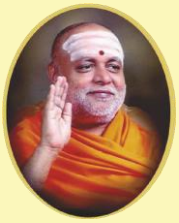

|| Jai Sri Gurudev ||

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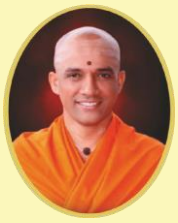
BGS College Of Engineering and Technology



VTU – Dec.2025 /Jan.2026 – III Sem Question Papers

2022 - Scheme

2022-Sheme - Dec.2025/Jan.2026

Theory Question Papers for 3rd Semester

Sl.No	Name of the Subject & Code
1	Mathematics for Computer Science (BCS301)
2	Digital Design and computer Organization (BCS302)
3	Operating System (BCS303)
4	Data Structures and Applications (BCS304)
5	Object Oriented Programming with Java (BCS306A)

CBCS SCHEME

USN | | | | | | | | | | |

BCS/BAD/BAI/BDS301

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Mathematics for Computer Science

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	A random variable X has the following probability function for various values of X. X : 0 1 2 3 4 5 6 7 P(x) : 0 K 2k 2k 3k k^2 $2k^2$ $7k^2+k$ i) Find the value of k. ii) Evaluate P[x < 6] , P[0 < x < 5] , P[x ≥ 6].	6	L2	CO1
	b.	Find the mean and standard deviation of Binomial distribution.	7	L2	CO2
	c.	If the probability of a bad reaction from a certain injection is 0.001. Determine the probability that out of 2000 individuals more than two will get a bad reaction.	7	L3	CO2
		OR			
Q.2	a.	Find K such that $F(x) = \begin{cases} k e^{-x} & , \ 0 < x < 1 \\ 0 & , \ \text{otherwise} \end{cases}$ Represents a valid pdf and hence find mean of the distribution.	6	L2	CO1
	b.	In a certain town the duration of a shower is exponentially distributed with mean 5 minutes. What is the probability that a shower will last for i) 10 minutes or more ii) less than 10 minutes.	7	L3	CO2
	c.	The marks of 1000 students in an examination follows a normal distribution with $\mu = 70$ and S.D = 5. Find the number of students whose marks will be i) less than 65 ii) more than 75 iii) between 65 & 75. Given $\phi(1) = 0.3413$.	7	L3	CO2
		Module – 2			
Q.3	a.	The joint probability distribution of two random variables x and y is x \ y: -4 2 7 1: 1/8 1/4 1/8 5: 1/4 1/8 1/8 i) Find the marginal distribution of x and y. ii) Obtain the covariance of x and y.	6	L2	CO2

	b.	Find the unique fixed probability vector of $P = \begin{bmatrix} 0 & 1 & 0 \\ \frac{1}{6} & \frac{1}{2} & \frac{1}{3} \\ 0 & \frac{2}{3} & \frac{1}{3} \end{bmatrix}$	7	L2	CO3
	c.	A student study habit are as follows : If he studies one night , he is 70% sure of not studying next night , on the other hand if he does not study one night , he is 60% sure not to study the next night. In the long run how often does he study?	7	L3	CO3
		OR			
Q.4	a.	Define the following : i) Probability vector ii) Regular stochastic matrix iii) Absorbing state.	6	L2	CO3
	b.	If X and Y are two independent random variables with the following distribution. Find the joint probability distribution of X and Y and hence find the covariance. x | 1 | 2 f(x) | 0.7 | 0.3 y | -2 | 5 | 3 g(y) | 0.3 | 0.5 | 0.2	7	L2	CO2
	c.	Three girls A, B, C are throwing the ball to each other. A always throws the ball to B, B always throws the ball to C. C is just as likely to throw the ball to B as to C. If C was the first person to throw the ball, find the probability that after 3 throws A, B , C has the ball.	7	L3	CO3
		Module – 3			
Q.5	a.	Explain the following terms : i) Null Hypothesis ii) Type 1 and 2 error iii) Test of significance	6	L1	CO5
	b.	A die is thrown 9000 times and throw of 3 or 4 was observed 3240 times. Do the data indicate that an unbiased dice at 5% level of significance $Z_{0.05} = 1.96$.	7	L3	CO4
	c.	A random sample for 1000 workers in company has mean wage of Rs 50 per day and S.D of Rs 15. Another sample of 1500 workers from another company has mean wage of Rs 45 per day and S.D of Rs 20. Does the mean rate of wages varies between two companies at 1% level of significance.	7	L3	CO4
		OR			
Q.6	a.	Certain tubes manufactured by a company have mean life time of 800 hours and S.D of 60 hrs. Find the probability that a random sample of 16 tubes taken from the group will have a mean life time of : i) Between 790 hrs and 810 hrs ii) Less than 785 hrs iii) More than 820 hrs Given $\phi(0.67) = 0.2486$; $\phi(1) = 0.3413$; $\phi(1.33) = 0.4082$	6	L3	CO4

