CBCS SCHEME

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BCM301

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Mathematics for Computer and Communication Engineering

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.	An alternating current after passing through a rectifier has the form $i = \begin{cases} I_0 \sin x, & 0 \le x \le \pi \\ 0, & \pi \le x \le 2\pi \end{cases}$ where I_0 is the maximum current. Express i as a Fourier series.	6	L3	CO1
	b.	Obtain the Fourier series expansion of the wave form given by $f(x) = 2x - x^2$ which is periodic with the period 3 over the interval (0, 3).	7	L3	CO1
	c.	The displacement y of a part of mechanism is tabulated with corresponding angular movemen t'x' of the crank. Express y as a Fourier series upto the first harmonic.	7	L3	CO1

x :	0°	60°	120°	180°	240°	300°	360°
y :	7.9	7.2	3.6	0.5	0.9	6.8	7.9

OR

Q.2	a.	Find the Fourier series of $f(x) = \begin{cases} 1+\frac{4x}{3} & \frac{-3}{2} < x < 0 \\ 1-\frac{4x}{3} & 0 < x < \frac{3}{2} \end{cases}$	6	L3	CO1
	b.	Obtain the Fourier series expansion of f(x) = Sin mx, where m is neither zero nor an integer over $(-\pi, \pi)$.	7	L3	CO1
	c.	Expand $f(x) = x(\pi - x)$ as half range Fourier sine series over $(0, \pi)$ and hence deduce that $\frac{1}{1^3} - \frac{1}{3^3} + \frac{1}{5^3} - \frac{1}{7^3} + \ldots\ldots = \frac{\pi^3}{32}$.	7	L3	CO1
		Module – 2			
Q.3	a.	Find the Fourier Cosine transform of $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2 - x, & 1 < x < 2 \\ 0, & x > 2 \end{cases}$	6	L3	CO2
	b.	Find the Fourier transform of $e^{-a^2x^2}$, $a < 0$.	7	L3	CO2
	c.	Find the Z – transform of Cosnθ and sinnθ. Hence evaluate $Z_T(4 \sin n\pi/4)$	7	L3	CO2

OR

Q.4	**a.**	Find the Inverse Z – transform of $\frac{2z^2+3z}{(z+2)(z-4)}$.	**6**	**L3**	**CO2**
	b.	Solve $U_{n+2} + 2U_{n+1} + U_n = n$, given $U_0 = 0$, $U_1 = 0$ by using Z – transform.	**7**	**L3**	**CO2**
	c.	If the Fourier sine transform of f(x) is $\frac{e^{-as}}{s}$, $a > 0$, then find f(x).	**7**	**L3**	**CO2**

Module – 3

Q.5	**a.**	The following table gives the marks obtained by 10 students in the subjects English and Mathematics. Find the rank correlation between the subjects. English: 56, 75, 45, 71, 62, 64, 58, 80, 76, 61 Mathematics: 66, 70, 40, 60, 65, 56, 59, 77, 67, 63	**6**	**L3**	**CO3**
	b.	Fit a second degree parabola of the form $y = a + bx + cx^2$ to the following data : x: 0, 1, 2, 3, 4 y: 1, 1.8, 1.3, 2.5, 6.3	**7**	**L3**	**CO3**
	c.	With the usual notations show that $\tan\theta = \frac{1-r^2}{r} \times \frac{\sigma_x \sigma_y}{\sigma_x^2 + \sigma_y^2}$. Explain the significance when $r = 0$ and $r = \pm 1$.	**7**	**L3**	**CO3**

OR

Q.6	**a.**	Find the straight – line $y = a + bx$ to the following data : x: 1, 3, 4, 6, 8, 9, 11, 14 y: 1, 2, 4, 4, 5, 7, 8, 9	**6**	**L3**	**CO3**
	b.	Find the least square fit of the form $y = ax^b$ to the data x: 61, 26, 7, 26 y: 350, 400, 500, 600	**7**	**L3**	**CO3**
	c.	Find the coefficient of correlation between industrial production and export for the data given below : Production (Crore tons): 55, 56, 58, 59, 60 Export (Crore tons): 35, 38, 38, 39, 44 Also find the export when the production is 57 Crore tons.	**7**	**L3**	**CO3**

