

**B.L.D.E.A's V.P.Dr.P.G.HALAKATTI COLLEGE OF ENGINEERING AND
TECHNOLOGY VIJYAPUR 586103**

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DEPARTMENT OF COMPUTER SCIENCE & INFORMATION SCIENCE

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18CS32

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024 Data Structures and Applications

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define data structures, with neat block schematics, explain different types of data structures with examples. (05 Marks)
- b. Discuss the drawbacks of static memory allocation. Explain how dynamic memory allocation overcome these draw backs, with syntax and examples. Explain `colloc()`, `malloc()` and `realloc()` functions. (08 Marks)
- c. Write a 'C' program to insert an element into an unsorted array based on the position. (07 Marks)

OR

- 2 a. Define pattern matching without using built in function, write a function to
 - i) To find length of a string
 - ii) Compare two strings. (07 Marks)
 - b. Define sparse matrix. Express the following matrix in triplet form and find its transpose. (08 Marks)
- $$A = \begin{bmatrix} 10 & 0 & 0 & 40 \\ 11 & 0 & 22 & 0 \\ 0 & 0 & 0 & 0 \\ 20 & 0 & 0 & 50 \\ 0 & 15 & 0 & 25 \end{bmatrix}$$
- c. Discuss the difference between structures and union. (05 Marks)

Module-2

- 3 a. Define stack. Write a C program to implement the operations of the stack. Demonstrate with diagrammatic representations. (10 Marks)
- b. Write an algorithm to convert the parenthesized infix expression to postfix form. Convert the following expression to postfix showing the contents of stack $(a/(b - c + d)) * (e - a)$. (07 Marks)
- c. Write a recursive program to find the GCD of two positive numbers. (03 Marks)

OR

- 4 a. Define queue. Discuss the limitations of ordinary queue. Explain with the diagrammatic representation and 'C' function, the inset and delete operations in circular queue. (10 Marks)
- b. Evaluate the following postfix expression by showing the contents of stack $56 + 437 - *$ (05 Marks)
- c. Write a recursive program to solve the tower of Hanoi problem. (05 Marks)

Module-3

- 5 a. Define linked list. Write a 'C' function to create a node, insert at front end and delete at rear end of a singly linked list where each node contains name, USN, Branch, semester and phone number of a student. Give the diagrammatic representation. (10 Marks)
- b. Write a C function using doubly linked list.
- To insert a node at a specified position.
 - To delete a node based on the information field.

(10 Marks)

OR

- 6 a. List the advantages of circular singly linked list over singly linked list. Write a 'C' function using circular singly linked list.
- To insert a node at the end.
 - Deletion of node in the beginning.
- b. Write a 'C' function to add two polynomials. Show the linked list representation of the polynomial given below along with resultant polynomial.
- $$P_1 = 3x^3 + 2x^2 + 1x$$
- $$P_2 = 5x^5 + 3x^2 + 7$$

(10 Marks)

(10 Marks)

Module-4

- 7 a. Define binary tree. Prove that a complete binary tree of height n has $(2^{n+1} - 1)$ nodes. (06 Marks)
- b. Draw the binary search tree for the following input 14, 5, 6, 2, 18, 20, 16, 18, -1, 21. Write a 'C' function to search an element in a binary search tree ignoring supuplicate elements. (10 Marks)
- c. Draw the binary tree for the following traversal
- Post order : HIDEBFGCA
- In order : HDIBEAFCG.

(04 Marks)

OR

- 8 a. List the disadvantages of binary tree. How do you overcome them using threaded binary tree write a 'C' function to implement in order traversal of right in-threaded binary tree with an example. (10 Marks)
- b. Define expression tree. Write 'C' function to evaluate the expression tree. Evaluate the postfix expression $abc - d* + e^f +$ given $e = 1, a = 6, b = 5, c = 2, d = 5$ and $f = 7$. (10 Marks)

(10 Marks)

Module-5

- 9 a. Define graph. Explain with examples the different ways of representing graphs. (10 Marks)
- b. Write an algorithm to traverse the graph using BFS. Traverse the following graph and print all the vertices reachable considering starting vertex as a. (10 Marks)

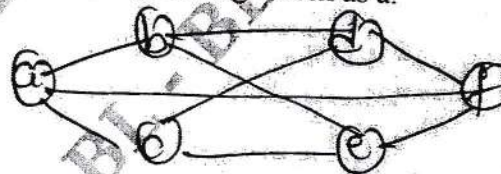


Fig.Q.9(b)

OR

- 10 a. Write a 'C' program to sort the elements using insertion sort. Trace the program for the elements 25, 75, 40, 10, 20. (10 Marks)
- b. Define hashing. List the collision resolution techniques. Using open addressing linear probing, explain how the following keys are inserted in the hash table 131, 4, 8, 7, 21, 5, 31, 61, 9, 29. (10 Marks)

(10 Marks)

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Third Semester B.E. Degree Examination, Dec.2023/Jan.2024 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. Explain construction and working principle of photo diode. (08 Marks)
- b. Explain factors affecting the load voltage and performance parameters of a power supply. (08 Marks)
- c. The base bias circuit is shown in Fig. Q1 (c) below for the value indicated, calculate I_B , I_C and V_{CE} . (04 Marks)

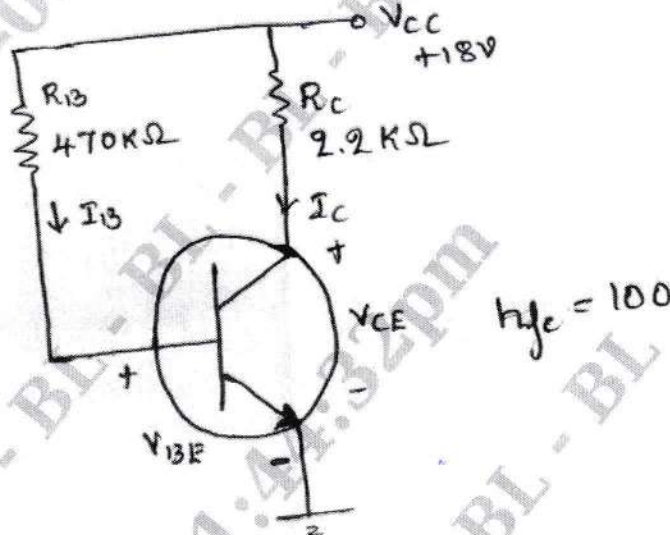


Fig. Q1 (c)

OR

2. a. With a neat diagram, explain R-2R ladder network DAC. Also mention its advantage over weighted resistive DAC. (08 Marks)
- b. Design an astable multivibrator using 555 timer for a frequency of 2 kHz and a duty cycle of 75%. Assume $C_1 = 0.1 \mu F$. (08 Marks)
- c. Differentiate basic biasing techniques. (04 Marks)

Module-2

3. a. Determine the minimum sum of product expression and minimum product of sums expression for,

$$f = \overline{b} \overline{c} \overline{d} + b \overline{c} d + a \overline{c} d + a \overline{b} c + a b \overline{c} d$$
 and also implement each derived expression using logic gates. (10 Marks)
- b. Simplify the following using Quine McCluskey method, list primary implicants and identify essential prime implicants.

$$f(A, B, C, D) = \sum m(3, 4, 5, 7, 10, 12, 14, 15) + \sum d(2)$$
 (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 4 a. A switching circuit has two control inputs (C_1 and C_2), two data inputs (X_1 and X_2), and one output (Z). The circuit performs one of the logic operations AND, OR, EQU (Equivalence) or XOR (exclusive OR) on the two data inputs. The function performed depends on the control inputs.

C_1	C_2	Function performed by circuit
0	0	OR
0	1	XOR
1	0	AND
1	1	EQU

- (i) Derive a truth table for Z .
 (ii) Use a Karnaugh map to find a minimum AND-OR gate circuit to realize Z . (10 Marks)
- b. For the following functions, find all the prime implicants and find all minimum sum-of-product solution. Using Quine Mc Cluskey method.
 $f(a, b, c, d) = \sum m(0, 1, 3, 5, 6, 7, 8, 10, 14, 15)$ (10 Marks)

Module-3

- 5 a. Consider logic function : $F(A, B, C, D) = \sum m(0, 4, 5, 10, 11, 13, 14, 15)$
 (i) Find two different minimum circuits which implement 'F' using AND-OR gates. Identify two hazards in each circuit. Then find an AND-OR circuit for 'F' which has no hazards.
 (ii) Find the minimum OR-AND circuit for 'F' has two hazard. Identify it, and then find an OR-AND circuit for 'F' that has no hazards. (10 Marks)
- b. Explain programmable logic devices. And implement full adder using PAL. (10 Marks)

OR

- 6 a. Illustrate 3 to 8 decoder with neat diagram. (07 Marks)
 b. What is multiplexer? Explain working principle of 8-to-1 multiplexer with its logic diagram. (07 Marks)
 c. Explain hazards in combinational logic circuits,
 (i) Static-1 Hazard
 (ii) Static-0 Hazard.
 (iii) Dynamic Hazard. (06 Marks)

Module-4

- 7 a. Write a VHDL module for a 4-bit adder using structural description. (08 Marks)
 b. Write VHDL code for,
 (i) 2 : 1 MUX using VHDL statement and conditional assignment statement.
 (ii) 4 : 1 MUX using VHDL statement and conditional assignment statement. (08 Marks)
 c. Differentiate combinational and sequential circuits. (04 Marks)

OR

- 8 a. Assume that the inverter in the given circuit has a propagation delay of 5 ns and the AND gate has a propagation delay of 10 ns. Draw a timing diagram for the circuit showing x, y and z. Assume that x is initially 0, y is initially 1, after 10 ns, x becomes 1 for 80 ns and then x is 0 again.

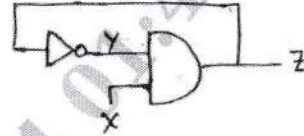


Fig. Q8 (a)

- b. Convert the following by adding external gates,
(i) A 'D' flipflops to a J-K flip-flop. (08Marks)
(ii) A T flipflop to a D flip-flop. (08 Marks)
c. Differentiate Latches and flip-flops. (04 Marks)

Module-5

- 9 a. Explain with neat figure, how data can be transferred from the output of one of two registers into a third register using tri-state buffer. (10 Marks)
b. What is a shift register? Explain with neat diagram, a 4-bit right shift register. (10 Marks)

OR

- 10 a. Design a 3 bit synchronous binary counter using D-flip flops. (10 Marks)
b. Design a counter to generate sequence 0, 4, 7, 2, 3, 0 using T flip flop. (10 Marks)

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18CS34

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024 Computer Organization

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Draw the connection between processor and memory and mention the functions of each component in the connection. (07 Marks)
- b. What is the function of an assembler directive? Give two examples of assembler directives used for the reservation of memory locations for variables state their functions. (05 Marks)
- c. With the help of suitable examples, illustrate encoding of machine instructions. (08 Marks)

OR

- 2 a. Explain how the following typical instructions can be executed with relevant steps:
MOVE NUM1, R2
ADD R3, NUM2 (05 Marks)
- b. Explain Big-Endian and Little-Endian method of byte addressing with an example. (07 Marks)
- c. Explain shift and rotate operations with example. (08 Marks)

Module-2

- 3 a. Explain in brief with the help of diagram the working of daisy chain with multiple priority levels and multiple devices in each level. (10 Marks)
- b. With a block diagram, explain how the printer is interfaced to processor. (05 Marks)
- c. Briefly discuss the main phases involved in the operation of SCSI bus. (05 Marks)

OR

- 4 a. Define and explain interrupt nesting. (05 Marks)
- b. What is bus arbitration? Explain the centralized arbitration with a neat diagram. (08 Marks)
- c. Explain the tree structure of USB with split bus operation. (07 Marks)

Module-3

- 5 a. Discuss the internal organization of a 2M×8 asynchronous DRAM chip. (10 Marks)
- b. Briefly explain any four non-volatile memory concepts. (05 Marks)
- c. Calculate the average access time experienced by a processor if a cache hit rate is 0.88, miss penalty is 0.015 milliseconds and cache access time is 10 microseconds. (05 Marks)

OR

- 6 a. Explain the working of 16 mega byte DRAM chip configured as 1M×16 memory chip. (10 Marks)
- b. Show with diagram the memory hierarchy with respect to speed, size and cost. (05 Marks)
- c. Define : (i) Hit rate (ii) Miss rate (iii) Miss penalty (05 Marks)

Module-4

- 7 a. Write a note on fast adders. (05 Marks)
- b. Discuss Booth algorithm by multiplying the number -13 and +11 (08 Marks)
- c. Illustrate the steps for non-restoring division algorithm on the following data
dividend = 1000 divisor = 11. (07 Marks)

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OR

- 8 a. Write the logic diagram of 4-bit carry lookahead adder. Explain the operation. (10 Marks)
b. Explain bit pair recording technique by multiplying the numbers +13 and -6 (06 Marks)
c. Differentiate between restoring and non-restoring division. (04 Marks)

Module-5

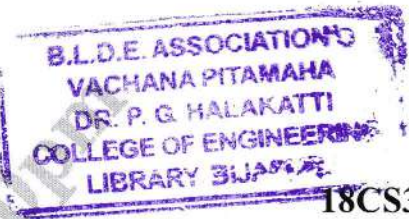
- 9 a. What is pipelining? Explain the basis concept of pipeline performance with neat sketch. (08 Marks)
b. Explain with neat diagram, microprogrammed control method for design of control unit and write the micro routine for the instruction branch < 0. (08 Marks)
c. Differentiate between hardwired and microprogrammed control unit. (04 Marks)

OR

- 10 a. What is the purpose of control unit? With neat sketches, explain the organization of hardwired control unit in detail. (10 Marks)
b. What is pipelining? Explain the five stage instruction pipeline with timing diagram. (10 Marks)

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18CS35

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024 Software Engineering

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. List and explain Software Engineering codes of Ethics. (06 Marks)
- b. With neat diagram explain water-fall model of software development process. (08 Marks)
- c. With the help of diagram explain about insulin pump control system. (06 Marks)

OR

- 2 a. Explain functional and non-functional requirements with one example for each. (06 Marks)
- b. Explain Boehm's spiral model with neat diagram. (08 Marks)
- c. Why the understanding requirements from stakeholders is a difficult task? Explain. (06 Marks)

Module-2

- 3 a. Explain the three system models. (09 Marks)
- b. Define abstraction and encapsulation. (06 Marks)
- c. How data and behavior can be combined in OO approach? (05 Marks)

OR

- 4 a. Define Multiplicity and differentiate cardinality and multiplicity. (06 Marks)
- b. What is object oriented development? What are the advantages and disadvantages of object oriented development? Explain the stages of OO methodology. (10 Marks)
- c. Explain the terms: Identify, classification inheritance, polymorphism. (04 Marks)

Module-3

- 5 a. What is design pattern? Explain four elements of design pattern. (06 Marks)
- b. Draw the context model for patient management system. How the interactions are modelled? (08 Marks)
- c. What is behavioural model? Explain with suitable example. (06 Marks)

OR

- 6 a. Explain the phases of Rational Unified Process (RUP) with neat diagram. (06 Marks)
- b. What is model driven engineering? Explain three types of abstract system models produced. (09 Marks)
- c. List and explain all the activities in an object oriented design process. (05 Marks)

Module-4

- 7 a. Define program evolution dynamics. Explain Lehman's laws for program evolution dynamics. (10 Marks)
- b. What is development testing? Explain three levels of granularity carried out in testing. (05 Marks)
- c. What is user testing? Explain the different stages of acceptance testing process. (05 Marks)

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OR

- 8 a. What is test driven development? What are the benefits of test driven development? (06 Marks)
b. Explain the four strategic options of legacy system management. (06 Marks)
c. Explain about unit testing and component testing with suitable example. (08 Marks)

Module-5

- 9 a. Explain COCOMO-II estimation model. (08 Marks)
b. List and explain the factors affecting software pricing. (06 Marks)
c. Describe plan driven development. (06 Marks)

OR

- 10 a. What are product metrics? Explain two classes of metrics. (06 Marks)
b. Explain reviews and inspections. (06 Marks)
c. What are configuration management? Explain four activities of configuration management. (08 Marks)

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Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Discrete Mathematical Structure

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define proposition, tautology and contradiction. Determine whether the following compound statement is a tautology or not
 $\{(p \vee q) \rightarrow r\} \leftrightarrow \{\sim r \rightarrow \sim (p \vee q)\}$ (07 Marks)
- b. Using the laws of logic, prove the following :
 $[\sim p \wedge (\sim q \wedge r)] \vee [(q \wedge r) \vee (p \wedge r)] \leftrightarrow r$ (06 Marks)
- c. Find whether the argument is valid.
 If a triangle has two equal sides, then it is isosceles.
 If a triangle is isosceles, then it has two equal angles.
 A certain triangle ABC doesnot have two equal angles.
-
- $\therefore$ The triangle ABC does not have two equal sides (07 Marks)

OR

- 2 a. Prove that for any 3 proposition p, q, r
 $[(p \leftrightarrow q) \wedge (q \leftrightarrow r) \wedge (r \leftrightarrow p)]$ is logically equivalent to
 $[(p \rightarrow q) \wedge (q \rightarrow r) \wedge (r \rightarrow p)]$ (07 Marks)
- b. Give (i) a direct proof (ii) an indirect proof and (iii) proof by contradiction for the following statement.
 "If n is an odd integer, then n + 9 is an even integer" (06 Marks)
- c. Establish the validity of the following argument,
 $\forall x, (p(x) \vee q(x))$
 $\forall x, \sim p(x)$
 $\forall x, [\sim q(x) \vee r(x)]$
 $\forall x, [s(x) \rightarrow \sim r(x)]$
 $\therefore \forall x, \sim s(x)$ (07 Marks)

Module-2

- 3 a. By mathematical induction prove that,
 $\sum_{i=1}^n \frac{1}{i(i+1)} = \frac{n}{n+1} \quad \forall n \in \mathbb{Z}$ (07 Marks)
- b. Determine the coefficient of $a^2b^3c^2d^5$ in the expansion of $(a+2b-3c+2d+5)^{16}$ (06 Marks)
- c. A certain question paper contains 3 parts A, B, C with 4 questions in Part A, 5 questions in Part B and 6 questions in Part C. It is required to answer 7 questions selecting at least two questions from each part. In how many ways can a student select his seven question for answering? (07 Marks)

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OR

- 4 a. For the Fibonacci sequence $F_0, F_1, F_2, \dots$. Prove that $F_n = \frac{1}{\sqrt{5}} \left[\left(\frac{1+\sqrt{5}}{2} \right)^n - \left(\frac{1-\sqrt{5}}{2} \right)^n \right]$. (07 Marks)
- b. How many arrangements are there for all letters in the word SOCIOLOGICAL? In how many of these arrangements (i) A & G are adjacent? (ii) All the vowels are adjacent? (06 Marks)
- c. In how many ways can one distribute eight identical balls into four distinct containers so that,
 (i) No container is left empty.
 (ii) The fourth container gets an odd number of balls. (07 Marks)

Module-3

- 5 a. Let $A = \{1, 2, 3\}$, $B = \{2, 4, 5\}$. Determine the following:
 (i) $|A \times B|$
 (ii) Number of relations from A to B
 (iii) Number of relations on A
 (iv) Number of relations from A to B, that contains exactly 5 ordered pairs
 (v) Number of relations on A that contains at least 7 ordered pairs. (06 Marks)
- b. Find the least number of ways of choosing three different numbers from 1 to 10, so that all choices have the same sum. (07 Marks)
- c. Let f, g, h be functions from Z to Z defined by $f(x) = x - 1$, $g(x) = 3x$ and $h(x) = \begin{cases} 0, & \text{if } x \text{ is even} \\ 1, & \text{if } x \text{ is odd} \end{cases}$. (07 Marks)

OR

- 6 a. Suppose $A, B, C \subseteq Z \times Z$ with $A = \{(x, y) / y = 5x - 1\}$, $B = \{(x, y) / y = 6x\}$, $C = \{(x, y) / 3x - y = -7\}$, find (i) $A \cap B$ (ii) $B \cap C$ (iii) $\overline{A \cup C}$ (06 Marks)
- b. Let $A = \{1, 2, 3, 4, 6\}$ and R be the relations on A defined by aRb iff a is a multiple of b
 (i) represent the relation R as a set of ordered pairs (ii) Draw its digraph (iii) write the matrix of R . (07 Marks)
- c. Draw the Hasse diagram representing the positive divisors of 36 (07 Marks)

Module-4

- 7 a. In how many ways 5 numbers of a's, 4 number of b's and 3 number of c's can be arranged so that all the identical letters are not in a single block? (06 Marks)
- b. There are n pairs of children's gloves in a box. Each pair is of a different colour. Suppose the right gloves are distributed at random to n children, and then the left gloves are also distributed to them. Find the probability that (i) no child gets a matching pair (ii) Every child gets a matching pair (iii) Exactly one child gets a matching pair and (iv) at least two child gets matching pair. (07 Marks)
- c. An apple, banana, a mango and an orange are to be distributed to 4 boys B_1, B_2, B_3, B_4 . The boys B_1 and B_2 do not wish to have apple, the boy B_3 does not want banana or mango and B_4 refuses orange. In how many ways the distribution can be made so that no boy is displeased? (07 Marks)

OR

- 8 a. Find the number of permutations of letters a, b, c, ..., z in which none of the patterns spin, game, path or net occurs. (06 Marks)
- b. Four persons P_1, P_2, P_3, P_4 who arrive late for a dinner party. Find that only one chair at each of 5 tables T_1, T_2, T_3, T_4 and T_5 is vacant. P_1 will not sit at T_1 or T_2 , P_2 will not sit at T_2 . P_3 will not sit at T_3 or T_4 and P_4 will not sit at T_4 or T_5 . Find the number of ways they can occupy the vacant chairs? (07 Marks)
- c. Obtain the solution of the relation $a_{n+1} - 2a_n = 5$. (07 Marks)

Module-5

- 9 a. Define Isomorphism. Show that the following two graphs are isomorphic. (06 Marks)

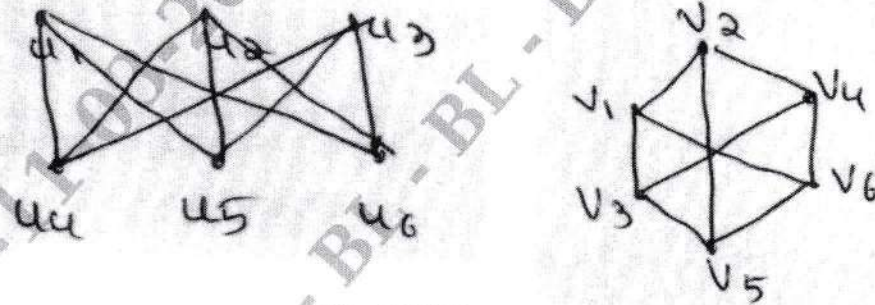


Fig. Q9 (a)

- b. Describe Konigsberg Bridge problem. (07 Marks)
- c. Construct an optimal prefix code for the symbols a, b, c, d, e, f, g, h, i, j that occur with frequencies 78, 16, 30, 35, 125, 31, 20, 50, 80, 3 respectively. (07 Marks)

OR

- 10 a. In every graph, the number of vertices of odd degree is even. (06 Marks)
- b. A tree with n vertices, has $n - 1$ edges. (07 Marks)
- c. Sort the following set of integers using Merge-Sort technique {2, 9, 12, 7, 3, 2, 8, 10, 5} (07 Marks)

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COLLEGE OF ENGINEERING
LIBRARY BUDAP

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18MATDIP31

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024 Additional Mathematics – I

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Express $\sqrt{8} + 4i$ in the polar form and hence find its modulus and amplitude. (08 Marks)
- b. Find the real part of $\frac{1}{1 + \cos \theta - i \sin \theta}$ (06 Marks)
- c. Show that $(1 + \cos \theta + i \sin \theta)^n + (1 + \cos \theta - i \sin \theta)^n = 2^{n+1} \cos^n \left(\frac{\theta}{2} \right) \cos \left(\frac{n\theta}{2} \right)$ (06 Marks)

OR

- 2 a. If $\vec{A} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{B} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{C} = 3\hat{i} + \hat{j}$, find p such that $\vec{A} + p\vec{B}$ is perpendicular to $\vec{C}$. (08 Marks)
- b. Find the area of the parallelogram whose adjacent sides are the vectors $\vec{A} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\vec{B} = \hat{i} + 2\hat{j} + 3\hat{k}$. (06 Marks)
- c. If $\vec{A} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{B} = 3\hat{i} - \hat{j} + 2\hat{k}$ then show that $\vec{A} + \vec{B}$ and $\vec{A} - \vec{B}$ are orthogonal. (06 Marks)

Module-2

- 3 a. Obtain the Maclaurin's series expansion of $\log(\sec x)$ upto the term containing x^3 . (08 Marks)
- b. Using Euler's theorem, prove that $xu_x + yu_y = \frac{5}{2}u$ where $u = \frac{x^3 + y^3}{\sqrt{x+y}}$ (06 Marks)
- c. If $u = f(x - y, y - z, z - x)$, then show that $u_x + u_y + u_z = 0$. (06 Marks)

OR

- 4 a. Prove that $\sqrt{1 + \sin 2x} = 1 + x - \frac{x^2}{2} - \frac{x^3}{6} + \frac{x^4}{24} + \dots$ by using Maclaurin's series. (08 Marks)
- b. If $u = \sin^{-1} \left\{ \frac{x^2 y^2}{x+y} \right\}$, then show that $xu_x + yu_y = 3 \tan u$, by using Euler's theorem. (06 Marks)
- c. If $u = 2xy$, $v = x^2 - y^2$ and $x = r \cos \theta$, $y = r \sin \theta$, find $\frac{\partial(u, v)}{\partial(r, \theta)}$. (06 Marks)

Module-3

- 5 a. A particle moves along the curve $x = 1 - t^3$, $y = 1 + t^2$, $z = 2t - 5$ where t is time. Find the components of velocity and acceleration at $t = 1$ in the direction $2\hat{i} + \hat{j} + 2\hat{k}$ (08 Marks)
- b. Find the unit normal to the surface $xy^3z^2 = 4$ at $(-1, -1, 2)$ (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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OR

