CBCS SCHEME

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21CS33

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Analog and Digital Electronics

Time: 3 hrs. Max. Marks: 100

Note : ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. With a neat diagram and mathematical analysis explain fixed bias circuit. **(06 Marks)**

b. With hysteresis characteristics explain the working of Inverting Schmitt trigger. **(06 Marks)**

c. Explain current to voltage and voltage to current convertor. **(08 Marks)**

OR

2 a. Discuss Regulated power supply parameters. **(06 Marks)**

b. Explain the working of R-2R ladder D to A convertor. **(06 Marks)**

c. Explain successive approximation A to D convertor. **(08 Marks)**

Module-2

3 a. Find all the prime implicates of the function
$f(a,b,c,d) = \Pi(0,2,3,4,5,12,13) + \Pi d(8,10)$
using the Quine-McCluskey method. **(10 Marks)**

b. Plot the Karnaugh maps and find all the minimal sums and minimal products of the following Boolean functions.
i) $f(a,b,c) = \sum(2,4,5,6,7)$ ii) $f(a,b,c) = \Pi(1,4,5,6)$. **(10 Marks)**

OR

4 a. With an example, explain Petrik's method. **(06 Marks)**

b. For the given Boolean function, determine a minimal sum and a minimal product using MEV techniques using a, b and c as the map variables.
$f = \sum(3,4,5,7,8,11,12,13,15)$. **(08 Marks)**

c. Explain entered variable map method. **(06 Marks)**

Module-3

5 a. Implement the following function using 8 : 1 multiplexer,
$F(a,b,c,d) = \sum m(0, 1, 5, 6, 8, 10, 12, 15)$. **(07 Marks)**

b. Implement 7-segment decoder using PLA. **(08 Marks)**

c. Discuss Four kinds of three state buffers. **(05 Marks)**

OR

6 a. Implement Full Adder using 3 : 8 Decoder. **(07 Marks)**

b. Design Hexadecimal to ASCII code converter using suitable ROM. Give the connection diagram of ROM. **(08 Marks)**

c. Explain static 1 Hazard with its recover method. **(05 Marks)**

Module-4

7	a.	Explain structure of VHDL program. Write VHDL code for 4 bit parallel adder using full adder as component.	**(08 Marks)**
	b.	Explain the working of SR latch using NOR gates.	**(06 Marks)**
	c.	Explain edge triggered D flip flop.	**(06 Marks)**

OR

8	a.	Explain J-K Master slave flip flop with suitable timing diagram.	**(10 Marks)**
	b.	Derive the characteristics equations for D, T, SR and JK flip flops.	**(10 Marks)**

Module-5

9	a.	With a neat diagram, explain 4-bit parallel adder with accumulator.	**(10 Marks)**
	b.	Define counter. Design mod-5 counter using J-K flip flop.	**(10 Marks)**

OR

10	a.	With neat diagram, explain 4 bit SISO register.	**(08 Marks)**
	b.	Mention the application of shift registers.	**(05 Marks)**
	c.	Explain the working of a 3 bit shift register.	**(07 Marks)**

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CBCS SCHEME

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21CS34

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

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Outline the basic operational concepts of processor with neat diagram. **(08 Marks)**

b. Explain Big-Endian and Little-Endian byte and word addressing with an example. **(08 Marks)**

c. Evaluate (A) + (B) * (C) + D using one address instruction. **(04 Marks)**

OR

2 a. Write note on :
i) Byte addressability
ii) Condition codes
iii) Single bus structure. **(08 Marks)**

b. List different addressing modes. With neat figure and an example, explain indirection and pointers addressing mode. **(08 Marks)**

c. Discuss the basic performance equation and ways to achieve high performance. **(04 Marks)**

Module-2

3 a. What is bus arbitration? Explain distributed arbitration scheme. **(08 Marks)**

b. With neat timing diagram, explain an input transfer using multiple clock cycles in synchronous bus. **(08 Marks)**

c. With supporting figure, explain interrupt nesting. **(04 Marks)**

OR

4 a. How would you organize hardware interrupt to implement a common interrupt request line? **(08 Marks)**

b. With neat diagram, explain a general 8 bit parallel interface circuit. **(08 Marks)**

c. What are exceptions? List and explain different types of exceptions. **(04 Marks)**