Module – 4

Q.7	**a.**	A random variable X has the following probability function : 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 $p(x < 6)$ iii) Evaluate $p(x \geq 6)$	**6**	**L3**	**CO4**
	b.	Derive an expression for mean and standard deviation of Binomial distribution.	**7**	**L2**	**CO4**
	c.	In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation of the distribution. [Given : $\phi(0.5) = +0.19$ and $\phi(1.4) = 0.42$].	**7**	**L3**	**CO4**

		OR			
Q.8	**a.**	'X' is a continuous random variable with the probability density function given by $f(x) = \begin{cases} kx & , \ 0 \le x < 2 \\ 2k & , \ 2 \le x < 4 \\ -kx + 6k & , \ 4 \le x < 6 \end{cases}$ Find k and the mean value of X.	**6**	**L3**	**CO4**
	b.	Fit a poisson distribution to the set of observations x : 0 1 2 3 4 f : 122 60 15 2 1	**7**	**L3**	**CO4**
	c.	The sales per day in a shop is exponentially distributed with the average sales amounting to Rs 100 and net profit is 8%. Find the probability that the net profit exceeds Rs 30 on two consecutive days.	**7**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	The joint probability distribution of two random variables X and Y is defined by $f(x, y) = \frac{1}{27}(2x + y)$, where x = 0, 1, 2 and y: 0, 1, 2. Construct the joint probability distribution table and hence obtain COV(X, Y).	**6**	**L3**	**CO5**
	b.	A Company claims that the mean thermal efficiency of diesel engines produced by them is 32.3%. To test this claim, a random sample of 40 engines were examined which showed the mean thermal efficiency of 31.4% and standard deviation of 1.6%. Can the claim be accepted or not at 0.01 level of significance? (Given : $\phi(2.58) = 0.495$).	**7**	**L3**	**CO5**
	c.	An ambulance service company claims that on an average it takes 20 minutes between a call for an ambulance and the patient's arrival at the hospital. If in 6 calls the time taken (between a call and arrival at hospital) are 27, 18, 26, 15, 20, 32. Can the Company's claim be accepted? (Given : $\phi(2.015) = 0.05$).	**7**	**L3**	**CO5**
		OR			
Q.10	**a.**	The joint distribution of two random variables X and Y is given below : X \ Y | -4 | 2 | 7 1 | 1/8 | 1/4 | 1/8 5 | 1/4 | 1/8 | 1/8 i) Determine the marginal distribution of X & Y. ii) Verify that X and Y are dependent random variables. iii) Evaluate P(Z = X + Y) iv) Evaluate P (X + Y > 3).	**6**	**L3**	**CO5**

	b.	A fair coin is tossed thrice. The random variables X and Y are defined as follows : X = 0 or 1 according as tail occurs on the first toss. Y = Number of heads. i) Determine the distributions of X and Y. ii) Determine the joint distribution of X – Y. iii) Evaluate E(X), E(Y) and E(X, Y).	**7**	**L3**	**CO5**
	c.	The number of computer malfunctions per day is recorded for 260 days with the following results : No. of malfunctions : 0, 1, 2, 3, 4, 5 No. of days : 77, 87, 55, 30, 5, 6 Fit a Poisson distribution and test for the goodness of fit at $\alpha = 5\%$.	**7**	**L3**	**CO5**

No. of malfunctions :	0	1	2	3	4	5
No. of days :	77	87	55	30	5	6

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CBCS SCHEME

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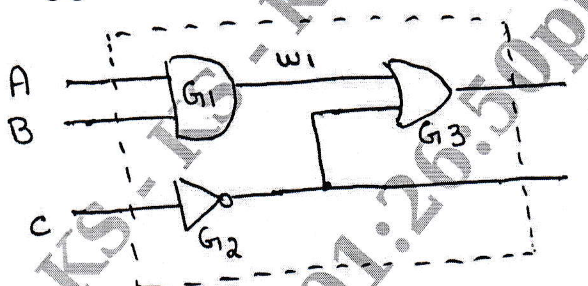
Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Digital Design and Computer Organization