	b.	It has been found from experience that the mean breaking strength of a particular brand of thread is 275.6 gms with standard deviation of 39.7 gms. Recently a sample of 36 pieces of thread showed a mean braking strength of 253.2 gms. Can one conclude at a significance level of 5% that the thread has become inferior?	7	L3	CO4
	c.	In an elementary school examination of mean grade of 32 boys was 72 and S.D 8, while the mean grade of 36 girls was 75 and S.D 6. Test the hypothesis that the performance of girls is better than boys at 1 % l.O.S.	7	L3	CO4
		Module – 4			
Q.7	a.	An unknown distribution has mean 635 and S.D 1.36 samples of size 36 are drawn from this population. Find the probability that the sample mean is between 634.76 and 635.24 given $\phi(1.06) = 0.3554$.	6	L2	CO4
	b.	The mean and S.D of the maximum loads supported by 60 cables are 11.09 tonnes and 0.73 tonnes respectively. Find 95% C.I for mean of the maximum loads of all cables produced by the company.	7	L2	CO4
	c.	A certain stimulus administrated to each of the 12 patients resulted in the following change in blood pressure, 5, 2, 8, -1, 3, 0, 6 -2, 1, 5, 0, 4. Can it be concluded that the stimulus will increase the blood pressure given $t_{0.05} = 2.201$ for 11 d.o.f.	7	L3	CO4
		OR			
Q.8	a.	Ten individuals are chosen at random from a population and their heights in inches are found to be 63, 63, 66, 67, 68, 69, 70, 70, 71, 71. Test the hypothesis that the mean height of the universe is 66 inches ($t_{0.05} = 2.262$ for 9 d.o.f).	6	L3	CO4
	b.	A sample of 11 rats from 9 population had an average blood viscosity of 3.92 with a S.D of 0.61. On the basis of the sample establish 95% C.I for the mean blood viscosity of the population. ($Z_{0.05} = 1.96$).	7	L2	CO5
	c.	A die is thrown 264 times and the number appearing on the face (x) follows the following frequency distribution : x: 1, 2, 3, 4, 5, 6 y: 40, 30, 26, 56, 52, 60 Calculate the value of χ^2 at 5% of level of significance.	7	L3	CO4

Module – 5

Q.9 **a.** A manufacturing company has purchased three new machines of different makes and wishes to determine whether one of them is faster than the others in producing a certain output. Five hourly production figures are observed at random from each other machine and the results are given below. Use Anova and determine whether the machines are significantly different in their mean speed ($F_{2,12} = 3.89$). **10 L3 CO5**

Observation	A_1	A_2	A_3
1	25	31	24
2	30	39	30
3	36	38	28
4	38	42	25
5	31	35	28

b. Set up on two way Anova analysis for the following two way design results. **10 L3 CO5**

Varieties of fertilizers	A	B	C
W	6	5	5
X	7	5	4
Y	3	3	3
Z	8	7	4

State whether variety differences are significant at 5% level given that $F_{2,6} = 5.14$ and $F_{3,6} = 4.76$.

