TECNIA INSTITUTE OF ADVANCED STUDIES

NAAC GRADE "A" INSTITUTE (CYCLE-2)

Approved by AICTE, Ministry of Education Govt. of India,

Affiliated to G.G.S.I.P. University & Recognized Under Sec. 2(f) of UGC Act 1956.

INSTITUTIONAL AREA, MADHUBAN CHOWK, ROHINI, DELHI-110085

COURSE PLAN

#AS PER BCA SCHEME & SYLLABUS 2024-2025 ONWARDS GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY, NEW DELHI.

Prog. Code:	020	Prog.:	Bachelor of Computer A	Session:	2025-26	L	4	T/P	0	Credits	4					
Course Code:	BCA-205T	Course Name:	Computer Organization	Faculty	Mr Sukant Vats	Type:	Core									

LEARNING OBJECTIVES:

PREREQUISITE: Fundamentals of Computer.

Course Outcome & Mapping, Course Articulation

				Disciplinary Knowledge: Apply the knowledge of computer application concepts and domain knowledge to solve the problems in IT domain/IT industry	Problem Analysis: Identify, formulate, review research literature, and analyse complex computer application problem at their workplace and for the society.	Design /Development of Solutions:Design and evaluate solutions for computer applications problems, and design the processes that meet specified needs with appropriate consideration for the public health, safety, cultural, societal, and environmental considerations.	Modern Tool Usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computer application activities, with an understanding of the limitations.	Professional Ethics: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.	Life-long Learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.	Project management and finance: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	Communication Efficacy with Cooperation/teamwork Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations	Societal and Environmental Concern: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices	Innovation and Entrepreneurship Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.			
				PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
		CO1	Able to understand the fundamentals of digital principles and able to design digital circuits by simplifying the Boolean functions.	4	4	4	3	-	3	-	-	-	3			
		CO2	Implement the combinational and sequential circuits for the given specifications	4	4	4	3	-	3	-	-	-	3			

Digitally Signed by Dr. Ajay Kumar
Organization: TECNIA INSTITUTE OF ADVANCED STUDIES
Date: 2026.10.24 13:02:42
Reason: Approve this document
Location: New Delhi

		CO3	**Able to trace the execution sequence of an instruction through the processor**	4	4	3	2	-	3	-	-	-	1			
		CO4	**Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os.**	4	3	3	2	-	3	-	-	-	1			
		CO5	**Demonstrate the ability to classify the addressing modes, instructions set**	4	3	3	2	-	3	-	-	-	1			
			Course Articulation (Average)	4	4	3	2		3				2			
S.No.	**Lecture No.**	**Unit**	**Topic**	**Sessional Outcome**	**Experiential Learning**	**Problem Solving Methodology**	**Participative Learning**	**Mode of Delivery**	**ICT Tools**	**Mapping with CO**	**Class Material + PPT**	**Additional Material**	**Pedagogical Approach**	**Mode of Assessment**	**Bloom's Taxonomy**	**References**
1	L1	1	Boolean Algebra	Explain Boolean concepts	Examples	Identify expressions	Discussion	Lecture	Logicly	CO1	Slides	Boolean Algebra Tutorial	Lecture Based Teaching	Assignment	L2 (Understand)	TB1
2	L2	1	Basic Laws	Apply laws	Practice	Simplification	Peer	Lecture	CircuitVerse	CO1	Notes	Boolean Laws and Theorems	Group Discussion and Collaborative Learning	Test	L3 (Apply)	TB2
3	L3	1	Logic Gates	Identify gates	Demo	Gate operations	Group	Lecture	DigiSim	CO1	PPT	Logic Gates Notes	Case Studies	Case Study	L2 (Understand)	TB2
4	L4	1	Tutorial	Solve problems	Practice	Debugging	Group	Tutorial	LogicDrawer	CO1	Notes	Digital Electronics Tutorials	Project Based Learning	Quiz	L3 (Apply)	TB1
5	L5	1	K-Map	Simplify expressions	Practice	Optimization	Peer	Lecture	Gate Lab	CO1	PPT	Karnaugh Map Tutorial	Blended Learning	Assignment	L3 (Apply)	RB2
6	L6	1	SOP	Apply SOP	Practice	Simplification	Group	Lecture	DeldSim	CO1	Notes	SOP and POS Forms	Industry Expert Session	Prsentation	L3 (Apply)	RB3
7	L7	1	POS	Apply POS	Practice	Simplification	Peer	Lecture	CircuitVerse	CO1	PPT	POS Form Tutorial	Practical / Hands-on Training	Quiz	L3 (Apply)	TB2
8	L8	1	Tutorial	Solve simplification	Practice	Debugging	Group	Tutorial	DigiSim	CO1	Notes	Don't Care Conditions in K-	Peer Teaching and Self Study	Assignment	L3 (Apply)	TB1
9	L9	1	Don't Care	Apply conditions	Practice	Optimization	Peer	Lecture	Gate Lab	CO1	PPT	Adder and Subtractor Circuits	Lecture Based Teaching	Test	L3 (Apply)	RB2
10	L10	1	Adders/Subtractors	Explain circuits	Demo	Circuit design	Group	Lecture	Logicly	CO1	Notes	Parallel Adder Tutorial	Group Discussion and Collaborative Learning	Quiz	L2 (Understand)	RB3
11	L11	1	Parallel Adder	Analyze circuits	Practice	Problem solving	Peer	Lecture	DigiSim	CO1	PPT	Multiplexer in Digital Electronics	Case Studies	Assignment	L3 (Apply)	TB2
12	L12	1	Tutorial	Solve circuits	Practice	Debugging	Group	Tutorial	CircuitVerse	CO1	Notes	Demultiplexer Tutorial	Project Based Learning	Test	L3 (Apply)	TB2
13	L13	1	Multiplexer	Explain MUX	Demo	Selection logic	Lecture	PPT	DeldSim	CO1	Slides	Encoder and Decoder	Blended Learning	Quiz	L2 (Understand)	TB1
14	L14	1	Demultiplexer	Apply DEMUX	Practice	Signal routing	Lab	PPT	Gate Lab	CO1	Notes	Latch Circuits	Industry Expert Session	Assignment	L3 (Apply)	RB2
15	L15	1	Encoder/Decoder	Analyze circuits	Demo	Conversion logic	Lecture	PPT	DigiSim	CO1	PPT	SR Flip-Flop Tutorial	Practical / Hands-on Training	Test	L4 (Analyze)	RB3
16	L16	1	Tutorial	Solve MUX/DEMUX	Practice	Debugging	Group	Tutorial	Logicly	CO1	Notes	JK and D Flip-Flop	Peer Teaching and Self Study	Quiz	L3 (Apply)	TB2