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
Q.1	a.	Determine the complement of the following function: (i) $F = xy' + x'y$ (ii) $F = x'yz' + x'y'z$	06	L3	CO1
	b.	Describe map method for three variables.	04	L2	CO1
	c.	Apply K map technique to simplify the following function: (i) $F(x, y, z) = \Sigma(0, 2, 4, 5, 6)$ (ii) $F(x, y, z) = x'y + yz' + y'z'$	10	L3	CO1
		OR			
Q.2	a.	Apply K map technique to simplify the function : $F(w, x, y, z) = \Sigma(1, 3, 7, 11, 15)$ and $d(w, x, y, z) = \Sigma(0, 2, 5)$	06	L3	CO1
	b.	Determine all the prime implicants for the Boolean function F and also determine which are essential $F(w, x, y, z) = \Sigma(0, 2, 4, 5, 6, 7, 8, 10, 13, 15)$	10	L3	CO1
	c.	Develop a verilog gate-level description of the circuit shown in Fig.Q2(c).  Fig.Q2(c)	04	L3	CO1
		Module – 2			
Q.3	a.	Explain the combinational circuit design procedure with code conversion example.	10	L2	CO2
	b.	Design a full adder circuit. Also develop data flow verilog model for full adder.	10	L3	CO2
		OR			
Q.4	a.	Describe 4 × 1 MUX with block diagram and truth table. Also develop a behavioral model verilog code for 4 × 1 MUX.	10	L2	CO2
	b.	What are storage elements? Explain the working of SR and D latch along with logic diagram and function table.	10	L2	CO2
		Module – 3			
Q.5	a.	Explain the basic operational concepts between the processor and memory.	10	L2	CO3
	b.	Describe the following: (i) Processor clock (ii) Basic performance equation (iii) Clock rate (iv) SPEC rating	10	L2	CO3
		OR			
Q.6	a.	Define addressing mode. Explain any four types of addressing mode with example.	10	L2	CO3

	b.	Mention four types of operations to be performed by instructions in a computer. Explain the basic types of instruction formats to carry out. $C \leftarrow [A] + [B]$	10	L2	CO3
Module – 4					
Q.7	a.	With a neat diagram, explain the concept of accessing I/O devices.	10	L2	CO4
	b.	What is bus arbitration? Explain centralized and distributed arbitration method with a neat diagram.	10	L2	CO4
OR					
Q.8	a.	With neat sketches, explain various methods for handling multiple interrupts requests raised by multiple devices.	10	L2	CO4
	b.	What is cache memory? Explain any two mapping function of cache memory.	10	L2	CO4
Module – 5					
Q.9	a.	Draw the single bus architecture and write the control sequence for execution of instruction ADD (R_3), R_1.	10	L3	CO5
	b.	With suitable diagram, explain the concept of register transfer and fetching of word from memory.	10	L2	CO5
OR					
Q.10	a.	With a neat diagram, explain the flow of 4-stage pipeline operation.	10	L2	CO5
	b.	Explain the role of cache memory and pipeline performance.	10	L2	CO5

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BCS303

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
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
Q.1	a.	Define Operating System. Explain dual mode of operating systems with a neat diagram.	06	L1 L2	CO1
	b.	Distinguish between the following terms: i) Multiprogramming and Multitasking ii) Multiprocessor and Clustered system	06	L2	CO1
	c.	Explain with a neat diagram VM-WARE Architecture.	08	L1 L2	CO1
		OR			
Q.2	a.	List and explain the services provided by OS for the user and efficient operation of system.	06	L2	CO1
	b.	Explain the different computing equipments.	06	L2	CO1
	c.	What are systems calls? List and explain the different types of systems calls.	08	L1 L2	CO1
		Module – 2			
Q.3	a.	What is process? Explain process state diagram and process control block with a neat diagram.	10	L1 L2	CO2
	b.	What is interprocess communication? Explain direct and indirect communication with respect to message passing system.	10	L1 L2	CO2
		OR			
Q.4	a.	List and explain the different types of multithreading models.	06	L1 L2	CO2
	b.	Calculate the average waiting time and average turnaround time by drawing the Gantt-chart using FCFS, SJF, RR (Q = 4ms) and priority scheduling (Higher Number is having highest priority).	14	L3	CO2