Module-3

5 a. With neat diagram, explain organization of bit cells in a memory chip consisting of 16 words of 8 bits each. **(08 Marks)**

b. Explain the internal structure of synchronous DRAM. **(08 Marks)**

c. Explain the following:
i) Memory Bandwidth
ii) Memory Latency **(04 Marks)**

OR

6 a. Explain internal organization of a 16 Megabit DRAM chip configured as 2M × 8 cells. **(08 Marks)**

b. What is memory mapping? Explain set-associate mapping. **(08 Marks)**

c. Explain the following: i) ROM ii) EPROM **(04 Marks)**

Module-4

7 a. Perform the following using 2's complement :

i) (+2) + (+3)
ii) (+7) + (-3)
iii) (+7) – (-7)
iv) (+6) – (-7) **(08 Marks)**

b. With neat diagram, explain register transfers. **(08 Marks)**

c. Describe array implementation for multiplication of positive numbers. **(04 Marks)**

OR

8 a. Explain in detail, organization of control unit. **(08 Marks)**

b. With neat diagram, explain 4-bit-carry look ahead adder. **(08 Marks)**

c. With neat sketch, explain the organization of micro programmed control unit. **(04 Marks)**

Module-5

9 a. Explain parallel processing, with neat diagram. **(10 Marks)**

b. Explain Single Instruction Stream Multiple Data (SIMD) array processor. **(10 Marks)**

OR

10 a. Explain basic idea of instruction pipe line. **(10 Marks)**

b. Write note on memory interleaving. **(10 Marks)**

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CBCS SCHEME

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BCS/BAD/BAI/BDS301

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Mathematics – III for Computer Science Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Mathematics Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

<table>
<tr><th colspan="3">Module – 1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td>Q.1</td><td>a.</td><td>A random variable x has the following prob. density function for various values of x.
<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>P(x)</td><td>0</td><td>k</td><td>2k</td><td>2k</td><td>3k</td><td>k^2</td><td>$2k^2$</td><td>$7k^2+k$</td></tr>
</table>
Find the value of k and evaluate $P(x < 6)$, $P(3 < x \le 6)$ and $(x \ge 6)$.</td><td>07</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Derive the mean and variance of Poisson distribution.</td><td>06</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>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) less than 10 minutes (ii) more than 10 minutes and (iii) between 10 and 12 minutes.</td><td>07</td><td>L3</td><td>CO2</td></tr>
<tr><th colspan="6">OR</th></tr>
<tr><td>Q.2</td><td>a.</td><td>The probability density function of
$$f(x) = \begin{cases} Kx^2, & -3 < x < 3 \\ 0, & \text{elsewhere} \end{cases}$$
Find the value of K and evaluate (i) $P(x < 2)$, $P(x > 1)$ (ii) $P(1 \le x \le 2)$</td><td>07</td><td>L3</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>When a coin is tossed 4 times, find the probability of getting (i) exactly one head (ii) atleast three heads and (iii) less than two heads.</td><td>06</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>The marks of 1000 students in an examination follows a normal distribution with mean > 0 and S.D 5. Find the number of students whose marks will be (i) less than 65 (ii) more than 75 and (iii) between 65 and 75.</td><td>07</td><td>L2</td><td>CO2</td></tr>
<tr><th colspan="6">Module – 2</th></tr>
<tr><td>Q.3</td><td>a.</td><td>If the joint probability distribution of x and y is given by
$$f(x, y) = \frac{1}{30}(x + y), \text{ for } x = 0, 1, 2, 3 ;\ y = 0, 1, 2$$
Find (i) $P(x \le 2,\ y = 1)$ (ii) $P(x > y)$</td><td>07</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Find the unique fixed probability vector of
$$P = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$$</td><td>06</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>Three boys A, B and C are throwing a ball to each other. A always throw the ball to B. B always throw the ball to A and C is just as likely to throw the ball to A as to B. Find the probability that C has the ball after three throws, if C starts the game.</td><td>07</td><td>L3</td><td>CO3</td></tr>
</table>

OR

Q.4 **a.** The joint prob. distribution for the following data, find E(x) and E(y). **07 L2 CO2**

X \ Y	-2	-1	4	5
1	0.1	0.2	0.0	0.3
2	0.2	0.1	0.1	0

b. Show that the matrix $P = \begin{bmatrix} 0 & 0 & 1 \\ 1/2 & 0 & 1/2 \\ 0 & 1 & 0 \end{bmatrix}$ is a regular stochastic matrix. **06 L2 CO3**

c. A gambler's luck follows pattern. If he wins a game the prob. of winning the next game is 0.6. However, if he loses a game, the prob. of losing the next game is 0.7. There is an even chance of the gambler winning the first game. What is the prob. of he winning the second game. **07 L3 CO3**