17	L17	2	Latch	Explain latch	Demo	State change	Lecture	PPT	CircuitVerse	CO2	Slides	Clocked Flip-Flops	Lecture Based Teaching	Assignment	L2 (Understand)	TB1
18	L18	2	SR Flip-Flop	Apply SR	Practice	Logic design	Lab	PPT	DeldSim	CO2	Notes	Race Around Condition	Group Discussion and Collaborative Learning	Test	L3 (Apply)	RB2
19	L19	2	JK, D Flip-Flop	Compare FF	Demo	Conversion	Lecture	PPT	DigiSim	CO2	PPT	Master Slave Flip-Flop	Case Studies	Quiz	L4 (Analyze)	TB1
20	L20	2	Tutorial	Solve FF	Practice	Debugging	Tutorial	PPT	Gate Lab	CO2	Notes	Flip-Flop Conversion	Project Based Learning	Assignment	L3 (Apply)	TB2
21	L21	2	Clocked FF	Explain clocking	Demo	Timing	Lecture	PPT	LogicDrawer	CO2	PPT	Applications of Flip-Flops	Blended Learning	Test	L2 (Understand)	TB2
22	L22	2	Clocked FF	Apply	Practice	Timing logic	Lab	PPT	CircuitVerse	CO2	Notes	Shift Registers	Industry Expert Session	Quiz	L3 (Apply)	TB1
23	L23	2	Race Condition	Analyze race	Demo	Problem solving	Lecture	PPT	DigiSim	CO2	PPT	Registers in Digital Logic	Practical / Hands-on Training	Assignment	L4 (Analyze)	RB2
24	L24	2	Tutorial	Solve FF	Practice	Debugging	Tutorial	PPT	Gate Lab	CO2	Notes	Bus Transfer and Registers	Peer Teaching and Self Study	Test	L3 (Apply)	RB3
25	L25	2	Master Slave FF	Explain	Demo	Design	Lecture	PPT	Logicly	CO2	PPT	Counters in Digital Logic	Lecture Based Teaching	Quiz	L2 (Understand)	TB2
26	L26	2	FF Realization	Implement	Coding	Logic	Lab	PPT	DeldSim	CO2	Notes	Register Operations	Group Discussion and Collaborative Learning	Assignment	L3 (Apply)	TB1
27	L27	2	FF Realization	Apply	Practice	Debugging	Lab	PPT	DigiSim	CO2	PPT	Micro Operations	Case Studies	Test	L3 (Apply)	RB2
28	L28	2	Tutorial	Solve problems	Practice	Debugging	Tutorial	PPT	Logicly	CO2	Notes	Bus and Memory Transfer	Project Based Learning	Quiz	L3 (Apply)	RB3
29	L29	2	FF Applications	Explain uses	Demo	Application	Lecture	PPT	CircuitVerse	CO2	PPT	Instruction Codes	Blended Learning	Assignment	L2 (Understand)	TB2
30	L30	2	Shift Registers	Apply registers	Practice	Data transfer	Lab	PPT	DigiSim	CO2	Notes	Computer Registers	Industry Expert Session	Test	L3 (Apply)	TB2
31	L31	3	Parallel Registers	Apply	Practice	Data transfer	Lab	PPT	LogicDrawer	CO2	PPT	Instruction Cycle	Lecture Based Teaching	Test	L3 (Apply)	TB1
32	L32	3	Bus Transfer	Explain bus	Demo	Data flow	Lecture	PPT	Gate Lab	CO2	Notes	Stack Organization	Group Discussion and Collaborative Learning	Assignment	L2 (Understand)	RB2
33	L33	3	Counters	Analyze counters	Practice	Counting logic	Lab	PPT	DeldSim	CO2	PPT	Instruction	Case Studies	Assignment	L3 (Apply)	RB3
34	L34	3	Tutorial	Solve counters	Practice	Debugging	Tutorial	PPT	CircuitVerse	CO2	Notes	Addressing Modes	Project Based Learning	Quiz	L3 (Apply)	TB1
35	L35	3	Register Operations	Explain register operations	Demo examples	Identify operations	Discussion	Lecture	DigiSim	CO3	Slides	Peripheral Devices	Blended Learning	Assignment	L2 (Understand)	TB2
36	L36	3	Micro-operations	Apply micro-operations	Practice	Operation design	Peer	Lecture+Lab	Gate Lab	CO3	Notes	I/O Interface	Industry Expert Session	Test	L3 (Apply)	TB2
37	L37	3	Bus & Memory Transfer	Analyze data transfer	Demo	Data movement logic	Group	Lecture	Logicly	CO3	PPT	I/O Operations Tutorial	Practical / Hands-on Training	Quiz	L4 (Analyze)	TB1
38	L38	3	Tutorial (Registers & Micro Ops)	Solve problems	Practice	Debugging	Group	Tutorial	DigiSim	CO3	Notes	Asynchronous Data Transfer	Peer Teaching and Self Study	Assignment	L3 (Apply)	RB2
39	L39	3	Instruction Codes	Explain instruction codes	Demo	Instruction decoding	Discussion	Lecture	CircuitVerse	CO3	Slides	Interrupts in Computer Organization	Lecture Based Teaching	Quiz	L2 (Understand)	RB3
40	L40	3	Computer Registers	Apply registers	Practice	Data handling	Peer	Lecture	DeldSim	CO3	Notes	Direct Memory Access (DMA)	Group Discussion and Collaborative Learning	Test	L3 (Apply)	TB2
41	L41	3	Instruction Cycle	Analyze cycle	Demo	Execution stages	Group	Lecture	Gate Lab	CO3	PPT	Main Memory Basics	Case Studies	Assignment	L4 (Analyze)	TB1
42	L42	3	Tutorial (Instruction Cycle)	Solve problems	Practice	Debugging	Group	Tutorial	DigiSim	CO3	Notes	Auxiliary Memory	Project Based Learning	Quiz	L3 (Apply)	RB2

43	L43	3	Stack Organization	Explain stack	Demo	Memory usage	Discussion	Lecture	Logicly	CO3	Slides	Virtual Memory and Cache	Blended Learning	Test	L2 (Understand)	RB3
44	L44	3	Instruction Format	Analyze formats	Practice	Instruction design	Peer	Lecture	CircuitVerse	CO3	Notes	CircuitVerse	Project Based Learning	Assignment	L4 (Analyze)	TB2
45	L45	3	Tutorial (I/O)	Solve problems	Practice	Debugging	Group	Tutorial	DeldSim	CO3	PPT	Logicly	Blended Learning	Test	L3 (Apply)	TB2
46	L46	4	Addressing Modes (Advanced)	Analyze addressing	Case study	Optimization	Discussion	Lecture	DigiSim	CO3	PPT	LogicDrawer	Practical / Hands-on Training	Quiz	L4 (Analyze)	TB1
47	L47	4	Peripheral Devices	Explain I/O devices	Demo	Device identification	Discussion	Lecture	Gate Lab	CO4	Slides	DeldSim	Peer Teaching and Self Study	Assignment	L2 (Understand)	RB2
48	L48	4	I/O Interfaces	Analyze interfaces	Demo	Data exchange	Peer	Lecture	LogicDrawer	CO4	Notes	CircuitVerse	Lecture Based Teaching	Test	L4 (Analyze)	RB3
49	L49	4	I/O operations	Solve problems	Practice	Debugging	Group	Tutorial	CircuitVerse	CO4	Notes	Gate Lab	Group Discussion and Collaborative Learning	Assignment	L3 (Apply)	TB2
50	L50	4	Peripheral Devices	Explain I/O devices	Demo	Device identification	Discussion	Lecture	DigiSim	CO4	Slides	Logicly	Peer Teaching and Self Study	Assignment	L2 (Understand)	TB2
51	L51	4	I/O Interfaces analysis	Analyze interfaces	Demo	Data exchange	Peer	Lecture	Gate Lab	CO4	Notes	DigiSim	Lecture Based Teaching	Test	L4 (Analyze)	TB1
52	L52	4	Tutorial (I/O)	Solve problems	Practice	Debugging	Group	Tutorial	Logicly	CO4	Notes	LogicDrawer	Group Discussion and Collaborative Learning	Assignment	L3 (Apply)	RB2
53	L53	4	Asynchronous Transfer	Apply transfer	Demo	Timing issues	Lecture	PPT	DeldSim	CO5	Docs	DeldSim	Case Studies	Understand	L3 (Apply)	RB3
54	L54	4	Interrupts	Analyze interrupts	Case study	Priority handling	Discussion	Lecture	DigiSim	CO5	Notes	Gate Lab	Project Based Learning	Assignment	L4 (Analyze)	TB2
55	L55	4	DMA	Explain DMA	Demo	Data transfer	Peer	Lecture	Logicly	CO5	PPT	Logicly	Blended Learning	Test	L2 (Understand)	TB1
56	L56	4	Tutorial (DMA & Interrupts)	Solve problems	Practice	Debugging	Group	Tutorial	CircuitVerse	CO5	Notes	CircuitVerse	Practical / Hands-on Training	Assignment	L3 (Apply)	RB2
57	L57	4	Main Memory	Explain memory	Demo	Memory hierarchy	Lecture	PPT	DigiSim	CO5	Docs	DigiSim	Peer Teaching and Self Study	Quiz	L3 (Apply)	RB3
58	L58	4	Auxiliary Memory	Compare memory types	Case study	Analysis	Discussion	Lecture	LogicDrawer	CO5	Notes	LogicDrawer	Lecture Based Teaching	Assignment	L4 (Analyze)	TB2
59	L59	4	Cache & Virtual Memory	Analyze memory	Demo	Performance	Peer	Lecture	Gate Lab	CO5	PPT	Gate Lab	Group Discussion and Collaborative Learning	Test	L4 (Analyze)	TB2
60	L60	4	Tutorial (Memory)	Solve problems	Practice	Debugging	Group	Tutorial	DeldSim	CO5	Notes	DeldSim	Case Studies	Viva	L3 (Apply)	TB1

TB1	**Morris Mano, Computer System Architecture, 3rd Edition, Prentice-Hall of India Private**
TB2.	**Moris Mano, "Digital Logic and Computer Design", PHI Publications, 2002**

REFERENCES:

RB1.	**R. P. Jain, "Modern Digital Electronics", TMH, 3rd Edition, 2003**
RB2.	**WIliam Stallings, Computer Organization and Architecture, 4th Edition, Prentice Hall of**
RB3.	**Subrata Ghosal," Computer Architecture and Organization", Pearson 2011**
RB4.	**Malvino, "Digital Computer Electronics: An Introduction to Microcomputers", McGraw Hill**

Subject Incharge

HOD : Dr. Sushma Bahuguna

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COURSE PLAN

AS PER BCA SCHEME & SYLLABUS 2025-2026 ONWARDS GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY, NEW DELHI.

Programme Code:	**020**	**Programme:**	**Bachelor of Computer Applications**		**Session:**	**2025-26**	**L**	**3**	**T/P**	**0**	**Credits**	**3**		**3**
Course Code:	**BCA 104**	**Course Name:**	**Web Based Programming**	**Skill Enhancement Course**	**Faculty: Mr. Akshit Bhardwaj**	**Type:**								

LEARNING OBJECTIVES:

In this course, the learners will be able to develop expertise related to the following:-

1. Understand the syntax and semantics language.

2. Design and develop web applications using PHP as a server side language

3. Perform database connectivity using MYSQL as database server.

PRE-REQUISITES:

1. Basic knowledge of HTML, CSS and JavaScript.

2. Able to Design static Webpage.

Course Outcome & Mapping, Course Articulation

			Understand the fundamental concepts of Computers, Software hardware and peripheral devices and evolution of computer technologies.	Familiarized with Business environment and Information Technology and its Applications in different domains.	Gain knowledge to identify, explain and apply functional programming and objectoriented	Analyze, design, implement and evaluate computerized solutions to real life problems,	Understand the front end and backend of software applications	Gain expertise in at least one emerging technology.	Acquire knowledge about computer networks, network devices and their configuration	Apply techniques of software validation and reliability analysis to the development of computer programs	Acquire Technical, Communication and management Skills to convey or present information, applications, instructions, policies, procedures, decisions, documentations etc. verbally as well as in writing.	Recognize the various issues related to society, environment, health and vivid cultures and	Acquire technical skills to lead a productive life in the society as a professional or as an	Capability for life long learning
			PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
	CO1	Design and develop dynamic web pages with good aesthetic sense of designing and latest technical know-how's.	2	-	3	3	3	2	-	2	-	-	2	2