Process	B.T. (ms)	Priority
P_1	24	1
P_2	03	2
P_3	03	3

		Module – 3			
Q.5	a.	What is critical section? Give the Peterson's solution to 2 processes critical section problem.	05	L1 L2	CO3
	b.	Explain Reader's and Writer's problem in detail.	07	L2	CO3
	c.	What is semaphore? Discuss the solution to the classical dinning philosopher problem.	08	L1 L2	CO3

OR

Q.6	**a.**	What is a Deadlock? What are the necessary conditions for the deadlock to occur?	**06**	**L1 L2**	**CO3**
	b.	Consider the following snap shot of the system. Process | Allocation (A B C) | Max (A B C) | Available (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 Answer the following questions: i) What is the content of the matrix need? ii) Is the system on a safe state? If so, find safe sequence. iii) If P_1 requirements for (1, 0, 2) additional resources can P_1 be granted.	**14**	**L3**	**CO2**
		Module – 4			
Q.7	**a.**	What is paging? Explain with a neat diagram paging hardware with TLB.	**10**	**L1 L2**	**CO4**
	b.	Explain the different strategies used to select a free hole from available holes.	**05**	**L1**	**CO4**
	c.	What is Fragmentation? List and explain its types.	**05**	**L2**	**CO4**
		OR			
Q.8	**a.**	What is page fault? With a neat diagram explain steps in handling page fault.	**08**	**L2**	**CO4**
	b.	Consider the page reference string for a memory with 3 frames determine the number of page faults using FIFO, optimal and LRU replacement algorithms. Which algorithms is more efficient? 7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1	**12**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Define File. List and explain different file operations and file attributes.	**10**	**L1**	**CO5**
	b.	Explain the different file allocation methods.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	What is Access Matrix? Explain the implementation of Access Matrix.	**10**	**L2**	**CO5**
	b.	A drive has 5000 cylinders numbered 0 to 4999. The drive is currently servicing at a request 143 and previously served a request at 125. The queue of pending request in FIFO order. 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130 starting from current head position. What is the total distance travelled (in cylinders) by a disk arm to satisfy the request using FCFS, SSTF, SCAN, LOOK and C-Look algorithm	**10**	**L3**	**CO5**

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BCS304

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
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 Structures. Explain the classification of data structures with a neat diagram.	8	L2	CO1
	b.	Write a C Functions to implement pop , push and display operations for stacks using assays.	7	L2	CO2
	c.	Differentiate structures and unions.	5	L2	CO1
		OR			
Q.2	a.	Write an algorithm to evaluate a postfix expression and apply the same for the given postfix expression. 6 2 / 3 – 4 2 * +.	7	L3	CO2
	b.	Explain the dynamic memory allocation function in detail.	8	L2	CO1
	c.	What is Sparse matrix? Give the triplet form of a given matrix and find its transpose $A = \begin{bmatrix} 0 & 0 & 3 & 0 & 4 \\ 0 & 0 & 5 & 7 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 6 & 0 & 0 \end{bmatrix}$	5	L3	CO1
		Module – 2			
Q.3	a.	Define Queue. Discuss how to represent a queue using dynamic assays.	8	L2	CO2
	b.	Write a C Function to implement insertion ( ) , deletion ( ) and display ( ) operations on circular queue.	6	L3	CO2
	c.	Write a note on Multiple stacks and queues with suitable diagram.	6	L2	CO2
		OR			
Q.4	a.	What is a linked list? Explain the different types of linked list with neat diagram.	6	L2	CO3
	b.	Write a C function for the following on singly linked list with example : i) Insert a node of the beginning ii) Delete a node at the front iii) Display.	8	L3	CO3
	c.	Write the C function to add two polynomials.	6	L2	CO3