- 6 a. Find $\nabla \cdot \vec{F}$ and $\nabla \times \vec{F}$ where $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$ (08 Marks)
 b. If $\vec{F} = (x + y + 1)\hat{i} + \hat{j} - (x + y)\hat{k}$, then show that $\vec{F} \cdot \text{curl } \vec{F} = 0$. (06 Marks)
 c. Find the value of a such that $\vec{F} = (x + 3y)\hat{i} + (y - 2z)\hat{j} + (x + az)\hat{k}$ is solenoidal. (06 Marks)

Module-4

- 7 a. Evaluate $\int_0^{\pi/2} \sin^5 x \, dx$ (08 Marks)
 b. Evaluate $\int_0^{\infty} \frac{x^4}{(1+x^2)^4} \, dx$ (06 Marks)
 c. Evaluate $\iint_R (x^2 + y^2) \, dx \, dy$ where R is the region bounded by $y = x$ and $y = x^2$. (06 Marks)

OR

- 8 a. Evaluate $\int_0^{\pi/2} \cos^6 x \, dx$ (08 Marks)
 b. Evaluate $\int_0^a x \sqrt{ax - x^2} \, dx$ (06 Marks)
 c. Evaluate $\int_0^a \int_0^b \int_0^c (x + y + z) \, dx \, dy \, dz$ (06 Marks)

Module-5

- 9 a. Solve: $y(2x - y + 1)dx + x(3x - 4y + 3)dy = 0$ (08 Marks)
 b. Solve: $\frac{dx}{dy} + \frac{y \cos x + \sin y + y}{\sin x + x \cos y + x} = 0$ (06 Marks)
 c. Solve: $\frac{dx}{dy} + \frac{2y}{x} = y^2 x$ (06 Marks)

OR

- 10 a. Solve: $\frac{dy}{dx} + \frac{y}{x} = y^2 x$ (08 Marks)
 b. Solve: $(5x^4 + 3x^2y^2 - 2xy^3)dx + (2x^3y - 3x^2y^2 - 5y^4)dy = 0$ (06 Marks)
 c. Solve: $\frac{dy}{dx} + y \cot x = \cos x$ (06 Marks)

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21CS32

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Data Structures and Applications

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. What is data structure? Explain in detail classification of data structures with example. (10 Marks)
- b. Write an algorithm for inserting and deleting an element at a given location in an array and implement the same in 'C' language. (10 Marks)

OR

- 2 a. Explain the nested structures with an example of a 'C' program. (07 Marks)
- b. What are self-referential structures? (03 Marks)
- c. Explain 'C' library functions for memory allocation/deallocation functions with example. (10 Marks)

Module-2

- 3 a. What is stack? Explain basic operations of stack with algorithm. (05 Marks)
- b. Write 'C' program to implement stack using array. (05 Marks)
- c. Write an algorithm to convert an infix notation to post fix notation to post fix notation and apply the algorithm for the following infix expression to convert it into post fix.
 $A - (B/C + (D\%E * F)/G) * H.$ (10 Marks)

OR

- 4 a. What is queue? Explain basic operations of queue with algorithm. (06 Marks)
- b. Write 'C' program to implement linear queue using array. (07 Marks)
- c. Explain different types of queues with example. (07 Marks)

Module-3

- 5 a. What are linked lists? Explain with algorithm inserting a new node in a linked list for the following cases:
Case 1 : The new node is inserted at the beginning.
Case 2 : The new node after a given node. (10 Marks)
- b. What are circular linked lists? Explain with algorithm deleting a node from a circular linked list for the following cases:
Case 1 : The first node
Case 2 : The last node. (10 Marks)

OR

- 6 a. Represent polynomial using linked list and explain addition of two polynomial with algorithm. (10 Marks)
- b. Write a 'C' program to implement stack using linked list. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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Module-4

- 7 a. What are binary trees? Explain the linked representation of binary tree. (08 Marks)
b. What is binary search tree? Construct the binary tree for the following expression:
 $\text{exp} = ((a + b) - (c * d)) \% ((e \wedge f) / (g - h))$. (07 Marks)
c. Write applications of trees. (05 Marks)

OR

- 8 a. Explain pre-order and in-order traversal with example and also write algorithm. (10 Marks)
b. Explain inserting and deleting a new node in a binary search tree with algorithm. (10 Marks)

Module-5

- 9 a. What are AVL trees? Explain operations on AVL trees with example. (10 Marks)
b. What are red-black trees? Explain operations on red-black trees with example. (10 Marks)

OR

- 10 a. Explain the graph representation using adjacency matrix. (05 Marks)
b. Explain the two standard graph traversal algorithms in detail with example. (10 Marks)
c. Explain different hash functions with example. (05 Marks)

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Third Semester B.E. Degree Examination, Dec.2023/Jan.2024

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. What is Biasing? List the types of Biasing and discuss fixed bias. (06 Marks)
- b. Describe the working of Schmitt trigger circuit (non inverting) with transfer characteristics. (08 Marks)
- c. Explain First Order Low Pass Filter with Mathematical Analysis. (06 Marks)

OR

- 2 a. Discuss Regulated power supply with block diagram. (06 Marks)
- b. With neat sketch, explain successive approximation ADC method. (08 Marks)
- c. With the help of a neat diagram, explain the working principle of relaxation oscillator. (06 Marks)

Module-2

- 3 a. Reduce the following function using K-map technique and implement the expression with Basic gates :

$$f(a, b, c, d) = \sum m(0, 1, 6, 8, 9, 11) + \sum d(3, 7, 14, 15)$$
 (10 Marks)
- b. What are Prime Implicants? Find all the prime implicants and simplified expression for the function using Q-M method,

$$f(a, b, c, d) = \sum m(0, 2, 3, 4, 8, 10, 12, 13, 14) + d(11, 15)$$
 (10 Marks)

OR

- 4 a. Simplify the following POS expression using K-map and implement using Basic gates,

$$f(a, b, c, d) = \prod M(0, 1, 3, 4, 5, 7, 11, 12, 13, 14, 15)$$
 (08 Marks)
- b. Obtain the simplified expression using EVM method for the given function,

$$f(a, b, c, d) = \sum m(0, 1, 5, 13, 14, 15) + d(8, 9, 10, 11)$$
 (06 Marks)
- c. With example, explain Petrick's 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)

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Module-4

- 7 a. Explain the structure of VHDL program. Write VHDL code of JK Flip Flop. (08 Marks)
b. Derive characteristic equation of JK, D, D, SR flip flops. (08 Marks)
c. What is T-FF? Give the implementation circuit. (04 Marks)

OR

- 8 a. Explain Master Slave JK FF with neat diagram, Truth table and timing diagram. (08 Marks)
b. What are the three different models of writing module body in VHDL. Give VHDL code of 4 : 1 multiplexer using conditional assign statement. (08 Marks)
c. Give excitation table of JK and SR FF. (04 Marks)

Module-5

- 9 a. With a neat diagram, explain n-bit parallel Adder with Accumulators (10 Marks)
b. Design Mod-8 Counter using JK Flip flop. (10 Marks)

OR

- 10 a. With neat diagram, explain SISO register. (10 Marks)
b. Design a synchronous counter for the given sequence.
 $0 \rightarrow 4 \rightarrow 1 \rightarrow 2 \rightarrow 6 \rightarrow 0 \rightarrow 4$ (10 Marks)

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CBCS SCHEME

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2TCS34

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024 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. With a neat diagram, explain basic operational concepts of a computer. (10 Marks)
- b. Define the basic performance equation. Summarize the measures to improve the performance. (05 Marks)
- c. Explain the overall SPEC rating for the computer in a programming suit. (05 Marks)

OR

- 2 a. What is addressing mode? Explain different types of addressing mode with examples. (10 Marks)
- b. Show the big and little endian assignments for the number 22354456. (05 Marks)
- c. Explain with basic types of the instruction formats to carry out $c \leftarrow [A] + [B]$. (05 Marks)

Module-2

- 3 a. Illustrate a program that reads one line from the keyboard, stores in memory buffer, and echoes it back to the display in an I/O interfaces. (05 Marks)
- b. Explain the following with respect to interrupts:
 - (i) Interrupt Nesting
 - (ii) Simultaneous requests(10 Marks)
- c. Define exception. Explain two kinds of exception. (05 Marks)

OR

- 4 a. With a neat diagram, explain the centralized arbitration scheme and distributed bus arbitration scheme. (10 Marks)
- b. With a neat timing diagram, illustrate the asynchronous bus data transfer during an input operation. Use Handshake scheme. (05 Marks)
- c. With neat diagram, explain how to connect keyboard to processor. (05 Marks)

Module-3

- 5 a. With a neat diagram, explain the organization of a $2M \times 32$ memory module using $512K \times 8$ static memory chips. (10 Marks)
- b. Explain different types of non volatile memories. (05 Marks)
- c. Explain with a neat block diagram of memory hierarchy in a contemporary computer system indicating variation of size, speed and cost per bit in the hierarchy. (05 Marks)

OR

- 6 a. Briefly explain any two mapping function used in cache memory. (10 Marks)
- b. With a diagram, explain how virtual memory address is translated. (05 Marks)
- c. Calculate the average access time experienced by a processor, if a cache hit rate is 0.88, miss penalty is 0.015 millisec and cache access time is 10 micro seconds. (05 Marks)

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Module-4

- 7 a. Convert the following numbers into signed 5 bit numbers and add them. Also, tell whether overflow has occurred or not. (i) 13, 5 (ii) -15, -7 (05 Marks)
- b. Explain with diagram the design and working of 16 bit carry look ahead adder built from 4-bit adders. (10 Marks)
- c. Solve the following using sequential circuit binary multiplier: (i) 11×13 (ii) 12×9 (05 Marks)

OR

- 8 a. With a neat diagram, explain single bus organization of computer. (10 Marks)
- b. List out the actions needed to execute the instruction Add (R3), R1. Write the sequence control steps for the execution of the same. (05 Marks)
- c. Explain with a neat diagram, micro-programmed control unit method for design of control unit. (05 Marks)

Module-5

- 9 a. Explain pipelining processing with example. (10 Marks)
- b. Explain processor with multiple functional units. (05 Marks)
- c. Explain arithmetic pipeline. (05 Marks)

OR

- 10 a. Explain four segment instruction pipeline. (10 Marks)
- b. Explain SIMD array processor. (05 Marks)
- c. Explain vector processing. (05 Marks)

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21MAT31

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024 Transform Calculus Fourier Series & Numerical Techniques

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1
 - a. Find the Laplace transform of, (i) $e^{-3t} \sin 5t \cos 3t$ (ii) $\frac{e^{at} - e^{bt}}{t}$. (06 Marks)
 - b. If a periodic function of period 'a' is defined by $f(t) = \begin{cases} E, & \text{for } 0 < t < \frac{a}{2} \\ -E, & \text{for } \frac{a}{2} < t < a \end{cases}$ then show that $L\{f(t)\} = \frac{E}{s} \tanh\left(\frac{as}{4}\right)$. (07 Marks)
 - c. Using convolution theorem find the inverse Laplace transform of $\frac{s}{(s+2)(s^2+9)}$. (07 Marks)

OR

- 2
 - a. Express the function $f(t) = \begin{cases} \cos t & \text{for } 0 < t < \pi \\ \cos 2t & \text{for } \pi < t < 2\pi \\ \cos 3t & \text{for } t > 2\pi \end{cases}$ in terms of unit step function and hence find its Laplace transform. (07 Marks)
 - b. Find the inverse Laplace transform of $\frac{2s^2 - 6s + 5}{s^3 - 6s^2 + 11s - 6}$. (06 Marks)
 - c. Solve the differential equation $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = e^{-t}$ with $y(0) = y'(0) = 0$ by using Laplace transform. (07 Marks)

Module-2

- 3
 - a. Find a Fourier series to represent $f(x) = |x|$ in $-\pi \leq x \leq \pi$. (06 Marks)
 - b. Obtain the half-range cosine series for $f(x) = x \sin x$ in $(0, \pi)$ and hence show that $\frac{\pi-2}{4} = \frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \dots \infty$. (07 Marks)
 - c. Express y as a Fourier series up to second harmonics for the following data :

x:	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π
y:	1	1.4	1.9	1.7	1.5	1.2	1.0

(07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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OR

- 4 a. Obtain the Fourier series expansion for the function, $f(x) = 2x - x^2$ in $(0, 2)$. (06 Marks)

- b. Find the half range sine series for the function, $f(x) = \begin{cases} \frac{1}{4} - x & \text{for } 0 < x < \frac{1}{2} \\ x - \frac{3}{4} & \text{for } \frac{1}{2} < x < 1 \end{cases}$ (07 Marks)

- c. The following table gives the variation of periodic current over period :

t sec :	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$	T
A (amp) :	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of the first harmonic. (07 Marks)

Module-3

- 5 a. Find the Fourier transform of the function $f(x) = \begin{cases} 1 - x^2 & \text{for } |x| \leq 1 \\ 0 & \text{for } |x| > 1 \end{cases}$. Hence evaluate

$$\int_0^{\infty} \left(\frac{x \cos x - \sin x}{x^3} \right) dx. \quad (06 \text{ Marks})$$

- b. Find the Fourier sine and cosine transform of $f(x) = \begin{cases} x & \text{if } 0 < x < 1 \\ 2 - x & \text{if } 1 < x < 2 \\ 0 & \text{otherwise} \end{cases}$. (07 Marks)

- c. Find the z-transform of $\cosh\left(n\frac{\pi}{2} + \theta\right)$. (07 Marks)

OR

- 6 a. Find the Fourier sine transform of $f(x) = e^{-ax}$, $a > 0$. (06 Marks)

- b. Find the inverse z transform of $\frac{18z^2}{(2z-1)(4z+1)}$. (07 Marks)

- c. Solve the difference equation $u_{n+2} + 6u_{n+1} + 9u_n = z^n$ with $u_0 = u_1 = 0$ using z-transform. (07 Marks)

Module-4

- 7 a. Classify the following partial differential equations :

(i) $\frac{\partial^2 u}{\partial x^2} + 4 \frac{\partial^2 u}{\partial x \partial y} + 4 \frac{\partial^2 u}{\partial y^2} - \frac{\partial u}{\partial x} + 2 \frac{\partial u}{\partial y} = 0.$

(ii) $x^2 \frac{\partial^2 u}{\partial x^2} + (1 - y^2) \frac{\partial^2 u}{\partial y^2} = 0, -\infty < x < \infty, -1 < y < 1.$

(iii) $(1 + x^2) \frac{\partial^2 u}{\partial x^2} + (5 + 2x^2) \frac{\partial^2 u}{\partial x \partial t} + (4 + x^2) \frac{\partial^2 u}{\partial t^2} = 0.$

(iv) $(x+1) \frac{\partial^2 u}{\partial x^2} - 2(x+2) \frac{\partial^2 u}{\partial x \partial y} + (x+3) \frac{\partial^2 u}{\partial y^2} = 0. \quad (10 \text{ Marks})$

- b. Evaluate the values at the mesh points for the equation $u_{tt} = 16u_{xx}$ taking $h = 1$ upto $t = 1.25$. The boundary conditions are $u(0, t) = u(5, t) = 0$ and the initial conditions are $u(x, 0) = x^2(5 - x)$ and $u_t(x, 0) = 0$. (10 Marks)

OR

- 8 a. Using Schmidt two-level formula to solve the equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ under the conditions,
- (i) $u(0, t) = u(1, t) = 0 \quad t \geq 0$
- (ii) $u(x, 0) = \sin \pi x, \quad 0 < x < 1$ by taking $h = \frac{1}{4}$ and $\alpha = \frac{1}{6}$ co. (10 Marks)
- b. Solve the two-dimensional Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ at the interior mesh points of the square region and the values of u at the mesh points on the boundary are shown in Fig.Q8 (b).

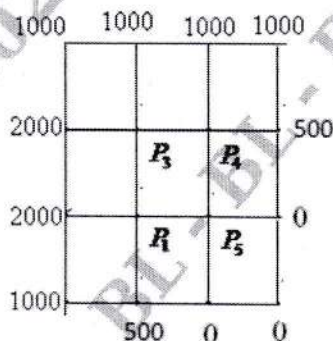


Fig. Q8 (b)

(10 Marks)

Module-5

- 9 a. Using Runge-Kutta method of 4th order to solve the differential equation $\frac{d^2 y}{dx^2} + 2x \frac{dy}{dx} - 4y = 0$ with $y(0) = 0.2$ and $y'(0) = 0.5$ for $x = 0.1$. Correct to four decimal places. (07 Marks)
- b. State and prove Euler's equation. (07 Marks)
- c. Find the extremal of the functional $I = \int_0^{\frac{\pi}{2}} (y^2 - y'^2 - 2y \sin x) dx$ under the end conditions $y(0) = 0, y\left(\frac{\pi}{2}\right) = 0$ (06 Marks)

OR

- 10 a. Apply Milne's method to compute $y(0.3)$. Given that $\frac{d^2 y}{dx^2} = 1 - 2y \frac{dy}{dx}$ and $y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762, y'(0) = 0, y'(0.2) = 0.1996, y'(0.4) = 0.3937, y'(0.6) = 0.5689$ (07 Marks)
- b. Prove that the shortest distance between two points in a plane is a straight line. (07 Marks)
- c. Find the extremal of the functional $I = \int_{x_1}^{x_2} (y^2 + y'^2 + 2ye^x) dx$ (06 Marks)

CBCS SCHEME

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BCS301

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024 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. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.
4. Mathematics hand book is permitted.*

Module – 1			M	L	C																		
Q.1	a.	A Random variable X has the following probability function for variable values of x. <table border="1"><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>k²</td><td>2k²</td><td>7k²+k</td></tr></table> (i) Find the value of k. (ii) Evaluate P(x ≥ 6) and P(3 < x ≤ 6).	x	0	1	2	3	4	5	6	7	P(x)	0	k	2k	2k	3k	k ²	2k ²	7k ² +k	6	L2	CO1
	x	0	1	2	3	4	5	6	7														
	P(x)	0	k	2k	2k	3k	k ²	2k ²	7k ² +k														
b.	Find the mean and variance of Binomial distribution.	7	L2	CO2																			
	c.	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. (iii) Between 10 and 12 minutes.	7	L3	CO2																		
OR																							
Q.2	a.	A random variable x has the following density function $P(x) = \begin{cases} Kx^2 & -3 \leq x \leq 3 \\ 0 & \text{elsewhere} \end{cases}$. Find the value of K. Evaluate (i) P(1 ≤ x ≤ 2) (ii) P(x ≤ 2)	6	L2	CO1																		
	b.	In a factory producing blades, the probability of any blade being defective is 0.002. If blades are supplied in packets of 10, using Poisson distribution determine the number of packets containing, (i) No defective. (ii) One defective (iii) Two defective blades respectively in a consignment of 10,000 packets.	7	L2	CO2																		
	c.	In a test on electric bulbs, it was found that the life time of a particular brand was distributed normally with an average life of 2000 hours and standard deviation of 60 hours. If a firm purchases 2500 bulbs find the number of bulbs that are likely to last for, (i) More than 2100 hours. (ii) Between 1900 to 2100 hours. (iii) Less than 1950 hours. (Given $\phi(1.67) = 0.4525$, $\phi(0.83) = 0.2967$)	7	L3	CO2																		

Module – 2																				
Q.3	a.	The joint probability distribution table for two random variable x and y is as follows : <table><tr><th>Y \ X</th><th>-2</th><th>-1</th><th>4</th><th>5</th></tr><tr><th>1</th><td>0.1</td><td>0.2</td><td>0</td><td>0.3</td></tr><tr><th>2</th><td>0.2</td><td>0.1</td><td>0.1</td><td>0</td></tr></table> Determine the marginal probability distribution of x and y. Obtain the correlation coefficient between x and y.	Y \ X	-2	-1	4	5	1	0.1	0.2	0	0.3	2	0.2	0.1	0.1	0	6	L2	CO2
Y \ X	-2	-1	4	5																
1	0.1	0.2	0	0.3																
2	0.2	0.1	0.1	0																
	b.	Find the unique fixed probability vector for the regular stochastic matrix $A = \begin{bmatrix} 0 & 1 & 0 \\ \frac{1}{6} & \frac{1}{2} & \frac{1}{3} \\ 0 & \frac{2}{3} & \frac{1}{3} \end{bmatrix}$	7	L2	CO3															
	c.	Three boys A, B, C are throwing ball to each other. A always throws the ball to B and B always throws the ball to C. C is just as likely to throw the ball to B as to A. If C was the first person to throw the ball find the probabilities that after three throws : (i) A has the ball. (ii) B has the ball. (iii) C has the ball.	7	L3	CO3															
OR																				
Q.4	a.	The joint probability distribution of two discrete random variables x and y is given by $f(x, y) = k(2x+y)$ where x and y are integers. Such that $0 \leq x \leq 2, 0 \leq y \leq 3$. (i) Find the value of the constant K. (ii) Find the marginal probability distribution of X and Y. (iii) Show that the random variables X and Y are dependent.	6	L2	CO2															
	b.	Find the unique fixed probability vector for the matrix, $P = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$.	7	L2	CO3															
	c.	Each year a man trades his car for a new car in 3 brands of the popular company. If he has a 'swift' he trades it for 'Dzire'. If he has a 'Dzire' he trades it for a 'Wagnor'. If he has a 'Wagnor' he is just as likely to trade it for a new 'Wagnor' or for a 'Dzire' or a 'Swift' one. In 2020 he bought his first car which was 'Wagnor'. Find the probability that he has (i) 2022 Wagnor. (ii) 2022 Swift. (iii) 2023 Dzire. (iv) 2023 Wagnor.	7	L3	CO3															
Module – 3																				
Q.5	a.	Explain the following terms: (i) Statistical Hypothesis. (ii) Critical region of statistical test. (iii) Test for significance.	6	L1	CO5															

	b.	In 324 throws of a six faced die an odd number turned up 181 times. Is it reasonable to think that the die is an unbiased one at 5% level of significance?	7	L3	CO4																		
	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 200 flights. Is there a significant difference in the two types of aircrafts so far as engine defects are concerned? Test at 5% significance level.	7	L3	CO4																		
OR																							
Q.6	a.	Define : (i) Null Hypothesis. (ii) Significance level. (iii) Type I and II error.	6	L1	CO5																		
	b.	A coin was tossed 1000 times and head turns up 540 times. Test the hypothesis that the coin is unbiased at 1% level of significance.	7	L3	CO4																		
	c.	In an exit poll enquiry it was revealed that 600 voters in one locality and 400 voters from an other locality favoured 55% and 48% respectively a particular party to come to power. Test the hypothesis that there is a difference in the locality in respect of the opinion at 1% level of significance.	7	L3	CO4																		
Module – 4																							
Q.7	a.	A random sample of size 64 is taken from an infinite population having mean 112 and variance 144. Using central limit theorem, find the probability of getting the sample mean $\bar{X}$ greater than 114.5	6	L2	CO5																		
	b.	The following data shows the runs scored by two batsman: Can it be said that the performance of batsman A is more consistent than the performance of batsman B? Use 1% level of significance ($F_{0.01, 4, 7} = 7.85$) <table border="1" style="margin: 10px auto;"><tr><td>Batsman A</td><td>40</td><td>50</td><td>35</td><td>25</td><td>60</td><td>70</td><td>65</td><td>55</td></tr><tr><td>Batsman B</td><td>60</td><td>70</td><td>40</td><td>30</td><td>50</td><td>-</td><td>-</td><td>-</td></tr></table>	Batsman A	40	50	35	25	60	70	65	55	Batsman B	60	70	40	30	50	-	-	-	7	L2	CO4
Batsman A	40	50	35	25	60	70	65	55															
Batsman B	60	70	40	30	50	-	-	-															
	c.	A coins are tossed 100 times and the following results were obtained. Fit a binomial distribution for the data and calculate the theoretical frequencies. <table border="1" style="margin: 10px auto;"><tr><td>Number of heads</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Frequency</td><td>5</td><td>29</td><td>36</td><td>25</td><td>5</td></tr></table> (Given $\chi^2_{0.05} = 9.49$ for 4 degree of freedom)	Number of heads	0	1	2	3	4	Frequency	5	29	36	25	5	7	L3	CO4						
Number of heads	0	1	2	3	4																		
Frequency	5	29	36	25	5																		
OR																							
Q.8	a.	Suppose that 10, 12, 16, 19 is a sample taken from a normal population with variance 6.25. Find at 95% confidence interval for the population mean.	6	L2	CO4																		
	b.	The individuals are choosen 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. (Given $t_{0.05} = 2.262$ for 9 degree of freedom).	7	L3	CO5																		
	c.	A sample analysis of examination results of 500 students war made. It was found that 220 students had failed, 170 had secured third class, 90 had secured second class and 20 had secured first class. Do these figures support the general examination result which is in the ratio 4 : 3 : 2 : 1 for the respective categories (Given $\chi^2_{0.05} = 7.81$ for 3 degree of freedom).	7	L3	CO4																		