	CO2	Have a good understanding of Web Application Terminologies	2	2	2	2	2	-	-	-	-	-	-	1	
	CO3	Design and develop dynamic web pages with good aesthe c sense of designing and latest technical know-how's.	2	-	3	3	3	2	-	2	-	-	2	2	
		Course Articulation (Average)	**2**	**2**	**3**	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**2**	**2**	
S. No.	**Lecture No**	**Unit No**	**Topic**	**Sessional Outcome Students will be able to**	**Experiential Learning**	**Participative Learning**	**Problem Solving Methodologies**	**ICT Tools & E-Resources Utilization**	**Mapping with CO**	**Class Material (PPT Faculty + Student)**	**Additional Material**	**Mode Of Assesment**	**Pedagogical Approach**	**BT Level**	**Ref.**
1	L1	I	L1 Introduction to Web Applications	Understand web application concepts	Case study discussion	Conceptual analysis	Interactive discussion	PPT, Browser	CO1	PPT, Notes	MDN Web Docs	Assignment	Technology Based Learning	L2 (Understand)	RB1
2	L2	I	L2 Client & Server Side Scripting	Differentiate scripting types	Real-world examples	Comparative study	Interactive discussion	PHP, IDE	CO1	Notes	W3Schools Web Development	Test	Group Learning & Teaching	L2 (Understand)	RB1
3	L3	I	L3 Client vs Server Side Scripting	Analyze scripting roles	Use-case discussion	Logical comparison	Discussion	PPT	CO1	PPT	TutorialsPoint PHP	Case Study	Learning through Problem Solving	L4 (Analyze)	RB1
4	L4	I	L4 Web Servers	Understand server types	Server demo	Concept analysis	Interaction	XAMPP	CO1	Notes	Apache HTTP Server	Quiz	Game-Based Learning	L2 (Understand)	RB1
5	L5	I	L5 WAMP/LAMP/XAMPP/MAMP	Learn installation tools	Installation demo	Tool comparison	Discussion	XAMPP	CO1	PPT	XAMPP Official Site	Assignment	Peer Teaching	L3 (Apply)	RB2
6	L6	I	L6 Static vs Dynamic Websites	Differentiate web models	Website demo	Analytical thinking	Discussion	Browser	CO1	Notes	GeeksforGeeks Web Tech	Prsentation	Learning through Problem Solving	L4 (Analyze)	RB2
7	L7	I	L7 Introduction to PHP	Understand PHP basics	Code walkthrough	Syntax understanding	Interaction	PHP, IDE	CO1	PPT	PHP Official Manual	Quiz	Individual Learning	L2 (Understand)	RB3
8	L8	II	L8 PHP Syntax & Data Types	Apply PHP syntax	Live coding	Syntax practice	Coding discussion	PHP	CO1	Notes	Programiz PHP	Assignment	Group Learning & Teaching	L3 (Apply)	RB3
9	L9	II	L9 Variables & Constants	Use variables effectively	Code demo	Logical reasoning	Discussion	PHP	CO1	PPT	Javatpoint PHP	Test	Learning through Problem Solving	L3 (Apply)	RB2

10	L10	II	L10 Operators & Expressions	Apply operators	Problem examples	Expression evaluation	Interaction	XAMPP	CO1	Notes	W3Schools PHP Operators	Quiz	Individual Learning	L3 (Apply)	RB1
11	L11	II	L11 Super Global Variables	Understand PHP globals	Example demos	Data flow analysis	Q&A	PHP	CO1	PPT	PHP Superglobals	Assignment	Peer Teaching	L2 (Understand)	RB1
12	L12	II	L12 Regular Expressions	Use regex for validation	Pattern demos	Pattern analysis	Discussion	PHP	CO1	Notes	MDN Web Docs	Test	Learning through Problem Solving	L3 (Apply)	RB1
13	L13	II	L13 PHP Errors	Identify PHP errors	Error demo	Debug analysis	Interaction	PHP	CO1	PPT	W3Schools Web Development	Quiz	Technology Based Learning	L4 (Analyze)	RB1
14	L14	II	L14 if, if-else	Apply conditions	Code walkthrough	Decision logic	Discussion	PHP	CO1	Notes	TutorialsPoint PHP	Assignment	Group Learning & Teaching	L3 (Apply)	RB2
15	L15	II	L15 Nested if	Solve complex conditions	Dry-run examples	Logical decomposition	Interaction	PHP	CO1	PPT	Apache HTTP Server	Test	Technology Based Learning	L4 (Analyze)	RB2
16	L16	II	L16 switch-case	Implement menu logic	Case demo	Flow control	Discussion	PHP	CO1	Notes	XAMPP Official Site	Quiz	Individual Learning	L3 (Apply)	RB3
17	L17	II	L17 for, while loops	Apply iteration	Loop demos	Iterative logic	Interaction	PHP	CO2	PPT	GeeksforGeeks Web Tech	Assignment	Game-Based Learning	L3 (Apply)	RB3
18	L18	II	L18 do-while, foreach	Compare loop types	Code demo	Control analysis	Discussion	PHP	CO2	Notes	PHP Official Manual	Test	Learning through Problem Solving	L4 (Analyze)	RB2
19	L19	II	L19 Indexed & Assoc Arrays	Use arrays	Array demo	Data structuring	Interaction	PHP	CO2	PPT	Programiz PHP	Quiz	Peer Teaching	L3 (Apply)	RB1
20	L20	II	L20 Multidimensional Arrays	Handle complex arrays	Examples	Data analysis	Discussion	PHP	CO2	Notes	Javatpoint PHP	Assignment	Learning through Problem Solving	L4 (Analyze)	RB1
21	L21	II	L21 Array Functions	Apply built-in functions	Code demo	Function selection	Interaction	PHP	CO2	PPT	W3Schools PHP Operators	Test	Technology Based Learning	L3 (Apply)	RB1
22	L22	II	L22 Functions	Define functions	Coding demo	Modular thinking	Discussion	PHP	CO2	Notes	PHP Superglobals	Quiz	Individual Learning	L3 (Apply)	RB1

23	L23	II	L23 Pass by Value/Reference	Analyze parameter passing	Demo programs	Memory analysis	Interaction	PHP	CO2	PPT	MDN Web Docs	Assignment	Learning through Problem Solving	L4 (Analyze)	RB2
24	L24	III	L24 Variable Scope	Understand scope	Code examples	Scope analysis	Discussion	PHP	CO2	Notes	W3Schools Web Development	Test	Peer Teaching	L4 (Analyze)	RB2
25	L25	III	L25 Inbuilt & Mail Functions	Use built-in utilities	Demo	Functional analysis	Interaction	PHP	CO2	PPT	TutorialsPoint PHP	Quiz	Learning through Problem Solving	L3 (Apply)	RB3
26	L26	III	L26 Error Handling & Debugging	Analyze errors	Debug demo	Error tracing	Discussion	PHP	CO2	Notes	Apache HTTP Server	Assignment	Group Learning & Teaching	L4 (Analyze)	RB3
27	L27	III	L27 HTML Form Controls	Understand form elements	Form demo	UI logic	Interaction	HTML, PHP	CO2	PPT	XAMPP Official Site	Test	Learning through Problem Solving	L2 (Understand)	RB2
28	L28	III	L28 Forms using GET	Process GET data	Demo	Data handling	Discussion	PHP	CO2	Notes	GeeksforGeeks Web Tech	Quiz	Learning through Problem Solving	L3 (Apply)	RB1
29	L29	III	L29 Forms using POST	Secure form handling	Demo	Input validation	Interaction	PHP	CO2	PPT	PHP Official Manual	Assignment	Project-Based Learning	L3 (Apply)	RB1
30	L30	III	L30 GET vs POST	Compare methods	Example analysis	Comparative logic	Discussion	PHP	CO2	Notes	Programiz PHP	Test	Project-Based Learning	L4 (Analyze)	RB1
31	L31	III	L31 Cookies	State management basics	Demo	State logic	Interaction	PHP	CO2	PPT	Javatpoint PHP	Quiz	Learning through Problem Solving	L4 (Analyze)	RB1
32	L32	III	L32 Sessions	Session handling	Workflow demo	State analysis	Discussion	Browser	CO3	Notes	W3Schools PHP Operators	Assignment	Game-Based Learning	L4 (Analyze)	RB2
33	L33	III	L33 Query String & Hidden Fields	Data transfer methods	Demo	Data flow analysis	Interaction	PHP	CO3	PPT	PHP Superglobals	Test	Game-Based Learning	L4 (Analyze)	RB2
34	L34	III	L34 File Open/Close	File basics	Demo	I/O logic	Discussion	PHP	CO3	Notes	MDN Web Docs	Assignment	Learning through Problem Solving	L3 (Apply)	RB3