OR

Q.10 **a.** Set up analysis of variance table for the following per acre production data for 3 varieties of wheat each grown on 4 plots and state if the variety differences are significant given $F_{2,9} = 4.26$. **10 L3 CO6**

Plot of land	Per acre production variety of wheat		
	A	B	C
1	6	5	5
2	7	5	4
3	3	3	3
4	8	7	4

b. Analyse and interpret the following statistics concerning output of wheat per field obtained as a result of experiment conducted to test four varieties of wheat A, B, C, D under Latin square design given $F_{3,6} = 4.76$. **10 L3 CO6**

C_{25}	B_{23}	A_{20}	D_{20}
A_{19}	D_{19}	C_{21}	B_{18}
B_{19}	A_{14}	D_{17}	C_{20}
D_{17}	C_{20}	B_{21}	A_{15}

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CBCS SCHEME

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BCS302

Third Semester B.E/B.Tech. Degree Examination, Dec.2025/Jan.2026
Digital Design and Computer Organization

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
1	a.	Obtain the minimum expression for the POS expression : $F(A, B, C, D) = \pi M(0, 1, 5, 7, 9, 13, 15) + d(3, 10)$.	5	L2	CO1
	b.	Implement the following logic function in SOP form using NOR gates. $Y = A\overline{B} + B\overline{C} + ABC$.	5	L3	CO1
	c.	Identify the essential prime implicants of the following functions : $F(w, x, y, z) = (0, 1, 4, 5, 6, 7, 9, 11, 14, 15)$ $F(A, B, C, D) = (0, 2, 3, 5, 7, 8, 10, 11, 14, 15)$.	10	L3	CO1
		OR			
2	a.	Demonstrate the positive and negative logic using AND gate.	5	L2	CO1
	b.	Simplify the following Boolean functions using K-map : i) $F(P, Q, R, S) = \Sigma(0, 2, 5, 7, 8, 10, 13) + d(1, 4, 15)$ ii) $F(A,B,C,D) = (\overline{A}+B+C)(\overline{A}+\overline{C}+D)(\overline{B}+C+D)$.	10	L3	CO1
	c.	Explain Dataflow Modeling in verilogy with an example program.	5	L1	CO1
		Module – 2			
3	a.	Explain the difference between combinational and sequential circuits with their block diagrams and examples.	5	L2	CO2
	b.	Write the verilog program to implement full adder and full subtractor circuits.	7	L2	CO2
	c.	Describe and explain 4 bit adder with carry look ahead.	8	L3	CO2
		OR			
4	a.	Implement the Boolean function : $F(A, B, C, D) = \Sigma m(1, 3, 4, 11, 12, 13, 14, 15)$ using 8 : 1 MUX.	5	L3	CO2
	b.	What is encoder? Design 8 : 3 encoder circuits with logic diagram and truth table and also list its applications.	7	L3	CO2
	c.	What is Latch? Demonstrate the working of SR flip-flop and D Flip-flop and write the characteristics table and equations.	8	L3	CO2

		Module – 3			
5	a.	What do you mean by an addressing mode? Explain any 5 addressing modes.	10	L2	CO3
	b.	Describe the Big-endian and Little-endian address assignment.	5	L1	CO3
	c.	A program with 5000 machine instructions needs an average of 3 basic steps to execute one instruction. Find the performance of the computer having a clock speed of 500 KHz.	5	L3	CO3
		OR			
6	a.	Demonstrate the Branching operations using loop to add n numbers with block diagram.	8	L3	CO3
	b.	Show how below expression will be executed in one address and three address processor in accumulator organization. X = (A * B) + (C * D).	7	L3	CO3
	c.	What are Condition Code Flags? Mention the significance of the flag N, Z, V and C.	5	L1	CO3
		Module – 4			
7	a.	Explain memory mapped I/O and I/O interface for an input device with a diagram.	10	L2	CO4
	b.	Explain DMA with a neat diagram.	10	L4	CO4
		OR			
8	a.	Explain how to handle interrupt from multiple devices using daisy chain and priority scheme.	10	L3	CO4
	b.	Explain centralized and distributed Bus Arbitration approaches.	10	L2	CO4
		Module – 5			
9	a.	With a diagram, explain the single bus organization of the data path inside a processor.	10	L2	CO5
	b.	Describe the basic idea of instruction pipeline.	10	L2	CO5
		OR			
10	a.	Explain the process of fetching word from memory in processor.	10	L4	CO5
	b.	Explain the pipeline performance of a processor and pipeline stalls.	10	L2	CO5

