Progressive Education Society's

Modern college of Arts, Science and Commerce,

Ganeshkhind,Pune-16

Autonomous

NEP 2020 (2)

(Under Faculty of Science and Technology)

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

Choice Based Credit System Syllabus
To be implemented from Academic Year 2024-2025

Page 1

Title of the Course : B.Sc. Mathematics (Computer Science)

Aims:

(i) Provide the students with sufficient knowledge as well as advanced principles of the Mathematics subject which forms the base for computer science.
(ii) Develop the skills of solving, interpreting and modeling using various mathematical tools for further study in science and technology.
(iii) Enhancing the skills of problem solving, thinking ability, abstract thinking, study of applications of the subject, to make the students competent for various kinds of employment opportunities.
(iv) Generate great interest and positive attitude towards mathematics and make students aware about its importance in various fields.

Objectives:

(i) A student should be able to recall basic facts about mathematics and shouldbe able to display knowledge of conventions such as notations, terminology and recognize basic geometrical figures and graphical displays , state important facts resulting from their studies.
(ii) A student should get a relational understanding of mathematical conceptsand concerned structures, and should be able to follow the patterns involved, mathematical reasoning.
(iii) A student should get adequate exposure to global and local concerns thatexplore them many aspects of Mathematical Sciences.
(iv) A student be able to apply their skills and knowledge ,that is, translateinformation presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
(v) A student should be made aware of history of mathematics and hence of itspast, present and future role as part of our culture.

Structure of the course:-

Semester - I	Semester - II	Credits
Discrete Mathematics	Graph Theory	2
Practical based on Discrete Mathematics	Practical based on Graph Theory	2

Semester - I

Detailed Syllabus

Name of the Paper : Discrete Mathematics (Theory).
Paper Code : 24CMAT11101
Total No. of Credits : 2 **Total No. of lectures : 30**

Course Learning Outcomes	
CO1	The logical thinking of student will be developed.
CO2	Student will be able to apply mathematical foundations to design computer based algorithms.
CO3	Enhancement in the ability of student to develop algorithms.
CO4	Student will be able to translate the presented information in mathematical form and draw the relevant conclusion using his mathematical knowledge.
CO5	Help in solving a very wide variety of practical problems.

Course Contents

Unit 1 : Logic [6 Lectures]

1.1 Revision : Propositional Logic, Propositional Equivalences.
1.2 Rules of Inference : Argument in propositional Logic, Validity Argument(Direct and Indirect methods) Rules of Inference for Propositional Logic, Building Arguments.
1.3 Predicates and Quantifiers : Predicate, n-Place Predicate or ,n-ary Predicate,

1.4 Quantification and Quantifiers, Universal Quantifier, Existential Quantifier, Quantifiers with restricted domains, Logical Equivalences involving Quantifiers.

Unit 2 : Lattices and Boolean Algebra [10 Lectures]

2.1 Relations, types of relations, equivalence relations, Partial ordering relations
2.2 Digraphs of relations, matrix representation and composition of relations.
2.3 Transitive closure and Warshall's Algorithm
2.3 Poset, Hasse diagram.
2.4 Lattices, Complemented lattice, Bounded lattice and Distributive lattice.
2.5 Boolean Functions : Introduction, Boolean variable, Boolean Function of degree n, Boolean identities, Definition of Boolean Algebra.
2.6 Representation of Boolean Functions : Minterm, Maxterm Disjunctive normal form, Conjunctive normal Form.

Unit 3 : Counting Principles [7 Lectures]

3.1 Cardinality of Set : Cardinality of a finite set.
3.2 Basics of Counting : The Product Rule, The Sum Rule, The Inclusion- Exclusion Principle.
3.3 The Pigeonhole Principle: Statement, the Generalized Pigeonhole Principle,Its Applications.
3.4 Generalized Permutations and Combinations : Permutation and
3.5 Combination with Repetitions, Permutations with Indistinguishable Objects

Unit 4: Recurrence Relations [7 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.

TextBooks:

1. Discrete Mathematics and its applications, by Kenneth Rosen, Tata McGraw Hill, Seventh Edition.
2. Discrete Mathematical Structures, by Kolman, Busby, Ross, Rehman, Prentice Hall,
3. Elements of Discrete Mathematics, by C. L. Liu, Tata McGraw Hill,

Unit 1: Text Book 1: Chapter 1: Sec. 1.1, 1.2, 1.3, 1.4, 1.5

Unit 2: Text Book 2: Chapter 6: Sec. 6.1, 6.2, 6.3, 6.4, 6.5
Unit 3: Text Book 1: Chapter 2: Sec. 2.1, Chapter 5: Sec.5.1, 5.2, 5.3
Unit 4: Text Book 3: Chapter 10: Sec. 10.1, 10.2, 10.3, 10.4, 10.5, 10.6