Module – 5

Module – 5

Q.9	a.	Three different kinds of food are tested on three groups of rats for 5 weeks. The objective is to check the difference in mean weight (in grams) of the rats per week. Apply one-way ANOVA using a 0.05 significance level to the following data : <table border="1" style="margin-left: auto; margin-right: auto;"><tr><td>Food 1</td><td>8</td><td>12</td><td>19</td><td>8</td><td>6</td><td>11</td></tr><tr><td>Food 2</td><td>4</td><td>5</td><td>4</td><td>6</td><td>9</td><td>7</td></tr><tr><td>Food 3</td><td>11</td><td>8</td><td>7</td><td>13</td><td>7</td><td>9</td></tr></table>	Food 1	8	12	19	8	6	11	Food 2	4	5	4	6	9	7	Food 3	11	8	7	13	7	9	10	L3	CO6											
Food 1	8	12	19	8	6	11																															
Food 2	4	5	4	6	9	7																															
Food 3	11	8	7	13	7	9																															
	b.	Analyze and interpret the following statistics concerning output of wheat per field obtained as a result of experiment conducted to test four varieties of wheat viz. A, B, C, D under a Latin-square design. <table border="1" style="margin-left: auto; margin-right: auto;"><tr><td>C</td><td>B</td><td>A</td><td>D</td></tr><tr><td>25</td><td>23</td><td>20</td><td>20</td></tr><tr><td>A</td><td>D</td><td>C</td><td>B</td></tr><tr><td>19</td><td>19</td><td>21</td><td>18</td></tr><tr><td>B</td><td>A</td><td>D</td><td>C</td></tr><tr><td>19</td><td>14</td><td>17</td><td>20</td></tr><tr><td>D</td><td>C</td><td>B</td><td>A</td></tr><tr><td>17</td><td>20</td><td>21</td><td>15</td></tr></table>	C	B	A	D	25	23	20	20	A	D	C	B	19	19	21	18	B	A	D	C	19	14	17	20	D	C	B	A	17	20	21	15	10	L4	CO6
C	B	A	D																																		
25	23	20	20																																		
A	D	C	B																																		
19	19	21	18																																		
B	A	D	C																																		
19	14	17	20																																		
D	C	B	A																																		
17	20	21	15																																		
OR																																					
Q.10	a.	Set up an analysis of variance table for the following per acre production data for three varieties of wheat, each grown on four plots and state if the variety differences are significant at 5% significant level (Two way ANOVA). <table border="1" style="margin-left: auto; margin-right: auto;"><tr><th rowspan="3">Plot of land</th><th colspan="3">Per acre production data</th></tr><tr><th colspan="3">Variety of wheat</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>1</td><td>6</td><td>5</td><td>5</td></tr><tr><td>2</td><td>7</td><td>5</td><td>4</td></tr><tr><td>3</td><td>3</td><td>3</td><td>3</td></tr><tr><td>4</td><td>8</td><td>7</td><td>4</td></tr></table>	Plot of land	Per acre production data			Variety of wheat			A	B	C	1	6	5	5	2	7	5	4	3	3	3	3	4	8	7	4	10	L3	CO6						
Plot of land	Per acre production data																																				
	Variety of wheat																																				
	A	B	C																																		
1	6	5	5																																		
2	7	5	4																																		
3	3	3	3																																		
4	8	7	4																																		
	b.	Set up ANOVA table for the following information relating to three drugs testing to judge the effectiveness in reducing blood pressure for three different groups of people. <table border="1" style="margin-left: auto; margin-right: auto;"><tr><th rowspan="2">Group of people</th><th colspan="3">Drug</th></tr><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td rowspan="2">A</td><td>14</td><td>10</td><td>11</td></tr><tr><td>15</td><td>9</td><td>11</td></tr><tr><td rowspan="2">B</td><td>12</td><td>7</td><td>10</td></tr><tr><td>11</td><td>8</td><td>11</td></tr><tr><td rowspan="2">C</td><td>10</td><td>11</td><td>8</td></tr><tr><td>11</td><td>11</td><td>7</td></tr></table> Do the drugs act differently? Are the different groups of people affected differently? Is the interaction term significant? Answer the above questions taking a significant level of 5%?	Group of people	Drug			X	Y	Z	A	14	10	11	15	9	11	B	12	7	10	11	8	11	C	10	11	8	11	11	7	10	L4	CO6				
Group of people	Drug																																				
	X	Y	Z																																		
A	14	10	11																																		
	15	9	11																																		
B	12	7	10																																		
	11	8	11																																		
C	10	11	8																																		
	11	11	7																																		

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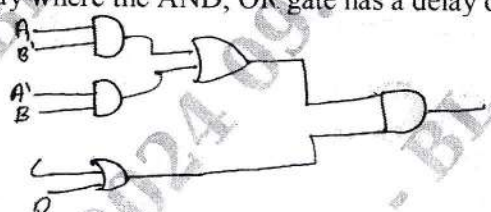
BCS302

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024 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.	Obtain a minimum product of sums with a Karnaugh map. $F(w, x, y, z) = x'z' + wyz + w'y'z' + x'y$.		10	L3	CO1
	b.	Find the minimum sum of products for each function using a Karnaugh map i) $F_1(a, b, c) = M_0 + M_2 + M_5 + M_6$ ii) $F_2(d, e, f) = \sum m(0, 1, 2, 4)$ iii) $F_3(r, s, t) = rt' + r's' + r's$		10	L3	CO1
OR						
Q.2	a.	Identify the prime implicants and essential prime implicants of the following functions: i) $f(A, B, C, D) = \sum (1, 3, 4, 5, 10, 11, 12, 13, 14, 15)$ ii) $f(W, X, Y, Z) = \sum (0, 1, 2, 5, 7, 8, 10, 15)$.		10	L3	CO1
	b.	Write the verilog code for the given expression using dataflow and behavioral model where $Y = (AB' + A'B)(CB + AD)(AB'C + AC)$.		5	L2	CO1
	c.	Write the verilog code and time diagram for the given circuit with propagation delay where the AND, OR gate has a delay of 30ns and 10ns. 		5	L2	CO1
Module – 2						
Q.3	a.	What is Latch? With neat diagram, explain S-R latch using NOR gate. Derive characteristics equation.		10	L3	CO2
	b.	What is priority encoder? Design 4:2 priority encoder with necessary diagrams.		10	L3	CO2
OR						
Q.4	a.	Design and explain four bit adder with carry look ahead.		10	L3	CO2
	b.	What is multiplexer? Design 9:1 mux using 2:1 mux.		10	L3	CO2

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Module – 3

Q.5	a.	Explain four types of operation performed by computer with an example.	10	L2	CO3
	b.	Show how below expression will be executed in one address, two address zero address and three address processor in an accumulator organization $X = (A * B) + (C * D)$.	10	L1	CO3
OR					
Q.6	a.	What is addressing mode? Explain different types of addressing mode with an examples.	10	L2	CO3
	b.	With a neat diagram, explain basic operational concepts of a computer.	10	L2	CO3
Module – 4					
Q.7	a.	Explain the following with respect to interrupts with diagram. i) Vector interrupt ii) Interrupt nesting iii) Simultaneous request.	10	L2	CO3
	b.	Explain Direct Memory Access with a neat diagram.	10	L2	CO3
OR					
Q.8	a.	What is Bus arbitration? Explain different types of bus arbitration.	10	L2	CO3
	b.	Discuss different types of mapping functions of coaches.	10	L2	CO3
Module – 5					
Q.9	a.	Draw and explain the single-bus organization of the data path inside a processor.	10	L2	CO4
	b.	List out the actions needed to execute the instruction ADD (R3), R1 write and explain the sequence of control steps for the execution of the same.	10	L2	CO4
OR					
Q.10	a.	Analyze how does execution of a complete instruction carry out.	10	L4	CO4
	b.	What is pipeline? Explain the performance of pipeline with an example.	10	L4	CO4

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BCS303

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024

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 OS with a neat diagram.	5	L1, L2	CO1																				
	b.	Distinguish between the following terms: i) Multiprogramming and Multitasking ii) Multiprocessor system and clustered system.	10	L2	CO1																				
	c.	With a neat diagram, explain the concept the concept of VM-WARE architecture.	5	L1, L2	CO1																				
OR																									
Q.2	a.	Explain the operating system services with respect to programs and users.	5	L2	CO1																				
	b.	List and explain the different computing environments.	5	L1, L2	CO1																				
	c.	What are system calls? List and explain the different types of system calls.	10	L1, L2	CO1																				
Module – 2																									
Q.3	a.	Define process. Explain different states of a process with state diagram.	8	L1, L2	CO1																				
	b.	What is IPC? Explain direct and indirect communication with respect to message passing.	8	L1, L2	CO2																				
	c.	Explain context-switching.	4	L2	CO2																				
OR																									
Q.4	a.	What is multi-threaded process? Explain the four benefits of multithreaded programming.	6	L2	CO2																				
	b.	Calculate the average waiting time and average turn around time by drawing the Gantt-chart using FCFS, SJF-non preemptive, SRTF, RR(q = 2ms) and porosity algorithms. <table><tr><td>Process</td><td>Arrival time</td><td>Burst time</td><td>Porosity</td></tr><tr><td>P1</td><td>0</td><td>9</td><td>3</td></tr><tr><td>P2</td><td>1</td><td>4</td><td>2</td></tr><tr><td>P3</td><td>2</td><td>9</td><td>1</td></tr><tr><td>P4</td><td>3</td><td>5</td><td>4</td></tr></table>	Process	Arrival time	Burst time	Porosity	P1	0	9	3	P2	1	4	2	P3	2	9	1	P4	3	5	4	14	L3	CO2
Process	Arrival time	Burst time	Porosity																						
P1	0	9	3																						
P2	1	4	2																						
P3	2	9	1																						
P4	3	5	4																						
Module – 3																									
Q.5	a.	What is critical section? What are the requirements for the solution to critical section problem? Explain Peaterson's solution.	8	L1, L2	CO3																				
	b.	Explain Reader's-Writer's problem using semaphores.	12	L2	CO3																				

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BCS306A

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024 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.	Discuss the different data types supported by Java along with the default values and literals.	8	L2	CO1	
	b.	Develop a Java program to convert Celsius temperature to Fahrenheit.	6	L3	CO2	
	c.	Justify the statement "Compile once and run anywhere" in Java.	6	L2	CO1	
OR						
Q.2	a.	List the various operators supported by Java. Illustrate the working of >> and >>> operators with an example.	8	L2	CO1	
	b.	Develop a Java program to add two matrices using command line argument.	10	L3	CO2	
	c.	Explain the syntax of declaration of 2D arrays in Java.	2	L2	CO1	
Module – 2						
Q.3	a.	Examine Java Garbage collection mechanism by classifying the 3 generations of Java heap.	6	L2	CO1	
	b.	Develop a Java program to find area of rectangle, area of circle and area of triangle using method overloading concept. Call these methods from main method with suitable inputs.	10	L3	CO2	
	c.	Interpret the general form of a class with example.	4	L2	CO2	
OR						
Q.4	a.	Outline the following keywords with an example : (i) this (ii) static	6	L2	CO2	
	b.	Develop a Java program to create a class called 'Employee' which contains 'name', 'designation', 'empid' and 'basic salary' as instance variables and read () and write () as methods. Using this class, read and write five employee information from main () method.	10	L3	CO2	
	c.	Interpret with an example, types of constructions.	4	L2	CO2	
Module – 3						
Q.5	a.	Illustrate the usage of super keyword in Java with suitable example. Also explain the dynamic method dispatch.	10	L2	CO3	
	b.	Build a Java program to create an interface Resizable with method resize (int radius) that allow an object to be resized. Create a class circle that implements resizable interface and implements the resize method.	10	L3	CO3	
OR						
Q.6	a.	Compare and contrast method overloading and method overriding with suitable example.	8	L2	CO2	

	b.	Define inheritance and list the different types of inheritance in Java.	4	L2	CO3
	c.	Build a Java program to create a class named 'Shape'. Create 3 sub classes namely circle, triangle and square ; each class has 2 methods named draw () and erase (). Demonstrate polymorphism concepts by developing suitable methods and main program.	8	L3	CO3
Module – 4					
Q.7	a.	Examine the various levels of access protections available for packages and their implications with suitable examples.	10	L2	CO4
	b.	Build a Java program for a banking application to throw an exception, where a person tries to withdraw the amount even though he/she has lesser than minimum balance (Create a custom exception)	10	L3	CO4
OR					
Q.8	a.	Define Exception. Explain Exception handling mechanism provided in Java along with syntax and example.	10	L2	CO4
	b.	Build a Java program to create a package "balance" containing Account Class with displayBalance () method and import this package in another program to access method of Account Class.	10	L3	CO4
Module – 5					
Q.9	a.	Define a thread. Also discuss the different ways of creating a thread.	6	L2	CO5
	b.	How synchronization can be achieved between threads in Java? Explain with an example.	6	L2	CO5
	c.	Develop a Java program for automatic conversion of wrapper class type into corresponding primitive type that demonstrates unboxing.	8	L3	CO5
OR					
Q.10	a.	Summarize the type wrappers supported in Java.	6	L2	CO5
	b.	Explain Autoboxing/Unboxing that occurs in expressions and operators.	6	L2	CO5
	c.	Develop a Java program to create a class myThread. Call the base class constructor in this class's constructor using super and start the thread. The run method of the class starts after this. It can be observed that both main thread and created child thread are executed concurrently.	8	L3	CO5

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BCS304

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024

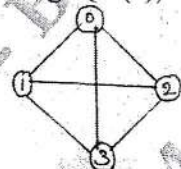
Data Structures and Applications

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				
Q.1	a.	Define Data Structures. Explain with neat block schematic different type of data structures with examples. What are the primitive operations that can be performed?	M 10	L L2 C CO1
	b.	Differentiate between structures and unions shown examples for both.	5	L1 CO1
	c.	What do you mean by pattern matching? Outline knuth, Morris, Pratt 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, /, 3, -, 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 is a linked list? Explain the different types of linked lists with neat diagram.	4	L2 CO2
	b.	Give the structure definition for singly linked list (SLL). Write a C function to, (i) Insert an element at the end of SLL. (ii) Delete a node at the beginning of SLL.	8	L3 CO2
	c.	Write a C-function to add two polynomials show the linked list representation of below two polynomials $p(x) = 3x^{14} + 2x^8 + 1$ $q(x) = 8x^{14} - 3x^{10} + 10x^6$	8	L3 CO2
Module - 3				
Q.5	a.	Write a C-function for the following operations on Doubly Linked List (DLL): (i) addition of a node. (ii) concatenation of two DLL.	8	L3 CO3
	b.	Write C functions for the following operations on circular linked list : (i) Inserting at the front of a list. (ii) Finding the length of a circular list.	8	L3 CO3

	c.	For the given sparse matrix, give the diagrammatic linked representation. $A = \begin{bmatrix} 2 & 0 & 0 & 0 \\ 4 & 0 & 0 & 3 \\ 0 & 0 & 0 & 0 \\ 8 & 0 & 0 & 1 \\ 0 & 0 & 6 & 0 \end{bmatrix}$	4	L3	CO3
OR					
Q.6	a.	Discuss how binary tree are represented using, (i) Array (ii) Linked list	6	L2	CO3
	b.	Discuss inorder, preorder, postorder and level order traversal with suitable recursive function for each.	8	L2	CO3
	c.	Define Threaded Binary Tree. Discuss In-Threaded binary Tree.	6	L2	CO3
Module – 4					
Q.7	a.	Write a function to perform the following operations on Binary Search Tree (BST) : (i) Inserting an element into BST. (ii) Recursive search of a BST.	8	L3	CO4
	b.	Discuss selection Trees with an example.	8	L2	CO4
	c.	Explain Transforming a first 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 (Refer Fig. Q8 (a)). 	6	L3	CO4
	b.	Define the following Terminologies with examples, (i) Digraph (ii) Weighted graph (iii) Self loop (iv) Parallel edges	8	L1	CO4
	c.	Explain in detail elementary graph operations.	6	L2	CO4
Module – 5					
Q.9	a.	What is collision? What are the methods to resolve collision? Explain linear probing with an example.	7	L2	CO5
	b.	Explain in detail, about static and dynamic hashing.	6	L2	CO5
	c.	Discuss Leftist Trees with an example.	7	L2	CO5
OR					
Q.10	a.	Explain different types of HASH function with example.	6	L2	CO5
	b.	Discuss AVL tree with an example. Write a function for insertion into an AVL Tree.	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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18CS42

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024

Design & Analysis of Algorithms

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.***Module-1**

- 1 a. Explain asymptotic notations BigO, BigΩ and Bigθ that are used to compare the order of growth of an algorithm with example. (06 Marks)
- b. List two methods to measure the time complexity of algorithm by counting program steps. Apply the same for the algorithm to find the SUM of n numbers. (06 Marks)
- c. Write an algorithm to search a key using sequential search. Derive its time efficiency for best case, worst case and average case. (08 Marks)

OR

- 2 a. Define an Algorithm. Discuss the criteria's that an algorithm must satisfy with an example. (06 Marks)
- b. Consider the following algorithm :
Algorithm : GUESS (A[][])
Method : for i ← 0 to n-1
 for j ← 0 to i
 A[i][j] ← 0
 (i) What does the algorithm compute?
 (ii) What is the basic operation?
 (iii) What is the time complexity of this algorithm? (06 Marks)
- c. Explain the mathematical analysis of non-recursive algorithm. Write an algorithm to check whether all the elements of given array are distinct. Give its worst case time complexity. (08 Marks)

Module-2

- 3 a. Write the algorithm for Merge Sort. Illustrate with an example. (06 Marks)
- b. Apply the source removal method to obtain topological sort for the graph in Fig. Q3 (b). (06 Marks)

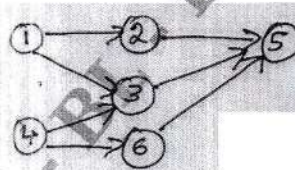


Fig. Q3 (b)

- c. Apply quicksort to sort the following list in ascending order :
25, 91, 46, 35, 11, 82, 14, 55
Represent the recursive call in the form of tree. (08 Marks)

OR

- 4 a. What are the 3 variations of decrease and conquer technique. Explain in detail. (06 Marks)
- b. Solve the following recurrence relation and find the upper bound using substitution method.
$$T(n) = 2.T\left(\frac{n}{2}\right) + n ; T(1) = 2$$
 (06 Marks)
- c. Explain recursive binary search algorithm. Derive its time efficiency for best, worst and average case. (08 Marks)

Module-3

- 5 a. What is the solution generated by job sequencing when $n = 5$
 $(P_1, P_2, P_3, P_4, P_5) = (20, 15, 10, 5, 1)$
 $(d_1, d_2, d_3, d_4, d_5) = (2, 2, 1, 3, 3)$ (06 Marks)
- b. Construct Huffman code for the following data :
- | | | | | | |
|-------------|------|-----|-----|-----|------|
| Symbol : | A | B | C | D | E |
| Frequency : | 0.35 | 0.1 | 0.2 | 0.2 | 0.15 |
- Also Encode CAB and DAC. (06 Marks)
- c. Apply Prim's and Kruskal's algorithm to get the minimum spanning tree for the graph given in Fig. Q5 (c). (08 Marks)

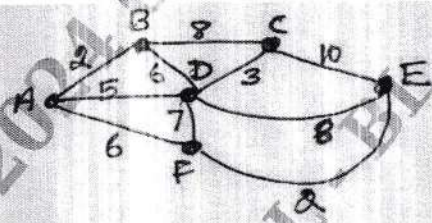


Fig. Q5 (c)

OR

- 6 a. Obtain the solution for the fractional Knapsack problem using greedy method for $n = 3$. Capacity $m = 20$, Values $V_1 = 25$, $V_2 = 24$, $V_3 = 15$ and weights $w_1 = 18$, $w_2 = 15$, $w_3 = 10$ respectively. (06 Marks)
- b. Sort the array 2, 9, 7, 6, 5, 8 by heap sort. Show the intermediate steps. (06 Marks)
- c. Apply Dijkstra's algorithm to find single source shortest path for the graph given in Fig. Q6 (c). Consider node 6 as source. (08 Marks)

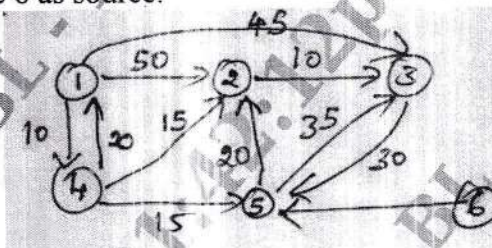


Fig. Q6 (c)

Module-4

- 7 a. Find all pair shortest path for the graph given in Fig. Q7 (a) using Floyd's algorithm. (10 Marks)

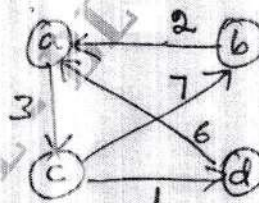


Fig. Q7 (a)

- b. Apply bottom up dynamic programming algorithm for the following instance of the knapsack problem. Knapsack capacity $M = 10$.

Item	Weight	Value
1	7	42
2	3	12
3	4	40
4	5	25

OR

- 8 a. Apply Bellman-ford algorithm to the graph given in Fig. Q8 (a). Find the shortest path to all the vertices from S. (10 Marks)

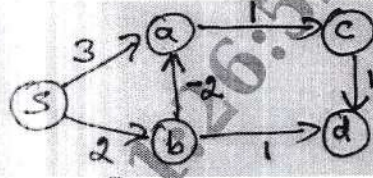


Fig. Q8 (a)

- b. Solve the following TSP using dynamic programming,

	1	2	3	4
1	0	10	15	20
2	5	0	9	10
3	6	13	0	12
4	8	8	9	0

Starting City = 1

(10 Marks)

Module-5

- 9 a. Let $w = \{3, 5, 6, 7\}$ and $m = 15$. Find all possible subsets of w that sum to m . Draw the state space tree. (10 Marks)
- b. With the help of state space tree, solve the following instance of knapsack problem by branch and bound algorithm. Knapsack capacity $w = 10$.

Item No.	1	2	3	4
Weight	4	7	5	3
Value	40	42	25	12

(10 Marks)

OR

- 10 a. Apply branch and bound algorithm to solve the TSP for the graph given in Fig. Q10 (a). Consider start city as A. Give the state space tree. (10 Marks)

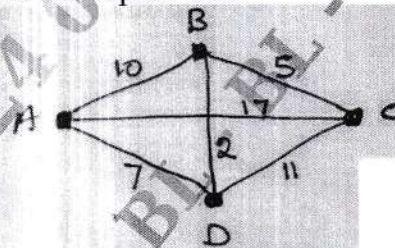


Fig. Q10 (a)

- b. Explain the following with example :
- Class NP problems
 - Class P problems
 - NP complete problem
 - NP hard problem

(10 Marks)

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Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Operating Systems

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. What is Operating System? Explain the role of operating system from different view points. (05 Marks)
- b. With a neat diagram, describe the storage structure and I/O structure of operating system. (10 Marks)
- c. Explain the dual mode of operation of an operating system. (05 Marks)

OR

- 2 a. List and explain the services provided by operating system for the user and efficient operation of system. (06 Marks)
- b. Describe the implementation of interprocess communication using shared memory and message passing. (08 Marks)
- c. Explain the different states of a process, with a neat diagram. (06 Marks)

Module-2

- 3 a. Explain different types of multithreading models. (07 Marks)
- b. Explain different scheduling criteria in process scheduling concept. (05 Marks)
- c. Consider the following set of processes with CPU burst time (in ms).

Process	Arrival Time	Burst Time
P1	0	6
P2	1	3
P3	2	1
P4	3	4

Compute the average waiting time and average turnaround time for the above processes using FCFS and Round Robin (Time Quantum = 2 ms) scheduling algorithm. (08 Marks)

OR

- 4 a. What is critical section problem? What are the requirements that solution to the critical reaction problem must satisfy? (06 Marks)
- b. With an example, explain the Peterson's solution for critical section problem and prove that all the three requirements are preserved. (07 Marks)
- c. Show how semaphores provide solution to reader writers problem. (07 Marks)

Module-3

- 5 a. What is deadlock? What are the necessary conditions an operating system must satisfy for a deadlock to occur? (05 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8=50, will be treated as malpractice.

- b. Determine whether the following system is in safe state by using Banker's algorithm.

