Department of Mathematics, Central University of Jammu

Ist Sem M A/M Sc Applied Mathematics

Lecture-wise teaching plan

Course Code: MAMT-102 **Course title:** Discrete Mathematics

Course Instructor: Dr. Pavinder Singh

Lecture 1

Function: Definition, Examples, Types of function, functions on a finite set

Lecture 2

Pigeonhole Priciple(weak form) and some of its applications

Lecture 3

Pigeonhole Principle(strong form) and some of its applications

Lecture 4

Recurrence relations: Definition, Examples, Types and order of recurrence relation, Problems based on these topics

Lecture 5

Homogeneous recurrence relations with constant coefficients and their solutions,

Lecture 6

Fibonacci sequence: Definition and its solutions, Problems on Homogeneous recurrence relations with constant coefficients

Lecture 7

Partial Order relation: Definition, Examples, Chains, Antichains, Dilworth's theorem, Problems based on these topics

Lecture 8

Equivalence Relation: Definition, Examples, Fundamental theorem of an equivalence relation, Problems based on these topics

Lecture 9

Lattice: Definition and Examples, Join and Meet, Algebraic system defined by a lattice, Problems based on these topics

Lecture 10

Principle of Duality, Properties of an algebraic system defined by lattice, Problems based on these topics

Lecture 11

Distributive and Complemented Lattices: Definition and Examples, Universal lower bound and upper bound, Problems based on these topics

Lecture 12

Boolean Lattice and Boolean algebra: Definition and Examples, DeMorgan's laws, Problems based on these topics

Lecture 13

Some identities in Boolean Algebras, Uniqueness of finite Boolean Algebras,

Lecture 14

Boolean Functions and Boolean Expressions: Definition and Examples, Normal forms: Conjunctive and Disjunctive normal forms, Problems based on these topics

Lecture 15

Propositional Calculus, Design and Implementaion of Digital Networks, Problems based on these topics

Lecture 16

Switching Circuits, Problems based on these topics

Lecture 17

Graph: Definition and Examples, Representation of a graph, degree of a vertex, Subgraph, Problems based on these topics

Lecture 18

Basic Properties of Graphs, Isomorphic Graphs, Problems based on these topics

Lecture 19

Walk, Open and closed walk, Path, Cycle, Components of a graph, Problems based on these topics

Lecture 20

Konigsberg bridge problem, Euler's Graph, Classification of Euler's graphs, Problems based on these topics

Lecture 21

Hamiltonian Paths and Cycles, Examples, Existence of Hamiltonian cycle, Problems based on these topics

Lecture 22

Bipartite Graphs: Definition and Examples, $\mathcal{K}_{m,n}$ complete bipatite graph of order (m, n), Problems based on these topics

Lecture 23

Properties of Bipartite graphs, Marriage Problem, Problems based on these topics

Lecture 24

Marriage Theorem and some of its consequences

Lecture 25

Tree: Definition and Examples, Basic Properties of trees, Exercises based on these topics

Lecture 26

Spanning Tree of a graph: Definition and Examples, Existence of spanning tree, Properties of a spanning tree, Problems based on these topics

Lecture 27

Weighted graph, Minimal spanning tree in a weighted graph, Kruskal's algorithm to find a minimum-weight spanning tree

Lecture 28

Rooted Trees, Binary rooted tree, Examples and its proprties, Exercises based on these topics Algorithms to grow spanning tree

Lecture 29

Algorithms to grow spanning trees rooted at a vertex: BFS and DFS algorithms, Exercises

based on these topics

Lecture 30

Planar Graphs: Definition, Examples and its Properties

Lecture 31

Euler's formula and its consequences, Exercises based on these topics

Lecture 32

Kuratowski's two graphs $\mathcal{K}_5$ and $\mathcal{K}_{3,3}$, Classification of planar graphs

Lecture 33

Graph Colouring: chromatic number, Examples, Bounds for chromatic number, Exercises based on these topics

Lecture 34

classification of $\mathcal{K}_n$ and bipattite graphs in terms of chromatic number.

Lecture 35 Greedy Algorithm for Graph colouring, Four colour conjecture, Exercises based on these topics

Lecture 36

Directed Graphs: Definition, Examples and its properties, Directed Hamitonian path and cycle, Tournament

Lecture 37

Existence of Hamiltonian path in a tournament, Trading Problem, Core allocation

Lecture 38

Existence of core allocation for trading problem

Lecture 39

Network: Network Flow, Value of the flow, cut and capacity of a cut, Some basic results about network flow

Lecture 40

Max-flow and min-cut theorem

Textbooks:

1. R A Brualdi, Introductory Combinatorics, 5th Edition, Prentice Hall.

2. C L Liu and D P Mohapatra; Elements of Discrete Mathematics, McGraw Hill, 1985.

Reference Books:

1. S M Cioaba and M Ram Murty, A first Course in Graph Theory, Trim series, Hindustan Book Agency.

2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, PHI, New Delhi, 2011.

3. Tremblay and Manohar, Discrete Mathematics Structures with applications to Computer Science, McGraw Hill, 1985.