35	L35	III	L35 Create Files/Dirs	File creation	Demo	File logic	Interaction	Browser	CO3	PPT	W3Schools Web Development	Assignment	Game-Based Learning	L3 (Apply)	RB3
36	L36	III	L36 Read/Write Files	File processing	Demo	Data handling	Discussion	PHP	CO3	Notes	TutorialsPoint PHP	Quiz	Technology Based Learning	L3 (Apply)	RB2
37	L37	III	L37 File Inclusion	Modular files	Demo	Code reuse	Interaction	PHP	CO3	PPT	Apache HTTP Server	Assignment	Learning through Problem Solving	L3 (Apply)	RB1
38	L38	IV	L38 Upload/Download Files	File transfer	Demo	Validation logic	Discussion	PHP	CO3	Notes	XAMPP Official Site	Test	Individual Learning	L4 (Analyze)	RB1
39	L39	IV	L39 File Information	Metadata usage	Demo	File analysis	Interaction	PHP	CO3	PPT	GeeksforGeeks Web Tech	Quiz	Individual Learning	L4 (Analyze)	RB1
40	L40	IV	L40 Classes & Objects	OOP basics	Code demo	Object modeling	Discussion	PHP	CO3	Notes	PHP Official Manual	Assignment	Technology Based Learning	L3 (Apply)	RB1
41	L41	IV	L41 Access Modifiers	Encapsulation	Demo	Access control	Interaction	PHP	CO3	PPT	Programiz PHP	Quiz	Learning through Problem Solving	L4 (Analyze)	RB2
42	L42	IV	L42 Constructors/Destructors	Object lifecycle	Demo	Reusability logic	Discussion	PHP	CO3	Notes	Javatpoint PHP	Test	Learning through Problem Solving	L4 (Analyze)	RB2
43	L43	IV	L43 DB & SQL Intro	DB fundamentals	SQL demo	Query logic	Interaction	MySQL	CO3	PPT	W3Schools PHP Operators	Assignment	Peer Teaching	L2 (Understand)	RB3
44	L44	IV	L44 MySQL Operations	DB operations	phpMyAdmin demo	Data modeling	Discussion	MySQL	CO3	Notes	PHP Superglobals	Quiz	Project-Based Learning	L3 (Apply)	RB3
45	L45	IV	L45 PHP DB Connectivity	Build DB apps	End-to-end demo	Query analysis	Interaction	PHP, MySQL	CO3	PPT	W3Schools Web Development	Test	Group Learning & Teaching	L6 (Create)	RB2

TEXT BOOKS:

TB1. Programming PHP: Creating Dynamic Web Pages, Kevin Tatroe. Peter Macintyre, Rasmus Lerdorf,O'Reilly, Third Edition

REFERENCE BOOKS:

RB1. Professional PHP Programming,Jesus Castagnetto,Harish Rawat, Sascha Schumann,Chris Scollo,Deepak Veliath - Wrox Publications

RB2. PHP 5 Advanced, Larry Ullman, Peachpit Press

RB3. Core PHP Programming. Leon Atkinson (Prentice Hall, ISBN 0130463469).
RB4. Beginning PHP5 and MySQL: From Novice to Professional, W. Jason Gilmore, 2004,Apress, ISBN:1-893115-51-8

Subject Incharge Mr. Akshit Bhardwaj

HOD :Dr. Sushma Bahuguna

TECNIA INSTITUTE OF ADVANCED STUDIES

NAAC GRADE "A" INSTITUTE (CYCLE-2)

Approved by AICTE, Ministry of Education Govt. of India,

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INSTITUTIONAL AREA, MADHUBAN CHOWK, ROHINI, DELHI-110085

Course Delivery Plan

#AS PER MCA SCHEME & SYLLABUS 2020-21 ONWARDS GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY, NEW DELHI.

Programme Code:	**044**	**Programme:**	**Master of Computer Applications (MCA)**	**Session:**	**2025-26**	**L**	**3**	**T/P**	**1**	**Credits:4**			
Course Code:	**MCA-201**	**Course Name:**	**Design and Analysis of Algorithms**			**Type:**	**Core Course**						

Name of Faculy: Ms.Bharti Aggarwal

LEARNING OBJECTIVES:

PREREQUISITE: 1. Programming Skills

		Demonstrate competencies in fundamentals of computing, computing specialization, mathematics and domain knowledge suitable for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.	Demonstrate competencies in fundamentals of computing, computing specialization, mathematics and domain knowledge suitable for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.	Design efficient solutions for complex, real-world problems to design systems, components or processes that meet the specifications with suitable consideration to public health, safety, cultural, societal and environmental considerations	Ability to research, analyze and investigate complex computing problems through design of experiments, analysis and interpretation of data and synthesis of the information to arrive at valid conclusions.	Create, select, adapt and apply appropriate technologies and tools to a wide range of computational activities while understanding their limitations	Ability to perform professional practices in an ethical way, keeping in the mind cyber regulations & laws, responsibilities and norms of professional computing practices.	Ability to engage in independent learning for continuous self-development as a computing professional.	Ability to apply knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments.	Ability to effectively communicate with the technical community and with the society at large about *complex* computing activities by being able to understand and write effective reports, design documentation, make effective presentations with the capability of giving and taking clear instructions.	Ability to recognize and assess societal, environmental, health, safety, legal and cultural issues within local and global contexts and the consequential responsibilities applicable to professional computing practices.	Ability to work in multi-disciplinary team collaboration both as a member and leader, as per need.	Ability to apply innovation to track a suitable opportunity to create value and wealth for the betterment of the individual and society at large.
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**Demonstrate P and NP complexity classes of the problem and budget and budget components, types and working.**	3	3	3	_	_	_	_	_	_	_	_	_
CO2	**Apply the concepts of asymptotic notations to analyze the complexities of various algorithms.**	3	3	3	_	_	_	_	_	_	_	_	_
CO3	**Analyze and evaluate the searching, sorting and tree-based algorithms**	3	3	3	3	3	_	_	_	_	_	_	_
CO4	**Design efficient solutions using various algorithms for given problems**	3	3	3	3	3	3	2	2	_	_	_	_

CO5	**Develop innovative solutions for real-world problems using different paradigms**	3	3	3	3	3	2	2	_	2	2	_	_
	Course Articulation (Average)	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	_	_