Module – 3

Q.5 **a.** Define (i) Null hypothesis (ii) A statistic (iii) Standard error (iv) Level of significance (v) Test of significance. **07 L1 CO4**

b. A coin was tossed 400 times and head turned up 216 times. Test the hypothesis that the coin is unbiased at 5% LOS. **06 L3 CO4**

c. In a city A 20% of a random sample of 900 school boys had a certain slight physical defect. In another city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant at 5% significance level? **07 L3 CO5**

OR

Q.6 **a.** Explain the following terms: **07 L1 CO4**

(i) Type-I and Type-II errors
(ii) Statistical hypothesis
(iii) Critical region
(iv) Alternate hypothesis

b. The average marks in Engg. Maths of a sample of 100 students was 51 with S.D 6 marks. Could this have been a random sample from a population with average marks 50? **06 L2 CO5**

c. One type of aircraft is found to develop engine trouble in 5 flights out of a total of 100 and another type in 7 flights out of a total of 200 flights. Is there a significance difference in the two types of aircrafts so far as engine defects are concerned? Test at 0.05 significance level. **07 L3 CO4**

Module – 4

Q.7 **a.** State central limit theorem. Use the theorem to evaluate $P(50 < x < 56)$ where $\bar{x}$ represents the mean of a random sample of size 100 from an infinite population with mean $\mu = 53$ and variance $\sigma^2 = 400$. **07 L2 CO4**

b. Suppose that 10, 12, 16, 19 is a sample taken from a normal population with variance 6.25. Find 95% confidence interval for the population mean. Given that $Z(0.15) = 0.0596$. **06 L2 CO5**

c. Fit a Poisson distribution to the following data and test for goodness of fit at 5% LOS. **07 L3 CO5**

x	0	1	2	3	4
f	419	352	154	56	19

OR

Q.8 a. Height of a random sample of 50 college student showed a mean of 174.5 cms and a S.D 6.9 cms. Construct 99% confidence limits for the mean height of all college students. **07 | L2 | CO4**

b. A random sample of 10 boys had the following I.Q : 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. DO these data support the assumption of a population mean I.Q of 100 (at 5% LOS)? **06 | L3 | CO5**

c. The theory predicts the propositions of beans in the four groups, G_1 , G_2 , G_3 , G_4 should be in the ratio 9 : 3 : 3 : 1. In experiment with 1600 beans the numbers in the groups were 882, 313, 287 and 118. Does the experimental support the theory. **07 | L3 | CO5**

Module – 5

Q.9 a. The varieties of wheat A, B, C were shown in four plots each and the following yields in quintals per acre were obtained. **10 | L3 | CO6**

A	8	4	6	7
B	7	6	5	3
C	2	5	4	4

Test the significance of difference between the yields of varieties, given that 5% tabulated value of F = 4.26 with (2, 9) d.f. Set up one-way ANOVA and using direct method.

b. Present your conclusion after doing ANOVA to the following results of the Latin-square design conducted in respect of five fertilizers which were used on plots of different fertility. **10 | L3 | CO6**

A(16)	B(10)	C(11)	D(9)	E(9)
E(10)	C(9)	A(14)	B(12)	D(11)
B(15)	D(8)	E(8)	C(10)	A(18)
D(12)	E(6)	B(13)	A(13)	C(12)
C(13)	A(11)	D(10)	E(7)	B(14)

OR

Q.10 a. Set up two-way ANOVA table for the data given below, using coding method subtracting 40 from the given numbers. **10 | L3 | CO6**

Pieces of land	Treatment			
	A	B	C	D
P	45	40	38	37
Q	43	41	45	38
R	39	39	41	41

b. There are three main brands of a certain power. A set of its 120 sales is examined and found to be allocated among four groups (A, B, C, D) and brands (I, II, III) as follows: **10 | L3 | CO6**

Brands	Groups			
	A	B	C	D
I	0	4	8	15
II	5	8	13	6
III	18	19	11	13

Is there any significant difference in brands preference? Answer at 5% level, using one-way ANOVA. Take 10 as the code value to subtract it from all given values.