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CBCS SCHEME

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BCS303

Third Semester B.E/B.Tech. Degree Examination, Dec.2025/Jan.2026
Operating Systems

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
1	a.	Explain the various types of system calls with an example for each.	8	L2	CO1
	b.	Explain cloud computing its types and their services it offers.	8	L2	CO1
	c.	What is dual mode operation and what is the need of it?	4	L2	CO1
		OR			
2	a.	Explain the different architecture of OS starting from Simple Structure, Layered Structure, Micro Kernels, Modules and Hybrid Systems.	8	L4	CO1
	b.	Discuss the essential properties of the following types of systems : i. Time sharing system ii. Multi-programmed batch systems.	6 6	L2	CO1
		Module – 2			
3	a.	Explain Inter Process Communication.	6	L2	CO2
	b.	Discuss Multilevel Queue Scheduling Algorithm.	6	L4	CO2
	c.	Consider the set of 3 processes whose arrival time and burst time are given below.	8	L3	CO2

Process Id	Arrival Time	Burst Time
P1	0	9
P2	1	4
P3	2	9

If the CPU scheduling policy is SRTF, calculate the average waiting time and average turnaround time.

OR

4	a.	Compare User Level Threads and Kernel Level threads.	4	L4	CO2
	b.	Illustrate with a neat sketch, Process States and Process Control Block (PCB).	8	L2	CO2
	c.	Consider the set of 6 processes whose arrival time and burst time are given below. If the CPU scheduling policy is Round Robin with time quantum = 3, calculate Average Waiting time and Turnaround time.	8	L3	CO2

Process ID	Arrival Time	Burst Time
P_1	5	5
P_2	4	6
P_3	3	7
P_4	1	9
P_5	2	2
P_6	6	3

Module – 3

5	a.	Discuss in detail the critical section problem and write the algorithm for producer consumer problem.	10	L2	CO3
	b.	Consider the following system using data structures in the Bankers Algorithm with resource type ABC Maximum instance present in the system A = 10, B = 5, C = 7. i. Calculate Need Matrix ii. Check whether system is safe or not.	10	L3	CO3

Process	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P_0	0	1	0	7	5	3	3	3	2
P_1	2	0	0	3	2	2			
P_2	3	0	2	9	0	2			
P_3	2	1	1	2	2	2			
P_4	0	0	2	4	3	3			

OR

6	a.	Outline the solutions of Dinning –Philosopher problem.	5	L2	CO3
	b.	Describe a resource allocation graph with an example.	5	L4	CO3
	c.	Using Bankers algorithm, solve the following problem : i. Calculate the Need Matrix ii. Check whether system is safe or not.	10	L2	CO3

Process	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P_0	0	0	1	2	0	0	1	2	1	5	2	0
P_1	1	0	0	0	1	7	5	0				
P_2	1	3	5	4	2	3	5	6				
P_3	0	6	3	2	0	6	5	2				
P_4	0	0	1	4	0	6	5	6				

