Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: M.Tech**

Sub_Code: P1CSBC03

1st Semester Regular/Back Examination: 2025-26

SUBJECT: Advanced Computer Architecture

BRANCH(S): COMPUTER SCIENCE AND ENGG, COMPUTER SCIENCE AND TECH.

Time: 3 Hours

Max Marks: 100

Q.Code: U600

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.

The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Differentiate between local and shared memory.

b) Justify which pipelined architecture is better – superscalar or super-pipelined and why?

c) Define the following terms: Bisection-Width, Diameter, Node degree with respect to interconnection networks. Give example from each parameter.

d) Justify the use of "virtual memory".

e) Consider three different processors P1, P2, and P3 executing the same instruction set with the following clock rates and CPIs:

Processor	Clock Rate	CPI
P1	2 GHz	1.5
P2	1.5 GHz	1.0
P3	3 GHz	2.5

Which processor has the highest performance expressed in instructions per second?

f) Differentiate between "write-through" and "write-back" protocols.

g) Highlight the advantages of VLIW processors architecture over others.

h) Define locality of reference. Why is it necessary? Give examples from each type of reference.

i) Define "Pages" and "Frames". Why page replacement algorithms are necessary?

j) Highlight the role of cluster computing systems.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Explain the mechanism of cache-coherence with an example.

b) Analyse the features of Systolic processors with diagram.

c) Differentiate between static and dynamic data flow computers.

d) Describe the classification of parallel systems (with diagram) as proposed by Flynn. Also give examples from each type.

e) Consider a machine with 64 MB physical memory and 32-bit virtual address space. If the page size is 4 KB, compute the approximate size of the page table.

f) List out some of the key features of cloud computing citing examples from each.

g) A virtual memory system has an address space of 8K words, a memory space of 4 K words, and page and block size of 1 K words. The following page reference changes occur during a given time interval:
4, 2, 0, 1, 2, 6, 1, 4, 0, 1, 0, 2, 3, 5, 7
Given that four pages are resident in main memory, determine the number of page faults that occur in each of the algorithm:
(i) FIFO; (ii) LRU; (iii) Optimal

h) Explain how the following instructions are executed in a serial processor and in a VLIW processor:
ADD R1, R2, R3
MUL R4, R5, R6
SUB R7, R8, R9

i) An 80 MHz processor was used to execute a benchmark program with the following instruction mix and clock cycle count:

Instruction Type	Instruction Count	CPI
Integer Arithmetic	50000	10
Load	30000	3
Floating Point	25000	5

Determine the MIPS and Execution Time of the program.

j) Explain and differentiate between NUMA and UMA architectures.

k) Identify the hazards from the given set of instructions and also compute the number of clock cycles required to execute them in a 5-stage pipeline.
I0: MUL R2, R0, R1
I1: DIV R5, R3, R4
I2: ADD R2, R5, R3

l) A computer has a 256 KB, 8-way set associative, write-back data cache with block size of 32 bytes. The processor sends 32-bit addresses to the cache controller. Each cache tag directory entry contains in addition to address tag, 2 valid bits, 1 modified bit and 1 replacement bit. Compute the total number of bits required for the TAG field, SET field and BLOCK field. Also, compute the size of cache tag directory.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Compare and contrast between RISC and CISC computer architectures. Justify whether VLIW is a RISC or CISC with proper example. **(16)**

Q4 Differentiate between static and dynamic interconnection networks. Explain the functioning of an 8 * 8 Omega switching network with a neat diagram. **(16)**

Q5 A computer has a cache, main memory and a disk used for virtual memory. An access to the cache takes 20 ns. An access to main memory takes 200 ns and an access to disk takes 20,000 ns. The cache hit-ratio is 0.9 and the main memory hit ratio is 0.8. Compute the effective access time required to access a referenced word on the system when a hierarchical access memory organization is used. **(16)**

Q6 Difference between Cluster computing and Distributed computing. Explain different layers of cloud architecture indicating the implementation and use of IaaS, SaaS, PaaS. **(16)**

Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: M.Tech**

Sub_Code: P1CSBC04

1st Semester Regular/Back Examination: 2025-26

SUBJECT: Advanced Data Structure and Algorithm

BRANCH(S): COMPUTER SCIENCE AND ENGG, COMPUTER SCIENCE AND TECH.

Time: 3 Hours

Max Marks: 100

Q.Code: U705

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.