S.No	Lec No	Unit	Topic	Sessional Outcome	Experiential Learning	Participative Learning	Problem Solving	ICT TOOLS	MAPPING WITH CO	CLASS MATERIAL	Additional Material	MODE OF ASSESSMENT	Pedagogy	BT	Ref.
1	L1	I	Introduction to Algorithm Specification	Understand the basics of Algorithm Specification	Analyze simple daily problems	Group discussion	Algorithm Analysis	PPT	CO1	Case Study	NPTEL DAA Course	Assignment	Lecture Based Teac	**L1 (Remember)**	TB1 Ch1
2	L2	I	Classification of Performance Analysis: Space and Time Complexity	Understand the classifications of Performance Analysis: Space and Time Complexity,	Solve complexity examples	Peer learning	Case Study Method	Smart board	CO1	Numerical Examples	Big-O Cheat Sheet	Test	Group Discussion a	**L2 (Understand)**	TB1 Ch1
3	L3	I	Classification of Correctness of Algorithms, Growth of Functions,	Understand the classifications of Performance Analysis: Space and Time Complexity,	Verify outputs	Think-Pair-Share	Divide and Conquer Stra	Draw.io	CO1	Proof Exercises	Growth of Functions	Case Study	Case Studies	**L3 (Apply)**	TB1 Ch2
4	T1	I	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Solve complexity questions	Group Activity	Greedy Method Approa	LMS	CO1	Extra Problems	Quizizz	Quiz	Project Based Learr	**L4 (Analyze)**	TB1
5	L4	I	Asymptotic Notations , Concept of Randomized Algorithms ,	Understand the concept of Correctness of Algorithms, Growth of Functions, Asymptotic Notations	Solve order problems	Collaborative Learning	Dynamic Programming I	LMS	CO1	Charts	Randomized Algorithms MI	Assignment	Blended Learning	**L5 (Evaluate)**	TB1 Ch3
6	L5	I	Recurrences: Substitution	Understand the concept of Correctness of Algorithms, Growth of Functions, Asymptotic Notations	Solve notation problems	Peer Discussion	Backtracking Technique	PPT	CO1	Examples	Recurrence Relations	Prsentation	Industry Expert Ses	**L3 (Apply)**	TB1 Ch3
7	L6	I	Iteration , Understand the concept of Master	Understand the Recurrence Tree method.	Solve probability examples	Group Discussion	Branch and Bound Meth	Smart board	CO1	Online Demo	Master Theorem	Quiz	Practical / Hands-or	**L4 (Analyze)**	TB1 Ch5
8	T2	I	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Solve recurrence equations	Collaborative Work	Problem Decomposition	LMS	CO1	Numerical Problems	Google Forms	Assignment	Peer Teaching and	**L5 (Evaluate)**	TB1 Ch4
9	L7	I	Recurrence Tree method.	Understand the Recurrence Tree method.	Solve recurrence problems	Group Practice	Flowchart and Pseudoc	Spreadsheet	CO1	Practice Set	Recursion Tree Method	Test	Lecture Based Teac	**L3 (Apply)**	TB1 Ch4
10	L8	I	Divide and Conquer Paradigm: Problem Solving	Understand the basics of Concept of Randomized Algorithms	Solve recurrence examples	Peer Learning	Comparative Algorithm	LMS	CO3	Numerical Examples	Divide and Conquer	Quiz	Group Discussion a	**L4 (Analyze)**	TB1 Ch4
11	L9	I	Divide and Conquer Paradigm	Perform Recurrences: Substitution	Solve mixed problems	Group Activity	Coding and Debugging S	PPT	CO2	Additional Questions	Visualgo	Assignment	Case Studies	**L5 (Evaluate)**	TB1
12	T3	I	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Solve theorem-based problems	Think-Pair-Share	Complexity Evaluation E	PPT	CO1	Formula Chart	Kahoot	Test	Project Based Learr	**L3 (Apply)**	TB1 Ch4
13	L10	I	Comparative Analysis of different Sorting Techniques , Searching Techniques	Understand the concept of sorting and searching	Solve complexity problems	Group Work	Group Problem Solving	Smart board	CO1	Practice Questions	Sorting Visualizations	Quiz	Blended Learning	**L4 (Analyze)**	TB1 Ch4
14	L11	I	Strassen's Matrix Multiplication Method	Learned basics of Strassen's Matrix Multiplication Method.	Practice MCQs	Discussion	Competitive Programmi	Draw.io	CO1	Question Bank	Strassen Matrix Multiplicati	Assignment	Industry Expert Ses	**L5 (Evaluate)**	RB4
15	L12	II	**Sorting in linear time , Counting Sort**	Perform sorting techniques	Solve recursive problems	Collaborative Learning	Mini Projects and Applic	LMS	CO2	Examples	Counting Sort	Test	Practical / Hands-or	**L2 (Understand)**	TB1 Ch7
16	T4	II	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Solve search problems	Group Coding	Comparative Algorithm	LMS	CO3	Code Examples	Google Classroom	Quiz	Peer Teaching and	**L3 (Apply)**	TB1 Ch7
17	L13	II	Bucket Sort, Radix Sort	Perform sorting techniques	Solve sorting analysis	Peer Discussion	Coding and Debugging S	PPT	CO3	Programs	Radix Sort	Assignment	Lecture Based Teac	**L2 (Understand)**	TB1 Ch8
18	L14	II	String Matching Concept : Naive String-Matching Algorithm	To Perform Comparative Analysis of different Sorting Techniques	Solve complexity questions	Group Activity	Complexity Evaluation E	Smart board	CO3	Extra Programs	Naive String Matching	Test	Group Discussion a	**L3 (Apply)**	RB5
19	L15	II	String Matching with Finite Automata	To Perform Comparative Analysis of different Sorting Techniques	Solve matrix problems	Group Learning	Group Problem Solving	LMS	CO2	Numerical Examples	JFLAP Official	Quiz	Case Studies	**L2 (Understand)**	TB1 Ch9
20	T5	II	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Solve sorting problems	Pair Learning	Competitive Programmi	Spreadsheet	CO4, CO5	Code Practice	Quizizz Platform	Assignment	Project Based Learr	**L3 (Apply)**	TB1 Ch8
21	L16	II	Knuth Morris Pratt Algorithm	To understand Knuth Morris Pratt Algorithm	Solve bucket problems	Collaborative Learning	Mini Projects and Applic	LMS	CO4	Examples	KMP Algorithm	Test	Blended Learning	**L3 (Apply)**	TB1 Ch8
22	L17	II	The Rabin-Karp Algorithm	To understand Rabin-Karp Algorithm	Solve digit sorting problems	Peer Learning	Comparative Algorithm	PPT	CO2	Practice Set	Rabin Karp Algorithm	Quiz	Industry Expert Ses	**L4 (Analyze)**	TB1 Ch8
23	L18	II	Red Black Trees , Disjoint Set and their Implementation	To understand Red Black Trees	Solve matching examples	Group Discussion	Coding and Debugging S	PPT	CO2	Examples	Red Black Tree Visualizatior	Assignment	Practical / Hands-or	**L5 (Evaluate)**	TB1 Ch32
24	T6	II	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Solve pattern problems	Group Activity	Complexity Evaluation E	Smart board	CO2	Additional Programs	Kahoot Platform	Test	Peer Teaching and	**L3 (Apply)**	TB1
25	L19	II	Medians , Order Statistics	To perform Medians	Solve matching problems	Collaborative Learning	Group Problem Solving	Draw.io	CO2	Automata Diagram	Order Statistics	Quiz	Lecture Based Teac	**L4 (Analyze)**	TB1 Ch32

26	L20	II	Greedy Algorithms , Concept & Applications	To perform Greedy Algo.	Solve string problems	Pair Learning	Competitive Programmi	LMS	CO2	Code Examples	Greedy Algorithms	Assignment	Group Discussion a	**L5 (Evaluate)**	TB1 Ch32
27	L21	II	Activity Selection Problem, Fractional	To understand selection problem	Solve matching problems	Peer Discussion	Mini Projects and Applic	LMS	CO2	Examples	Fractional Knapsack	Test	Case Studies	**L3 (Apply)**	TB1 Ch32
28	T7	II	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Solve tree balancing	Group Learning	Comparative Algorithm	PPT	CO2	Tree Diagrams	Google Classroom	Quiz	Project Based Learr	**L4 (Analyze)**	TB1 Ch13
29	L22	II	Knapsack problem, Job Sequencing with Deadlines	To perform Knapsack problem	Solve connectivity problems	Collaborative Learning	Coding and Debugging S	Smart board	CO2	Programs	Job Sequencing Problem	Assignment	Blended Learning	**L5 (Evaluate)**	TB1 Ch21
30	L23	II	Huffman Coding , Analysis Prims & Correctness of Prim's	To perform String Matching with Finite Automata	Group coding	Peer Learning	Complexity Evaluation E	LMS	CO2	Practice Programs	Huffman Coding	Test	Industry Expert Ses	**L3 (Apply)**	TB1
31	L24	II	Kruskal Algorithm , Dijkstra Algorithm	To Analysis Huffman Coding	Solve selection problems	Group Discussion	Group Problem Solving	Spreadsheet	CO2	Numerical Examples	Dijkstra Algorithm	Quiz	Practical / Hands-or	**L4 (Analyze)**	TB1 Ch28
32	T8	II	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Practice algorithms	Discussion	Competitive Programmi	LMS	CO2	Question Bank	Google Forms	Assignment	Peer Teaching and	**L5 (Evaluate)**	TB1
33	L25	III	Dynamic Programming: General Concept, Matrix-Chain Multiplication Problem	To Understand Dynamic Programming	Solve greedy examples	Collaborative Learning	Mini Projects and Applic	PPT	CO4, CO5	Real-life Examples	Matrix Chain Multiplication	Test	Lecture Based Teac	**L3 (Apply)**	TB1 Ch15
34	L26	III	Longest Common Subsequence Problem, Bellman-Ford Algorithm	To performLongest Common Subsequence Problem	Solve optimization problems	Group Activity	Comparative Algorithm	PPT	CO4	Practice Questions	Longest Common Subseque	Assignment	Group Discussion a	**L4 (Analyze)**	TB1
35	L27	III	Analysis of Floyd-Warshall Algorithm, Correctness of Floyd-Warshall Algorithm	To understand Disjoint Set and their Implementation	Solve numerical problems	Pair Learning	Coding and Debugging S	Smart board	CO3	Examples	Floyd Warshall Algorithm	Assignment	Case Studies	**L5 (Evaluate)**	TB1
36	T9	III	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Solve optimization problems	Group Discussion	Complexity Evaluation E	Draw.io	CO3	Extra Questions	Quizizz	Quiz	Project Based Learr	**L3 (Apply)**	TB1
37	L28	III	Optimal Binary Search Trees , 0/1 Knapsack Problem	To analusis Medians and Order Statistics	Solve sequencing problems	Collaborative Learning	Group Problem Solving	LMS	CO2	Examples	0/1 Knapsack Problem	Assignment	Blended Learning	**L4 (Analyze)**	TB1
38	L29	III	Network Flow Problem	To understand Network Flow Problem	Solve coding problems	Peer Learning	Competitive Programmi	LMS	CO3	Tree Examples	Network Flow Algorithm	Test	Industry Expert Ses	**L5 (Evaluate)**	TB1
39	L30	III	Backtracking, n-Queen's Problem	To understand Backtracking	Solve graph problems	Group Coding	Mini Projects and Applic	PPT	CO3	Graph Examples	N Queen Problem	Quiz	Practical / Hands-or	**L3 (Apply)**	TB1
40	T10	III	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Solve graph problems	Collaborative Learning	Comparative Algorithm	Smart board	CO3	Graph Problems	Kahoot Learning	Assignment	Peer Teaching and	**L4 (Analyze)**	TB1
41	L31	III	Hamiltonian Circuit Problem ,	To understand Hamiltonian Circuit Problem	Solve graph examples	Peer Discussion	Coding and Debugging S	LMS	CO3	Practice Problems	Hamiltonian Cycle	Quiz	Lecture Based Teac	**L3 (Apply)**	TB1
42	L32	III	Subset-Sum Problem	To Understand Subset-Sum Problem	Group coding	Collaborative Learning	Complexity Evaluation E	Spreadsheet	CO3	Additional Problems	Graph Coloring Problem	Test	Group Discussion a	**L4 (Analyze)**	TB1
43	L33	III	Graph Coloring Problem	To Understand Graph Coloring Problem	Solve DP examples	Group Learning	Group Problem Solving	LMS	CO3	Examples	Google Classroom	Assignment	Case Studies	**L5 (Evaluate)**	TB1 Ch16
44	T11	III	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Solve multiplication problems	Pair Learning	Competitive Programmi	PPT	CO3	Numerical Examples	Traveling Salesman Problen	Quiz	Project Based Learr	**L4 (Analyze)**	TB1
45	L34	III	**Branch and Bound:** Assignment Problem	To Understand Branch and Bound	Solve sequence problems	Peer Learning	Mini Projects and Applic	PPT	CO3	Examples	Polynomial Time Verificatio	Test	Blended Learning	**L5 (Evaluate)**	TB1
46	L35	III	Travelling Salesman Problem, Introduction to Computability	To Understand Travelling Salesman	Solve optimization questions	Group Activity	Comparative Algorithm	Smart board	CO3	Practice Programs	Quizizz Platform	Assignment	Lecture Based Teac	**L4 (Analyze)**	TB1
47	L36	III	Polynomial-time Verification	To Understand Polynomial-time Verification	Solve graph problems	Collaborative Learning	Coding and Debugging S	Draw.io	CO3	Graph Examples	NP Completeness	Test	Group Discussion a	**L5 (Evaluate)**	TB1
48	T12	III	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Solve graph examples	Group Discussion	Complexity Evaluation E	LMS	CO3, CO5	Matrix Examples	Reducibility in TOC	Case Study	Case Studies	**L4 (Analyze)**	TB1
49	L37	III	NP-Completeness	To Understand NP-Completeness	Solve optimization problems	Pair Learning	Group Problem Solving	LMS	CO3	Numerical Examples	NP Completeness Proofs	Quiz	Project Based Learr	**L5 (Evaluate)**	TB1
50	L38	III	**Complexity Classes:** Reducibility	To Understand Complexity Classes	Collaborative Learning	Offline	Competitive Programmi	PPT	CO3	Tutorial	Kahoot	Assignment	Blended Learning	**L4 (Analyze)**	RB1
51	L39	IV	NP-Completeness Proof	To Understand NP-Completeness Proof	Solve recursive problems	Group Learning	Mini Projects and Applic	Smart board	CO4	Examples	NP Complete Problems	Prsentation	Industry Expert Ses	**L5 (Evaluate)**	TB1 Ch14
52	T13	IV	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Solve chessboard problems	Collaborative Learning	Comparative Algorithm	LMS	CO4	Practice Set	NP Hard Problems	Quiz	Practical / Hands-or	**L4 (Analyze)**	TB1
53	L40	IV	NP-Complete	To Understand NP-Completeness Proof	Solve cycle problems	Peer Discussion	Coding and Debugging S	PPT	CO4	Graph Examples	P vs NP Problem	Assignment	Peer Teaching and	**L5 (Evaluate)**	TB1
54	L41	IV	NP-Hard, Problem	To Understand NP-Completeness Proof	Group Activity	Offline	Complexity Evaluation E	Smart board	CO4	Tutorial	Google Forms	Test	Lecture Based Teac	**L4 (Analyze)**	RB2
55	L42	IV	Classification-P, NP	To Understand NP-Completeness Proof	Analyze solutions	Group Learning	Group Problem Solving	Draw.io	CO4	Examples	NPC Problems	Quiz	Group Discussion a	**L5 (Evaluate)**	TB1
56	T14	IV	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Collaborative Learning	Offline	Competitive Programmi	LMS	CO4	Tutorial	NP Hard Concepts	Assignment	Case Studies	**L4 (Analyze)**	RB3
57	L43	IV	NPC	To Understand NPC	Solve optimization problems	Group Activity	Mini Projects and Applic	LMS	CO4, CO5	Numerical Examples	3SAT Problem	Test	Project Based Learr	**L5 (Evaluate)**	TB1
58	L44	IV	NP-Hard	To Understand NP hard	Solve optimization problems	Peer Learning	Mini Projects and Applic	PPT	CO4	Graph Problems	Google Classroom	Quiz	Blended Learning	**L4 (Analyze)**	TB1
59	L45	IV	Circuit Satisfiability, 3SAT	To Understand Circuit Satisfiability	Classify problems	Collaborative Discussion	Mini Projects and Applic	Smart board	CO4, CO5	Charts	Google Classroom	Assignment	Industry Expert Ses	**L5 (Evaluate)**	TB1
60	T15	IV	Revision of previous lectures	Students will be able to clear doubts of previous lectures.	Solve proof examples	Group Discussion	Mini Projects and Applic	LMS	CO4, CO5	Extra Problems	Google Classroom	Test	Practical / Hands-or	**L5 (Evaluate)**	TB1