		Module – 4			
7	a.	Discuss the given memory management technique with diagram. i. Paging ii. Translation Look-Aside Buffer.	**6** **6**	**L2**	**CO4**
	b.	Discuss about Contiguous Memory Allocation with a neat diagram.	**8**	**L2**	**CO4**
		OR			
8	a.	Consider the reference string : 6, 1, 1, 2, 0, 3, 4, 6, 0, 2, 1, 2, 1, 2, 0, 3, 2, 1, 2, 0 For a memory with three frames and calculate number of page faults by using i. LRU replacement ii. FIFO replacement.	**10**	**L3**	**CO4**
	b.	Describe the process of demand paging in OS.	**10**	**L2**	**CO4**
		Module – 5			
9	a.	Explain in detail about directory and disc structure.	**6**	**L2**	**CO5**
	b.	Analyze the file system implementation.	**6**	**L4**	**CO5**
	c.	The requested tracks, in the order received are {176, 79, 34, 60, 92, 11, 41, 114} Apply the following disk scheduling algorithms starting track at 50. i) FCFS ii) SSTF. Calculate the total seek time.	**8**	**L3**	**CO5**
		OR			
10	a.	Explain Free Space Management with an example.	**6**	**L2**	**CO2**
	b.	Explain the Access Matrix method of system protection with the domain as objects and its implementation.	**6**	**L2**	**CO2**
	c.	The requested tracks, the order received are {176, 79, 34, 60, 92, 11, 41, 114} Apply the following disk scheduling algorithms starting track at 50. i) Look ii) C – Look. Calculate the total seek time.	**8**	**L3**	**CO3**

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Visvesvaraya Technological University

Belagavi, Karnataka - 590 018.

Scheme & Solutions Signature of Scrutinizer

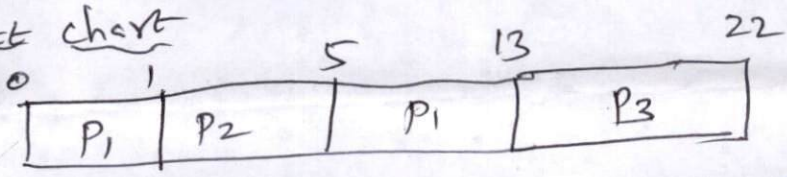
Subject Title : Operating System **Subject Code :** BCS303

Question Number	Solution	Marks Allocated
1) (a)	System Calls Types / Example 1) process control — Create process, end, abort, load, execute. 2) File Management — Create file, delete file 3) Device Management — read, write, reposition 4) Information Maintanence — get time or date etc. 5) Communications — Client - server 6) protection — Control access	(8)
(b)	Cloud Computing - Delivers Computing, Storage, even apps as a service across a network - Types of Cloud : public cloud, private cloud, Hybrid cloud - Types of services : IaaS, PaaS, SaaS	(2) (3) (3)
(c)	Dual Mode operation (i) User Mode (ii) Kernel Mode Need Protect the operating System from errant Users.	(4)

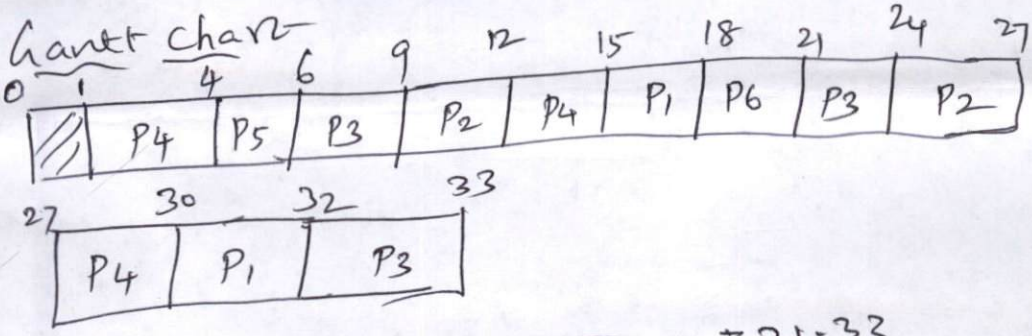
Subject Title : Operating System **Subject Code :** BCS303

