BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI

INSTRUCTION DIVISION

FIRST SEMESTER 2018-2019

COURSE HANDOUT(PART-II)

Date: 02/08/2018

In addition to Part-I (General Handout for all courses appended to the Timetable) this portion gives further specific details regarding the course.

Course No.	**:** CS F222
Course Title	**:** Discrete Structures for Computer Science
Instructor In Charge	**: NAVNEET GOYAL (goel@)**
Instructor	**:Ashutosh Bhatia (ashustosh.bhatia@)**

2. SCOPE & OBJECTIVE:

To develop logical and mathematical concepts necessary to appreciate computational systems. & study of concepts, techniques, and skills necessary to comprehend the structure of problems encountered in design and analysis of algorithms. To provide mathematical foundations for courses in computer science that rely upon the comprehension of formal abstract concepts. To study recursion and to write recursive definitions for certain sequences and collections of objects. Graphs, directed graphs, planar graphs & their relevance to circuit design & map coloring problems. Trees and their applications. Basic algebraic structures and their applications.

3. TEXT BOOK:

Mott, Kandel, &Baker : Discrete Mathematics for Computer Scientists & Mathematicians , PHI, 2e, 2002.

4. REFERENCE BOOKS:

R1. K H Rosen:Discrete Mathematics & its Applications, TMH, 7e, 2011.

R2. Douglas West: Introduction to Graph Theory, Pearson, 2e, 2001.

S.No	Topic	Sub-Topics	Description	Ref.	Lecture #
1.	Overview	Course Overview and Introduction	• Introduction • Importance of Discrete Structures		1-2
2.	Induction and Recursion	Induction	• Mathematical Induction • Using mathematical induction to prove the theorems or statements • Strong induction and well ordering	Ch.1 (1.8, 1.10) R1: Ch. 4.1, Ch. 4.2	3-4
		Recursion	• Recursive or Inductive definitions of functions, sets, and structures • Structural induction, proofs using structural induction • Problem solving using Recursion • Recursive Algorithms • Recursion vs Iteration	R1: Ch. 4 (4.3, 4.4)	5-7
3.	Relations	Properties of Relations	• Mathematical definitions of relations • n-ary relations • Properties: reflexive, symmetric, transitive, antisymmetric, and asymmetric • Operations on Relations	Ch.4 (4.1, 4.2, 4.5) R1: Ch. 7 (7.1, 7.2)	8-9
		Representing Relations	• Matrices • Diagraphs	Ch. 4.7 R1: Ch. 7.3	10-11
		Closures of Relations	• Reflexive, Symmetric, and Transitive closures • Warshall's Algorithm	Ch. 4.6 R1: Ch. 7.4	12-14
		Equivalence Classes and Partial Ordering	• Equivalence Relations and Classes • Partial Ordering Relations • Hasse Diagram	Ch. 4 (4.3, 4.4) R1: Ch. 7.3	15-18
4.	Graphs	Introduction to Graph Theory	• Basic Concepts • Special Graphs • Elementary Theorems on Graphs • Graph Representation: Adjacency & Incidence Matrices • Problem modeling	Ch. 5.1 R1: Ch.8 (8.1, 8.2, 8.3)	19-20
		Graph Isomorphism and Connectivity	• Path and Cycles • Isomorphism in Graphs • Connected graphs, connected components, cut-vertices, and cut-edges	Ch. 5 (5.1, 5.2) R1: Ch. 8 (8.3, 8.4)	21-25

			• Applications		
		Euler and Hamiltonian Graphs	• Definitions, Conditions (necessary and sufficient) for existence of Euler path and Hamiltonian cycles	Ch. 5 (5.9, 5.10) R1: Ch. 8.5	26-27
		Planar Graphs and Graph Coloring	• Planar Graphs, Euler formula for planer graphs, characterization of planar graphs, • Graph Coloring: Vertex and Edge coloring, Chromatic graphs chromatic number. Basic bounds on chromatic number. Five color theorem • Applications of Graph planarity • Applications of graph coloring	Ch. 5 (5.7, 5.11) R1: Ch. 8 (8.7, 8.8)	28-31
		Matching	• Matching and Covering in Bi-partite graph, Perfect Matching, • Applications	R2. Ch. 3	32-33
		Graph Algorithms	• Graph Traversal: BFS, DFS • Spanning Tree: Prim, Kruskal • Shortest Path: Dijkstra, Bellman Ford	R1: Ch. 8.6	34-36
5.	Trees	Introduction	• Introduction, Application, Terminology and Theorems, Tree Traversal Algorithms	Ch. 5.3 R1: Ch. 9.1	37-38
		Spanning Trees	• Spanning and Minimum Spanning Tree	Ch. 5.4 R1: Ch. 9.4	39
6.	Algebraic Structures	Introduction to Algebraic Structures	• The structure of algebra, Types of algebraic systems: Semi-group, monoid, group, generator of a group • Rings, Fields, & Vector Spaces	R1: Ch. 11 (11.1, 11.2, 11.3, 11.4, 11.5)	40-42

EVALUATION SCHEME:

Component	Duration	Weightage (%)	Date & Time	Remarks
Midsem Test	90 mins.	30	10/10 4:00 - 5:30 PM	CB
Quiz + Modelling Problem	45mins.	15+15	13/09(Th. 2) 25/10(Th.2)	CB
Comprehensive	3 hours	40	5/12 AN	Partly Open

7. CHAMBER CONSULTATION HOUR: Sec. 1 (MW 5.45 - 6.30 PM), Sec. 2 (MWF 5.00 – 5.45 PM)

8. MAKE-UP Policy: Prior permission needed for make-up.

9. NOTICES: All notices related to the course will be put up on NALANDA.

Instructor–in-charge