

END TERM EXAMINATION

THIRD SEMESTER [MCA] DEC 2025-JAN 2026

Paper Code: MCA-201

Subject: Design and analysis of Algorithm

Time: 3 Hours

Maximum Marks: 60

Note: Attempt all questions as directed. Internal choice is indicated.

Q1. Attempt **any four** of the following questions: (4×5=20)

- (a) Explain divide and conquer paradigm with a simple example.
- (b) Explain bucket sort and when it is suitable.
- (c) Compute substring matches using Rabin-Karp for pattern: ANA in BANANA.
- (d) Identify and correct the error in Dijkstra code:
if(dist[u] + weight[u][v] < dist[v])
dist[v] == dist[u] + weight[u][v]; // error?.
- (e) Solve 0/1 knapsack
Weights = [2,3,4,5], Values = [3,4,5,6], Capacity = 5.
- (f) Identify the error in merge sort code:
mid = (low + high) / 2;
merge(a, low, mid);
merge(a, mid, high); // error?
- (g) Explain greedy choice property with an example.
- (h) Using branch-and-bound, compute TSP path cost for the given matrix:
0 10 15 20
10 0 35 25
15 35 0 30
20 25 30 0
- (i) Describe Strassen's matrix multiplication and its significance.
- (j) Explain the idea of backtracking using a simple example.

Q2. (a) Solve the recurrence: $T(n) = 2T(n/2) + n \log n$ using Master Theorem. (5)

(b) Compare Big-O, Big-Theta and Big-Omega notations with suitable examples demonstrating growth behavior. (5)

OR

Q3. (a) Solve the recurrence: $T(n) = T(n-1) + 3$ and determine its order of growth. (5)

(b) Explain the recurrence tree method and illustrate its use through a sample recurrence. (5)

Q4. (a) Compare counting sort, bucket sort, and radix sort with respect to stability and complexity. (5)

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- (b) Explain the KMP algorithm and how prefix function reduces pattern comparisons. (5)

OR

- Q5. (a) Describe the Rabin-Karp hashing mechanism and explain how collisions are handled. (5)
(b) Compare binary search trees and red-black trees in terms of balancing and performance guarantees. (5)
- Q6. (a) Explain Bellman-Ford algorithm and show how it handles negative edges. (5)
(b) Describe longest common subsequence and how dynamic programming solves it efficiently. (5)

OR

- Q7. (a) Compare greedy algorithms and dynamic programming with two suitable examples. (5)
(b) Compare 0/1 knapsack and fractional knapsack with respect to optimality. (5)
- Q8. (a) Compare backtracking and branch-and-bound approaches with suitable examples. (5)
(b) Explain Hamiltonian circuit problem and why it is NP-complete. (5)

OR

- Q9. (a) Describe polynomial-time verification and explain its relevance in NP problems. (5)
(b) Compare SAT and 3-SAT problems with small examples. (5)

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THIRD SEMESTER [MCA] DECEMBER 2025

Paper Code: MCA-203

Subject: Artificial Intelligence and Machine Learning

Time: 3 Hours

Maximum Marks: 60

Note: Attempt all questions as directed. Internal choice is indicated.

- Q1 Attempt **any five** of the following:- (5x4=20)
- (a) Define Artificial Intelligence and list the task domains of Artificial Intelligence.
 - (b) Explain Principal Component Analysis.
 - (c) Describe the Modus Ponens and Modus Tollens as propositional rule of inference.
 - (d) Differentiate between A* and AO* algorithm.
 - (e) Discuss the advantages of Machine Learning.
 - (f) Explain Bias and Variance with example.
 - (g) List and discuss the different characteristics of an AI problem.
 - (h) Discuss and differentiate between Supervised and Unsupervised learning (give suitable example for each)
 - (i) What is neural network?