Question Number	Solution	Marks Allocated
2) (a)	1) Simple Structure - MS DOS 2) Layered Approach 3) Microkernel System (MACH) 4) Modules (Linux, Solaris) 5) Hybrid system (Mac OS) } Explanation all with diagrams	(8)
(b)	Timesharing (Multitasking) - Definition, advantages, usage etc.	(6)
	Multiprogramming (Batch System) - Definition, advantages and usage.	(6)
	-x-	
3) (a)	Inter Process Communication Definition - (2 marks)	(6)
	Types of IPC (i) Shared Memory - with diagram (2 marks) (ii) Message passing - with diagram (2 marks)	
(b)	Multilevel Queue Scheduling Algorithm. Introduction - (2 marks) Explanation with examples (3 marks) diagram - (1 mark).	(6)

Subject Title : Operating System **Subject Code :** BCS303

Question Number	Solution	Marks Allocated
c)	SRTF : Solutions. Gantt chart  Average Turn Around Time : 12.33 Average Waiting time : 5 -x-	(8)
4 (a)	Comparisim of Kernel level threads and User level Threads. User Threads : POSIX Pthreads Win32 threads Java threads - Advantages Kernel Threads : Windows XP/2000 Solaris, Linux. - Advantages.	(4).
(b)	Process States Diagram - new, running, waiting, ready, terminated - diagram. (4 marks) Process Control Block. -process state, number, program counter, - diagram. (4 marks)	(8)

Subject Title : Operating System **Subject Code :** BCS303

Question Number	Solution	Marks Allocated
4 (c)	Round Robin Algorithm (solutions). Gantt chart  Average Turn around Time = 21.33 Average Waiting Time = 16	(8)
5 (a)	Critical section Introduction Explanation (entry section & exit section) } 5 marks Producer - Consumer problem (Pseudocode Explanation) } 5 marks.	(10)
5 (b)	Need Matrix (~~5~~ marks)	(10)

Process	Need		
	A	B	C
P0	7	4	3
P1	1	2	2
P2	6	0	0
P3	0	1	1
P4	4	3	1

Safe sequence is : P1, P3, P4, P0, P2.

(All Sequential steps to be derived) (~~5~~ marks)

Subject Title : Operating System Subject Code : BCS303

Question Number	Solution	Marks Allocated
6) a)	Dining-philosophers Problem – Definition – Example & Explanation. – Pseudo code Explanation.	(5)
b)	Resource Allocation Graph. – Definition – Explanation about (i) Claim edge (ii) Request edge – Diagram with example.	(5).
(c)	Need Matrix	(10)

Process	Need			
	A	B	C	D
P_0	0	0	0	0
P_1	0	7	5	0
P_2	1	0	0	2
P_3	0	0	2	0
P_4	0	0	4	2

Safe Sequence: P_0, P_2, P_3, P_4, P_1

Subject Title : Operating System Subject Code : BCS303

Question Number	Solution	Marks Allocated
7) (a)	(i) Paging - Definition - frames, Page table, Page number, page offset (explanation) - paging Hardware (diagram)	(6)
	(ii) Translation Look-a side Buffer - Definition - TLB - Explanation with digram - Example.	(6)
(b)	Contiguous Memory Allocation. - Definition - Explanation about Base register, Limit register, MMU - Diagram.	(8)
	-x-	
8) a)	LRU Replacement Algorithm. Solution: Number of Page Hits = 7 Number of Page faults = 13.	(10)
	FIFO Replacement Algorithm. Solutions: No of Page Hits = 8 No of Page Faults = 12	

Subject Title : Operating System Subject Code : BCS303

Question Number	Solution	Marks Allocated
8) b)	**Demand Paging** - Basic Concepts - Diagram with explanation - Aspects of Demand Paging - Performance of Demand Paging.	(10)
	-x-	
9) a)	Directory Structure - Explanation - Diagram.	(6)
	Disk Structure - Explanations (partitions, RAID, Volume) - Diagram.	
b)	File System Implementation - Introduction - File System Structure - Layered file systems.	(6)
c)	**FCFS** Introduction Diagram to be drawn based on the steps. Total Seek time is 510 (4 marks)	(8)