TEXT BOOKS:

TB1. T.H. Cormen,
TB2. S. Dasgupta, C. Papadimitriou and U.Vazirani, "Algorithms", McGraw Hill Higher, Education, 1st Edition, 2017.
TB3 J. Kleinberg and E. Tardos, "Algorithm Design", Pearson Education, 2nd Edition, 2009.

REFERENCE BOOKS:

RB1. S. Horowitz, "Fundamentals of Computer Algorithms", University Press, 2nd Edition, 2008.
RB2. R. Panneerselvam. "Design and Analysis of Algorithms". PHI. 2nd Edition. 2016.
RB3. T. H. Cormen. "Algorithms Unlocked". MIT Press. 1st Edition. 2013.
RB4. S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press, 1st Edition, 2014.
RB5. R. Neapolitan and K. Naimipour, "Foundations of Algorithms", Jones & Bartlett, Publishers, 4th Edition, 2010.
RB6. A. Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson, Education, 3rd Edition, 2012.

HOD Dr. SUSHMA BAHUGUNA

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Course Plan

#AS PER MCA SCHEME & SYLLABUS 2025-2026 ONWARDS GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY, NEW DELHI.

Programme Code:	**044**	**Programme:**	**Master of Computer Applications (MCA)**		**Session:**	**2025-26**	**L**	**3**	**T/P**	**0**	**Credits**	**3**	
Course Code:	**MCA-102**	**Course Name:**	**Data and File Stuctures**	**Type:**	**Core Course**		**Type:**	**Core Course**		Faculty	Dr. Nupur Jain		

LEARNING OBJECTIVES:

PREREQUISITE: **1. Discrete Structures**

						Demonstrate competencies in fundamentals of computing, computing specialization, mathematics and domain knowledge suitable for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.	Demonstrate competencies in fundamentals of computing, computing specialization, mathematics and domain knowledge suitable for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.	Design efficient solutions for complex, real-world problems to design systems, components or processes that meet the specifications with suitable consideration to public health, safety, cultural, societal and environmental considerations	Ability to research, analyze and investigate complex computing problems through design of experiments, analysis and interpretation of data and synthesis of the information to arrive at valid conclusions.	Create, select, adapt and apply appropriate technologies and tools to a wide range of computational activities while understanding their limitations	Ability to perform professional practices in an ethical way, keeping in the mind cyber regulations & laws, responsibilities and norms of professional computing practices.	Ability to engage in independent learning for continuous self-development as a computing professional.	Ability to apply knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments.	Ability to effectively communicate with the technical community and with the society at large about *complex* computing activities by being able to understand and write effective reports, design documentation, make effective presentations with the capability of giving and taking clear instructions.	Ability to apply innovation to track a suitable opportunity to create value and wealth for the betterment of the individual and society at large.
						PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO12**
CO1	Recall different type of data structures.					3	-	-	-	-	-	-	-	-	-
CO2	Explain the fundamentals of an Abstract Data Type (ADT).					3	3	-	-	-	-	-	-	-	-
CO3	Apply linear and nonlinear data structures to solve real time problems.					3	3	3	3	-	3	-	-	-	-
CO4	Appraise and determine the correct data structure for any given real-world problem.					3	3	3	3	-	3	-	-	-	-
CO5	Create innovative solutions for real world problems					3	3	3	3	1	1	-	-	-	-
	Course Articulation (Average)					3	3	3	3	1	2	-	-	-	-

S. No.	**Lecture No.**	**Unit No.**	**Topic**	**Sessional Outcome**	**Experiential Learning**	**Participative Learning**	**Problem Solving Methodologies**	**ICT Tools & E-Resources Utilization**	**Mapping with CO**	**Class Material (PPT Faculty+ Students)**	**Additional Material (Links/ Journals/ Articles/ NEWS)**	**Mode of Assessment**	**Pedagogical Approach**	BT Level	**REFERENCEBOOK**
1	**L1**	1	Introduction of Data Structures	To enable student understand data struture	Organize real objects like books on shelves	Group discussion on real-life data organization (e.g., library, school records)	Interactive discussion	GeeksforGeeks – Intro to DS	CO1	PowerPoint / Google Slides presentation	https://www.geeksforgeeks.org/data-structures/	Case Study	Learning through Problem-Solving	L2 (Understand)	TB1.
2	**L2**	1	Classification of Data Structures	To enable student understand data struture	Create mind-maps of Linear vs Non-Linear types	Students classify given scenarios (e.g., student database, image pixels) into primitive/non-primitive	Q&A	TutorialsPoint – Classification	CO1	PowerPoint slide with diagrams; whiteboard + document camera	https://www.geeksforgeeks.org/types-of-data-structures/	Presentations	Learning through Problem-Solving	L3 (Apply)	TB1.
3	**L3**	1	Abstract Data Types	To make student understand data type	Design a "black box" defining ADT behavior	Pair-share: Identify ADT for Stack, Queue, List from daily life	Discussion	GeeksforGeeks – ADT	CO1	Live coding in C using Code::Blocks / Dev-C++	https://www.geeksforgeeks.org/abstract-data-types/	Presentations	Kinesthetic Learning	L3 (Apply)	TB2