- Q2 State and explain Best First Search algorithm with an example. Give one advantage and one disadvantage of Breadth First Search and Depth First Search. (10)

OR

- Q3 A Water Jug Problem: You are given two jugs, a 4-gallon one and a 3-gallon one, a pump which has unlimited water which you can use to fill the jug, and the ground on which water may be poured. Neither jug has any measuring markings on it. How can you get exactly 2 gallons of water in the 4-gallon jug: (10)
- (a) Write down the production rules for the above problem
 - (b) Write any one solution to the above problem

- Q4 Explain the differences between: (10)
- (a) Deductive and inductive learning
 - (b) Forward and Backward Reasoning

OR

- Q5 Consider the following set of well-formed formulas in predicate logic: (10)
- (a) Man (Marcus)
 - (b) Pompeian (Marcus)
 - (c) $\forall x: \text{Pompeian}(x) \rightarrow \text{Roman}(x)$
 - (d) ruler (Caesar)
 - (e) $\forall x: \text{Roman}(x) \rightarrow \text{loyalto}(x, \text{Caesar}) \vee \text{hate}(x, \text{Caesar})$
 - (f) $\forall x, \forall y: \text{loyalto}(x, y)$
 - (g) $\forall x, \forall y: \text{man}(x) \wedge \text{ruler}(y) \wedge \text{tryassassinate}(x, y) \rightarrow \neg \text{loyalto}(x, y)$
 - (h) Tryassassinate (Marcus, Caesar)

Convert these into clause form and prove that hate (marcus, Caesar) using resolution proof.

- Q6 How regression differs from classification? Briefly discuss the following types of regressions: (10)
(a) Linear Regression
(b) Multiple Linear Regression.
(c) Logistic Regression

OR

- Q7 What is Confusion matrix? Define Accuracy and Precision. Describe how are SST (Total sum of squares), SSE (Sum of Square of Residuals) and SSR (Sum of square of Regression) related? (10)

- Q8 Explain K- Means Algorithm. Also give two applications of K- Means Algorithm. (10)

OR

- Q9 What is Ensemble Learning? Discuss any one of the ensemble learning method. (10)

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THIRD SEMESTER [MCA] DEC 2025-JAN 2026

Paper Code: MCA-223	Subject: Cloud Computing
Time: 3 Hours	Maximum Marks: 60
Note: Attempt all questions as directed. Internal choice is indicated.	

- Q1 Attempt **any Four** of the following questions: **(4X5=20)**
- a) What is "EUCALYPTUS" stands for? Explain what is the use of "EUCALYPTUS" in cloud computing?
 - b) Explain cloud provider and cloud broker?
 - c) Explain Middleware Support for Virtualization.
 - d) Describe Guest operating System?
 - e) What are the main characteristics of platform-as-a-service solution?
 - f) Distinguish between authentication and authorization.
 - g) Explain Containers and Cloud Services aimed at Mid-Markets
 - h) Give the basic operations of docker engine.

- Q2 a) Explain different types of Cloud service models
 b) Compare Distributed vs. Grid vs. Cloud **(10)**

OR

- Q3 a) What are the characteristics of cloud architecture that separates it from traditional one?
 b) Explain different models for deployment in cloud computing? **(10)**

- Q4 a) Explain different types Of Virtualization.
 b) What are different security issues in cloud? **(10)**

OR

- Q5 a) Explain Information security, privacy and trust.
 b) What are the different Virtualization Techniques? Explain any two techniques. **(10)**

- Q6 a) Define the key architectural building blocks of a data center. Discuss how each component contributes to the overall functionality and efficiency of the data center.
 b) Describe the five operational and technical phases of a data centre. What are the primary objectives and challenges associated with each phase? **(10)**

OR

- Q7 a) Describe the role of Web APIs in cloud computing. How do they facilitate communication between different services and applications?
 b) Explain the concept of web applications. How do they differ from traditional software applications in terms of functionality and user experience? **(10)**

- Q8 What role does cloud security play in the migration process? Discuss the measures that organizations should take to safeguard their data in the cloud. **(10)**

OR

- Q9 Explain the concept of load balancing in cloud computing. How does it improve the performance and reliability of deployed virtual machines? **(10)**

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THIRD SEMESTER [MCA] DECEMBER 2025

Paper Code: MCA-235

Subject: Internet of Things

Time: 3 Hours

Maximum Marks: 60

Note: Attempt any five questions including Q.No1 which is compulsory.
Attempt one question from each Unit.

- Q1 Answer **any five** of the following questions:- (4x5=20)
- a) Explain the difference between IoT and traditional internet-based systems.
 - b) How do enabling technologies like cloud computing contribute to IoT?
 - c) Analyze the importance of Big Data analytics in IoT applications.
 - d) Illustrate the role of sensors in IoT-enabled smart cities.
 - e) Why is the IoT paradigm considered revolutionary compared to SCADA systems?
 - f) Evaluate the advantages of MQTT as a messaging protocol in IoT.
 - g) How does the LoWPAN protocol differ from BLE in IoT applications?
 - h) Discuss the significance of REST-based APIs in IoT communication.
 - i) Explain the role of the HC-05 Bluetooth module in integrating IoT devices.
 - j) How do Python packages like paho-mqtt simplify IoT development?