Process	Allocation			Maximum			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	0	4	3	3			

If a request for P₁ arrives for (1 0 2), can the request be granted immediately. (10 Marks)

- c. Discuss the various approaches used for deadlock recovery. (05 Marks)

OR

- 6 a. With a neat diagram, explain the various steps of address binding. (07 Marks)
 b. Distinguish between internal and external fragmentation. (04 Marks)
 c. What are Translation Lookaside Buffer (TLB)? Explain TLB in detail with a simple paging system with a neat diagram. (09 Marks)

Module-4

- 7 a. Describe the steps in handling a page fault. (10 Marks)
 b. Consider the following page reference string 7,0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1. Assuming there are 3 memory frames and all are initially empty. How many page faults would occur in case of (i) FCFS (ii) LRU (iii) Optimal Page replacement (10 Marks)

OR

- 8 a. Explain briefly the various operations performed on files. (05 Marks)
 b. Explain the various types of directory structure with a neat diagram. (10 Marks)
 c. Explain the various access methods of files. (05 Marks)

Module-5

- 9 a. Explain the following disk scheduling algorithm with examples: (10 Marks)
 (i) FCFS (ii) SSTF (iii) SCAN (iv) LOOK
 b. Explain the access matrix model of implementing protection in operation system. (10 Marks)

OR

- 10 a. Explain the components of Linux system with a neat diagram. (05 Marks)
 b. Explain process management in a Linux system. (08 Marks)
 c. Explain the file system implementation in Linux. (07 Marks)

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Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Microcontroller and Embedded Systems

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Explain ARM core data flow model with neat diagram. (08 Marks)
- b. List and explain ARM processor modes. Also explain ARM core changing from user mode to interrupt request mode on an exception, with a neat diagram. (08 Marks)
- c. Differentiate: Microprocessor vs Microcontroller. (04 Marks)

OR

- 2 a. What is pipeline? Compare ARM7 three stage pipeline, ARM9 five-stage pipeline and ARM10 six stage pipeline. (08 Marks)
- b. Explain exception of interrupt. Narrate interrupt vector table. (08 Marks)
- c. Write a short note on Hardware extensions for a ARM core. (04 Marks)

Module-2

- 3 a. Explain single register load store addressing modes with examples. (08 Marks)
- b. Explain the program status register instructions. Also write a code fragment to.
 - i) Copy the cpsr into register r1
 - ii) Clear bit 7 of r1
 - iii) Copy the register r2 back to cpsr. (08 Marks)
- c. Explain the following ARM instructions with examples:
 - i) BIC ii) MRS iii) STMIB iv) SWP. (04 Marks)

OR

- 4 a. With neat diagram and example, explain block memory transfer in the memory map using load-store multiple instructions. (08 Marks)
- b. Explain stack operation of ARM processors. Also explain the load-store multiple addressing aliases available to support stack operations. (08 Marks)
- c. Explain software interrupt instruction with its syntax. (04 Marks)

Module-3

- 5 a. Write a function in assembly that can sum any number of integers. The argument should be the number of integers to sum followed by a list of the integers. (08 Marks)
- b. What is an Embedded system? Explain the different classifications of embedded systems. Give example for each. (08 Marks)
- c. Write the difference between microprocessors and microcontrollers. (04 Marks)

OR

- 6 a. What is Programmable Logic Device (PLD)? What are the different types of PLDs? Explain advantages of PLDs in embedded system design. (08 Marks)
- b. What is 7-segment LED display? What are two different configurations of 7-segment LED display? Explain. (08 Marks)
- c. Differentiate sensors v/s actuators. (04 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

Module-4

- 7 a. What is hardware software co-design? Explain the fundamental issues in hardware software co-design. (08 Marks)
b. Explain the product life-cycle curve of an embedded product development. (08 Marks)
c. What is the difference between compiler and cross compiler? (04 Marks)

OR

- 8 a. Explain different embedded firmware design approaches in detail. (08 Marks)
b. Explain sequential program model. (08 Marks)
c. Differentiate 'C' versus 'Embedded C'. (04 Marks)

Module-5

- 9 a. What is Kernal? What are the different functions handled by Kernal for a general purpose OS? (08 Marks)
b. What is Task Control Block (TCB)? Explain structure of TCB. (08 Marks)
c. Differentiate between thread and process. (04 Marks)

OR

- 10 a. Explain different techniques available for embedding firmware into the target board for a non-os based embedded system. (08 Marks)
b. Explain structure of a process and explain process life cycle with various activities involved in the creation of process. (08 Marks)
c. Write a note on Remote Procedure Call (RPC) mechanism for IPC. (04 Marks)

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18CS45

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Object Oriented Concepts

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Explain the various features of Object Oriented Concept. (08 Marks)
- b. Explain function overloading with an example. (08 Marks)
- c. Explain type conversion with an example. (04 Marks)

OR

- 2 a. List properties of friend function. Write a C++ program to add two numbers using friend function. (08 Marks)
- b. What is an inline function? Write a C++ program to find the maximum of two numbers using inline function. (08 Marks)
- c. Explain scope resolution operator with an example. (04 Marks)

Module-2

- 3 a. List characteristics of constructor. Explain default constructor with an example. (08 Marks)
- b. Explain with examples,
 - (i) Array and Objects (08 Marks)
 - (ii) Destructors (04 Marks)
- c. Write short notes on namespace with example. (04 Marks)

OR

- 4 a. List and explain Java Buzzwords. (08 Marks)
- b. Describe the program to calculate the average among the elements (4, 8, 10, 12) using for each in Java. How it is different from for loop? (08 Marks)
- c. Explain switch case with an example. (04 Marks)

Module-3

- 5 a. Explain the concept of Inheritance and its classification in Java. (08 Marks)
- b. Explain exception handling mechanism with an example. (08 Marks)
- c. Write short notes on this keyword with an example. (04 Marks)

OR

- 6 a. Explain the Java garbage collection. (08 Marks)
- b. Discuss the following terms with an example :
 - (i) Super keyword (08 Marks)
 - (ii) Final keyword (04 Marks)
- c. Explain the method overriding with an example. (04 Marks)

Module-4

- 7 a. Explain the packages in Java with an example. (10 Marks)
- b. Explain the interfaces in Java using suitable code. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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OR

- 8 a. Explain the concept of multithreading in Java. Explain how to make class threadable? (10 Marks)
b. With a syntax, explain is Alive () and Join () with suitable program. (10 Marks)

Module-5

- 9 a. What is an applet? Explain the life cycle of the applet. (10 Marks)
b. Write a short notes on :
(i) Event listener interface
(ii) Event classes (10 Marks)

OR

- 10 Explain the following with suitable code :
a. JButton
b. JLabel
c. JComboBox
d. JSlider (20 Marks)

Module-4

- 7 a. With a neat flow diagram, illustrate the working of CSMA/CA protocol. (10 Marks)
b. Explain the three channelization protocols in the data link layer. (10 Marks)

OR

- 8 a. With neat FSM state diagram at the sender and receiver, explain stop and wait protocol. (10 Marks)
b. With necessary diagrams, explain any two controlled access protocols. (10 Marks)

Module-5

- 9 a. Describe the frame format of standard Ethernet. (10 Marks)
b. With necessary diagrams, explain the architecture of IEEE 802.11 standard. (10 Marks)

OR

- 10 a. With neat diagram, explain the Bluetooth architecture. (10 Marks)
b. Explain the operation of cellular telephony. (10 Marks)

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18CS46

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Data Communication

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, explain the components of data communication. (06 Marks)
- b. With necessary diagrams, give the advantages and disadvantages of star and mesh topology. (08 Marks)
- c. A channel with a 1-MHz bandwidth has a SNR value 15. Calculate bit rate and signal levels. (06 Marks)

OR

- 2 a. What is data communication? Explain the fundamental characteristics of data communication. (06 Marks)
- b. With a neat diagram, explain encapsulation and decapsulation process in TCP/IP model. (08 Marks)
- c. Calculate the propagation time and the transmission time for a 2.5 Kbyte message, if the bandwidth of the network is 1 Gbps. Assume that the distance between the sender and the receiver is 12,000 km and that light travels at 2.4×10^8 m/s. (06 Marks)

Module-2

- 3 a. With a neat diagram, illustrate pulse code modulation encoder and decoder along with quantization levels. (12 Marks)
- b. Represent sequence 01001110 using polar NRZ-L, Manchester, AMI and pseudoternary line coding schemes. (08 Marks)

OR

- 4 a. With appropriate diagrams, explain transmission modes in physical layer. (10 Marks)
- b. With necessary diagrams, explain amplitude shift keying and frequency shift keying along with the implementation and bandwidth requirements. (10 Marks)

Module-3

- 5 a. What is spread spectrum? Describe two different techniques to spread the bandwidth. (10 Marks)
- b. Four channels are multiplexed using Time division multiplexing. If each channel sends 100 bytes/s and we multiplex 1 byte per channel, show the frame travelling on the link, the size of the frame, the duration of a frame and bit rate for the link. (10 Marks)

OR

- 6 a. With appropriate diagrams, explain frequency division multiplexing and wavelength division multiplexing. (10 Marks)
- b. A bit stream 10011101 is transmitted using the standard CRC method. The generator polynomial is $x^3 + 1$. What is the actual bit string transmitted? Suppose the third bit from the left is inverted during transmission. How will receiver detect this error? (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

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21CS42

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024

Design and Analysis of Algorithms

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Design an algorithm to search an element in an array using sequential search. Discuss its efficiency in best, worst and average cases. (08 Marks)
- b. Give the general plan for analyzing any non recursive algorithm. Write an algorithm to check whether array elements are distinct. Discuss its efficiency. (08 Marks)
- c. Define Big Oh (O) and Big Omega (Ω) notations. (04 Marks)

OR

- 2 a. Discuss the various steps in algorithm design and analysis process with the flow diagram. What are the criteria satisfied by any algorithm. (08 Marks)
- b. Give the general plan for analyzing any recursive algorithm. Write and solve the recurrence relation to find the solution for Tower's of Hanoi problem. (08 Marks)
- c. Write an algorithm to sort 'n' number using selection sort method. (04 Marks)

Module-2

- 3 a. Design an algorithm to sort 'n' numbers using Quick sort. Apply the algorithm for the data 35, 20, 15, 45, 10, 60, 15, 70. Each time, show the splitting position. (08 Marks)
- b. Discuss the general Divide and Conquer method along with control abstraction. Write the recurrence relation for divide and conquer. (06 Marks)
- c. Write an algorithm sort the numbers using insertion sort. Discuss its efficiency. (06 Marks)

OR

- 4 a. Obtain the Topological sequence for the following graph using i) Source removal method ii) DFS based algorithm. [Refer Fig.Q4(a)]

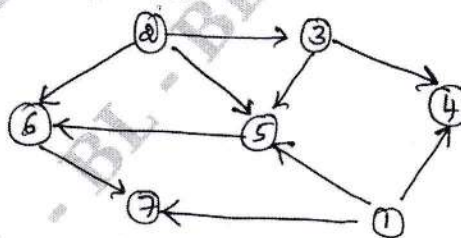


Fig.Q4(a)

- b. Design an algorithm to sort numbers using merge sort. Write the complexity of merge sort. (07 Marks)
 - c. Write recursive algorithm to find maximum and minimum element in an array. Construct tree of recursive call for the data, 22, 13, -5, -8, 15, 60, 17, 31, 47 (07 Marks)
- (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

Module-3

- 5 a. Write an algorithm to solve Greedy knapsack problem. Find an optimal solution to the knapsack instance $n = 7$, $m = 15$, $(P_1, P_2, \dots, P_7) = (10, 5, 15, 7, 6, 18, 3)$ and $(w_1, w_2, \dots, w_7) = (2, 3, 5, 7, 1, 4, 1)$ using Greedy method. (10 Marks)
- b. Design Prim's algorithm to find the minimum cost spanning tree. Apply Pr_1 Write an algorithm to construct heap using Bottom-up approach. Apply both bottom-up and Top down method to construct the max heap for the data 12, 23, 45, 28, 55, 15, 67, 33. (10 Marks)

OR

- 6 a. Design Prim's Algorithm to find the minimum cost spanning tree. Apply Prim's algorithm for the following graph in Fig.Q6(a).

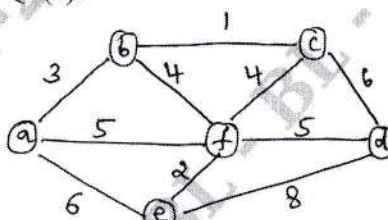


Fig.Q6(a)

- b. Write Huffman's algorithm. Construct Huffman tree and find the code for each character. (10 Marks)

Characters :	A	B	C	D	E
Probability :	0.4	0.1	0.2	0.15	0.15

(10 Marks)

Module-4

- 7 a. Write Floyd's Algorithm to solve all pairs shortest path problem. Apply Floyd's algorithm for the following graph in Fig.Q7(a).

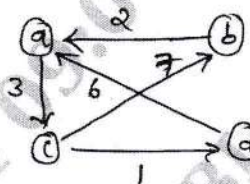


Fig.Q7(a)

- b. Write the pseudocode for comparison counting sort. Discuss its efficiency. (10 Marks)
- c. Write Bellman and Ford Algorithm to compute the shortest path. (06 Marks)

(04 Marks)

OR

- 8 a. Discuss general dynamic programming approach. Find the optimal tour for the salesperson if he starts from city 1, using dynamic programming. Graph and the distance matrix are given. [Refer Fig.Q8(a)]

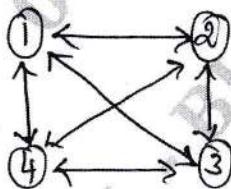


Fig.Q8(a)

	1	2	3	4
1	0	10	15	20
2	5	0	9	10
3	6	13	0	12
4	8	8	9	0

- b. Write pseudocode for Horspool's string matching algorithm. (10 Marks)
- c. Write Warshall's algorithm to compute Transitive closure. (06 Marks)

(04 Marks)

Module-5

- 9 a. Discuss general Backtracking technique. Construct state space tree to solve Four Queens problem. (08 Marks)
- b. Discuss the following :
- Graph coloring problem and its solution using Backtracking.
 - Branch and Bound technique to solve knapsack problem. (12 Marks)

OR

- 10 a. Discuss general branch and bound technique. Construct state space tree to solve the following assignment problem with 4 jobs and 4 persons. Assignment cost is given.

$$C = \begin{matrix} & \begin{matrix} 1 & 2 & 3 & 4 \end{matrix} \\ \begin{matrix} a \\ b \\ c \\ d \end{matrix} & \begin{bmatrix} 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix} \end{matrix}$$

(08 Marks)

- b. Discuss the following :
- Sum of subset problem and solution using backtracking.
 - P, NP and NP complete problem. (12 Marks)

CBCS SCHEME

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21CS43

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024

Microcontroller and Embedded Systems

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Explain with neat diagram, about ARM core data flow model. (10 Marks)
- b. Define RISC architecture. Compare with CISC processors. (10 Marks)

OR

- 2 a. Define pipelining? Explain how it helps the program execution. (10 Marks)
- b. Explain the major design rules related to RISC philosophy implementation. (10 Marks)

Module-2

- 3 a. Write a program to find sum of first 20 integer numbers. (10 Marks)
- b. Explain about load store instructions in ARM with example. (10 Marks)

OR

- 4 a. Write a program to find the factorial of a number. (10 Marks)
- b. Write a program to find largest and smallest number in an array of 16 numbers. (10 Marks)

Module-3

- 5 a. Write a program to arrange a series of 32 bit numbers in ascending/descending order. (10 Marks)
- b. What are the different types of memories used in Embedded system design? (10 Marks)

OR

- 6 a. Write a program to count the number of ones and zeros in two consecutive memory locations. (10 Marks)
- b. Write a program to display 'Microcontroller' message using Internal UART. (10 Marks)

Module-4

- 7 a. Explain classification of embedded systems. (10 Marks)
- b. Write a program and explain about interface of DC motor. (10 Marks)

OR

- 8 a. Explain the characteristics of embedded systems. (10 Marks)
- b. Write a program to demonstrate the use of external interrupt to toggle an LED on/off. (10 Marks)

Module-5

- 9 a. With neat diagram, explain operating system architecture. (10 Marks)
- b. Explain steps involved in selecting RTOS. (10 Marks)

OR

- 10 a. Explain the concept of dead lock with example. (10 Marks)
- b. Explain types of operating systems with example. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

CBCS SCHEME

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21CS44

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Operating System

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- Define Operating System. Explain the role of operating system with respect to user view and system view. (06 Marks)
 - With a neat diagram, explain dual mode operation. (06 Marks)
 - Briefly explain the services provided by the operating system that are helpful to the user. (08 Marks)

OR

- Define process. Explain the different characteristics of scheduling criteria. (06 Marks)
 - Differentiate between long term and short term schedulers. (04 Marks)
 - Define IPC. Explain shared memory and message passing mechanisms. (10 Marks)

Module-2

- With a neat figure, discuss various multi-threaded models. (06 Marks)
 - List out different threading issues. Explain any two. (06 Marks)
 - Consider the following set of processes.
 - Draw the Gantt chart showing the execution of these processes using non-preventive SJF and SRTF scheduling algorithms.
 - Compute turn around time and waiting time.
 - Compute the average turn around time and average waiting time.

Process	Arrival time	Burst time
P ₁	0	8
P ₂	1	4
P ₃	2	9
P ₄	3	5

(08 Marks)

OR

- What are the three requirements to be met by a solution to the critical section problem? Explain. (06 Marks)
 - Briefly discuss monitor solution to the dining philosopher problem. (08 Marks)
 - Write a short note on semaphores. (06 Marks)

Module-3

- Define deadlock. Explain the necessary conditions to arise deadlock. (06 Marks)
 - Consider the following snapshot of a system.

	Allocation			Maximum			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 question using Bankers Algorithm.

- Is the system in a safe state?
- If a request from P₁ arrives (1, 0, 2) can the request be granted immediately.
- "A safe state is not deadlock state but a deadlock state is not safe state."

(10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8=50, will be treated as malpractice.

OR

- 6 a. With a neat diagram, explain paging hardware with TLB. (08 Marks)
 b. Define address binding explain multi-step processing of a user program. (06 Marks)
 c. Given five memory positions of 100 KB, 500 KB, 200 KB, 300 KB and 600 KB (in order), how would the first fit, best fit and worst-fit algorithms place processes of 212 KB, 417 KB, 112 KB and 426 KB (in order)? Which algorithm makes the most efficient use of memory? (06 Marks)

Module-4

- 7 a. Define demand paging. With a neat diagram explain the steps in handling page fault. (08 Marks)
 b. Consider the following page reference string
 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6
 How many page faults would occur for the LRU, FIFO and optimal page replacement algorithms? Assume frame size is 3. (12 Marks)

OR

- 8 a. Define file. Explain different operations can be performed on the file. (07 Marks)
 b. Explain different file access methods. (09 Marks)
 c. List out different allocation methods. Explain any one. (04 Marks)

Module-5

- 9 a. Suppose that a disk has 5000 cylinders numbered 0 to 4999. The drive is currently serving a request at cylinder 143 and the previous request was at cylinder 125. The queue of pending requests, in FIFO order is,
 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130
 Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk-scheduling algorithms?
 i) FCFS ii) SSTF iii) SCAN iv) LOOK (12 Marks)
 b. Write a short note on Access Matrix. (08 Marks)

OR

- 10 Write a short note on the following :
 a. Components of Linux system
 b. Process Management
 c. File System
 d. Interprocess communication (20 Marks)

CBCS SCHEME

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21MAT41

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Complex Analysis, Probability and Statistical Methods

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. State and prove Cauchy's Riemann in polar form. (06 Marks)
- b. Determine the analytic function $f(z) = u + iv$ given that the real part $u = e^{2x}(x \cos 2y - y \sin 2y)$. (07 Marks)
- c. Evaluate : $\int_{(0,3)}^{(2,4)} (2y + x^2)dx + (3x - y)dy$ along the parabola $x = 2t, y = t^2 + 3$. (07 Marks)

OR

- 2 a. State and prove Cauchy's integral theorem. (06 Marks)
- b. Evaluate $\int_C \frac{e^{2z}}{(z+1)(z-2)} dz$ where $C : |z| = 3$. (07 Marks)
- c. If $f(z)$ is analytic show that $\left[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right] |f(z)|^2 = 4 |f'(z)|^2$. (07 Marks)

Module-2

- 3 a. Obtain the series solution of Bessel's differential equation :
 $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$. (06 Marks)
- b. If α and β are roots $J_n(x) = 8$ then prove that $\int_0^1 x J_n(\alpha x) J_n(\beta x) dx = 0$. (07 Marks)
- c. If $x^3 + 2x^2 - x + 1 = a P_0(x) + b P_1(x) + c P_2(x) + d P_3(x)$ find the values of a, b, c, d . (07 Marks)

OR

- 4 a. Prove that $P_n(x) = \frac{1}{2^n \cdot n!} \frac{d^n}{dx^n} [(x^2 - 1)^n]$. (06 Marks)
- b. Prove that $P_3(\cos \theta) = \frac{1}{8} (3 \cos \theta + 5 \cos 3\theta)$. (07 Marks)
- c. Prove that $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$. (07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-3

- 5 a. Find the coefficient of correlation and obtain the lines of regression for the following data :

x	1	2	3	4	5	6	7	8	9
y	9	8	10	12	11	13	14	16	15

(06 Marks)

- b. The equations of regression lines of two variables x and y are $x = 19.13 - 0.87y$ and $y = 11.64 - 0.50x$, find the correlation coefficient and means of x and y .

(07 Marks)

- c. Fit a curve of the form $y = a + bx$ for the following data hence find y at $x = 15$.

x	1	3	4	6	8	9	11	14
y	1	2	4	4	5	7	8	9

(07 Marks)

OR

- 6 a. If the variable x and y such that :

i) $x + y$ has variance 15

ii) $x - y$ has variance 11

iii) $2x + y$ has variance 29 find σ_x , σ_y and coefficient of correlation.

(06 Marks)

- b. Fit a parabola $y = a + bx + cx^2$ to the following data :

x	1	2	3	4	5	6	7
y	2.3	5.2	9.7	16.5	9.4	35.5	54.4

(07 Marks)

- c. Fit a curve of the form $y = ax^b$ for the following data :

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

(07 Marks)

Module-4

- 7 a. The p.d.f of a variate x is given by the following data :

x	-2	-1	0	1	2	3
P(x)	0.1	K	0.2	2K	0.3	K

Find the value of K . Also find $P(x \geq 0)$ and $P(-2 < x < 2)$.

(06 Marks)

- b. Derive the mean and variance of the Binomial distribution.

(07 Marks)

- c. If the mean and standard deviation of the number of correctly answered questions in a test given to 4096 students are 2.5 and $\sqrt{1.875}$. Find an estimate of the number of conditions answering correctly i) 8 or more questions ii) 2 or less.

(07 Marks)

OR

- 8 a. The number of accidents in a year to taxi drivers in city follows a Poisson distribution with mean 3. Out of 1000 taxi drivers find approximately the number of the drivers with :

i) No accident in a year

ii) More than e accident in a year.

(06 Marks)

- b. Find the value of C such that $f(x) = \begin{cases} \frac{x}{6} + c & 0 \leq x \leq 3 \\ 0 & \text{elsewhere} \end{cases}$ is p.d.f. Also find $P(1 \leq x \leq 2)$.

(07 Marks)

- c. In a normal distribution 31% of the items are under 45 and 8% of the items are over 64. Find the mean and standard deviation of the distribution.

(07 Marks)

Module-5

- 9 a. x and y are independent random variable, x takes values 2, 5, 7 with the probability $\frac{1}{2}, \frac{1}{4}, \frac{1}{4}$ respectively. y takes the values 3, 4, 5 with probability $\frac{1}{3}, \frac{1}{3}, \frac{1}{3}$.
- Find the joint probability of X and Y
 - Show that the covariance of X and Y is equal to zero. (06 Marks)
- b. Define :
- Null hypothesis
 - Type – I and Type – II errors
 - Degree of freedom
 - Level of Significance. (07 Marks)
- c. 4 coins are tossed 100 times and the following results were obtained. Fit a binomial distribution for the data and test the goodness and fit. ($\chi^2_{0.05} = 9.49$ for 4 pd.f.). (07 Marks)

OR

- 10 a. In a hospital 230 females and 270 males were born in a year. Do these figures confirm the hypothesis that sexes are born in equal proportions. (10 Marks)
- b. Random sample of 1000 engineering students from a city A and 800 from city B were taken. It was found that 400 students in each of the sample were from payment quota. Does the data reveal a significant difference between the two cities in respect to payment quota students? (10 Marks)

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18CS51

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Management and Entrepreneurship for IT Industry

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define Management and bring out its characteristics. (06 Marks)
- b. Explain the skill set required for different levels of Managers. (08 Marks)
- c. Briefly explain the roles of Manager. (06 Marks)

OR

- 2 a. Define Planning. Explain the importance of Planning. (06 Marks)
- b. Briefly explain the steps in Planning. (08 Marks)
- c. Explain the process of Staffing selection. (06 Marks)

Module-2

- 3 a. Explain Maslow's need Hierarchy theory of motivation. (06 Marks)
- b. Briefly explain the leadership styles. (06 Marks)
- c. Define Directing and explain briefly its important requirements. (08 Marks)

OR

- 4 a. Explain the steps involved in the process of controlling. (06 Marks)
- b. Explain the importance of Communication. (06 Marks)
- c. What are the techniques used to establish control? (08 Marks)

Module-3

- 5 a. Define Entrepreneurship. Explain briefly stages of Entrepreneurship. (08 Marks)
- b. Differentiate between Entrepreneur and Intrapreneur. (06 Marks)
- c. Explain Market Feasibility study. (06 Marks)

OR

- 6 a. What is the role of Entrepreneurship in Economic development? (08 Marks)
- b. Discuss Technical and Financial feasibility study. (06 Marks)
- c. What are the sources of Business ideas? (06 Marks)

Module-4

- 7 a. What is Project Report? Explain the guidelines provided by Planning Commission for preparation of Project Report. (10 Marks)
- b. Explain Marketing Management and Supply Chain Management. (10 Marks)

OR

- 8 a. What is ERP? Discuss the importance of ERP to a Company. (08 Marks)
- b. Explain types of Report and methods of Report generation. (12 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-5

- 9 a. Write a short notes on :
i) DIC ii) NSIC.
b. Discuss on case study of Microsoft Multinational Company Establishment.

(10 Marks)

(10 Marks)

OR

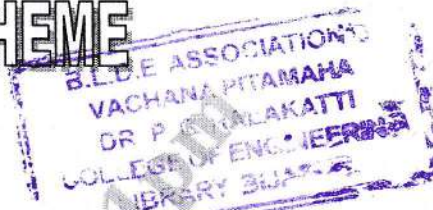
- 10 a. What do you mean by MSME?
b. List out the characteristics of MSME.
c. Define IPR and explain different forms of IPR.