4	**L4**	1	Arrays: Single Dimension, Multi Dimensions	To make student understand arrays	Use numbered boxes to access elements by index	Roll number mapping activity: 1D roll list vs 3D seat arrangement in exam hall	Discussion	W3Schools – Arrays	CO2	C compiler (Turbo C / GCC / OnlineGDB) showing array programs	https://www.geeksforgeeks.org/array-data-structure/	Assignments	Game-based Learning	L1 (Remember)	TB1.
5	**L5**	1	Memory Representation	To understand the terms of memory	Map classroom seating to a 2D array	Draw memory layout on board collaboratively for `int arr[5]`	Discussion	Python Tutor – Visualizer	CO4	PPT with memory diagrams + simple C demo in compiler	https://www.geeksforgeeks.org/array-data-structure/	Presentations	Learning through Problem-Solving	L4 (Analyze)	TB2
6	**L6**	1	Address Calculation, Sparse Matrices- Types	To make student understand address calculation	Draw memory diagrams labeling address and value	Calculate address of `arr[2][3]` for row-major and column-major in groups	Interaction	GeeksforGeeks – Address Calculation	CO3	PPT with formula examples + Excel sheet to compute addresses	https://www.geeksforgeeks.org/sparse-matrix/	Quizz with MCQ	Individual Learning/self study	L3 (Apply)	TB3
7	**L7**	1	Representation and Operations	To make student understand operations	Manually calculate base address plus offset	Role-play as memory cells storing/retrieving values	Discussion	GeeksforGeeks – Sparse Matrix	CO2	C compiler showing linear search program; projector display	https://www.geeksforgeeks.org/sparse-matrix/	Presentations	Peer Teaching	L3 (Apply)	TB3
8	**L8**	1	Linear	To make student understand linar search	Represent a zero-filled matrix in triplet form	Binary search game: Guess number with divide-and-conquer (class activity)	Interaction	VisuAlgo – Searching	CO1	C compiler + step-by-step dry run on PPT slides	https://www.geeksforgeeks.org/linear-search/	Projects(group /individual)	Individual Learning/self study	L1 (Remember)	RB1
9	**L9**	1	Binary Search, Selection Sort	To make student understand binary search	Write code to add two sparse matrices	Compare Selection Sort vs Bubble Sort outputs for same array	Q&A	VisuAlgo – Sorting	CO1	C compiler + animated PPT (swapping two coloured boxes)	https://www.geeksforgeeks.org/binary-search/	Assignments	Group-Teaching and Learning	L4 (Analyze)	RB2
10	**L10**	1	Bubble Sort	To make student understand bubble sort	Play "guess the number" in an unsorted list	Card sorting activity: Each student inserts a new card in sorted hand	Interaction	VisuAlgo – Bubble Sort	CO1	Document camera / visualizer to show hand-worked example	https://www.geeksforgeeks.org/bubble-sort/	Assignments	Game-based Learning	L4 (Analyze)	TB1.
11	**L11**	1	Sorting types	To make student understand insertion sort	Divide sorted cards to find a target	Visualize Merge Sort recursion tree using paper cutting activity	Discussion	VisuAlgo – Insertion Sort	CO1	PPT with step diagrams + short YouTube video clips	https://www.geeksforgeeks.org/insertion-sort/	Assignments	Game-based Learning	L3 (Apply)	TB1.
12	**L12**	1	**Linked List**	To make student understand linked list	Swap adjacent number placards on classroom floor	Draw stack vs heap memory diagram for array vs linked list	Interaction	VisuAlgo – Linked List	CO1	C compiler (global/local/static variables) with output on projector	https://www.geeksforgeeks.org/linked-list-data-structure/	Assignments	Inquiry based Learning	L3 (Apply)	TB1.
13	**L13**	1	**Stacks and Queues:** Introduction , Implementation**, Types of Queues**	To make student understand stack and queue	Link sticky-note nodes with arrows on whiteboard	Compare Stack vs Queue for given real-world scenarios (undo vs print queue)	Interaction	VisuAlgo – Stack & Queue	CO2	C compiler with array-of-stacks program shown on projector	https://www.geeksforgeeks.org/stack-data-structure/	Presentations	Individual Learning/self study	L4 (Analyze)	RB2
14	**L14**	1	Multi Stacks and Multi Queues, Applications of Stacks- Need, Evaluation and Conversion between Polish and Reverse Polish Notations	To make student understand type of queue,applications of Stacks- Need, Evaluation and Conversion between Polish and Reverse Polish Notations	Compare array-based vs pointer-based linked list	Convert infix `A+B*C` to postfix on board collaboratively	Interaction	GeeksforGeeks – Multi Stack	CO2	PPT with step tables + small online postfix evaluator website	https://www.geeksforgeeks.org/implement-two-stacks-in-an-array/	Presentations	Inquiry based Learning	L4 (Analyze)	TB1.
15	**L15**	2	Trees: Notations & Terminologies, Binary Trees, Binary Search Trees	To make student understand trees	Add sentinel node to simplify edge cases	Preorder/Inorder/Postorder walk: Students as nodes, visit in different orders	Interaction	VisuAlgo – BST	CO2	C compiler + table of outputs in PPT	https://www.geeksforgeeks.org/binary-search-tree-data-structure/	Projects(group /individual)	Learning through Problem-Solving	L3 (Apply)	TB1.
16	**L16**	2	Trees:Binary Trees, Binary Search Trees	To make student understand trees	Add sentinel node to simplify edge cases	Preorder/Inorder/Postorder walk: Students as nodes, visit in different orders	Interaction	VisuAlgo – BST	CO2	C compiler + table of outputs in PPT	https://www.geeksforgeeks.org/binary-search-tree-data-structure/	Projects(group /individual)	Learning through Problem-Solving	L3 (Apply)	TB1.
17	**L17**	2	Tree Traversals	To make student understand tree travsal	Pass token in a circle of students	Compare normal vs threaded tree traversal using string/thread on paper	Discussion	VisuAlgo – Tree Traversal	CO2	PPT with static pictures + PDF notes shared on LMS / WhatsApp	https://www.geeksforgeeks.org/tree-traversals-inorder-preorder-and-postorder/	Assignments	Individual Learning/self study	L3 (Apply)	TB2
18	**L18**	2	Tree Traversals	To make student understand tree travsal	Pass token in a circle of students	Compare normal vs threaded tree traversal using string/thread on paper	Discussion	VisuAlgo – Tree Traversal	CO2	PPT with static pictures + PDF notes shared on LMS / WhatsApp	https://www.geeksforgeeks.org/tree-traversals-inorder-preorder-and-postorder/	Assignments	Individual Learning/self study	L3 (Apply)	TB2
19	**L19**	2	Threaded Binary Tree	To make student understand binaryy tree	Add two polynomials stored as linked lists	Given traversals, reconstruct binary tree (group puzzle)	Interaction	GeeksforGeeks – Threaded Binary Tree	CO2	PPT slides showing rotations (LL, LR, RL, RR)	https://www.geeksforgeeks.org/threaded-binary-tree/	Case Study	Game-based Learning	L1 (Remember)	TB1.
20	**L20**	2	**AVL Trees:** Properties	To make student understand AVL tree	Stack physical books to experience LIFO behavior	LL, RR, LR, RR rotations: Students physically rotate their positions	Interaction	VisuAlgo – AVL Tree	CO2	C compiler showing AVL insertion code; trace on board	https://www.geeksforgeeks.org/avl-tree-set-1-insertion/	Assignments	Kinesthetic Learning	L4 (Analyze)	TB1.
21	**L21**	2	**AVL Trees-Operations-Insertion and Deletion.**	To make student understand AVL tree	Stack physical books to experience LIFO behavior	LL, RR, LR, RR rotations: Students physically rotate their positions	Interaction	VisuAlgo – AVL Tree	CO2	C compiler showing AVL insertion code; trace on board	https://www.geeksforgeeks.org/avl-tree-set-1-insertion/	Assignments	Kinesthetic Learning	L4 (Analyze)	TB1.