Name of the Paper : Practical based on Discrete Mathematics (Practical).
Paper Code : 24CMAT11102
Total No. of Credits : 2 **Total No. of Practical : 15**

List of Practical

Practical 1 : Problems on Unit 1 (Written)

Practical 2 : Problems on Unit 1 (Written)
Practical 3 : Problems on Unit 1 (Written)
Practical 4 : Problems on Unit 2 (Written)
Practical 5 : Problems on Unit 2 (Written)
Practical 6 : Problems on Unit 2 (Written)
Practical 7 : Problems on Unit 3 (Written)
Practical 8 : Problems on Unit 3 (Written)
Practical 9 : Problems on Unit 3 (Written)
Practical 10: Problems on Unit 4 (Written)
Practical 11 : Problems on Unit 4 (Written)
Practical 12 : Problems on Unit 4 (Written)
Practical 13 : Miscellaneous (Written)
Practical 14 : Miscellaneous (Written)
Practical 15 : Miscellaneous (Written)

Semester-II

Name of the Paper : Graph Theory (Theory).
Paper Code : 24CMAT12101
Total No. of Credits : 2 **Total No. of lectures : 30**

Course Learning Outcomes	
CO1	Able to work with graphs and identify certain parameters.
CO2	Develop the skill of converting mathematical problem graphically and vice-versa.
CO3	Motivates to solve real life problems.
CO4	Develop suitable techniques of analysis of problems.
CO5	Enable students to develop a positive attitude towards mathematics as an interesting and valuable subject to study.

Course Contents

Unit 1: Graphs: Introduction and operations. [10 lectures]

1.1. Definitions, Graph models, Handshaking lemma

1.2. Special types of graphs, properties and examples, directed graphs, types of digraphs
1.3. Matrix representation (Adjacency and Incidence matrix) and elementary results, Isomorphism of graphs.
1.4. Subgraph, vertex induced subgraph, edge induced subgraph, vertex deleted subgraph, edge deleted subgraph
1.5. Union, intersection and ring sum of two graphs, Fusion of two vertices, complement of a graph.
1.6. Isomorphism of graphs, self complementary graph

Unit 2: Connected graph [10 lectures]

2.1. Walk, trail, path, cycle, elementary properties of connectedness.

2.2. Center radius and dimeter of a graph
2.3. Cut edge (Bridge), Cut vertex, cut set, vertex connectivity, edge connectivity, and properties.
2.4. Shortest path problem, Dijkstra's algorithm.

2.5. Euler trail, path, circuit and tour, elementaryproperties and Fleury's algorithm.
2.6. Hamilton path, circuit, elementary properties and examples.

Unit 3. Trees [10 lectures]

3.1 Definitions, basic terminologies, properties and applications of trees.
3.2 Weighted graph, definition and properties of spanning tree, shortest spanning tree, Kruskal's algorithm.

3.3 M-ary tree, binary tree, definitions and properties, tree traversal: preorder, inorder, postorder, infix, prefix, postfix notations and examples.

Reference Books:

1. Narsingh Deo, Graph Theory with applications to computer science and engineering, Prentice Hall.
2. Kenneth Rosen, Discrete Mathematics and its applications, Tata McGraw Hill,Seventh Edition.
3. John Clark and Derek Holton, A first look at Graph theory, Allied Publishers.
4. Frank Harary , Graph Theory

Name of the Paper : Practical based on Graph Theory (Practical).
Paper Code : 24CMAT12102
Total No. of Credits : 2 Total No. of Practical : 15

List of Practical

Practical 1 : Problems on Unit 1 (Written)
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Practical 10 : Problems on Unit 4 (Written)
Practical 11 : Problems on Unit 4 (Written)
Practical 12 : Miscellaneous (Written)
Practical 13 : Miscellaneous (Written)
Practical 14 : Miscellaneous (Written)
Practical 15 : Miscellaneous (Written)

Modalities for conducting practical and practical Examination:

1) There will be 4 hour practical session per 15 students batch per week.
2) A question bank consisting of 50 problems in all for each semester, will be the course work for this paper. Question bank will be prepared by the individual subject teacher and the problems included should be changed every year.
3) Each student will maintain a journal to be provided by the college.
4) The internal 20 marks will be given on the basis of journal prepared by student and the cumulative performance of student at practical.
5) Written examination will be of 30 marks.
6) The pattern for the practical written examination will be as follows:

   - **Solve any 6 questions out of 10 questions.**
   - **Each question will be of 5 marks.**

7) Study tours may be arranged at places having important mathematical institutes or historical places.

Special Instruction:

a) Before starting each practical necessary introduction, basic definitions and prerequisites must be discussed.

b) Examiners should set separate question papers, solutions and scheme of marking for each batch and claim the remuneration as per rule.