(02 Marks)

(08 Marks)

(10 Marks)

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Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024

Computer Networks and Security

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.***Module-1**

- 1 a. Consider an ecommerce site that wants to keep purchase record for each of its customer. Describe how this can be done with cookies. (10 Marks)
- b. Describe in detail the services provided by DNS with neat diagram, explain the resolution of DNS query by DNS server with the help of iterative method. (10 Marks)

OR

- 2 a. Define HTTP. Explain with neat diagram the HTTP request and response method. (10 Marks)
- b. Illustrate how user 1 and user 2 can send and receive mail with the help of SMTP, POP, IMAP protocols. (10 Marks)

Module-2

- 3 a. With neat diagram, describe the various fields of UDP segment and with the help of an example explain how UDP will compute the clock sum. (10 Marks)
- b. With the help of FSM explain the operation of GBN protocol. (10 Marks)

OR

- 4 a. Explain with neat diagram, all the fields of a TCP segment. (07 Marks)
- b. Explain the following related to TCP connection management:
 - i) Three way handshake (08 Marks)
 - ii) Closing of the TCP connection. (05 Marks)
- c. Write a note on pipelined protocols. (05 Marks)

Module-3

- 5 a. With an example explain distance vector algorithm. (10 Marks)
- b. Mention the three differences between distance vector and link state protocols. (03 Marks)
- c. Explain about routing table by using rip protocol in a router. (07 Marks)

OR

- 6 a. With an example explain link state algorithm. (10 Marks)
- b. Explain with neat diagram, different hierarchy in OSPF router. (06 Marks)
- c. Write a note on comparison of Interior Gateway (IGP) and Exterior Gateway (EGP) protocol. (04 Marks)

Module-4

- 7 a. Explain the various stages of RSA algorithm also show the encryption and decryption process for $p=3$, $q=11$, $e=7$, $M=9$. (10 Marks)
- b. With neat diagram, explain DES algorithm and Feistel structure. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

OR

- 8 a. Apply RSA and encrypt and decrypt the following $a = 3$ $b = 11$ $e = 3$ $M = 9$. (07 Marks)
b. Write a short note on firewalls. (05 Marks)
c. Explain Diffie Hellman key exchange protocol and prove that two keys K_1 and K_2 are equal. (08 Marks)

Module-5

- 9 a. With neat diagram explain the working of CDN (Content Distribution Network). (07 Marks)
b. With neat diagram, explain HTTP streaming. (07 Marks)
c. Write a note on Audio and Video properties. (06 Marks)

OR

- 10 a. With neat diagram, explain the Session Initiation Protocol (SIP) and call establishment process. (10 Marks)
b. Explain UDP and DASH streaming. (10 Marks)

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Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Database Management System

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. List out and discuss the main characteristics of the database approach and how it differs from traditional file systems. (10 Marks)
- b. What is the goal of three-schema architecture? How it is defined at different levels? (05 Marks)
- c. When will the recursive relationship be used? Explain it with some examples. (05 Marks)

OR

- 2 a. A university database contains information about professors (identified by a SSN) and courses (identified by a course ID). Each of the following situations concerns the relationship set between the teacher and the student. Draw an ER diagram for each situation (assuming that no further constraints hold).
 - i) Professors can teach the same course over several semesters and each offering must be recorded.
 - ii) Each professor teaches exactly one course.
 - iii) Each professor teaches at least one course and some professors teach multiple courses.
 - iv) Each professor teaches at least one course and some processors must teach all the courses.
- b. What is the difference between logical and physical data independence? Which one is harder to achieve? Why? (10 Marks)
- c. Discuss the advantages that must to be utilized by the DBA. (05 Marks)

Module-2

- 3 a. Justify the following statements:
 - i) Handling null values is difficult
 - ii) Relations must have a key
 - iii) Weak entities do not have their own key attributes.
- b. Find the results of these expressions for the relational schema R and S. (06 Marks)

R		
A	B	C
1	2	3
2	2	5
3	4	1
4	2	3

S		
C	D	E
1	2	4
3	4	1
5	1	6
4	2	3

i) $R \cup S$

ii) $R \cap S$

iii) $R - S$

iv) $R \bowtie S$

$RA = S.C$

v) $R \bowtie_{R.A=S.D} S$

- c. How does SQL implement the entity integrity constraints of the relational data model? (10 Marks)

(04 Marks)

OR

- 4 a. How are the OUTER JOIN operations different from the INNER JOIN operations? (04 Marks)
- b. Outline the steps to convert the basic ER model to relational database scheme. (10 Marks)
- c. Consider the following tables:

Works (Pname, Cname, Salary)
 LIVES (Pname, Street, City)
 LOCATED-IN (Cname, City)
 MANAGER (Pname, Mgrname)

Pname = Person Name
 Cname = Company Name
 Mgrname = Manager Name

Write the SQL for the following:

- Find the names of the persons who live and work in same city.
- Find the names of the persons whose salary is more than that all of the 'oracle' employees.
- List the names of the people who work for the company 'Wipro' along with the city they live in.

(06 Marks)

Module-3

- 5 a. Consider the following database:
 Employee (Name, SSN, address, salary, superssn, dno)
 DEPT (Dname, Dno, mgr_ssn)
 PROJECT (Pname, Pno, ploc, Dnum)
 WORKS_ON (ESSN, pno, Hours)
 DEPENDENT (ESSN, DepName, relationship).

Write the SQL query for the following:

- For each project on which more than 2 employees work, retrieve the project no, project name and the number of employees who work on the project.
 - Retrieve the names of all employees who have 2 or more dependents.
 - Retrieve the names of all employees who do not have supervisors.
 - Retrieve name of each employee who work on all projects controlled by dept. No5.
 - Create a view which can retrieve dept, Name, no of employees and total salary of the dept.
- b. When are stored procedures useful? Give an example. (05 Marks)
- c. Explain the three-tier application architecture. (05 Marks)

OR

- 6 a. Explain SQL triggers with examples. (06 Marks)
- b. Explain various JDBC classes and interfaces available with the sample code. (06 Marks)
- c. Consider the database given in Q.No.5a. Write the SQL for the following:
- Retrieve the number of employees in 'CSE' department.
 - Retrieve the names of managers who do not have dependents.
 - Retrieve the names of employees who do not work on any project.
 - List the names of all employees who are directly supervised by 'Anil'.

(08 Marks)

Module-4

- 7 a. Why should NULLs in a relation be avoided as far as possible? Discuss the problem of spurious tuples and how we may prevent it. (06 Marks)
- b. Consider the following for published books:
Book (Btitle, author-name, Btype, Listprice, Author-Aff, publisher)
Btitle → publisher, Btype
Btype → listprice
Author_name → author-aff
What is the key?
i) What normal form is the relation in? Explain your answer.
ii) Apply normalization until you cannot decompose the relations further. State the reasons behind each decomposition. (08 Marks)
- c. Define 5NF. Why 5NF is also called as PJNF? (06 Marks)

OR

- 8 a. Consider the following decomposition for the relation schema R.
Determine whether each decomposition has lossless join property with respect to F. Also determine which normal form each relation in the decomposition is in.
 $D = \{R_1, R_2, R_3, R_4, R_5\}$, $R_1 = \{A, B, C, D\}$, $R_2 = \{D, E\}$, $R_4 = \{F, G, H\}$, $R_3 = \{B, F\}$, $R_5 = \{D, I, J\}$, $F = \{(A, B) \rightarrow \{C\}, \{A\} \rightarrow \{D, E\}, \{B\} \rightarrow \{F\}, \{F\} \rightarrow \{G, H\}, \{D\} \rightarrow \{I, J\}\}$. (08 Marks)
- b. Discuss the purpose of Boyce-Codd normal form. Describe how BCNF differs from and is stronger than 3NF. Illustrate your answer with an example. (06 Marks)
- c. List and narrate the informal guidelines for a relational schema design. (06 Marks)

Module-5

- 9 a. Explain in detail the desirable properties of transactions. (06 Marks)
- b. Describe 2 phase locking techniques for concurrency control. (10 Marks)
- c. State and explain two-phase commit protocol. (04 Marks)

OR

- 10 a. Describe the 3 phases of the ARIES recovery method. (06 Marks)
- b. List the different deadlock prevention schemes. (06 Marks)
- c. Draw a state diagram and discuss the typical states that a transaction goes through during execution. (08 Marks)

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Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Automata Theory and Computability

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Construct the DFSM for the following languages :
- (i) $L = \{W \mid W \in \{a,b\}^* \mid W \text{ does not contain the substring } aab\}$
- (ii) $L = \{W \mid W \in \{a,b\}^* \text{ where } W \text{ ends either with } a \text{ or } b\}$ (08 Marks)
- b. Minimize the given Fig. Q1 (b) DFSM by applying min DFSM method. (08 Marks)

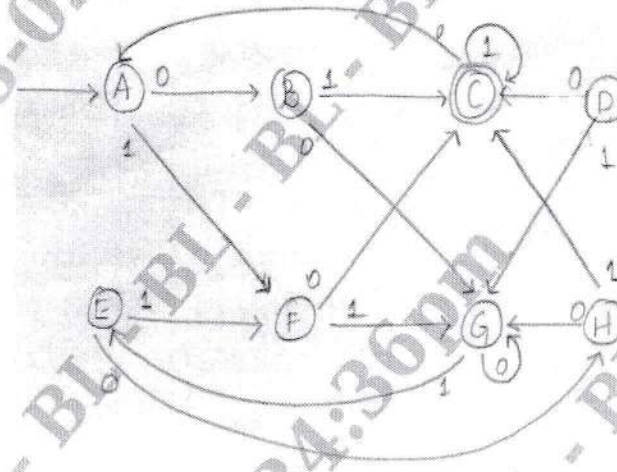


Fig. Q1 (b)

- c. Explain the operations on strings and languages. (04 Marks)

OR

- 2 a. By applying ndfsm to dfsm convert the given Fig. Q2 (a) DFSM to its equivalent DFSM. (10 Marks)

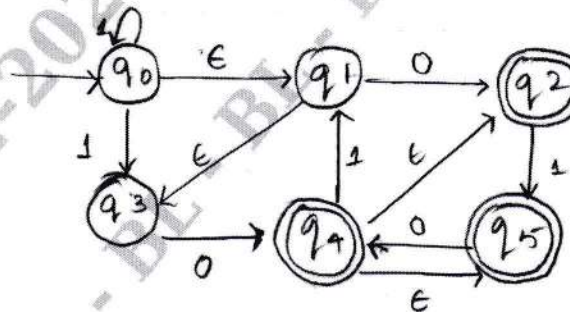


Fig. Q2 (a)

- b. Construct DFSM for the language,
 $L = \{W \mid W \in \{a,b\}^* \text{ where } W \text{ is having even number of } a\text{'s and odd number of } b\text{'s}\}$ (05 Marks)
- c. Explain the difference between DFSM and NDFSM with example. (05 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-2

- 3 a. Illustrate that the regular languages are closed under union, concatenation and compliment. (10 Marks)
- b. State and prove pumping Lemma for regular languages and prove that the following languages are not regular.
- (i) $L = \{a^n b^n \mid n \geq 0\}$
- (ii) $L = \{WW^R \mid W \in \{a, b\}^*\}$ (10 Marks)

OR

- 4 a. Consider the FSM M given in Fig. Q4 (a). Use the fsmto regx heuristic method to construct a regular expression that describe $L(M)$. (08 Marks)

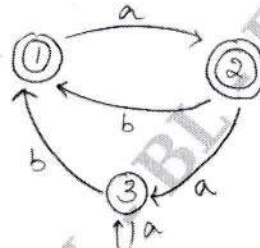


Fig. Q4 (a)

- b. Write the regular expression for the following languages ;
- (i) $L = \{a^{2n} b^{2m} \mid n \geq 0, m \geq 0\}$
- (ii) $L = \{a^n b^m \mid m \geq 1, n \geq 1, n + m \geq 3\}$
- (iii) $L = \{W \mid W \in \{a, b\}^* \text{ and } |W| \text{ is multiples of } 3\}$. (06 Marks)
- c. Draw a FSM for the given below regular expressions :
- (i) $(0+1)^* 0 (0+1)^* 0$
- (ii) $ab(a+b)^* a$ (06 Marks)

Module-3

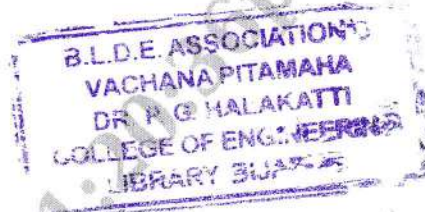
- 5 a. Obtain a context free Grammar for the language :
- (i) $L = \{0^{2n} 1^m \mid n \geq 0, m \geq 0\}$
- (ii) $L = \{0^i 1^j 2^k \mid i = j \text{ or } j = k\}, i, j, k \geq 0$ (04 Marks)
- b. Convert the following CFG into CNF :
- $R = \{ A \rightarrow a \quad B \rightarrow b \mid bR$
 $A \rightarrow aB \quad C \rightarrow C \mid cC$
 $A \rightarrow BaC$
 $A \rightarrow BbC$
 $\}$ where A is the start symbol (06 Marks)
- c. Design a PDA to accept the language $L = \{a^n b^n \mid n \geq 0\}$, draw the transition diagram and show the string acceptance for $W = aaabbb$. (10 Marks)

OR

- 6 a. What is ambiguous grammar? Prove that the given grammar is ambiguous : $S \rightarrow (S) \mid SS \mid \epsilon$ (06 Marks)
- b. Design a PDA for the language $L = \{WCW^R \mid W \in \{a, b\}^*\}$ and draw the transition diagram and show the string acceptance for $W = a a b c b a a$. (10 Marks)

- c. Convert the following CFG to CNF

$R = \{$
 $S \rightarrow XY$
 $X \rightarrow A$
 $A \rightarrow B/a$
 $Y \rightarrow bT$
 $T \rightarrow Y/C$
 $\}$



(04 Marks)

Module-4

- 7 a. Design a Turing Machine to accept $L = \{0^n 1^n 2^n \mid n \geq 0\}$. Draw the transition diagram and show the moves made for the string $W = a a b b c c$. (10 Marks)
- b. Explain multitape Turing machine and prove that language accepted by multitape Turing machine is also accepted by singletape Turing machine. (10 Marks)

OR

- 8 a. Explain non-deterministic Turing machine and prove that there exists equivalent DTM. (10 Marks)
- b. Design a Turing machine for the language,
 $L = \{W \mid W \in \{a, b\}^* \text{ where } W \text{ is a string of palindrome of odd or even length}\}$.
 Draw the transition diagram. Show the string acceptance for $W = ababa$. (10 Marks)

Module-5

- 9 a. Explain post correspondence problem. (07 Marks)
- b. Explain Halting problem in Turing machine. (06 Marks)
- c. Explain recursively enumerable language. (07 Marks)

OR

- 10 Write short notes on:
- Growth rate of function.
 - Classes of P & NP
 - Quantum computers.
 - Church Turing Thesis

(20 Marks)

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Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Application Development using Python

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. What is variable in program? Explain rules for declaring variable name. Explain with example. (05 Marks)
- b. Write types of operators in Python. Explain types of operators with examples. (07 Marks)
- c. Draw flowchart for if-else-ladder in python. Explain execution of if-else-statement with example. (08 Marks)

OR

- 2 a. Write syntax for defining function in Python. Explain function definition and function call in Python with the help of example. (05 Marks)
- b. What is scope of variable? Explain types of scopes of variable with examples. Explain use of 'global' keyword in Python. (07 Marks)
- c. Draw flowchart for while control statement in Python. Explain execution of while control statement with example. (08 Marks)

Module-2

- 3 a. Define list data type of Python. With example explain how positive and negative index can be used to access elements of list. (05 Marks)
- b. What is tuple data type in Python? With example explain difference between tuple and list data types. (07 Marks)
- c. Explain list data types index(), append(), insert() and remove() methods with examples. (08 Marks)

OR

- 4 a. How references are used in function call in Python. Explain copy module's copy() and deepcopy() functions with examples. (05 Marks)
- b. Define dictionary data type in Python. With example explain keys(), values(), items() methods of dictionary data type. (07 Marks)
- c. Explain following string methods with example: upper(), lower(), isupper(), islower(), startwith(), endswith(), join() and split(). (08 Marks)

Module-3

- 5 a. Explain following file related functions with examples open(), close(), read(), readline(), readlines(). (05 Marks)
- b. What is Shutil module? Explain how it is used for copying, moving and removing files and folders in Python. (07 Marks)
- c. With example explain different file opening modes in Python. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 6 a. With example explain walking a directory tree in Python. (05 Marks)
b. Define a regular expression to extract phone number. Using this regular expression write a Python program to extract phone number. (07 Marks)
c. Write a Python program to create zip file and to extract zip file. Explain these programs with appropriate comment lines in the code. (08 Marks)

Module-4

- 7 a. What is inheritance? Write and explain Python code for inheritance. (05 Marks)
b. Explain object oriented features of Python. Explain --init()-- and --str-- methods in Python class object. (07 Marks)
c. Write and explain code for pure function and modifiers. (08 Marks)

OR

- 8 a. Explain type-based dispatch concept in Python with help of example. (05 Marks)
b. Define a time class. Write a Python program to set values to attributes of class and to display values of attributes of class. (07 Marks)
c. Explain following terms with examples: class, object, attribute, operator overloading. (08 Marks)

Module-5

- 9 a. Write a Python program to download web content and save in file. (05 Marks)
b. Write a Python program to create and save excel file. (07 Marks)
c. With example explain reader and writer objects of 'csv' module. (08 Marks)

OR

- 10 a. Explain how a 'run' object is used in paragraph object of the word file to read text. (05 Marks)
b. Explain pypdf2 module in Python. Write a Python code to encrypt pdf file and decrypt a pdf file. (07 Marks)
c. List and explain 'Run' object text attributes. Explain each attribute with example. (08 Marks)

CBCS SCHEME

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18CS56

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024 UNIX Programming

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Explain with a neat block diagram, architecture of UNIX operating system. (08 Marks)
- b. What is a parent child relationship? With the help of neat diagram, explain UNIX file system. (06 Marks)
- c. Explain the commands to add, modify and delete a user. (06 Marks)

OR

- 2 a. List and explain the silent features of UNIX operating system. (08 Marks)
- b. What are internal and external commands in UNIX? Explain with any two examples in each type command used to identify whether command is internal or external command. (06 Marks)
- c. In brief explain the following commands with example : (06 Marks)
i) car ii) mv iii) wc iv) od.

Module-2

- 3 a. Using both relative and absolute methods of assigning permissions. Files current permissions are `rw - - w - r - -`. Write `chmod` expressions required to change them for the following : (08 Marks)
i) `r - - r - - - - x`
ii) `rw xrwx - - x`
iii) `r - xr - xr - x`
iv) `rw xrwxr - -`
b. Explain with example set and shift commands in UNIX to manipulate positional parameters. (06 Marks)
- c. With syntax and programming example explain while and for loops. (06 Marks)

OR

- 4 a. Which command is used for listening of file attributes? Explain the significance of each field. (08 Marks)
- b. Write syntax of `grep` command and explain any five options of `grep` command. (06 Marks)
- c. In detail discuss the three standard file supported by UNIX. (06 Marks)

Module-3

- 5 a. Explain with a neat diagram memory layout of a C program and briefly discuss the different functions used for memory allocation. (10 Marks)
- b. Explain the following general APIs along with syntax : (10 Marks)
i) open ii) create iii) read iv) write v) close.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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OR

- 6 a. With a neat block diagram, explain how a C program is started and how it terminates. (10 Marks)
 b. Explain getrlimit and setrlimit function with prototype. (06 Marks)
 c. Define race condition. Write a 'C' program to demonstrate the race condition. (04 Marks)

Module-4

- 7 a. What are pipes? What are its limitations? Write a program to send data from parent to child over a pipe. (10 Marks)
 b. Briefly explain the semaphore. Explain following APIs with prototype :
 i) semget() ii) semctl() iii) semop. (10 Marks)

OR

- 8 a. What is a FIFO? Write uses of FIFO with a neat diagram, explain client server communication using FIFO. (08 Marks)
 b. Explain the following APIs with prototype :
 i) Setreuid() and setregid() (08 Marks)
 ii) System(). (04 Marks)
 c. Briefly explain job control.

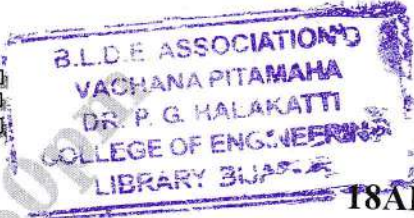
Module-5

- 9 a. With a neat diagram, explain the BSD syslog facility daemon process. (10 Marks)
 b. Explain the following APIs with prototype :
 i) Siprocmask
 ii) Sigaction. (10 Marks)

OR

- 10 a. What are daemon process List the coding rules. (10 Marks)
 b. Explain the following APIs with prototype
 i) Sigsetjmp and siglongjmp
 ii) Kill(). (10 Marks)

CBCS SCHEME



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18AI56

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Mathematics for Machine Learning

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Determine the values of k such that the system of linear equations $x + y + z = 1$, $x + 5y + 4z = k$ and $x + 4y + 10z = k^2$ is consistent and hence solve. (07 Marks)

- b. Let W be subspace of $\mathbb{R}^5$ spanned by the vectors

$$x_1 = \begin{bmatrix} 1 \\ 2 \\ -1 \\ -1 \\ -1 \end{bmatrix} \quad x_2 = \begin{bmatrix} 2 \\ -1 \\ 1 \\ 2 \\ -2 \end{bmatrix} \quad x_3 = \begin{bmatrix} 3 \\ -4 \\ 3 \\ 5 \\ -3 \end{bmatrix} \quad x_4 = \begin{bmatrix} -1 \\ 8 \\ -5 \\ -6 \\ 1 \end{bmatrix}$$

Find the subset that form the basis for W .

(07 Marks)

- c. (i) Compute the distance between $x = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$, $y = \begin{bmatrix} -1 \\ -1 \\ 0 \end{bmatrix}$

- (ii) Compute the angle between $x = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$, $y = \begin{bmatrix} -1 \\ -1 \end{bmatrix}$

(06 Marks)

OR

- 2 a. Investigate the values of λ and μ such that the system of equations $x + y + z = 6$, $x + 2y + 3z = 10$ and $x + 2y + \lambda z = \mu$ may have (i) Unique solution (ii) Infinite solution (iii) No solution. (07 Marks)
- b. Find the co-ordinate vector of $(10, 5, 0)$ relative to the vectors $(1, -1, 1)$, $(0, 1, 2)$ and $(3, 0, -1)$. (07 Marks)
- c. Show that $u = (u_1, u_2)$ and $v = (v_1, v_2)$ in $\mathbb{R}^2$ defined by $\langle u, v \rangle = 3u_1v_1 + 2u_2v_2$ is an inner product space. (06 Marks)

Module-2

- 3 a. Orthogonally diagonalize the matrix

$$A = \begin{bmatrix} 6 & -2 & -1 \\ -2 & 6 & -1 \\ -1 & -1 & 5 \end{bmatrix}$$

(10 Marks)

- b. Find singular value decomposition of $A = \begin{bmatrix} 4 & 11 & 14 \\ 8 & 7 & -2 \end{bmatrix}$

(10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, $42+8=50$, will be treated as malpractice.

OR

- 4 a. Apply Gram Schmidt orthogonalization process to the basis $B = \{(1, 0, 1), (1, 0, -1), (0, 3, 4)\}$ of the inner product space $\mathbb{R}^3$ to find an orthogonal basis of $\mathbb{R}^3$. Also find orthonormal basis of $\mathbb{R}^3$. (10 Marks)
- b. Find Eigen decomposition of the matrix

$$A = \begin{bmatrix} 11 & -4 & 7 \\ 7 & -2 & -5 \\ 10 & -4 & -6 \end{bmatrix}$$

(10 Marks)

Module-3

- 5 a. Compute the Taylor polynomials T_n , for $n = 0, 1, 5, 10$ for $f(x) = \sin x + \cos x$ at $x_0 = 0$. (07 Marks)
- b. Compute the derivative of the function $h(x) = (2x + 1)^4$ using the chain rule. (06 Marks)
- c. Consider the matrix $R \in \mathbb{R}^{M \times N}$ and $f: \mathbb{R}^{M \times N} \rightarrow \mathbb{R}^{N \times N}$ with $f(R) = R^T R = K \in \mathbb{R}^{N \times N}$. Find gradient dK/dR . (07 Marks)

OR

- 6 a. Find the gradient df/dx for the function $f(x_1, x_2) = x_1^2 x_2 + x_1 x_2^3 \in \mathbb{R}$. (06 Marks)
- b. Consider the function $h: \mathbb{R} \rightarrow \mathbb{R}$,

$$h(t) = (f \circ g)(t) \text{ with } f: \mathbb{R}^2 \rightarrow \mathbb{R}, \quad g: \mathbb{R} \rightarrow \mathbb{R}^2, \quad f(x) = e^{x_1 x_2^2}, \quad x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}, \quad g(t) = \begin{bmatrix} t \cos t \\ t \sin t \end{bmatrix}$$

Compute the gradient of h with respect to t .

(07 Marks)

- c. Consider the functions

$$f_1(x) = \sin(x_1) \cos(x_2), \quad x \in \mathbb{R}^2$$

$$f_2(x, y) = x^T y, \quad x, y \in \mathbb{R}^n$$

$$f_3(x) = x x^T, \quad x \in \mathbb{R}^n$$

- (i) What are the dimensions of $\frac{\partial f_i}{\partial x}$? (ii) Compute the Jacobians. (07 Marks)

Module-4

- 7 a. A box A contains two white and four black marbles. Another box B contains five white and seven black marbles. A marble is transferred from box A to box B, then a marble is drawn from B. Find the probability that it is white. (06 Marks)
- b. Consider the following bivariate distribution $p(x, y)$ of two discrete random variables X and Y . Compute (i) The marginal distributions $p(x)$ and $p(y)$ (ii) The conditional distribution $p(x | Y = y_1)$ and $p(y | X = x_3)$

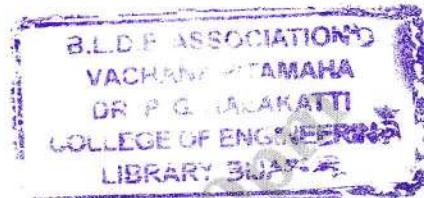
$Y \setminus X$	x_1	x_2	x_3	x_4	x_5
y_1	0.01	0.02	0.03	0.1	0.1
y_2	0.05	0.1	0.05	0.07	0.2
y_3	0.1	0.05	0.03	0.05	0.04

(07 Marks)

- c. Let X be a continuous random variable with probability density function on $0 \leq x \leq 1$ $f(x) = 3x^2$. Find the probability density function of $Y = X^2$. (07 Marks)

OR

- 8 a. Three machines A, B, C produces 50%, 30% and 20% of the items in a factory. The percentage of defective items are 3%, 4% and 5% respectively. If an item is selected at random, what is the probability that it is defective what is the probability that it is from A. (06 Marks)



18AI56

- b. The life of a bulb is a normal variate with a mean life of 2040 hours and standard deviation of 60 hours. In a consignment of 2000 lamps, find how many would be expected to burn for (i) more than 2150 hours (ii) less than 1950 hours, (iii) between 1920 hours and 2160 hours
Given $A(1.5) = 0.4332$, $A(1.83) = 0.4664$, $A(2) = 0.4772$ (07 Marks)
- c. Express Bernoulli distribution as exponential family form. (07 Marks)

Module-5

- 9 a. Find stationary points and indicate whether they are maximum, minimum or saddle points for the univariate function $f(x) = x^4 + 7x^3 + 5x^2 - 17x + 3$. (06 Marks)
- b. Derive dual linear program using Lagrange duality for the linear program

$$\min_{x \in \mathbb{R}^2} - \begin{bmatrix} 5 \\ 3 \end{bmatrix}^T \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \quad \text{subject to} \quad \begin{bmatrix} 2 & 2 \\ 2 & -4 \\ -2 & 1 \\ 0 & -1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \leq \begin{bmatrix} 33 \\ 8 \\ 5 \\ -1 \\ 8 \end{bmatrix} \quad (07 \text{ Marks})$$

- c. For the sum of the losses $\ell(t)$ where $\ell : \mathbb{R} \rightarrow \mathbb{R}$ derive the converse conjugate. (07 Marks)

OR

- 10 a. Derive the dual quadratic program using Lagrange duality for the quadratic program.

$$\min_{x \in \mathbb{R}^d} \frac{1}{2} x^T Q x + C^T x \quad \text{subject to} \quad A x \leq b \quad \text{where} \quad A \in \mathbb{R}^{m \times d}, \quad b \in \mathbb{R}^m \quad \text{and} \quad C \in \mathbb{R}^d.$$

(10 Marks)

- b. Find the convex conjugate of a quadratic function $f(y) = \frac{\lambda}{2} y^T k^{-1} y$ where $k \in \mathbb{R}^{n \times n}$ is a positive definite matrix and $y \in \mathbb{R}^n$. (10 Marks)

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21CS51

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024

Automata Theory and Compiler Design

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define the following terms :
i) String ii) Language iii) Alphabet iv) Length of string (04 Marks)
- b. Explain the various phases of compiler with neat diagram. (08 Marks)
- c. Define DFA and design a DFA to accept the following language:
i) To accept strings having even number of a's and odd number of b's. (08 Marks)
- ii) To accept strings of a's and b's not having the substring aab.