Subject Title : Operating System Subject Code : BCS303

Question Number	Solution	Marks Allocated
	SSTF Diagram to be drawn. Total seek time is 204 (4 marks). —x—	
10) a)	Free space Management - Introduction - Example - Explanation. (Bit vector, Bit map, Grouping, Counting, Space Map)	(6)
b)	Access Matrix Method - Introduction - Access Matrix Explanation - Use of Access Matrix - Implementation.	(6)
c)	Look Diagram to be shown. Total seek time is 291 (4 marks) C-Look Diagram to be shown. Total seek time is 321 (4 marks) —x—	(8)

CBCS SCHEME

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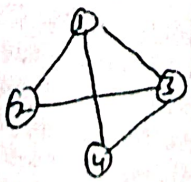
BCS304

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Data Structures and Applications

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define Data Structure. Explain with neat diagram different types of data structure with examples. What are the primitive operations that can be performed?	10	L2	CO1
	b.	Define structure and union? Explain how they are different from each other, with suitable example.	5	L2	CO1
	c.	What do you mean by pattern matching? Outline Kruth, pattern matching algorithm.	5	L2	CO1
		OR			
Q.2	a.	Define stack. Give the implementation of push ( ) POP ( ) and Display ( ) functions by considering its empty and full conditions.	7	L2	CO1
	b.	Write an algorithm to evaluate a postfix expression and apply the same for the given postfix expression 6, 2, 13, -4, 2,×,+	7	L3	CO1
	c.	Write the postfix form of the following using stack, (i) $A*(B*C+D*E)+F$ (ii) $(A+(B*C)/(D-E))$	6	L3	CO1
		Module – 2			
Q.3	a.	What are the disadvantages of ordinary queue? Discuss the implementation of circular queue.	8	L2	CO2
	b.	Write a note on multiple stacks and priority queue.	6	L2	CO2
	c.	Define Queue. Discuss how to represent Queue using dynamic arrays.	6	L2	CO2
		OR			
Q.4	a.	What are Linked list? Explain the different types of Linked List with neat diagram.	4	L2	CO2
	b.	Give the structure definition for Singly Linked List (SSL). Write a C function to, (i) Insert an element at the end of SSL. (ii) Delete at node at the end of SSL.	8	L3	CO2

	c.	Write a C function to add two polynomials show the Linked List representation of below two polynomials $p(x) = 3x^{14} + 2x^7 + 1$ $q(x) = 8x^{14} + 5x^5 + 3x^2 + 2$	8	L3	CO2
		Module – 3			
Q.5	a.	Write a C-function for the following operation on doubly Linked List (DLL) : (i) Addition of a DLL node. (ii) Concatenation of two DLL's.	8	L3	CO3
	b.	Write a C-function for the following operations on circular Linked List (i) Inserting at the front of a List. (ii) Find the number of nodes in circular list.	8	L3	CO3
	c.	Represent the given Sparse matrix using linked list representation. $A = \begin{bmatrix} 2 & 0 & 0 & 0 \\ 4 & 0 & 0 & 3 \\ 0 & 0 & 0 & 0 \\ 7 & 0 & 1 & 1 \\ 0 & 0 & 6 & 0 \end{bmatrix}$	4	L3	CO3
		OR			
Q.6	a.	Explain the different types binary tree representation with example.	8	L3	CO3
	b.	Define Threaded Binary tree. Discuss in threaded binary tree.	4	L3	CO3
	c.	Discuss Inorder, preorder, postorder and level order traversal with suitable recursive function for each.	8	L2	CO3
		Module – 4			
Q.7	a.	Write a function to perform the following operations on Binary Search Tree (BST) : (i) Inserting on element into BST. (ii) Recursive search of a BST.	8	L3	CO4
	b.	Discuss selection Trees with suitable example.	8	L2	CO4
	c.	Explain transforming a forest into a binary tree with an example.	4	L2	CO4
		OR			
Q.8	a.	Define graph. Show the adjacency matrix and adjacency. List representation of the graph given below.  Fig. Q8 (a)	6	L3	CO4