UNIT-I

- Q2 a) Discuss the evolution of IoT with relevant examples. (5)
b) Explain IoT challenges and their solutions for smart agriculture applications. (5)

- Q3 a) Compare M2M, SDN, and IoT with suitable use cases. (5)
b) Elaborate on IoT design methodology and its core components. (5)

UNIT-II

- Q4 a) Differentiate between IoT layers and IoT stack. (5)
b) Describe the function of CoAP and BLE in IoT transport protocols. (5)
- Q5 a) Discuss REST-based APIs for IoT communication. (5)
b) Explain the concept of fog computing and its importance in IoT. (5)

UNIT-III

- Q6 a) Draw and explain the pin diagram of Arduino. (5)
b) Compare the architecture of Raspberry Pi and Arduino for IoT applications. (5)
- Q7 a) How can sensors be integrated into IoT systems? Use examples of HDC or Ultrasonic sensors. (5)
b) Discuss the applications of the ESP8266 Wi-Fi module in IoT projects. (5)
(BTL)

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UNIT-IV

- Q8 a) Explain how Python packages like paho-mqtt and requests are used for IoT devices. (5)
b) Demonstrate Python code for handling file operations in an IoT system (5)
- Q9 a) Describe how time and sockets modules can be utilized in Python for IoT projects. (5)
b) Explain how Adafruit Python libraries are used to manage sensors in IoT (5)

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THIRD SEMESTER [MCA] DECEMBER 2025

Paper Code: MCA-253

Subject: Cyber Security and Cyber Laws

Maximum Marks: 60

Time: 3 Hours

Note: Attempt any five questions including Q.No1 which is compulsory. Attempt one question from each Unit.

b) Describe the different types of access management models used in information security. Explain how each model controls access to resources and provide examples of their practical use in organizations. (5)

Q7 a)

Explain the different types of firewalls used in network security. Describe how each type functions and provide examples of where they might be effectively implemented in protecting a network. (5)

b)

Explain the key techniques used in Intrusion Detection and Prevention Systems (IDPS). Describe how these techniques help in identifying and preventing potential security threats in a network. (5)

Q8 a)

Explain the key challenges faced in the field of computer forensics. Discuss how these challenges affect the investigation process and the reliability of digital evidence in legal cases. (5)

b)

Discuss the benefits and drawbacks of the Information Technology Act, 2000. Explain how this act impacts cybersecurity and digital transactions in India, highlighting both its positive and negative aspects. (5)

UNIT-IV

Q9 a)

Explain the differences between a patent, trademark, and trade secret. Discuss how each of these intellectual property rights protects innovations or business assets, providing examples of their practical use. (5)

b)

Describe the stages of the Digital Forensic Life Cycle. Explain how each stage contributes to the process of investigating and preserving digital evidence in a systematic manner. (5)

UNIT-I

Q2 a)

Identify and explain three types of cybercrimes committed against property. What methods are used in these crimes, and what impact do they have on the victims? (5)

b) Describe at least five types of cyberstalking. Provide examples of each to illustrate how they are applied in real-world scenarios. (5)

Q3 a)

Evaluate how CGA safeguards mobile phones from cyber-attacks. Justify the effectiveness of its protection measures. (5)

b) Analyze social engineering and provide four examples each of human-based and computer-based techniques. (5)

UNIT-II

Q4 a)

Explain the basic stages of a cyber-attack conducted by cybercriminals. How does understanding these stages help in developing effective cyber security measures? (5)

b) What types of damage can a backdoor Trojan cause? How does it differ from a standard backdoor? (5)

Q5 a)

Define Denial of Service (DoS) attacks and explain five different types of DoS attacks in detail. (5)

b) What is the purpose of a proxy server? Compare and contrast an anonymizer with a proxy server. (5)

UNIT-III

Q6 a)

Explain the format of an HTTP request and response, and describe how security is established in the HTTP protocol. Include key elements in both the request and response formats, and explain how encryption and certificates play a role in securing communication. (5)

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