OR

- 2 a. Design the equivalent DFA to the following ϵ -NFA.



- b. Minimize the following DFA by identifying distinguishable and non-distinguishable states. (05 Marks)

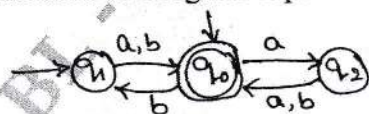
δ	0	1
A	B	F
B	G	C
C	A	C
D	C	G
E	H	F
F	C	G
G	G	H
H	G	C

- c. With neat diagram explain the components of language processing system in detail. (10 Marks)

(05 Marks)

Module-2

- 3 a. Define Regular Expressions. Write a regular expressions for the following :
i) $L = \{a^n b^m \mid n+m \text{ is even}\}$
ii) The set of all strings whose 3rd symbol from right end is 0
iii) $L = \{a^{2n} b^{2m} \mid n \geq 0, m \geq 0\}$ (10 Marks)
- b. Convert the following automata to a regular expression.



- c. Explain the concept of input buffering in the Lexical Analysis along with sentinels. (04 Marks)

(06 Marks)

OR

- 4 a. State and prove Pumping Lemma for regular languages and also prove the language $L = \{a^n b^n \mid n \geq 0\}$ is not a regular. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- b. Construct ϵ -NFA for the following regular expression
 $(0 + 11) 0^* 1$ (04 Marks)
- c. Define Token, Lexeme and Pattern with example. (06 Marks)

Module-3

- 5 a. Define CFG. Write a CFG to the following languages.
 i) All strings over $\{a, b\}$ that are even and odd Palindromes.
 ii) $L = \{a^n \mid n \geq 0\}$ (10 Marks)
- b. Define ambiguity. Consider the grammar $E \rightarrow E + E \mid E * E \mid (E) \mid id$
 Construct the leftmost and rightmost derivation, parse tree for the string $id + id * id$.
 Also show that the grammar is ambiguous. (10 Marks)

OR

- 6 a. Consider the CFG given below with the production set, compute the following for the same.
 (i) First() and Follow() set (ii) Predictive Parsing table
 Grammar is,
 $E \rightarrow TE'$
 $E' \rightarrow +TE' \mid E$
 $T \rightarrow FT'$
 $T' \rightarrow *FT' \mid E$
 $F \rightarrow (E) \mid id$ (14 Marks)
- b. Write an algorithm to eliminate left recursion from a grammar. Also eliminate left recursion from the grammar
 $S \rightarrow Aa \mid b$
 $A \rightarrow Ac \mid Sd \mid \epsilon$ (06 Marks)

Module-4

- 7 a. Define PDA. Design PDA for the language $L = \{WCW^R \mid W \in (a, b)^*\}$ and also show the Instantaneous Description (ID) for the input $aabCb aa$. (10 Marks)
- b. Construct LR(0) automata for the grammar given below.
 $S \rightarrow L = R \mid R$
 $L \rightarrow *R \mid id$
 $R \rightarrow L$ (10 Marks)

OR

- 8 a. Define shift reduce Parser and Handle. Also list and explain the different actions operations available in Bottom up parser. (10 Marks)
- b. Construct the LR(1) automata for the given grammar.
 $S \rightarrow AA$
 $A \rightarrow aA \mid b$ (10 Marks)

Module-5

- 9 a. Design a Turing machine to accept the language $L = \{0^n 1^n 2^n \mid n \geq 1\}$ (10 Marks)
- b. Write a short note on the following : (10 Marks)
- (i) Post correspondence problem (ii) Design issues in code generation

OR

- 10 a. Translate the arithmetic expression $a = b * -c + b * -c$ into
 (i) Three address code (ii) Quadruple (iii) Triple (10 Marks)
- b. Write a short note on : (10 Marks)
- (i) Decidable language (ii) Halting problems in Turing machines.

CBCS SCHEME

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21CS51

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024

Automata Theory and Compiler Design

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define the following terms :
 i) String ii) Language iii) Alphabet iv) Length of string (04 Marks)
 b. Explain the various phases of compiler with neat diagram. (08 Marks)
 c. Define DFA and design a DFA to accept the following language:
 i) To accept strings having even number of a's and odd number of b's. (08 Marks)
 ii) To accept strings of a's and b's not having the substring aab. (08 Marks)

OR

- 2 a. Design the equivalent DFA to the following ϵ -NFA.



- b. Minimize the following DFA by identifying distinguishable and non-distinguishable states. (05 Marks)

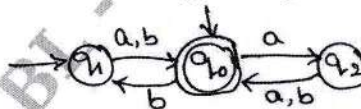
δ	0	1
$\rightarrow$ A	B	F
B	G	C
* C	A	C
D	C	G
E	H	F
F	C	G
G	G	H
H	G	C

- c. With neat diagram explain the components of language processing system in detail. (10 Marks)

(05 Marks)

Module-2

- 3 a. Define Regular Expressions. Write a regular expressions for the following :
 i) $L = \{a^n b^m \mid n+m \text{ is even}\}$
 ii) The set of all strings whose 3rd symbol from right end is 0
 iii) $L = \{a^{2n} b^{2m} \mid n \geq 0, m \geq 0\}$ (10 Marks)
 b. Convert the following automata to a regular expression.



- c. Explain the concept of input buffering in the Lexical Analysis along with sentinels. (04 Marks)

(06 Marks)

OR

- 4 a. State and prove Pumping Lemma for regular languages and also prove the language $L = \{a^n b^n \mid n \geq 0\}$ is not a regular. (10 Marks)

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- b. Construct ϵ -NFA for the following regular expression
 $(0 + 11)^* 0^* 1$ (04 Marks)
- c. Define Token, Lexeme and Pattern with example. (06 Marks)

Module-3

- 5 a. Define CFG. Write a CFG to the following languages.
 i) All strings over $\{a, b\}$ that are even and odd Palindromes.
 ii) $L = \{a^n \mid n \geq 0\}$ (10 Marks)
- b. Define ambiguity. Consider the grammar $E \rightarrow E + E \mid E * E \mid (E) \mid id$
 Construct the leftmost and rightmost derivation, parse tree for the string $id + id * id$.
 Also show that the grammar is ambiguous. (10 Marks)

OR

- 6 a. Consider the CFG given below with the production set, compute the following for the same.
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 Grammar is,
 $E \rightarrow TE'$
 $E' \rightarrow +TE' \mid E$
 $T \rightarrow FT'$
 $T' \rightarrow *FT' \mid E$
 $F \rightarrow (E) \mid id$ (14 Marks)
- b. Write an algorithm to eliminate left recursion from a grammar. Also eliminate left recursion from the grammar
 $S \rightarrow Aa \mid b$
 $A \rightarrow Ac \mid Sd \mid \epsilon$ (06 Marks)

Module-4

- 7 a. Define PDA. Design PDA for the language $L = \{WCW^R \mid W \in (a, b)^*\}$ and also show the Instantaneous Description (ID) for the input $aabCb aa$. (10 Marks)
- b. Construct LR(0) automata for the grammar given below.
 $S \rightarrow L = R \mid R$
 $L \rightarrow *R \mid id$
 $R \rightarrow L$ (10 Marks)

OR

- 8 a. Define shift reduce Parser and Handle. Also list and explain the different actions operations available in Bottom up parser. (10 Marks)
- b. Construct the LR(1) automata for the given grammar.
 $S \rightarrow AA$
 $A \rightarrow aA \mid b$ (10 Marks)

Module-5

- 9 a. Design a Turing machine to accept the language $L = \{0^n 1^n 2^n \mid n \geq 1\}$ (10 Marks)
- b. Write a short note on the following :
 (i) Post correspondence problem (ii) Design issues in code generation (10 Marks)

OR

- 10 a. Translate the arithmetic expression $a = b * -c + b * -c$ into
 (i) Three address code (ii) Quadruple (iii) Triple (10 Marks)
- b. Write a short note on :
 (i) Decidable language (ii) Halting problems in Turing machines. (10 Marks)

CBCS SCHEME

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21CS53

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Database Management Systems

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define DBMS. Explain all the basic operations that can be performed by DBMS on a database. (05 Marks)
- b. Explain the different users of a database system. (10 Marks)
- c. Describe the 3-Schema Architecture. (05 Marks)

OR

- 2 a. Define the following terms:
i) Data model ii) Schema iii) Insurance iv) Canned transaction (04 Marks)
- b. Describe the structural constraints of a database system with suitable example. (10 Marks)
- c. Explain all the E-R diagram notations. (06 Marks)

Module-2

- 3 a. Explain the four relational model constraints. (06 Marks)
- b. Explain all the steps of Relational database design using E-R to relational schema with a suitable example. (06 Marks)
- c. Discuss the DIVISION operation of relational algebra. Find the Quotient for the following :

A =

SNO	DNO
S ₁	P ₁
S ₁	P ₂
S ₁	P ₃
S ₁	P ₄
S ₂	P ₁
S ₂	P ₂
S ₃	P ₂
S ₄	P ₂
S ₄	P ₄

B₁ =

PNO
P ₂

B₂ =

PNO
P ₂
P ₄

B₃ =

PNO
P ₁
P ₂
P ₄

Find i) A/B₁ ii) A/B₂ iii) A/B₃ (08 Marks)

OR

- 4 a. Explain the characteristics of a relational model. (06 Marks)
- b. Explain all types of outer join operations in relational algebra. Demonstrate the advantage of outer join operation over the inner join operation. (06 Marks)
- c. Considering the following schema

Sailors (sid, sname, rating, age)

Boats (bid, bname, color)

Reserves (sid, bid, day)

Write a relational algebra queries for the following :

- i) Find the names of sailors who have reserved boat#103.
- ii) Find the names of sailors who have reserved a red boat.
- iii) Find the names of sailors who have reserved a red or green boat.
- iv) Find the names of sailors who have reserved all boats.

(08 Marks)

Module-3

- 5 a. Explain the basic data types available for attributes in SQL. (05 Marks)
 b. Demonstrate the following constraints in SQL with suitable example:
 i) NOT NULL ii) Primary key iii) Foreign key iv) Default v) Check. (10 Marks)
 c. What are triggers? Explain with syntax and suitable example. (05 Marks)

OR

- 6 a. Explain the basic definition of a cursor and its usage with the help of a suitable example. (05 Marks)
 b. What are Assertions? Assuming suitable company schema write an Assertion for the condition.
 "The salary of an Employee must not be greater than the salary of the manager of the department that the employee works for". (05 Marks)
 c. Referring to the below mentioned company schema. Write the SQL queries for the following:

Employee									
Fname	Lname	Minit	Ssn	Bdate	Address	Sex	Salary	SuperSsn	Dno
Department									
Dname	Dnumber	Mgr_Ssn	Mgr_start_date						
Department location									
Dnumber	Dlocation								
Project									
Pname	Pnumber	Plocation	Dnum						
Work_on									
Essn	DNo	HRS							
Defendant									
Essn	Dependentname	Sex	Bdate						

- i) For each department retrieve the department number, the number of employees in the department and their average salary.
 ii) For each project on which more than 2 employees work, retrieve the project number, the project name and the number of employees who work on the project.
 iii) For each project, retrieve the project number, the project name and the number of employees from department no. 5 who work on that project.
 iv) For each department that has more than 5 employees, retrieve the department number and the number of its employees who are making more than \$40,000 salary.
 v) Retrieve the names of an employees who have two or more dependents. (10 Marks)

Module-4

- 7 a. Explain the types of update anomalies with examples. (05 Marks)
 b. Explain Armstrong's rules of inference. (05 Marks)
 c. What is the need for normalization? Explain 1NF, 2NF and 3NF with examples. (10 Marks)

OR

- 8 a. Explain the informal design guidelines of a database. (06 Marks)
 b. What is equivalence of sets of functional dependencies? Check whether the following sets of F.D's are equivalent or not.
 $FD_1 = \{A \rightarrow B, B \rightarrow C, AB \rightarrow D\}$
 $FD_2 = \{A \rightarrow B, B \rightarrow C, A \rightarrow C, A \rightarrow D\}$ (08 Marks)
 c. Write an algorithm to find the closure of functional dependency 'F'. (06 Marks)

Module-5

- 9 a. Explain the desirable properties of a transaction. (06 Marks)
 b. Explain with a neat diagram, the state transition diagram of a transaction. (06 Marks)
 c. Explain two phase locking mechanism with suitable example. (08 Marks)

OR

- 10 a. Discuss on the database inconsistency problem. (10 Marks)

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21CS54

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Artificial Intelligence and Machine Learning

Time: 3 hrs.

Max. Marks: 100

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

Module-1

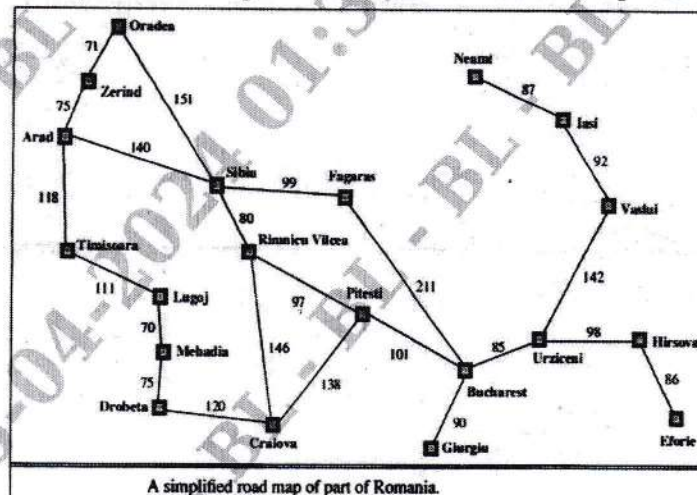
- 1 a. Identify the Turing test approach to provide a satisfactory operational definition of Intelligence. (04 Marks)
- b. Make use of the state space of the vacuum world and define the components to solve this problem. (06 Marks)
- c. Illustrate the properties and the algorithm for Breadth-first search technique. (10 Marks)

OR

- 2 a. Explain the concepts of thinking rationally and acting rationally. (04 Marks)
- b. Explain the tree search and graph search algorithms. (06 Marks)
- c. Explain problem solving agents alongwith the algorithm and illustrate the incremental formulation of 8-Queens problem. (10 Marks)

Module-2

- 3 a. Identify the differences between supervised and unsupervised learning. (04 Marks)
- b. Explain the types of Big data. (06 Marks)
- c. Apply A* algorithm to find the best path from Arad to Bucharest. [Refer Fig.Q3(c)].



A simplified road map of part of Romania.

Arad	366	Mehadia	241
Bucharest	0	Neamt	234
Craiova	160	Oradea	380
Drobeta	242	Pitesti	100
Eforie	161	Rimnicu Vilcea	193
Fagaras	176	Sibiu	253
Giurgiu	77	Timisoara	329
Hirsova	151	Urziceni	80
Iasi	226	Vaslui	199
Lugoj	244	Zerind	374

Values of h_{SLD} —straight-line distances to Bucharest.

Fig.Q3(c)

(10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. $42+8=50$, will be treated as malpractice.

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OR

- 4 a. Explain the machine learning process model along with diagram. (06 Marks)
- b. Consider the table given below which contains the machine learning course registration done by both boys and girls. There are 50 boys and 50 girls in the class and the registration of the course is given in the table. Apply Chi-square test and find out whether any differences exist between boys and girls for course registration.

Table 4(b)

Gender	Registered	Not Registered	Total
Boys	35	15	50
Girls	25	25	50
Total	60	40	100

(06 Marks)

- c. Apply the heuristic search algorithm on the given 8 puzzle problem to reach the goal state from the given initial state.

Initial State			Final State		
1	2	3	1	2	3
	4	6	4	5	6
7	5	8	7	8	

Fig.Q4(c)

(08 Marks)

Module-3

- 5 a. Consider the training dataset of 4 instances shown in the table below. Apply Find-S algorithm to find the final hypothesis.

Table 5(a)

CGPA	Interactiveness	Practical Knowledge	Communication Skills	Logical Thinking	Interest	Job Offer
29	Yes	Excellent	Good	Fast	Yes	Yes
29	Yes	Good	Good	Fast	Yes	Yes
28	No	Good	Good	Fast	No	No
29	Yes	Good	Good	Slow	No	Yes

(08 Marks)

- b. Explain why Instance based learners are called lazy learners and compare instance based learning and model based learning. (06 Marks)
- c. Explain the types of Regression methods with diagram. (06 Marks)

OR

- 6 a. Consider the student performance training dataset of 8 data instances in the below table. Based on the performance of a student, classify the test instance (6.1, 40, 5) to check whether the student will pass or fail in that course using KNN approach (K = 3).

Table 6(a)

S.No.	CGPA	Assessment	Project Submitted	Result
1	9.2	85	8	Pass
2	8	80	7	Pass
3	8.5	81	8	Pass
4	6	45	5	Fail
5	6.5	50	4	Fail
6	8.2	72	7	Pass
7	5.8	38	5	Fail
8	8.9	91	9	Pass

(12 Marks)

- b. Explain version space and the candidate elimination algorithm explaining the algorithm steps.

Module-4

- 7 a. Explain the advantages and disadvantages of decision trees. (06 Marks)
 b. Explain validating and pruning of decision trees. (06 Marks)
 c. Explain Bayes optimal classifier and solve to find whether a patient is diagnosed as COVID positive or COVID negative using the table given below.

Table 7(c)

$P(h_i/T)$	$P(\text{COVID positive})$	$P(\text{COVID negative}/h_i)$
0.3	0	1
0.1	1	0
0.2	1	0
0.1	1	0

(08 Marks)

OR

- 8 a. Explain the procedure to construct a decision tree using ID3 algorithm. (06 Marks)
 b. Explain Bayes theorem, Maximum A Posteriori (MAP) Hypothesis (h_{MAP}) and Maximum Likelihood (ML) Hypothesis (h_{ML}). (06 Marks)
 c. Illustrate the algorithm of Naïve Bayes and explain the popular variants of Bayesian classifier. (08 Marks)

Module-5

- 9 a. Explain the different activation functions used in ANN. (06 Marks)
 b. Illustrate the various types of Artificial Neural Networks. (08 Marks)
 c. Illustrate the applications and challenges of Clustering algorithms. (06 Marks)

OR

- 10 a. Explain the perceptron model and the algorithm. (08 Marks)
 b. Consider the following set of data given in the below table. Cluster it using K-means algorithm with the initial value of objects 2 and 5 with the coordinate values (4, 6) and (12, 4) as initial seeds.

Table 10(b)

Objects	X-coordinate	Y-coordinate
1	2	4
2	4	6
3	6	8
4	10	4
5	12	4

(12 Marks)



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21AI54

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024

Principles of Artificial Intelligence

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define AI. Explain the foundation of AI in detail. (10 Marks)
- b. Explain the history of AI in detail. (10 Marks)

OR

- 2 a. Briefly explain the properties of task environment. (10 Marks)
- b. Explain the following with respect to structure of agents:
i) Simple reflex agents ii) Model-based reflex agents iii) Utility-based agents. (10 Marks)

Module-2

- 3 a. Explain Goal formulation and problem formulation with examples. (10 Marks)
- b. Discuss problems that uses problem solving methods. (10 Marks)

OR

- 4 a. Explain BFS, DFS and Depth-limited search along with example. (10 Marks)
- b. Discuss the different solutions and metrics for searching. (10 Marks)

Module-3

- 5 a. Explain A* search and Memory-bounded heuristic search with example. (10 Marks)
- b. Discuss Heuristic functions in detail. (10 Marks)

OR

- 6 a. Explain the propositional logic syntax and semantics. (10 Marks)
- b. Explain the following with examples :
i) Logical Equivalence ii) Inference rules iii) Horn clauses (10 Marks)

Module-4

- 7 a. Explain the syntax and semantics of first-order logic. (10 Marks)
- b. Explain the following with respect to first-order logic:
i) Assertions and queries ii) Numbers, Sets and Lists iii) Wumpus world (10 Marks)

OR

- 8 a. Explain Unification and Simple forward chaining along with the examples. (10 Marks)
- b. Explain backward chaining algorithm with example. (10 Marks)

Module-5

- 9 a. Explain Basic Probability Notation in detail. (10 Marks)
- b. Explain Inference using Full Joint distributions. (10 Marks)

OR

- 10 a. Explain Baye's rule and its use in detail. (10 Marks)
- b. Explain Independence with respect to Quantifying uncertainty. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024

Software Testing

Max. Marks: 100

Time: 3 hrs.

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

Module-1

- 1 a. Define the following : i) Error ii) Fault iii) Failure iv) Incident v) Test case. (05 Marks)
 b. List and explain important error and fault taxonomic. (05 Marks)
 c. Explain Testing and Debugging Life Cycle, with a neat diagram. (10 Marks)

OR

- 2 a. Write a pseudo code for structured programming version of triangle programme. (10 Marks)
 b. Explain different types of Software test metrics in detail. (10 Marks)

Module-2

- 3 a. Explain Boundary value analysis, with any one suitable example. (10 Marks)
 b. Explain the following Equivalence testing types :
 i) Weak Normal ii) Strong Normal iii) Weak Robust iv) Strong Robust. (10 Marks)

OR

- 4 a. Explain the Decision Table – Based Testing with any one suitable example. (10 Marks)
 b. Explain Fault Based Adequacy Criteria. (05 Marks)
 c. Explain Mutation Analysis Terminologies. (05 Marks)

Module-3

- 5 a. Write a triangle program. Draw the program graph and find the DD paths, DD path graph. (10 Marks)
 b. Explain Mc Cabe's basis path testing method with an example. (10 Marks)

OR

- 6 a. Define Scaffolding. Explain Generic versus Specific Scaffolding. (10 Marks)
 b. Define Test Oracle. Explain with a neat diagram the concept of test harness. (10 Marks)

Module-4

- 7 a. Explain the following principles : i) Sensitivity ii) Redundancy (10 Marks)
 iii) Partition iv) Visibility v) Feedback. (10 Marks)
 b. List and explain dependability properties with examples.

OR

- 8 a. Explain the following : (10 Marks)
 i) Risk Planning ii) Monitoring the process.
 b. Write a short note on : (10 Marks)
 i) Organizing documents ii) Test design specification document.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-5

- 9 a. What is System Acceptance and Regressing Testing? Explain briefly.
b. Write context diagram and Level 1 dataflow diagram of SATM system.

(10 Marks)

(10 Marks)

OR

- 10 a. What is Call – Graph based integration testing? Explain the strategies under call based integration testing.
b. Explain the path based integration testing.