	b.	Define the following Terminologies with examples : (i) Vertex (node) (ii) Self loop (iii) Weighted graph (iv) Parallel edges	7	L1	CO4
	c.	Explain in detail elementary graph operations.	7	L1	CO4
		Module – 5			
Q.9	a.	What is collision? What are the methods to resolve collision? Explain linear probing with example.	8	L2	CO5
	b.	Explain in details about static and dynamic hashing.	6	L2	CO5
	c.	Discuss Leftist Trees with an example.	6	L2	CO5
		OR			
Q.10	a.	Explain different types of HASH functions with example.	6	L2	CO5
	b.	Discuss different types of rotations with suitable examples.	6	L3	CO5
	c.	Define Red-Black Tree, Splay tree. Discuss the method to insert an element into Red-Black tree.	8	L2	CO5

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CBCS SCHEME

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BCS306A

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Object Oriented Programming with Java

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain feature of Java.	7	L2	CO1
	b.	Define array, write a java program to calculate the average among the elements [8, 6, 2, 7].	7	L3	CO1
	c.	List and explain operators in JAVA with examples.	6	L2	CO1
		OR			
Q.2	a.	Explain OOP's features in java.	7	L2	CO1
	b.	Write a java program to sort the elements using a for loop.	7	L3	CO1
	c.	With example, explain different types of if statement in JAVA.	6	L2	CO1
		Module – 2			
Q.3	a.	Define Constructor. Explain two types of constructors with an example.	7	L3	CO2
	b.	Define Recursion. Write a recursive program to find factorial of a number.	7	L3	CO2
	c.	Explain garbage collection with an example, explain final and finalize ( ) method.	6	L2	CO2
		OR			
Q.4	a.	Define class. Explain call by value and call by reference with an example program.	7	L3	CO2
	b.	Using proper class and methods write a program to perform stack operations.	7	L3	CO2
	c.	Explain the use of this keyword in java with an example.	6	L2	CO2
		Module – 3			
Q.5	a.	Write a java program to implement multilevel inheritance with 3 levels of hierarchy.	7	L3	CO3
	b.	Define interface. With suitable program explain nested interface in java.	7	L3	CO3
	c.	Explain dynamic method dispatch with a suitable example.	6	L2	CO3

		OR			
Q.6	a.	Explain inheritance. Write a java program to implement single level inheritance.	7	L3	CO3
	b.	Explain the importance of the super key word in inheritance, illustrate with a suitable example.	7	L3	CO3
	c.	Define method overloading and overriding with example.	6	L2	CO3
		Module – 4			
Q.7	a.	Define Package, with an example, explain the steps are involved in creating a user-defined package.	7	L2	CO4
	b.	With sample code, explain chained exception.	7	L3	CO4
	c.	Define an exception, with syntax explain all five keywords used in exception handling.	6	L2	CO4
		OR			
Q.8	a.	Explain the concept of package importing in java with an example.	7	L2	CO4
	b.	How do you create your own exception class, explain with a program.	7	L2	CO4
	c.	With an example, explain working of a nested try block within an exception.	6	L3	CO4
		Module – 5			
Q.9	a.	Define Thread. With diagram explain the java thread model.	7	L2	CO5
	b.	Explain synchronization with an example, how synchronization is implemented in java.	7	L3	CO5
	c.	With suitable example, explain values( ) and valueOf( ) method in enumeration.	6	L2	CO5
		OR			
Q.10	a.	Define Multithreading, write a program to create multiple threads in java.	7	L2	CO5
	b.	Demonstrates the usage of compareTo( ) and equals( ) method with enumeration constants.	7	L3	CO5
	c.	Explain autoboxing / unboxing in expressions.	6	L2	CO5

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