The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) What is a Min-Heap?
b) Define Leftist Heap.
c) What is a Red-Black Tree?
d) Define B+ Tree.
e) What do you mean by asymptotic notation?
f) What is dynamic programming?
g) Define greedy algorithm.
h) What is a convex hull?
i) What is NP-complete problem?
j) State Cook's Theorem.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Explain the structure and properties of Binomial Heaps.
b) Compare Fibonacci Heap and Binomial Heap.
c) Explain AVL Tree rotations with examples.
d) Describe the structure and applications of B-Tree.
e) Explain Red-Black Tree properties and their importance.
f) Explain Segment Tree and its applications.
g) Discuss k-d Tree and its role in multidimensional searching.
h) Explain Dynamic Programming approach with reference to LCS problem.
i) Explain Greedy method with Single Source Shortest Path algorithm.
j) Describe Convex Hull problem and its significance.
k) Explain Tries and their use in text pattern matching.
l) What is Polynomial-Time Verification?

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3	Explain different types of Heap Structures**.** Discuss Binomial Heap and Fibonacci Heap in detail with algorithms and complexity analysis.	**(16)**
Q4	Explain the structure and operations of B+ Tree and Red-Black Tree. Compare them with respect to height, performance, and applications.	**(16)**
Q5	Explain Dynamic Programming and Greedy Algorithms. Illustrate using Matrix Chain Multiplication and Minimum Cost Spanning Tree algorithms.	**(16)**
Q6	What is NP-Completeness? Explain polynomial-time reducibility and prove NP-completeness using Cook's Theorem**.**	**(16)**

Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: M.Tech**
Sub_Code: P1CSBC05

1st Semester Regular/Back Examination: 2025-26
SUBJECT: Advanced Operating Systems
BRANCH(S): COMPUTER SCIENCE AND ENGG, COMPUTER SCIENCE AND TECH.
Time: 3 Hours
Max Marks: 100
Q.Code: U654
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) List any two types of system architectures used in distributed operating systems.
b) State the purpose of Lamport's Logical Clock.
c) What is meant by global state in a distributed system?
d) What is the role of voting in the Maekawa algorithm?
e) What is termination detection in distributed systems?
f) Mention any two performance measures of mutual exclusion algorithms.
g) List any two deadlock handling strategies.
h) Why are agreement protocols important in distributed systems?
i) Mention one difference between multiprocessor and distributed operating systems.
j) List any two types of faults handled by distributed systems.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Explain the concept of causal ordering of messages in distributed systems.
b) Define a Distributed Operating System and explain its key characteristics and objectives.
c) Describe Vector Clocks and explain how they overcome the limitations of logical clocks.
d) Explain the concept of cuts of a distributed computation and distinguish between consistent and inconsistent cuts.
e) Explain the working of the Ricart–Agrawala algorithm with message flow.
f) Compare token-based and non-token-based mutual exclusion algorithms based on performance.
g) Explain the need for mutual exclusion in distributed systems and discuss its basic requirements
h) Describe the Suzuki–Kasami broadcast algorithm for mutual exclusion.
i) Discuss the hierarchical deadlock detection approach in distributed systems.

j) Explain the role of wait-for graphs in deadlock detection.

k) Discuss fault tolerance in distributed systems and the techniques used to achieve it.

l) Describe the architecture and features of multiprocessor operating systems.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Explain the different system architecture types used in distributed systems with suitable examples. **(8)**

b) Explain the Chandy–Lamport Global State Recording Algorithm with steps and assumptions. **(8)**

Q4 **a)** Describe the Maekawa mutual exclusion algorithm and explain its quorum-based approach. **(8)**

b) Explain the Raymond Tree-based mutual exclusion algorithm with a neat diagram. **(8)**

Q5 **a)** Explain different deadlock handling strategies used in distributed systems. **(8)**

b) Describe the issues involved in achieving agreement among distributed processes. **(8)**

Q6 **a)** Explain the architecture and objectives of Distributed File Systems (DFS). **(8)**

b) Describe the concept of Distributed Shared Memory (DSM) and its advantages. **(8)**

Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **B.Tech/IDD**

P1PGCC01/25PCCC01

1st /7th Semester Regular/Back Examination: 2025-26

SUBJECT: Computational Methods and Techniques

BRANCH(S): CE, ECE, EE, ME,CIVILENGG., COMMUNICATIONSYSTEMS, COMPUTERSCIENCE AND ENGG,COMPUTER SCIENCE ANDTECH., ELECTRICVEHICLE TECHNOLOGY,ELECTRICAL, Environmental Engineering and Management, Industrial Safety and Engineering ANDELECTRO ENGG,ELECTRICAL ENGG.,ELECTRO & COMM.ENGG, ELECTRO AND TELECOMMUNICATIONENGG, ENVIRONMENTALENGINEERING,ENVIRONMENTALSCIENCE AND ENGG,HEAT POWER & THERMALENGG, HEAT POWERENGG, MACHINE DESIGN,ME, MECH. ENGG., MECH.SYSTEM DESIGN,PLASTICS ENGG.,POLYMER NANOTECH.,POWER AND ENERGYENGG, POWER ELECTRO& DRIVES, POWER ENGGAND ENERGY SYSTEMS,POWER SYSTEM ENGG, Power Systems Engineering, PRODUCTION ENGG,SIGNAL PROCESSINGAND COMMUNICATION,SOIL MECHANICS &FOUNDATION ENGG,STRUCTURAL &FOUNDATION ENGG,STRUCTURAL ENGG,THERMAL & FLUID ENGG,THERMAL ENGG, VLSI &EMBEDDED SYSTEMS,VLSI & EMBEDDEDSYSTEMS DESIGN,WATER RESOURCE ENGG AND MANAGEMENT

Time: 3 Hours

Max Marks: 100

Q.Code: U512

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.

The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 × 10)**

a) Define an artificial neuron. Name any two components of a neuron model.

b) Differentiate between supervised and unsupervised learning.

c) Define Kohonen's Feature Map. What type of learning does it use?

d) Define a fuzzy set. How does it differ from a crisp set?

e) Given a linguistic variable "Speed" with values Slow (0.3), Medium (0.6), Fast (0.1), identify the dominant linguistic term and explain its significance.

f) What is Karmakar's Algorithm? State its significance.

g) What is the difference between constrained and unconstrained optimization problems?

h) Write the Lagrangian function for minimizing $f(x, y) = x^2 + y^2$ subject to $x + y = 4$.

i) What is meant by hybrid optimization technique? Give two examples.

j) In a GA what is the significance of mutation? if chromosome length is 10 and mutation probability is 0.1, how many bits are expected to mutate on average?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Define membership function and its importance in fuzzy logic.

b) Explain the application of Dynamic Programming to shortest path or resource allocation problems. Illustrate the procedure with a simple numerical example.

c) Given that X = {x_1, x_2} Y = {y_1, y_2} Z = {z_1, z_2, z_3} and R and S be two relations defined on universal set X x Y and Y x Z respectively. R and S are given as $R = \begin{bmatrix} 0.6 & 0.2 \\ 0.4 & 0.9 \end{bmatrix}$ $S = \begin{bmatrix} 0.3 & 0.7 & 0.5 \\ 0.8 & 0.4 & 0.9 \end{bmatrix}$ Find R o S, by max-min composition.

d) Find the extreme points of the function f (x_1, x_2) = $x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$.

e) Consider two given fuzzy sets.
A = {1/2, 0.3/4, 0.5/6, 0.2/8}, B = {0.5/2, 0.4/4, 0.1/6, 1/8}
Perform union, intersection, difference, and complement over fuzzy sets *A* and *B*.

f) Explain the working of a fuzzy-logic-based Antilock Braking System (ABS) with suitable rules.

g) Explain Bacterial Foraging Optimization (BFO) algorithm with a flow chart/ step by step algorithm.

h) What are the different bitwise operators used in genetic algorithms? Explain its significance.

i) Explain the training algorithm of the radial basis function network.

j) Describe the Primal–Dual Affine method for solving linear programming problems.
Why is it preferred over Primal and Dual Affine methods?

k) Write the steps in Adaline training algorithm.

l) Find the dimensions of a box of largest volume that can be inscribed in a sphere of unit radius.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** State Kuhn-Tucker conditions. Use them to minimize f (x, y, z) = $x^2 + y^2 + z^2 + 20x + 10y$, subject to $x \geq 40$, $x + y \geq 80$, $x + y + z \geq 120$. **(10)**

b) Write the standard (canonical) form of the following LPP **(6)**
Maximize: $Z = 2x_1 + 3x_2 - 2x_3$, subject to $x_1 + 5x_2 - x_3 \leq 15$, $2x_1 - x_2 + x_3 \leq -10$, $x_1 + 2x_3 = 10$, $x_1, x_2 \geq 0$, x_3 unrestricted in sign

Q4 **a)** What is Fuzzy Inference System (FIS)? With block diagram, explain the working principle of an FIS. Differentiate between Mamdani and Sugeno FIS. **(8)**

b) What is Defuzzification? Explain different types of Defuzzification methods with example. **(8)**

Q5 **a)** Explain Genetic Algorithm with flowchart. **(12)**

b) For a GA with: Population size = 40, Chromosome length = 10, Crossover probability = 0.8 and Mutation probability = 0.05, find number of chromosomes selected for crossover and Expected number of mutated bits. **(4)**