(10 Marks)

(10 Marks)

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Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Web Technology and Its Applications

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. What are the main aims of HTML5? (04 Marks)
- b. Explain the structure of HTML documents. (08 Marks)
- c. What is CSS? List and explain benefits of CSS. (08 Marks)

OR

- 2 a. Explain two types of URL referencing technique with suitable script in HTML5. (08 Marks)
- b. List the different selectors available in CSS. Explain. (08 Marks)
- c. Discuss ordered and unordered list with example. (04 Marks)

Module-2

- 3 a. Create a table that correctly uses the caption, thead, tfoot and tbody elements. Briefly discuss the role of each of these elements. (08 Marks)
- b. What is responsive design? Explain the four key components that make a responsive design work. (08 Marks)
- c. Explain different form widgets created with <input> tags. (04 Marks)

OR

- 4 a. Explain different ways of positioning elements in CSS layout techniques. (08 Marks)
- b. List all the choice-controls with proper description. (08 Marks)
- c. Discuss the role of CSS preprocessor in the web development workflow. (04 Marks)

Module-3

- 5 a. Write Java Script code that display text "WEB TECHNOLOGY" with increasing font size in the interval of 100 ms in blue color, when font size reaches 50 pt in teal colour and should stop. (08 Marks)
- b. Define software layer. Explain the various common software design layers in Java script with a neat diagram. (08 Marks)
- c. List and explain different form events. (04 Marks)

OR

- 6 a. Write PHP program to greet the user based on time. (08 Marks)
- b. Discuss the different ways the Javascript can be included in HTML page with example. (08 Marks)
- c. Explain web server's responsibilities. (04 Marks)

Module-4

- 7 a. What are the superglobal arrays in PHP? What function is used to determine if a value was sent via query string? (10 Marks)
- b. Explain the different error handling methods with suitable code segments. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 8 a. Write PHP program to create a class employee with the following specifications:
Data members : Name, ID, Payment
Member functions : Read (getters) and Write (setters)
Use the above specification to read and print the information of 10 students. (10 Marks)
- b. Explain `_construct()` and `_destruct()` with example. (10 Marks)

Module-5

- 9 a. What is session state? How does session state works with suitable example. (08 Marks)
- b. Explain different types of caching need to improve performance of web application. (08 Marks)
- c. What does `$()` shorthand stand for in jQuery? (04 Marks)
- OR
- 10 a. Define AJAX. Explain AJAX request by writing UML diagram. (08 Marks)
- b. What are the commonly used animations in jQuery? Explain with suitable example. (08 Marks)
- c. Write a jQuery to get all the `<p>` that contain the word "Hello". (04 Marks)

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18CS652

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Introduction to Data Structures and Algorithms

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. What are the different types of conditional statements? Explain if, if-else and nested if with syntax and examples. (08 Marks)
- b. List the difference between while and do – while loop. (06 Marks)
- c. Write a C program to find the sum of natural numbers from 1 to n using while loop. (06 Marks)

OR

- 2 a. Define function. What are the advantages of user defined function? (06 Marks)
- b. Implement :
i) Copying one string to another
ii) Reverse the given string. (08 Marks)
- c. What is pointer? Explain with the help of an example (06 Marks)

Module-2

- 3 a. What is an algorithm? List the characteristics of an algorithm. (08 Marks)
- b. What is an asymptotic notation? Explain the various types of asymptotic notations. (12 Marks)

OR

- 4 a. Define array. Interpret the representation of one dimensional array in memory with the help of an illustration. (10 Marks)
- b. Write a C program to show how matrices are realized using two-dimensional arrays. (10 Marks)

Module-3

- 5 a. What is a linked list? Explain the typical operations that are performed on a linked list. (10 Marks)
- b. Define doubly linked list. Show the logical representation and implementation of doubly linked list. (10 Marks)

OR

- 6 a. Briefly describe the LIFO principle in stack. What are the various operations that can be performed on stacks? (10 Marks)
- b. Write a C function to implement PUSH and POP operation using arrays? (10 Marks)

Module-4

- 7 a. State linear queue. Mention the applications of queue. How to insert an item into the queue. (10 Marks)
- b. Write a C function to insert and delete an item in queue. (10 Marks)

OR

- 8 a. What is the difference between complete binary tree and perfect binary tree? (06 Marks)
b. What is binary search tree? Explain with the help of an example. (06 Marks)
c. How to insert an element into a binary search tree? (08 Marks)

Module-5

- 9 a. Define the graph and the following terms :
i) Indegree and out degree
ii) Weighted graph
iii) Connected graph
iv) Strongly connected graphs. (10 Marks)
b. What is BFS? Explain with the help of an example. (10 Marks)

OR

- 10 a. Write a C program that uses the bubble sorting technique to sort an array of elements. (10 Marks)
b. Write a C program that sorts the given set of integers and performs binary search on them. (10 Marks)

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18CS654

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024

Introduction to Operating System

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Explain Storage device hierarchy with a neat diagram. (06 Marks)
- b. Discuss the working of modern computer system with a neat diagram. (06 Marks)
- c. Discuss (i) Traditional Computing (ii) Client – Server computing. (06 Marks)
- d. Define (i) Operating System (ii) Control program. (02 Marks)

OR

- 2 a. Discuss different functions provided by the operating system services. (06 Marks)
- b. Discuss about system programs in detail. (06 Marks)
- c. Discuss about the Java Virtual Machine with a neat diagram. (04 Marks)
- d. Discuss MS-DOS layered structure of an operating system with a neat diagram. (04 Marks)

Module-2

- 3 a. Discuss process control block with a neat diagram. (06 Marks)
- b. Explain Interprocess Communication model with respect to (i) Message passing (ii) Shared memory. (06 Marks)
- c. Discuss communication in Client-Server systems using sockets. (04 Marks)
- d. Discuss any four reasons for providing an environment that allow process co-operation. (04 Marks)

OR

- 4 a. Explain the benefits of a multithreaded programming. (04 Marks)
- b. Discuss different multithreaded models. (06 Marks)
- c. Explain (i) P-threads (ii) Win-32 threads (iii) Java threads. (06 Marks)
- d. Discuss any two threading issues with multithreaded programs. (04 Marks)

Module-3

- 5 a. Using priority scheduling, calculate the average waiting time for the process given below:

Process	Burst-Time	Priority
P ₁	10	3
P ₂	1	1
P ₃	2	4
P ₄	1	5
P ₅	5	2

- b. Explain Symmetric Multithreading architecture with a neat diagram. (04 Marks)
- c. Discuss (i) Multilevel Queue Scheduling (ii) Multilevel feedback queue scheduling with a neat diagram. (06 Marks)
- d. (i) Define Dispatch latency (ii) Discuss different criterias involved in scheduling an algorithm. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 6 a. Explain about Semaphores. (04 Marks)
 b. Discuss (i) Readers - Writers problem (ii) Bounded - Buffer problem. (06 Marks)
 c. Differentiate between preemptive kernels and non-preemptive kernels. (06 Marks)
 d. Discuss about different types of Storage media. (04 Marks)

Module-4

- 7 a. Discuss different methods of handling deadlocks. (06 Marks)
 b. Define Deadlock. Discuss any three issues need to be addressed if preemption is required. (04 Marks)
 c. Discuss (i) Resource allocation graph algorithm. (ii) Bankers algorithm. (06 Marks)
 d. Discuss different methods of process termination. (04 Marks)

OR

- 8 a. Discuss Segmentation Hardware with an example and a neat diagram. (06 Marks)
 b. Discuss the structure of the page table. (06 Marks)
 c. Discuss (i) Memory allocation (ii) Fragmentation. (06 Marks)
 d. Define (i) Logical address (ii) Memory - Address Register. (02 Marks)

Module-5

- 9 a. Discuss the sequence for a page fault occurrence. (06 Marks)
 b. Discuss (i) FIFO page replacement (ii) Optimal page replacement. (06 Marks)
 c. Discuss basic mechanism of memory-mapped files with a neat diagram. (06 Marks)
 d. Discuss the benefits of a slab allocator. (02 Marks)

OR

- 10 a. Discuss file's attributes of an operating system. (07 Marks)
 b. Discuss basic file operations. (06 Marks)
 c. Discuss some of the operations associated with opening a file. (04 Marks)
 d. Discuss any 3 file types. (03 Marks)

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18CS653

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Programming in Java

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Explain the primitive data types in Java. (10 Marks)
- b. What is an array? How single dimensional and multi dimensional arrays defined in Java with an example. (10 Marks)

OR

- 2 a. Explain scope and lifetime of variables with an example. (08 Marks)
- b. Explain Java class Libraries. (04 Marks)
- c. Explain the blocks of code. (08 Marks)

Module-2

- 3 a. Explain selection statements in Java with an example. (10 Marks)
- b. Explain jump statements in Java with an example. (10 Marks)

OR

- 4 a. Explain bitwise logical operators in Java with an example. (08 Marks)
- b. Explain ternary operator in Java with an example. (04 Marks)
- c. Explain switch statements in Java with an example. (08 Marks)

Module-3

- 5 a. Explain the use of static and final keywords in Java with an example. (10 Marks)
- b. Explain the process of creating multilevel hierarchy with an example program. (10 Marks)

OR

- 6 a. What is inheritance? Explain the types of inheritance with an example program. (08 Marks)
- b. Explain overloading the constructor with an example program. (08 Marks)
- c. Explain dynamic method dispatch in Java. (04 Marks)

Module-4

- 7 a. What is an exception? Describe the working of nested try block with an example. (08 Marks)
- b. Explain check and unchecked exceptions. (08 Marks)
- c. Explain chained exception with an example program. (04 Marks)

OR

- 8 a. Illustrate the following :
 - i) Access protection
 - ii) Importing packages. (10 Marks)
- b. Explain throw, throws and finally keywords in Java with example program. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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Module-5

9 a. With examples, illustrate the following operations on strings :

- i) String comparison
- ii) String search
- iii) Modifying string
- iv) Changing the case of characters.

(10 Marks)

b. Explain StringBuffer and StringBuilder class in Java.

(10 Marks)

OR

10 a. What is an applet? Explain the program in an applet with a skeleton code.

(10 Marks)

b. What is stream? Explain the types of stream along with their specific classes and methods.

(10 Marks)

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18CS644

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Advanced Java and J2EE

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define Enumerations. Develop a Java program to implement the following built-in methods and explain : (i) values() (ii) valueOf() (iii) ordinal() (vi) compareTo() (v) equals() (10 Marks)
- b. What is Wrapper class? Explain the following with examples :
 - (i) Boxing
 - (ii) Un-Boxing
 - (iii) Auto-boxing
 - (iv) Auto-unboxing(10 Marks)

OR

- 2 a. What are annotations? Explain the following Built-in annotations with examples:
 - (i) @Override
 - (ii) @Inherited
 - (iii) @Retention
 - (iv) @Supress Warnings(10 Marks)
- b. Explain the following with respect to annotations :
 - (i) Single member annotations.
 - (ii) Default values in annotations.(10 Marks)

Module-2

- 3 a. What is collection frame work? Explain the methods defined by the following interfaces :
 - (i) Collection
 - (ii) List
 - (iii) Sorted Set
 - (iv) Queue(10 Marks)
- b. Explain how collections can be accessed using an iterator with example. (06 Marks)
- c. Explain HashMap with example. (04 Marks)

OR

- 4 a. Explain the following collection classes by constructing a JAVA program :
 - (i) Linked List
 - (ii) Array List
 - (iii) Tree Set
 - (iv) Hash Set(10 Marks)
- b. What is Legacy classes? Explain the different Legacy classes with a Java Program. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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Module-3

- 5 a. What is string in Java? Explain the different constructors of string class. Also list the difference between String Class and String Buffer class. (10 Marks)
 b. Explain the difference between equals and == with example. (05 Marks)
 c. Explain how to check the occurrence of a substring in a given string. (05 Marks)

OR

- 6 a. Explain the following built in methods with respect to string buffer class :
 (i) capacity ()
 (ii) delete ()
 (iii) replace ()
 (iv) append ()
 (v) substring () (10 Marks)
 b. Explain any two character handling functions in string class. (04 Marks)
 c. Write a java program to sort names in Bubble sort. (06 Marks)

Module-4

- 7 a. Explain the life cycle of servlet. (06 Marks)
 b. Write a Servlet program to accept parameter from HTML (username & password) and display. (08 Marks)
 c. Explain the role of Tomcat server in servlets. (06 Marks)

OR

- 8 a. List the difference between JSP and Servlet. Also explain the different JSP tags with example. (10 Marks)
 b. Explain sessions and cookies in JSP. (06 Marks)
 c. How arrays are defined in JSP? (04 Marks)

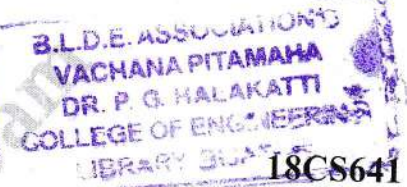
Module-5

- 9 a. What is JDBC? Explain the different JDBC driver types. (10 Marks)
 b. What is statement object in JDBC? Explain the following statement objects with example :
 (i) PreparedStatement
 (ii) CallableStatement (10 Marks)

OR

- 10 a. Explain ScrollableResultSet and UpdatableResultSet object in JDBC. (10 Marks)
 b. Explain transaction processing in JDBC. (06 Marks)
 c. Explain the types of exceptions occurred in JDBC. (04 Marks)

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Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Data Mining and Data Warehousing

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Differentiate between operational database systems and data warehouse. (10 Marks)
- b. Explain the data warehouse models. (10 Marks)

OR

- 2 a. Explain typical OLAP operations with examples. (10 Marks)
- b. What are the schemas of multidimensional data models? Explain. (10 Marks)

Module-2

- 3 a. List different indexing methods for OLAP data and explain with examples. (10 Marks)
- b. Differentiate between ROLAP, MOLAP and HOLAP servers. (10 Marks)

OR

- 4 a. What is data mining? Explain KDD process with the help of neat diagram. (10 Marks)
- b. Define similarity and dissimilarity between the objects. Find SMC and Jaccard's coefficient of two binary vectors given below.

$X = (1, 0, 0, 0, 0, 0, 0, 0, 0, 0)$

$Y = (0, 0, 0, 0, 0, 0, 1, 0, 0, 1)$

- c. For the following two data objects, calculate cosine similarity. (06 Marks)

$x = (3, 2, 0, 5, 0, 0, 0, 2, 0, 0)$

$y = (1, 0, 0, 0, 0, 0, 0, 1, 0, 2)$

(04 Marks)

Module-3

- 5 a. Define the Apriori principle. Explain frequent item set generation in the Apriori Algorithm. (10 Marks)
- b. What is association analysis? Define association rule, support and confidence by giving an example for each. (10 Marks)

OR

- 6 a. Construct an FP tree for the following dataset :

TID	Items
1	{a, b}
2	{b, c, d}
3	{a, c, d, e}
4	{a, d, e}
5	{a, b, c}
6	{a, b, c, d}
7	{a}
8	{a, b, c}
9	{a, b, d}
10	{b, c, e}

- b. Explain objective measures of interestingness for evaluation of quality of association patterns. (10 Marks)

Module-4

- 7 a. How does decision tree algorithm work. Explain with example. (10 Marks)
b. Examine the methods for comparing classifiers. (10 Marks)

OR

- 8 a. Describe Nearest Neighbor classifier. List its characteristics. (10 Marks)
b. Explain Bayesian classifier with an example. (10 Marks)

Module-5

- 9 a. What is cluster analysis? Discuss the different types of clusters with examples. (10 Marks)
b. Explain Agglomerative hierarchical clustering. How do you define proximity between clusters? (10 Marks)

OR

- 10 a. Discuss DBSCAN algorithm with an example. (10 Marks)
b. Explain the following :
i) Density based clustering
ii) Graph based clustering. (10 Marks)

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18CS62

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Computer Graphics and Visualization

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. List and explain any 6 applications of computer graphics. (06 Marks)
- b. Describe the basic structure of an OpenGL graphics program with the necessary OpenGL functions. (06 Marks)
- c. Digitize the line by using Bresenham's line drawing algorithm with end points (-2, 5) and (5, 12). List the drawbacks of DDA line drawing algorithm. (08 Marks)

OR

- 2 a. Compare and contrast Raster and Random-scan displays with suitable figure. (06 Marks)
- b. Explain the coordinate reference frames. How is a 2D world coordinate reference frame specified using OpenGL? (06 Marks)
- c. Explain the Bresenham's circle generation algorithm using suitable examples. (08 Marks)

Module-2

- 3 a. Explain the General Scan line polygon fill algorithm. (08 Marks)
- b. Scale the given triangle A(3, 2), B(6, 2), C(6, 6) using the scaling factors $S_x = \frac{1}{3}$, $S_y = \frac{1}{2}$ about the point A(3, 2). Draw the original and the scaled object. (06 Marks)
- c. Explain shear and reflection transformation technique. (06 Marks)

OR

- 4 a. Explain the two commonly used algorithm for identifying the interior areas of an object. (08 Marks)
- b. Develop a composite homogenous transformation matrix to rotate an object with respect to a pivot point. (06 Marks)
- c. Explain the 2D viewing pipeline. (06 Marks)

Module-3

- 5 a. Explain the working of Cohen-Sutherland line clipping algorithm. (06 Marks)
- b. Demonstrate 2D normalization and window to viewport transformation using appropriate matrices. (08 Marks)
- c. Explain RGB and CMY color models. (06 Marks)

OR

- 6 a. Explain Sutherland-Hodgeman polygon clipping algorithm with suitable example. (08 Marks)
- b. Explain rotation of a 3D object about an axis parallel to one of the coordinate axis. (06 Marks)
- c. Explain specular reflection and the Phong model. (06 Marks)

Module-4

- 7 a. Explain transformation from world to view coordinate system. (04 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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OR

- 8 a. List the 3D viewing coordinate parameters and explain. (06 Marks)
b. Derive the general-perspective transformation equation and explain the special cases of perspective projection equation. (08 Marks)
c. Explain the OpenGL visibility detection functions. (06 Marks)

Module-5

- 9 a. Explain Request, Sample and Event mode with suitable diagram. (06 Marks)
b. Explain Bezia Spline curves and list the properties of Bezier curves. (08 Marks)
c. What is a display list? Explain how a display list is defined and executed in OpenGL. (06 Marks)

OR

- 10 a. Define double buffering. Explain how double buffering is implemented in OpenGL. (04 Marks)
b. Explain Quadric and Curved Surfaces with necessary OpenGL functions. (08 Marks)
c. Explain Menu creation in OpenGL. Write an interactive OpenGL program to display a square when the left button is pressed and to exit the program if right button is pressed. (08 Marks)

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18AI643

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Web Programming

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. What are the three aims of HTML5 and expand the following: HTML, XML, PHP, WHATWG, W3C, and DOCTYPE AND CSS? (10 Marks)
- b. Discuss the structure of HTML documents and also explain HTML syntax with example. (10 Marks)

OR

- 2 a. What are Selectors? List and explain selectors with example. (10 Marks)
- b. Define CSS and list out its benefits with explanation also illustrate the CSS box model. (10 Marks)

Module-2

- 3 a. What is responsive design? Why it's important? Explain in detail. (10 Marks)
- b. Explain the following concerned with Forms (10 Marks)
 - i) Form structure
 - ii) Form control elements.

OR

- 4 a. Explain the different ways at positioning elements in CSS layout technique. (10 Marks)
- b. Explain the basic table structure, create an HTML document for the Table

Diet

Breakfast	Lunch	Dinner
Apple	Rice	Cucumber
Watermelon	Rice	Papaya

(10 Marks)

Module-3

- 5 a. Compare the server side technologies in detail. (10 Marks)
- b. What is Javascript and listener? Discuss the advantages and disadvantages of client side scripting. (10 Marks)

OR

- 6 a. Discuss arrays of javascript also explain with example PHP tags, PHP comments datatypes and constants. (10 Marks)
- b. Briefly describe the document object model. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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Module-4

- 7 a. Define constructor and discuss the concepts of inheritance, polymorphism and object interface with respect to OOP. (10 Marks)
b. Explain with the example, the two basic techniques for read/write files in PHP. (10 Marks)

OR

- 8 a. Explain the role of PHP's `$_GET` and `$_POST` arrays with data flow diagrams. (10 Marks)
b. Explain three approaches to restrict the file size in File upload with suitable code segments. (10 Marks)

Module-5

- 9 a. What are Cookies? What is the purpose of it? Demonstrate cookies with PHP program. (10 Marks)
b. What is Caching? Explain two basic strategies of caching web applications. (10 Marks)

OR

- 10 a. What is AJAX? Explain AJAX request by writing UML diagram. (10 Marks)
b. With a neat diagram, explain SOAP and RESET web service. (10 Marks)

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Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024 System Software and Compilers

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Explain registers, instruction formats and addressing modes of SIC/XE architecture. (08 Marks)
- b. Explain the following records with their formats: (06 Marks)
i) Header Record ii) Text Record iii) End Record
- c. What are the various data structures used by assembler? Explain. (06 Marks)

OR

- 2 a. Write the Pass I algorithms for two pass assembler. (08 Marks)
- b. List the various machine independent assembler features? Explain any one feature in detail. (06 Marks)
- c. What are the basic functions of the loader? Write an algorithm for design of an absolute loader. (06 Marks)

Module-2

- 3 a. Explain the various phases of the compiler? Clearly specify the output at each phase for the input $A = B * C + 369$ (10 Marks)
- b. List and explain the reasons for separating analysis phase into lexical and syntax. (04 Marks)
- c. What are the applications of compiler technology? Discuss any two. (06 Marks)

OR

- 4 a. Explain various input buffering schemes used in lexical analysis? Write the look ahead code for sentinel. (08 Marks)
- b. Enlist the algebraic laws for regular expressions. (04 Marks)
- c. Give the Regular definition and draw the transition diagram for
i) Relational operator in C
ii) Unsigned number
iii) Identifier and keyword (08 Marks)

Module-3

- 5 a. Define ambiguity. Show that the grammar $E \rightarrow E + E \mid E * E \mid id$ is ambiguous? Eliminate the ambiguity and rewrite the grammar. (08 Marks)
- b. For the following grammar eliminate the left recursion and for the resultant grammar construct the LL(1) parsing table and parse the input string (a, a)
 $S \rightarrow (L) \mid a$
 $L \rightarrow L, S \mid S$ (08 Marks)
- c. Give an algorithm for recursive descent parsing? What are its limitation and how to overcome it? (04 Marks)

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OR

- 6 a. Consider the following grammar

$$E \rightarrow 1 + T \mid 2 - T$$

$$T \rightarrow V \mid V * V \mid V + V \mid V - V$$

$$V \rightarrow a \mid b$$

- i) Do the left factoring
 - ii) Write an algorithm for FIRST and follow and obtain it for the left factored grammar
 - iii) Construct it for the above left factored grammar. (10 Marks)
- b. What is shift reduce parsing? Explain the conflicts that may occur during shift reduce parsing? Show the working of shift reduce parser for the following grammar and input string id * id

$$E \rightarrow E + T \mid T$$

$$T \rightarrow T * F \mid F$$

$$F \rightarrow (E) \mid id$$

(10 Marks)

Module-4

- 7 a. What is lex? With an example explain the structure of lex program. (06 Marks)
- b. Write the regular compression to identify the following :
 - i) Identifier
 - ii) Decimal number
 - iii) -ve integer
 - iv) +ve fraction
 (08 Marks)
- c. Write a yacc program to evaluate an arithmetic expression. (06 Marks)

OR

- 8 a. Explain the yacc tool with a sample program. (08 Marks)
- b. Write a short note on parser-lexer communication. (06 Marks)
- c. Discuss how to compile a yacc file. (06 Marks)

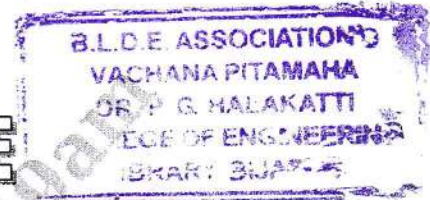
Module-5

- 9 a. Give the SDD for a simple desk calculator and show the annotated parse tree for $(3 + 4) * (5 + 6)$. (08 Marks)
- b. Give the SDD for simple type declaration construct a dependency graph for the declaration `int sum, num1, num2;` (06 Marks)
- c. Explain how DAG helps in intermediate code generation? Construct a DAG for the following :
 - (i) $a + b + (a + b)$
 - (ii) $a + b + a + b$
 (06 Marks)

OR

- 10 a. What are the different three address code instructions? Translate the arithmetic expression $a + -(b + c)$ into quadruples, triples and indirect triples. (08 Marks)
- b. Explain the issues in design of code generator. (08 Marks)
- c. Generate the assembly code for the following address statements. (04 Marks)
 - (i) $x = b * c$
 - (ii) $y = a + x$

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18CS71

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024

Artificial Intelligence and Machine Learning

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define Artificial Intelligence. What are the applications of Artificial Intelligence? (08 Marks)
- b. A water jug problem states "You are provided with two jugs, first one with 4-gallon capacity and the second one with 3-gallon capacity. Neither have any measuring markers on it. How can you get exactly 2-gallons of water into 4-gallon jug?"
 - i) Write down the production rules for the above problem.
 - ii) Write any one solution to the above problem. (12 Marks)

OR

- 2 a. Develop A* search algorithm for AI applications. (10 Marks)
- b. Explain problem characteristics with respect to heuristic search. (10 Marks)

Module-2

- 3 a. Explain the four approaches to knowledge representation. (10 Marks)
- b. Discuss the following set of sentences into WFF in predicate logic and hence find the answer with proof for the question whether the Marcus is loyal to Caesar or not.
 - i) Marcus was a man.
 - ii) Marcus was a Pompeian.
 - iii) All Pompeians were Romans.
 - iv) Caesar was a ruler.
 - v) All Romans were either loyal to Caesar or hated him.
 - vi) Everyone is loyal to someone.
 - vii) People only try to assassinate rulers they are not loyal to.
 - viii) Marcus tried to assassinate Caesar.
 - ix) All men are person. (10 Marks)

OR

- 4 a. Write Find S Algorithm and discuss issues with the algorithm. (10 Marks)
- b. Describe the Candidate Elimination algorithm. Find the maximum general hypothesis and maximum specific hypothesis for the training examples given in the table using candidate elimination algorithm.