		Module – 3			
Q.5	**a.**	Discuss how binary trees are represented using : i) Assay ii) Linked list.	**6**	**L2**	**CO4**
	b.	Define Threaded binary tree. Discuss In – threaded binary tree.	**6**	**L2**	**CO4**
	c.	Write the C function for the following additional list operation : i) Inverting Singly linked list ii) Concatenating Singly linked list.	**8**	**L3**	**CO3**
		OR			
Q.6	**a.**	Discuss Inorder , Preorder , Postorder and Level order traversal with suitable function for each.	**8**	**L3**	**CO4**
	b.	Define the threaded binary tree. Construct threaded binary tree for the following element : A, B, C, D, E, F, G, H, I.	**6**	**L2**	**CO4**
	c.	Write a C function for the following : i) Insert a node at the beginning of doubly linked list. ii) Deleting a node at the end of the doubly linked list.	**6**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Define Forest , Transform the forest into a binary tree and traverse using inorder , preorder and postorder traversal with an example.	**8**	**L1**	**CO5**
	b.	Define Binary search tree. Construct a binary search tree for the following elements : 100 , 85 , 45 , 55 , 120 , 20 , 70 , 90 , 115 , 65 , 130 , 145.	**6**	**L2**	**CO5**
	c.	Discuss Selection tree with an example.	**6**	**L2**	**CO5**
		OR			
Q.8	**a.**	Define Graph. Explain adjacency matrix and adjacency list representation with an example.	**8**	**L2**	**CO5**
	b.	Define the following terminology with example : i) Digraph ii) Weighted graph iii) Self loop iv) Connected graph.	**6**	**L2**	**CO5**
	c.	Briefly explain about Elementary graph operations.	**6**	**L3**	**CO5**
		Module – 5			
Q.9	**a.**	Explain in detail about Static and Dynamic Hashing.	**6**	**L2**	**CO5**
	b.	What is Collision? What are the methods to resolve collision?	**7**	**L2**	**CO5**
	c.	Explain Priority queue with the help of an examples.	**7**	**L2**	**CO5**
		OR			
Q.10	**a.**	Define Hashing. Explain different hashing functions with suitable examples.	**12**	**L2**	**CO5**
	b.	Write short note on : i) Leftist trees ii) Optimal binary search tree.	**8**	**L3**	**CO5**

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CBCS SCHEME

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BCS306A

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
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.	List and explain any three features of object oriented programming.	6	L1	CO1
	b.	What do you mean by type conversion and type casting? Give examples.	8	L2	CO1
	c.	How to declare and initialize 1-D and 2-D arrays in Java. Give examples.	6	L2	CO1
		OR			
Q.2	a.	List the short circuit operators and show the concept using few examples.	4	L2	CO1
	b.	With a java program, illustrate the use of ternary operator to find the greatest of three numbers.	6	L3	CO1
	c.	Develop a Java program to demonstrate the working of for each version of for loop. Initialize the 2D array with values and print them using for each.	10	L2	CO1
		Module – 2			
Q.3	a.	Develop a program in Java to implement a stack of integers.	12	L3	CO2
	b.	What are constructors? Give the types and explain the properties of constructors. Support with appropriate examples.	8	L2	CO2
		OR			
Q.4	a.	Illustrate with an example program to pass objects as arguments.	10	L2	CO2
	b.	Explain different access specifies in Java with example program.	10	L2	CO2
		Module – 3			
Q.5	a.	Define inheritance. List and explain different types of inheritance in Java with code snippets.	10	L2	CO3
	b.	Compare and contrast between overloading and overriding in Java with example program for each.	10	L2	CO3
		OR			
Q.6	a.	Analyze an interface in Java and list out the speed of an interface. Illustrate with the help of a program the importance of an interface.	10	L2	CO3
	b.	List the different uses of final and demonstrate each with the of code snippets.	10	L2	CO3

		Module – 4			
Q.7	**a.**	Define a package. Explain how to create user defined package with example.	**7**	**L2**	**CO4**
	b.	Discuss about exception handling in Java. Give the framework of the exception handling block. List the types of exception.	**8**	**L2**	**CO4**
	c.	Develop a Java program to raise a custom exception for division by zero using try, catch, throw and finally.	**5**	**L3**	**CO4**
		OR			
Q.8	**a.**	Compare throw and throws keyword by providing suitable example program.	**10**	**L2**	**CO4**
	b.	Explain about the need for finally block.	**5**	**L2**	**CO4**
	c.	Discuss about chained exceptions.	**5**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Define thread. Demonstrate creation of multiple threads with a program.	**10**	**L2**	**CO5**
	b.	Explain the two ways in which Java threads can be instantiated. Support your explanation with a sample program.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	What is enumeration? Explain the methods values( ) and valueof( ).	**10**	**L2**	**CO5**
	b.	Explain about type wrappers and auto boxing.	**10**	**L2**	**CO5**

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