22	**L22**	2	Operations- Insertion and Deletion.	To make student understand tree operations	Act out simple, circular, and priority queues	Compare B Tree vs B+ Tree using database index example (library catalog)	Discussion	GeeksforGeeks – AVL Insertion	CO2	PPT with node-splitting examples	https://www.geeksforgeeks.org/deletion-in-binary-search-tree/	Presentations	Expeditionary Learning	L2 (Understand)	TB2
23	**L23**	2	**M- Way Trees:** General Concept, **B Trees , B+ Trees ,B* Trees**	To make student understand M-WAY	Partition one array into multiple stacks	Why B Trees for disk? Discussion on block size vs tree height	Interaction	VisuAlgo – B+ Tree	CO2	PPT with complete binary tree pictures	https://www.geeksforgeeks.org/b-tree-set-1-introduction-2/	Quizz with MCQ	Peer Teaching	L2 (Understand)	TB1.
24	**L24**	2	**Heaps**: Structural Properties	To make student understand Heap	Trace browser history as a real stack	Build max-heap using students' marks (heapify from last non-leaf)	Interaction	VisuAlgo – Heap	CO4	C compiler + stepwise screenshots in PPT	https://www.geeksforgeeks.org/heap-data-structure/	Presentations	Game-based Learning	L1 (Remember)	TB2
25	**L25**	2	Heapify	To make student understand Heap	Convert and evaluate expressions using card stack	Draw graph (city map) as matrix and as list in groups	Discussion	VisuAlgo – Heap Sort	CO4	C program in IDE, input/output shown via projector	https://www.geeksforgeeks.org/heap-sort/	Quizz with MCQ	Learning through Problem-Solving	L4 (Analyze)	TB3
26	**L26**	2	Priority Queue Implementation, Representation of Graphs: Adjacency Matrix and Linked Representation	To make student understand Types of queue	Partition list around pivot, visualize recursion tree	Convert given adjacency matrix to adjacency list (pair activity)	Interaction	VisuAlgo – Graph Structures	CO4	PPT plus Excel sheet for adjacency matrix	https://www.geeksforgeeks.org/priority-queue-set-1-introduction/	Projects(group /individual)	Kinesthetic Learning	L2 (Understand)	TB3
27	**L27**	3	**Graph Traversals:** Breadth First Search	To make student understand graph	Label root, leaf, height on a family tree	DFS using stack: Maze solving activity (go deep, backtrack)	Interaction	VisuAlgo – BFS	CO4	C compiler + PPT queue snapshot diagrams	https://www.geeksforgeeks.org/linked-list-data-structure/	Presentations	Game-based Learning	L4 (Analyze)	RB1
28	**L28**	3	Depth First Search, Connected Components	To make student understand dept search	Insert numbers one by one into BST	Cut property activity: Find minimum weight edge crossing cut	Discussion	VisuAlgo – DFS	CO3	C compiler + board diagram showing DFS tree	https://www.geeksforgeeks.org/data-structures/	Assignments	Expeditionary Learning	L1 (Remember)	RB2
29	**L29**	3	**Spanning Trees**: MST Algorithms	To make student understand spanning trees	Walk through tree nodes following traversal rules	Find MST of small graph manually in groups (compare results)	Interaction	VisuAlgo – MST	CO3	PPT with highlighted edges on sample graph	https://www.geeksforgeeks.org/types-of-data-structures/	Quizz with MCQ	Learning through Problem-Solving	L3 (Apply)	RB1
30	**L30**	3	Kruskal's Algorithm, Prim's Algorithm	To make student understand prims	Add colored thread arrows to NULL links	Dijkstra simulation: Find shortest path from source to all nodes (class navigation)	Interaction	VisuAlgo – Kruskal & Prim	CO3	PPT step tables + manual colour-coding on graph diagram	https://www.geeksforgeeks.org/linked-list-data-structure/	Quizz with MCQ	Game-based Learning	L4 (Analyze)	RB2
31	**L31**	3	**Shortest Path Algorithms**: Single Source and All Pairs-Dijkstra's Algorithm	To make student understand shortest path	Measure balance factors after each node insertion	Dynamic graph case study: Google Maps traffic updates discussion	Discussion	VisuAlgo – Dijkstra	CO5	Excel sheet / PPT table updating distances step-by-step	https://www.geeksforgeeks.org/array-data-structure/	Projects(group /individual)	Group-Teaching and Learning	L4 (Analyze)	TB1.
32	**L32**	3	Floyd-Warshall Algorithm, Topological Sort, Case Studies: Dynamic Graphs	To make student understand floyd warshall	Perform LL, RR, LR, RL rotations on paper	Compare Dijkstra vs Floyd-Warshall (when to use which)	Interaction	GeeksforGeeks – Floyd-Warshall	CO5	PPT with matrix updates (k, i, j)	https://www.geeksforgeeks.org/linked-list-data-structure/	Assignments	Kinesthetic Learning	L1 (Remember)	TB1.
33	**L33**	3	Social Network Graphs and Sparse Graphs	To make student understand social network	Simulate disk indexing using B-Tree insertion	Direct address table vs hash table: Student roll number vs name	Interaction	Gephi – Graph Visualization	CO5	PPT diagrams + simple example in C / pseudo-code	https://www.geeksforgeeks.org/linked-list-data-structure/	Assignments	Peer Teaching	L3 (Apply)	TB2
34	**L34**	3	**Shortest Path Algorithms**: Single Source and All Pairs-Dijkstra's Algorithm	To make student understand shortest path	Measure balance factors after each node insertion	Dynamic graph case study: Google Maps traffic updates discussion	Discussion	VisuAlgo – Dijkstra	CO5	Excel sheet / PPT table updating distances step-by-step	https://www.geeksforgeeks.org/array-data-structure/	Projects(group /individual)	Group-Teaching and Learning	L4 (Analyze)	TB1.
35	**L35**	3	Floyd-Warshall Algorithm, Topological Sort, Case Studies: Dynamic Graphs	To make student understand floyd warshall	Perform LL, RR, LR, RL rotations on paper	Compare Dijkstra vs Floyd-Warshall (when to use which)	Interaction	GeeksforGeeks – Floyd-Warshall	CO5	PPT with matrix updates (k, i, j)	https://www.geeksforgeeks.org/linked-list-data-structure/	Assignments	Kinesthetic Learning	L1 (Remember)	TB1.
36	**L36**	3	Social Network Graphs and Sparse Graphs	To make student understand social network	Simulate disk indexing using B-Tree insertion	Direct address table vs hash table: Student roll number vs name	Interaction	Gephi – Graph Visualization	CO5	PPT diagrams + simple example in C / pseudo-code	https://www.geeksforgeeks.org/linked-list-data-structure/	Assignments	Peer Teaching	L3 (Apply)	TB2
37	**L37**	4	**Hashing:** Hash Table	To make student understand hashing	Map heap as tree and array simultaneously	Chaining vs Open addressing: Two groups implement different collision strategies	Discussion	VisuAlgo – Hashing	CO5	PPT examples + small C program showing collisions	https://www.geeksforgeeks.org/linked-list-data-structure/	Presentations	Expeditionary Learning	L4 (Analyze)	TB1.
38	**L38**	4	Hash Functions, Collision Resolution	To make student understand hash function	Extract max repeatedly to observe sorted output	Compare sequential vs random access using cassette tape vs CD	Interaction	GeeksforGeeks – Collision Resolution	CO5	C file-handling demo in compiler + sample .txt file	https://www.geeksforgeeks.org/linear-search/	Case Study	Peer Teaching	L4 (Analyze)	TB2
39	**L39**	4	**File Organization:** Sequential	To make student understand file organizations	Simulate hospital triage using priority queue	Write small C program to read/write `student.dat` (live coding)	Interaction	Replit – Online C Compiler	CO5	Live coding: fopen/fprintf/fscanf in IDE	https://www.geeksforgeeks.org/linked-list-data-structure/	Assignments	Individual Learning/self study	L1 (Remember)	RB1
40	**L40**	4	Creating, Updating, and Retrieving from Sequential Files	To make student understand	Draw social network as matrix and linked list	Debug file handling code (missing `fopen` modes, `fclose`, etc.)	Discussion	OnlineGDB – C Compiler	CO5	Screen-share / projector of code and output terminal	https://www.geeksforgeeks.org/bubble-sort/	Quizz with MCQ	Inquiry based Learning	L3 (Apply)	RB2

41	**L41**	4	Handling Sequential Files in C language	To make student understand file organizations	Simulate BFS and DFS on a campus map	`fseek`, `ftell`, `rewind` simulation using pointer on a paper tape	Interaction	GeeksforGeeks – File Handling in C	CO5	C compiler demo using fseek, ftell, fread, fwrite	https://www.geeksforgeeks.org/insertion-sort/	Assignments	Game-based Learning	L4 (Analyze)	TB1.
42	**L42**	4	**Seeking, Positioning, Reading and Writing Binary Files in C, External Sorting:** Merging Ordered Files	To make student understand file organizations	Find minimum cost network on a city map	Natural merge simulation: Identify runs in unsorted file	Interaction	TutorialsPoint – Binary Files in C	CO5	PPT with block diagrams + simple C merge program	https://www.geeksforgeeks.org/linked-list-data-structure/	Presentations	Individual Learning/self study	L2 (Understand)	TB1.
43	**L43**	4	Unordered Files, Natural Merge	To make student understand file organizations	Trace Dijkstra's steps on a road map	K-way merge using heap (multiway merge simulation)	Discussion	GeeksforGeeks – External Sorting	CO5	PPT timeline diagrams; hand-worked example on board	https://www.geeksforgeeks.org/linked-list-data-structure/	Quizz with MCQ	Peer Teaching	L1 (Remember)	TB2
44	**L44**	4	Balanced Merge, K-Way	To make student understand file organizations	Implement hash table and simulate merge sort	Compare 2-way, K-way, and Polyphase merge (advantages/disadvantages)	Interaction	GeeksforGeeks – Polyphase Merge	CO5	Kahoot / Google Forms quiz + PPT summary slides	https://www.geeksforgeeks.org/linked-list-data-structure/	Presentations	Kinesthetic Learning	L6 (Create)	TB1.
45	**L45**	4	Polyphase Merge.	To make student understand file organizations	Implement hash table and simulate merge sort	Compare 2-way, K-way, and Polyphase merge (advantages/disadvantages)	Interaction	GeeksforGeeks – Polyphase Merge	CO5	Kahoot / Google Forms quiz + PPT summary slides	https://www.geeksforgeeks.org/linked-list-data-structure/	Presentations	Kinesthetic Learning	L6 (Create)	TB1.

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TB2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education India, Fourth Edition, 2014.
TB3. Mary E. S. Loomis, "Data Management and File Structure", PHI, Second Edition, 2009.

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RB2. Alfred V. Aho, John E. Hopcroft and D. Ullman, "Data Structures and Algorithms", Addison-Wesley, 1st Edition, 2002.
RB3. Richard F. Gilberg and Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Cengage Learning, 2nd Edition, 2004.
RB4. D. Malhotra and N. Malhotra, "Data Structures and Program Design using C", Laxmi Publications, Indian adapted edition from Mercury Learning and Information, USA, 1st Edition, 2018.
RB5 Schaum's Outline Series, "Data Structure", TMH, Special Indian Ed., 17th Reprint, 2014.

RB^ D. Samanta, "Classic Data Structures", PHI, 2nd Edition, 2009.

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