Day	Sky	Air Temp.	Humidity	Wind	Water	Forecast	Enjoy Sport
1	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2	Sunny	Warm	High	Strong	Warm	Same	Yes
3	Rainy	Cold	High	Strong	Warm	Change	No
4	Sunny	Warm	High	Strong	Warm	Change	Yes

(10 Marks)

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Module-3

- 5 a. Define decision tree. Construct the decision tree to represent the following Boolean functions:
 i) $A \wedge \neg B$ ii) $A \vee [B \wedge C]$ iii) $A \text{ XOR } B$ (06 Marks)
 b. Write the ID3 algorithm. (08 Marks)
 c. What do you mean by gain and entropy? How it is used to build the decision tree? (06 Marks)

OR

- 6 a. Define artificial neural networks. Discover what are the appropriate problems for neural network. (06 Marks)
 b. Define perceptron. Explain the concept of single perceptron with neat diagram. (06 Marks)
 c. Explain the back propagation algorithm with example. (08 Marks)

Module-4

- 7 a. What is Baye's theorem and maximum posterior hypothesis? (05 Marks)
 b. Derive an equation for MAP hypothesis using Baye's theorem. (05 Marks)
 c. Consider a football game between two rival teams: Team - A and Team - B. Suppose Team - A wins 95% of the time and Team - B wins the remaining matches. Among the games won by Team - A only 30% of them come from playing on Team - B's football field. On the other hand, 75% of the victories for Team - B are obtained while playing at home. If Team - B is to host the next match between the two teams which team will most likely emerge as the winner? (10 Marks)

OR

- 8 a. Discuss the Naïve Baye's classifier. (10 Marks)
 b. Discuss Minimum Description length principle in brief. (10 Marks)

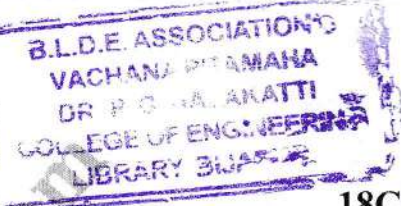
Module-5

- 9 a. Explain K-nearest neighbor learning algorithm. (10 Marks)
 b. Define : i) Simple Error ii) True Error. (04 Marks)
 c. What is reinforcement learning? (06 Marks)

OR

- 10 a. Explain locally weighted linear regression. (10 Marks)
 b. Define expected value, variance standard deviation and estimate bias of a random variable. (05 Marks)
 c. Explain Q-learning with example. (05 Marks)

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18CS72

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024 Big Data and Analytics

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. How is Data Architecture layers used for analytics? Explain with functions of each layer. (10 Marks)
- b. Briefly describe the three fundamental services offered by Cloud Computing. (10 Marks)

OR

- 2 a. List the features of Grid Computing. How does it differ from clusters and cloud computing. (10 Marks)
- b. Why is Data quality important in discovering new knowledge and decision making? (10 Marks)

Module-2

- 3 a. List Hadoop core components and explain with appropriate diagram. (10 Marks)
- b. Explain the working of the Hadoop Map Reduce frame work. (10 Marks)

OR

- 4 a. Explain the working of Hadoop – 2 Execution model (YARN Model). (10 Marks)
- b. With a diagram, explain the concept of APACHE Sqoop to acquire relational data. (10 Marks)

Module-3

- 5 a. Define NOSQL Explain Big Data NOSQL or Not – only SQL with its features, transactions and solutions. (10 Marks)
- b. Describe graph database characteristic, typical used and examples. (10 Marks)

OR

- 6 a. Explain Mongo DB with its features. (10 Marks)
- b. Compare and contrast RDBMS and Mongo DB databases. (05 Marks)
- c. What are the different ways of handling Big Data Problems? (05 Marks)

Module-4

- 7 a. Describe the Hive architecture components along with Hive Built – in functions. (10 Marks)
- b. Explain with respect to Hive QL:
 - i) Hive QL Data Definition Language (DDL).
 - ii) Hive QL Data Manipulation Language (DML).(10 Marks)

OR

- 8 a. Explain the architecture, feature and applications of PIG. (10 Marks)
- b. Illustrate by considering an example the working of the Map Reduce programming model. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

Module-5

- 9 a. How does regression analysis predict the value of the dependent variable in case of linear regression? (10 Marks)
- b. Explain with example and algorithm, the working principle of Apriori process for adopting the subset of frequent item sets as a frequent itemset. (10 Marks)

OR

- 10 a. Define Web Mining. Discuss the broad classification of web mining and their applications. (10 Marks)
- b. Define the term Social network. Explain social network as graphs with Centralities, Ranking and Anomaly Detection. (10 Marks)

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18CS734

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024

User Interface Design

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define GUI. Write the difference between GUI and webpage design. (10 Marks)
- b. Define user interface Design with example. Explain the importance and benefits of Good user Interface Design. (10 Marks)

OR

- 2 a. Discuss the general principles of UID. (10 Marks)
- b. Mention the advantages and disadvantages of GUI in details. (10 Marks)

Module-2

- 3 a. What is requirement analysis? What are the methods involved in it? What is the impact of it on UI design? (10 Marks)
- b. Define obstacles and pitfalls mention the general observation of design and common pitfalls and also explain five commandments used in Designing. (10 Marks)

OR

- 4 a. Explain the importance of human consideration in UI design with suitable example. (10 Marks)
- b. Explain briefly about human interaction speed. (10 Marks)

Module-3

- 5 a. Explain in brief the structure of Menu's. (10 Marks)
- b. Describe the components of a web navigation system with illustration. (10 Marks)

OR

- 6 a. Write a note on Graphical menus for the following
 - i) Pull down menu
 - ii) Pop up menu
 (10 Marks)
- b. Describe at least four guidelines to be followed in phasing of menu, during the development of system menus. (10 Marks)

Module-4

- 7 a. Discuss briefly about the types of windows with example. (Any five) (10 Marks)
- b. Write a note on the following
 - i) Track ball
 - ii) Joystick
 (10 Marks)

OR

- 8 a. Explain briefly about window management. (10 Marks)
- b. Write a note on components of a windows. (10 Marks)

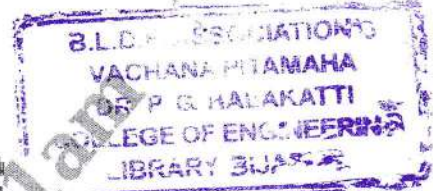
Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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Module-5

- 9 a. Explain briefly the following selection control
- i) Radio buttons
 - ii) Checkboxes
- (10 Marks)
- b. Explain the purpose of prototypes. Discuss any two kinds of prototypes with their importance to the system developers.
- (10 Marks)

OR

- 10 a. Explain the following with respect to kinds of Tests.
- i) Think – Aloud Evaluation
 - ii) Usability Test
- (10 Marks)
- b. Explain the types of presentation control.
- (10 Marks)



CBCS SCHEME

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18CS731

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024 Software Architecture and Design Patterns

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. What is design pattern? List and explain the four essential elements of a pattern with small talk MVC. (08 Marks)
- b. Explain catalog of design pattern with organizing the catalog. (08 Marks)
- c. How design pattern solve design problems? (04 Marks)

OR

- 2 a. Explain the types of UML diagrams with an example. (10 Marks)
- b. Develop the use case diagram for the library system.
 - i) Registering a new member
 - ii) Returning a book.(10 Marks)

Module-2

- 3 a. Define structural pattern. Explain in detail adapter design pattern. (10 Marks)
- b. What is decorator pattern? Explain with neat sketch various participants of decorator pattern. (10 Marks)

OR

- 4 a. Explain the participants and consequences of bridge pattern. (08 Marks)
- b. Explain motivation, applicability, structure and participants of façade design pattern. (08 Marks)
- c. Explain participants and consequences of proxy design pattern. (04 Marks)

Module-3

- 5 a. Define behavioral pattern. Explain in detail chain of responsibility design pattern. (10 Marks)
- b. Explain in detail interpreter design pattern. (10 Marks)

OR

- 6 a. Discuss participants and consequences of command pattern. (10 Marks)
- b. Explain when to use memento, observer, state and mediator, integrator design patterns. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg. $42+8=50$, will be treated as malpractice.

Module-4

- 7 a. What is architectural pattern? Explain the MVC architecture and alternative view of the MVC architecture. (10 Marks)
b. Explain the issues need to be highlighted when implementing the UNDO operation. (10 Marks)

OR

- 8 a. Explain design of item and its subclasses. (08 Marks)
b. Explain use case for drawing a line. (04 Marks)
c. Define controller explain the steps involved in defining the controller. (08 Marks)

Module-5

- 9 a. With a neat diagram, explain the basic architecture of client/server systems. (10 Marks)
b. Explain deploying the library system on the world wide web. (10 Marks)

OR

- 10 a. Explain Java remote method invocation. (10 Marks)
b. Explain :
i) HTML and Java servelets
ii) GET or POST METHOD. (10 Marks)

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18CS744

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024 Cryptography

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define following terms :
 - i) Cryptography
 - ii) Ciphertext
 - iii) Encryption
 - iv) Decryption
 - v) Kerchoff's principles.
- b. Perform simple cipher substitution for below message "meet me after the toga party" and explain the mathematical equations with key = 3. (10 Marks)

OR

- 2 a. With a neat diagram, explain the fiestel structure of DES method. (10 Marks)
- b. Encrypt the message "Meet me at the usual place at ten rather than eight O'clock". Using the hill cipher with key $\begin{pmatrix} 9 & 4 \\ 5 & 7 \end{pmatrix}$. Show your calculation and result. (10 Marks)

Module-2

- 3 a. Perform encryption using RSA algorithm following $P = 3$, $Q = 11$, $e = 3$ and $M = 9$. (10 Marks)
- b. Evaluate a Diffie – Hellman key exchange concept for prime number $q = 71$ and primitive root $\alpha = 7$.
 - i) If user A has private key $X_A = 5$, what is A's public key $Y_A = ?$
 - ii) If user B has private key $X_B = 12$, what is B's public key $Y_B = ?$
 - iii) What is shared key?(10 Marks)

OR

- 4 a. Compare how Diffie – Hellman key exchange algorithm useful in evaluating man – in – middle attack concept. (10 Marks)
- b. Consider an Elgamal scheme with common prime $q = 71$, and primitive root $\alpha = 7$.
 - i) If B has private key $Y_B = 3$, and A choose the random integer $k = 2$, what is the ciphertext of $M = 30$?
 - ii) If A now choose a different value of k so that the encoding of $M = 30$, is $c = (59, C_2)$ what is integer C_2 ?(10 Marks)

Module-3

- 5 a. Discuss elliptic curve cryptography for analog of Diffie – Hellman key exchange and explain with neat steps. (10 Marks)
- b. Explain pseudorandom number generation based on asymmetric cipher. (10 Marks)

OR

- 6 a. Apply the distribution of public key with respect to directory, authority and certificate. (10 Marks)
b. Explain secret key distribution with confidentiality and authentication. (10 Marks)

Module-4

- 7 a. What are X.509 standards? Explain the structure of X.509 certificate with neat diagram. (10 Marks)
b. Explain Kerberos version 5 message exchange with neat diagram. (10 Marks)

OR

- 8 a. Write a note on:
i) S/MIME functionality
ii) Types of S/MIME message. (10 Marks)
b. Explain internet mail architecture with its key components. (10 Marks)

Module-5

- 9 a. Explain the applications of IPsec with example. (10 Marks)
b. Summarize the below :
i) IPSec documents
ii) IPSec services. (10 Marks)

OR

- 10 a. Explain transport and tunnel modes of operations in ESP. (10 Marks)
b. Explain ESP packet format with Top level format and substructure of payload data. (10 Marks)

CBCS SCHEME

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18CS753

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024 Introduction to Artificial Intelligence

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. What is Artificial Intelligence? List the task domains of Artificial Intelligence. (05 Marks)
- b. Explain Depth – First search algorithm, with an example. (05 Marks)
- c. Explain the components and categories of production system. List the requirements of good control strategies. (10 Marks)

OR

- 2 a. A water – jug problem states “You are provided with two jugs first one with 4 – gallon capacity and the second one with 3 – gallon capacity. Neither have any measuring markers on it. How can you get exactly 2 – gallon of water into 4 – gallon jug”.
 - i) Write down the production rules for the above problem.
 - ii) Write any one solution to the above problem. (10 Marks)
- b. List and explain the problem characteristics which must be analyzed before deciding on a proper heuristic search. (10 Marks)

Module-2

- 3 a. Write the algorithm for conversion to Clause Form. (10 Marks)
- b. Explain the different approaches used for knowledge representation and list the qualities a good knowledge representation system should possess. (10 Marks)

OR

- 4 a. Consider the following sentences :
 - i) Marcus was a man
 - ii) Marcus was a Pompeian
 - iii) All Pompeians were Romans
 - iv) Caesar was a ruler
 - v) All Romans were either loyal to Caesar or hated him.
 - vi) Everyone is loyal to someone.
 - vii) People only try to assassinate rulers they are loyal to.
 - viii) Marcus tried to assassinate Caesar.
 - a) Translate all the sentences into formulas in predicate logic.
 - b) Convert formulas from previous step into Clause Form.
 - c) Prove that Marcus hate Caesar. (12 Marks)
- b. Explain Forward versus Backward Reasoning with examples. (08 Marks)

Module-3

- 5 a. Explain Justification based Truth Maintenance System (JTMS). What are the two critical criterion that must be met during labeling of JTMS and illustrate with suitable example. (10 Marks)
- b. What are the key issues in non – monotonic reasoning system? Explain the two approaches used for logic representation for non – monotonic reasoning. (10 Marks)

OR

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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- 6 a. Define Bayes theorem. What are its limitations? How certainty factor is used to overcome its limitations? (10 Marks)
b. Explain Dempster – Shafer theory with example. (05 Marks)
c. Explain Bayesian network with an example. (05 Marks)

Module-4

- 7 a. Explain MINIMAX search with appropriate algorithm. (10 Marks)
b. Write the algorithm for :
i) Depth first iterative deepening ii) Iterative deepening – A*. (10 Marks)

OR

- 8 a. List and explain the different steps in natural language understanding process. (10 Marks)
b. Explain Augmented Transition Networks and give an example of an Augmented Transition Networks in graphical notation. (10 Marks)

Module-5

- 9 a. Explain Candidate elimination algorithm with example. What is version space? (10 Marks)
b. What is Analogy based learning? Differentiate between transformations analogy and derivational analogy. (10 Marks)

OR

- 10 a. Explain Knowledge Acquisition. (10 Marks)
b. Explain how decision trees are used in learning. (04 Marks)
c. Explain Rote Learning. (06 Marks)

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18AI731

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024 Internet of Things

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Explain one M2M IoT standardized architecture with an eat diagram. (10 Marks)
- b. With a neat diagram explain the IoTWF standardized architecture. (10 Marks)

OR

- 2 a. Explain IoT management and compute stack. (10 Marks)
- b. Explain the following with examples : i) Sensors ii) Actuators. (10 Marks)

Module-2

- 3 a. Write short notes on Zigbee. (10 Marks)
- b. Explain the classification of smart objects with examples and also explain different communication criteria's in IoT. (10 Marks)

OR

- 4 a. Describe the characteristics and attributes considered when selecting and dealing with connection smart objects. (10 Marks)
- b. Explain the various network topologies with examples. (10 Marks)

Module-3

- 5 a. Explain COAP with standard track specification for COAP and message format. (10 Marks)
- b. Explain raw rocket scenarios for tunneling legacy SCAPA over IP networks. (10 Marks)

OR

- 6 a. Discuss the advantages of MQTT protocol. (10 Marks)
- b. Write short notes on profiles and compliances for IoT constrained nodes and network. (10 Marks)

Module-4

- 7 a. Explain Big Data Analytics Tool. (10 Marks)
- b. What are the common challenges in IoT security? (10 Marks)

OR

- 8 a. Explain Purdue model for control hierarchy. (10 Marks)
- b. Explain edge analysis core functions and explain the common applications of machine learning of IoT. (10 Marks)

Module-5

- 9 a. Write short notes on DSI 8B20 temperature sensor with its applications. (10 Marks)
- b. With a neat block diagram, explain a four layered architecture of a smart city IoT infrastructure. (10 Marks)

OR

- 10 a. Explain fundamentals of Arduino programming with example program. (10 Marks)
- b. Explain smart city architecture. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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18AI71

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024 Advanced Artificial Intelligence

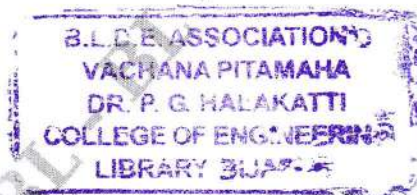
Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Differentiate between the following :
 - i) Fully observable Vs. Partially observable
 - ii) Single agent Vs. Multiagent
 - iii) Deterministic Vs. Stochastic
 - iv) Episodic Vs. Sequential
 - v) Static Vs. dynamic
- b. Differentiate between :
 - i) Simple reflex agents
 - ii) Model – based reflex agents
 - iii) Goal-based agents ; and
 - iv) Utility- based agents



(10 Marks)

(10 Marks)

OR

- 2 a. Solve the below problem using Alpha Beta Pruning technique, show all the necessary steps.

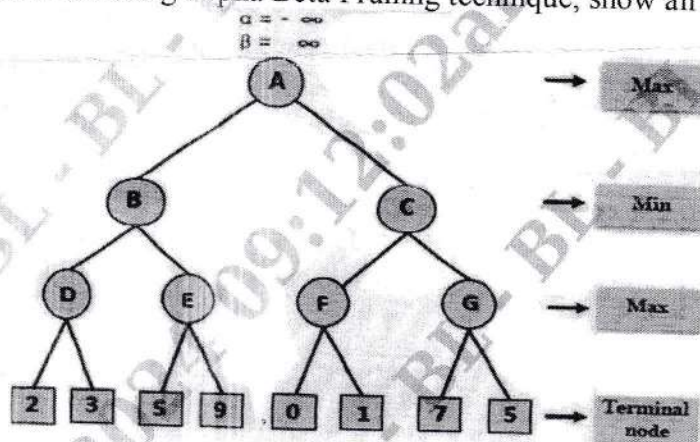


Fig Q2(a)

- b. Explain Minimax algorithm with an example.

(10 Marks)

(10 Marks)

Module-2

- 3 a. Given the full joint distribution shown in Table Q3(a), calculate following :
 - i) $P(\text{toothache})$ ii) $P(\text{Cavity})$ iii) $P(\text{Toothache} | \text{Cavity})$ iv) $P(\text{Cavity} | \text{toothache} \vee \text{catch})$

	Toothache		$\neg$ toothache	
	catch	$\neg$ catch	Catch	$\neg$ catch
cavity	0.108	0.012	0.072	0.008
$\neg$ cavity	0.016	0.064	0.144	0.576

A full joint distribution for the Toothache, Cavity, Catch world

- b. Discuss on Wumpus World Problem with neat diagram.

(10 Marks)

(10 Mark) 15

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OR

- 4 a. Consider the set of all possible five-card poker hands dealt fairly from a standard deck of fifty-two cards.
- How many atomic events are there in the joint probability distribution (i.e., how many five-card hands are there)?
 - What is the probability of each atomic event?
 - What is the probability of being dealt a royal straight flush? Four of a kind? (10 Marks)
- b. Three persons A, B and C have applied for a job in a private company. The chance of their selections is in the ratio 1 : 2 : 4. The probabilities that A, B and C can introduce change to improve the profits of the company are 0.8, 0.5 and 0.3, respectively. If the change does not take place, find the probability that it is due to the appointment of C. (10 Marks)

Module-3

- 5 a. Differentiate between Direct Sampling, Rejection Sampling and Likelihood sampling with pseudo code. (10 Marks)
- b. What is exact inference in Bayesian network? Explain inference by enumeration with pseudo code. (10 Marks)

OR

- 6 a. Explain the semantics of Bayesian networks with a neat diagram. (10 Marks)
- b. Construct a simple Bayesian network in which Weather is independent of the other three variables and Toothache and Catch are conditionally independent, given cavity. (10 Marks)

Module-4

- 7 a. Write short notes on :
i) Texture ii) Color iii) Lighting and Shading iv) Binocular stereopsis (10 Marks)
- b. Briefly explain the object recognition from structural information. (10 Marks)

OR

- 8 a. How do you use vision for controlling movement by providing the required information by the user? Explain with an example. (10 Marks)
- b. Consider a picture of a white sphere floating in front of a black backdrop. The image curve separating white pixels from black pixels is sometimes called the "outline" of the sphere. Show that the outline of sphere, viewed in a perspective camera, can be an ellipse, why do spheres not look like ellipses to you? (10 Marks)

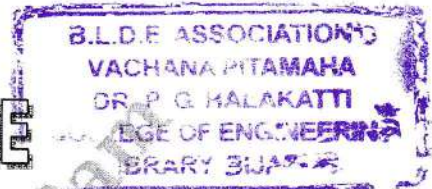
Module-5

- 9 a. Construct the surface structure and Deep structure for the following sentences :
i) The police will catch snatchers
ii) She saw stars in the sky (10 Marks)
- b. Consider the following Corpus of three sentences:
i) There is a big garden
ii) Children play in a garden
iii) The play inside beautiful garden
Calculate P for the sentence "They play in a big Garden" assuming a bi-gram language model. (10 Marks)

OR

- 10 a. List and explain the components of Transformation grammar. (10 Marks)
- b. Explain Binding theory with an example. (10 Marks)

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18CS752

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024 Python Application Programming

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Distinguish between :
 - i) Interpreter and compiler
 - ii) Syntax, logic and Semantic errors. (08 Marks)
- b. Define variable and keyword. List the keywords and rules followed to use variable names with an example. (06 Marks)
- c. Write a note on :
 - i) Accepting input from keyboard
 - ii) Choosing mnemonic variable names. (06 Marks)

OR

- 2 a. Demonstrate the conditional, alternative, chained and nested execution statements with syntax, flowchart and example. (12 Marks)
- b. Develop a student grading program that takes score with value between 0.0 to, 1.0 as its parameter and returns a grade as string. If score is out of range/string, then print appropriate error message using try and except concept.

Score	Grade
≥ 0.9	A
≥ 0.8	B
≥ 0.7	C
≥ 0.6	D
< 0.6	F

(08 Marks)

Module-2

- 3 a. Explain definite and indefinite loops with suitable examples. (05 Marks)
- b. Develop a program which repeatedly reads numbers until the user enters "done". Once "done" is entered, print total, count, average, maximum and minimum of numbers. Use try and except to print appropriate error message and skip to next number input. (10 Marks)
- c. List out the string handling methods with syntax and examples. (05 Marks)

OR

- 4 a. Describe the concept of parsing Strings and Format operators with suitable examples. (04 Marks)
- b. Demonstrate the open, read, write, search and close file methods with syntax and examples. (12 Marks)
- c. Develop a program to create a string made of first, middle and last character of a user specified string (Ex : Input : James Output : Jmc)

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Module-3

- 5 a. Illustrate 8 list handling methods in python. (08 Marks)
 b. Bring out the relationship between list and functions with suitable examples. (06 Marks)
 c. Development a program to turn every item of a list 1 into its square and place it into list 2. Print both lists. (06 Marks)

OR

- 6 a. Develop a program to read through a word file, find out the frequency of words in a file by ignoring the punctuation and alphabet case using dictionary. Print error if file does not exist. (08 Marks)
 b. Describe tuple assignment with examples. (06 Marks)
 c. Illustrate searching and extracting operational methods using regular expression. (06 Marks)

Module-4

- 7 a. Define instantiation. Explain the shallow and deep copy concept with examples. (08 Marks)
 b. Demonstrate the concept of sameness between instances and use of instances as arguments and return values. (12 Marks)

OR

- 8 a. Illustrate the concept of pure functions and modifiers. (05 Marks)
 b. Develop a program with initialization method and optional arguments. (10 Marks)
 c. Demonstrate operator overloading and polymorphism feature with sample code. (05 Marks)

Module-5

- 9 a. Develop a program that represent World's simplest web browser. Also draw a conceptual diagram. (07 Marks)
 b. Develop a program that can read any size file without using up all the memory in computer. (06 Marks)
 c. Demonstrate the XML and JSON formats for data exchange across the web. (07 Marks)

OR

- 10 a. Write a note on Google geo-coding API web service. (08 Marks)
 b. Demonstrate the use of CREATE, INSERT, SELECT, UPDATE and DELETE SQL commands in python. (12 Marks)

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18AI744

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024 Business Intelligence

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, explain Business Pressure – Response model. Also mention the reason for developing such model. (10 Marks)
- b. What is Information system and decision making? Briefly explain the support of Information system in decision making. (10 Marks)

OR

- 2 a. What are the nine cells of the decision framework? Explain what each is for. (10 Marks)
- b. Define BI. List and describe the major components of BI. (10 Marks)

Module-2

- 3 a. List and briefly describe Simon's four phases of decision making. (10 Marks)
- b. What are the impacts of the web on the phases of decision making? (05 Marks)
- c. Why is it important to classify a problem? What is meant by problem decomposition? (05 Marks)

OR

- 4 a. List some difficulties that may arise when analyzing multiple goals. (05 Marks)
- b. List the reasons for performing sensitive analysis. (10 Marks)
- c. Explain why a manager might perform what – if – analysis and might use goal seeking. (05 Marks)

Module-3

- 5 a. Define Data Warehouse. Explain how it works. Mention its benefits. (10 Marks)
- b. Explain Data Warehousing Architecture. (10 Marks)

OR

- 6 a. Explain Data Integration, Data Extraction and Data Transformation. (10 Marks)
- b. What issues should be considered when deciding which architecture to use in developing a datawarehouse? List 10 most important factors. (10 Marks)

Module-4

- 7 a. Define Knowledge Management. Explain Taxonomy of Knowledge. (10 Marks)
- b. Explain various approaches to Knowledge Management. (10 Marks)

OR

- 8 a. What are the two primary functions of IT in Knowledge Management? Explain KMS cycle with a neat diagram. (10 Marks)
- b. Describe how AI and Intelligent agents support Knowledge Management. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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Module-5

- 9 a. What is ES? Explain features of ES. Mention why we need ES.
b. Explain classical applications of ES.

(10 Marks)

(10 Marks)

OR

- 10 a. With a neat diagram, explain structure of Expert Systems.
b. Explain the process of Knowledge Engineering.

(10 Marks)

(10 Marks)

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18CS81

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Internet of Things

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. What is IOT? Explain in detail on genesis of IOT with example. (07 Marks)
- b. Write a short note on IOT impact in real world with example. (07 Marks)
- c. Discuss the IOT challenges with example. (06 Marks)

OR

- 2 a. What is M2M IOT architecture? Explain its elements with architecture in detail. (07 Marks)
- b. Explain in detail simplified IOT architecture with example. (07 Marks)
- c. Compare and contrast IT and OT. (06 Marks)

Module-2

- 3 a. List and explain types of sensors with example. (07 Marks)
- b. What is smart object? Explain its characteristics with example. (07 Marks)
- c. What is SANET? Explain its advantages and disadvantages that a wireless based solution offers. (06 Marks)

OR

- 4 a. List out the limitation of smart objects in WSN's and explain the data aggregation in WSN with neat diagram. (07 Marks)
- b. What is Zigbee? Explain 802.15.4 physical layer, MAC layer and security with example. (07 Marks)
- c. Explain in brief LORaWAN standard and Alliance MAC layer and security. (06 Marks)

Module-3

- 5 a. Explain Business case for IP with example. (07 Marks)
- b. Explain generic web based protocol with example. (07 Marks)
- c. What is COAP? Explain with example. (06 Marks)

OR

- 6 a. What is SCADA? Explain with example. (07 Marks)
- b. Explain optimization of IP with example. (07 Marks)
- c. What is RPL? Explain with example. (06 Marks)

Module-4

- 7 a. Explain structured vs unstructured data with example. (07 Marks)
- b. What is IOT data analytics? Explain its 4 types of data analytics with example. (07 Marks)
- c. What is Hadoop ecosystem? Explain in detail with example. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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OR

- 8 a. What is Apache Kafka? Explain in detail with example. (07 Marks)
b. Explain in detail Lambda architecture with example. (07 Marks)
c. What is distributed analytics system? Explain with example. (06 Marks)

Module-5

- 9 a. What is Ardino? Explain in detail with example and why Ardino. (07 Marks)
b. Explain foundation of Ardino program with example. (07 Marks)
c. What is SOC? Explain in detail with example. (06 Marks)

OR

- 10 a. What is Raspbery operating system? Explain its various OS with example. (07 Marks)
b. Explain in detail OS set upon Raspbery pi with example. (07 Marks)
c. How do you programming in Raspbery pi? Explain with example. (06 Marks)