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CBCS SCHEME

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BCS302

Third Semester B.E./B.Tech. Degree Examination, June/July 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.

			M	L	C
		Module – 1			
Q.1	**a.**	Demonstrate the positive and negative logic using AND gate.	**05**	**L2**	**CO1**
	b.	Show that NAND and NOR function are commutative and but not associative.	**05**	**L3**	**CO1**
	c.	Simplify the Boolean function $F(w,x,y,z) = \Sigma m\ (0,1,2,4,6,7,9,12,14)$ using K-Map and implement using NAND gates.	**10**	**L3**	**CO1**
		OR			
Q.2	**a.**	What is Binary Logic? List out any 4 laws of logic.	**05**	**L1**	**CO1**
	b.	Find the POS expression for $F(A.B.C,D) = \prod M(2,3,5,8,10,13,14) + d(1,6,7,11)$ and realize it using NOR gates.	**05**	**L3**	**CO1**
	c.	Simplify the following Boolean functions using K-map and write the verilog program for realizing the minimized expression. i) $F(X,Y,Z) = \Sigma m\ (0,1,4,5,6) + d\ (2,3)$ ii) $F(W,X,Y,Z) = \Sigma m\ (5,6,7,12,14,15) + d(9,11,13)$	**10**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	Define Decoder Implement the following boolean functions using a decoder $F_1(A,B,C) = \Sigma m(1,3,4,7)$ $F_2(A,B,C) = \Sigma m(0,2,,3,6)$	**06**	**L3**	**CO2**
	b.	Write the verilog program to implement full adder and full sub tractor circuits.	**06**	**L3**	**CO2**
	c.	Design an octal to Binary Encoder.	**08**	**L3**	**CO2**
		OR			
Q.4	**a.**	Define Multiplexer. Implement the Boolean function $F\ (A,B,C,D) = \Sigma m(1,3,4,11,12,13,14,15)$ with 8:1 multiplexer.	**06**	**L3**	**CO2**
	b.	Explain the working of 4 – bit adder using 4 full adders.	**06**	**L2**	**CO2**
	c.	Write the characteristic equation, Excitation table and FSM representations for SR,JK and D flip flops	**08**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	With a block diagram explain the processor and Memory communication.	**06**	**L2**	**CO3**
	b.	With relevant examples, Explain the following addressing modes. i) Index ii) Base with index and offset iii) Indirect.	**06**	**L2**	**CO3**
	c.	Demonstrate the instruction execution and sequencing for $C \leftarrow [A] + [B]$	**08**	**L2**	**CO3**

		OR			
Q.6	**a.**	Describe the Big Endian and little endian address assignment with examples	**06**	**L2**	**CO3**
	b.	The Registers R1 and R2 has decimal values 1200 and 4600. Calculate the EA of the memory operand in each of the following instructions when they are executed in sequence. i) load 20 (R1), R5 ii) Move # 3000, R5 iii) Store R5, 30(R1,R2) iv) add – (R2), R5 v) Sub (R1)+, R5 vi) add (R2)+,R1	**06**	**L3**	**CO3**
	c.	Demonstrate the Branching operations using a loop to add n – numbers with block diagram.	**08**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Explain the effect of size, cost and speed in Memory hierarchy.	**10**	**L2**	**CO4**
	b.	Explain Centralized and distributed Bus arbitration approaches.	**10**	**L2**	**CO4**
		OR			
Q.8	**a.**	Describe the different memory mapping functions.	**10**	**L2**	**CO4**
	b.	Explain how to handle interrupt from multiple devices using daisy chain and priority scheme.	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	With a neat diagram, explain the single bus organization of the data path inside a processor.	**10**	**L2**	**CO5**
	b.	Describe in detail, the basic idea of instruction pipeline.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	Explain the complete set of operations involved in executing the instruction ADD (R3), R1 along with control sequence.	**10**	**L2**	**CO5**
	b.	Explain the process of storing a word from processor to memory.	**10**	**L2**	**CO1**

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CBCS SCHEME

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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). Process | B.T. (ms) | Priority P_1 | 24 | 1 P_2 | 03 | 2 P_3 | 03 | 3	**14**	**L3**	**CO2**
		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. **14** **L3** **CO2**

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			

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.

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? **12** **L3** **CO4**

7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1

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. **10** **L3** **CO5**

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

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CBCS SCHEME

USN | | | | | | | | | | **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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