:

Express logic sentences in terms of predicates, quantifiers and also evaluate Boolean functions and simplify expression using Boolean algebra

Topics/Contents

Unit 1: Relation and Digraph [9 Lectures]

1.1 Ordered pairs, Cartesian Product of sets.
1.2 Relation, types of relation, equivalence relation, Partial Ordering.
1.3 Equivalence Class, properties and Partition of a set.
1.4 Transitive Closure and Warshall's Algorithm.
1.5 Digraphs of relations ,matrix representation and composition of relations.
1.6 Applications to Computer Science.

Unit 2:Logic [5 Lectures]

2.1 Revision: Propositional Logic, Propositional Equivalences.
2.2 Predicates and Quantifiers: predicate, n-place predicate or n-ary predicate, Quantifications
and Quantifiers, Universal Quantifier, Existential Quantifier, Quantifiers withrestricted domain, Logical Equivalences involving Quantifiers.
2.3 Rules of Inference : Argument in propositional Logic, Validity Argument (Direct and Indirect Methods) Rules of Inference for propositional Logic ,Building Arguments.
2.4 Applications to Computer Science.

Unit 3:Lattices and Boolean Algebra [5 Lectures]

3.1 Poset, Hasse diagram.
3.2 Lattices, Complemented Lattice, Bounded Lattice and Distributive Lattice.
3.3Boolean functions: Introductions, Boolean variable, Boolean function of degree n, Boolean
identities, Definitions of Boolean algebra.

3.4Representations of Boolean functions: Minterm, Maxterm, Disjunctive normal form, Conjunctive normal form.
3.5 Applications to Computer Science.

Unit 4:Recurrence Relations [9 Lectures]

4.1 Recurrence Relations: Introduction, Formation
4.2 Linear Recurrence Relations with constant coefficients.
4.3 Homogeneous solutions
4.4 Particular solutions.
4.5 Total solutions.
4.6 Applications to Computer Science.

Unit 5: Counting Principles [8 Lectures]
5.1 Cardinality of Sets: Cardinality of finite Sets.
5.2 Basics of Counting:The Product Rule, The Sum rule, The Inclusion-Exclusion Principle.
5.3 Generalized Permutations and Combinations.
5.4 Applications to Computer Science.

Text Book:

Kenneth Rosen, Discrete Mathematics and its applications, McGraw Hill Education Pvt. Ltd. (7^{th} Edition)
Chapter – 1, 5, 6, 7, 10.

Reference Books:

1. Discrete Mathematics Structure- Bernard Kolman, Robert Busby, Sharon Culter Ross, Nadeem-ur-Rehman , Pearson Education, 5^{th} Edition.
2. Elements of Discrete Mathematics – C. L. Liu, Tata McGraw Hill.

Class : F.Y. B. Sc.(Computer Science) (Semester- II)
Paper Code: CSMT1202

Paper : II**Title of Paper :**Calculus
Credit : 2 **No. of lectures:** 36

A) Learning Objectives:

- To introduce concepts of limit, continuity, differentiation
- To understand the behaviour of functions increasing, decreasing, concave up, concave down ,which is crucial in many practical situation

B) Learning Outcome:

Understanding of limit concepts and functions properties and their applications

Topics/Contents

Unit 1:Continuity and Differentiability [12 Lectures]

1.1 Continuity and Properties of Continuous functions defined on [a, b] (Without Proof) and Examples.
1.2 Differentiability
1.3 Theorem- Differentiability implies continuity but not conversely. Left hand derivative and
Right hand derivative.
1.4 Intermediate value theorem (Without Proof).
1.5 Rolle's theorem (With Proof and Geometric interpretation)
1.6 Lagrange's Mean Value Theorem (With Proof and Geometric interpretation)
1.7 Cauchy's Mean Value Theorem (With Proof) Verification and Application.
1.8 L' Hospital Rule (Without Proof)

Unit 2: Successive Differentiation [6 Lectures]
2.1 The n^{th} derivative of standard functions
2.2 Leibnitz's Theorem (Without Proof)
2.3 Applications to Computer Science.

Unit 3:Taylor's and Maclaurin's Theorems [8 Lectures]
3.1 Taylor's and Maclaurin's Theorems with Lagrange's and Cauchy's form of remainders (Without Proof)
3.2 Taylor's and Maclaurin's Series.
3.3 Applications to Computer Science.

Unit 4:Differential Equation. [10 Lectures]
4.1 Basic Concepts : Introduction, Definition, Directions fields.

4.2 First Order Differential Equation: Linear Differential Equation, separable Differential Equation, Exact Differential Equation, BernoulliDifferential Equation.
4.3 Applications to Computer Science.

Text Books:

1. Shanti Narayan, Mittal, Differential Calculus, S. Chand and Company Ltd, 1998.
   Chapters – 3, 4, 5.
2. G. F. Simmons, Differential Equations with applications and Historical Notes, Tata Mc-Graw Hill (Second Edition)
   Chapter – 2.

Reference Books:

1. Calculus and Analytical Geometry, Thomas Finny.
2. Differential Equations with Applications and Historical notes, George Simmons.

Class :F.Y. B. Sc.(Computer Science) (Semester- II)
Paper Code: CSMT1203
Paper :III **Title of Paper :** Practical based on CSMT1201 & CSMT1202
Credit :2 **No. of lectures:** 48

A) Learning Objectives:

- Problem solving ability and understanding of applications of Discrete mathematics
- Problem solving and understanding of concepts in Calculus such as limit, continuity and differentiation

B) Learning Outcome:

Lead students to apply these mathematical concepts in the study of computer science

Title of Experiments:

Discrete Mathematics:

1 Relations and digraphs
2 Logic
3 Lattices and Boolean Algebra
4 Recurrence Relation
5 Counting Principles
6 Discrete Mathematics using Maxima software
7 Miscellaneous

Calculus:

1 Continuity
2 Differentiability
3 Successive Differentiation
4 Taylors Series
5 Differential Equations
6 Calculus using Maxima Software
7 Miscellaneous