Q6 **a)** Explain the 'back propagation' algorithm in a feedforward neural network with one hidden layer. Derive the relevant expressions. What do you mean by an 'epoch'? **(10)**

b) What is Learning of ANN? What are the different types of learning methods used? **(6)**

Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: B.Tech/IDD**
Sub_Code: P1PGCC02

1st / 7th Semester Regular/Back Examination: 2025-26
SUBJECT: Internet of Things
BRANCH(S): CE, ECE, EE, ME,CIVIL ENGG., COMMUNICATION SYSTEMS, COMPUTER SCIENCE AND ENGG, COMPUTER SCIENCE AND TECH., ELECTRIC VEHICLE TECHNOLOGY, ELECTRICAL AND ELECTRO ENGG, ELECTRICAL ENGG., ELECTRO & COMM. ENGG, ELECTRO AND TELECOMMUNICATION ENGG, ENVIRONMENTAL ENGINEERING, ENVIRONMENTAL SCIENCE AND ENGG, HEAT POWER & THERMAL ENGG, HEAT POWER ENGG, MACHINE DESIGN, ME, MECH. ENGG., MECH. SYSTEM DESIGN, PLASTICS ENGG., POLYMER NANOTECH., POWER AND ENERGY ENGG, POWER ELECTRO & DRIVES, POWER ENGG AND ENERGY SYSTEMS, POWER SYSTEM ENGG, Power Systems Engineering, PRODUCTION ENGG, SIGNAL PROCESSING AND COMMUNICATION, SOIL MECHANICS & FOUNDATION ENGG, STRUCTURAL & FOUNDATION ENGG, STRUCTURAL ENGG, THERMAL & FLUID ENGG, THERMAL ENGG, VLSI & EMBEDDED SYSTEMS, VLSI & EMBEDDED SYSTEMS DESIGN, WATER RESOURCE ENGG AND MANAGEMENT
Time: 3 Hours
Max Marks: 100
Q.Code: U543
Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Why are IoT protocols essential in large-scale deployments?
b) How does IoT enable Industry 4.0?
c) What is meant by "Things" in the physical design of IoT?
d) Define Internet of Things and mention any two characteristics.
e) How do IoT functional blocks contribute to system reliability?
f) Why is cloud computing important for IoT applications?
g) How does Big Data support decision-making in IoT?
h) Why is SDN beneficial for IoT networks?
i) What role does RFID play in IoT systems?
j) Why is low-power design critical for IoT devices?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Explain physical design and logical design of IoT with neat diagram.
b) Describe IoT communication models and APIs.
c) Discuss IoT enabling technologies and their role in modern IoT ecosystems.
d) Explain domain-specific IoT applications in Smart Cities and Healthcare.
e) Compare IoT and M2M communication with suitable examples.
f) Discuss SDN and NFV for IoT with architecture.

g) Explain the stages of IoT design methodology.
h) Describe Raspberry Pi architecture and interfaces.
i) Explain the role of Python in IoT application development.
j) Discuss Big Data analytics and visualization in IoT.
k) Explain Industry 4.0 concepts and its integration with IoT.
l) Describe range-extension techniques and low-power communication in IoT.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Discuss Domain-Specific IoT Applications in detail for: Smart Cities, Smart Agriculture, & Smart Energy Systems with real-world examples. **(8 x 2)**

b) Explain the architecture of Raspberry P**i** and describe in detail how to interface LED, Switch, and LDR using Python.

Q4 **a)** Design an IoT-based Weather Monitoring System using IoT design methodology. Explain each stage with suitable diagrams. **(8 x 2)**

b) Explain IoT and its application**,** covering Big Data & Visualization, RFID & Low-power IoT, Industry 4.0, & Internet of Everything.

Q5 **a)** Explain in detail the IoT Design Methodology. **(8 x 2)**
Describe the following stages clearly:

- Purpose & Requirement Specification
- Domain Model Specification
- Information Model Specification
- Service Specification
- Functional & Operational View
- Device and Component Integration

Support your answer with a neat block diagram.

b) Discuss the Physical and Logical Design of IoT. Explain IoT Functional Blocks, Communication Models, Communication APIs, and IoT Levels with suitable examples.

Q6 **a)** Explain IoT Physical Devices and Endpoints in detail. Describe the basic building blocks of an IoT device and the working architecture of Raspberry Pi. Also explain Serial, SPI, and I2C interfaces with suitable applications. **(8 x 2)**

b) Discuss IoT in Industrial and Smart Infrastructure Applications.
Explain the role of IoT in:

- Smart Manufacturing
- Structural Health Monitoring
- Smart Grid Systems
- Fleet Tracking and Logistics

Include challenges and future scope.