

Time: 3 Hours

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

	Marks	CO	Blooms Level
1. a) Define Artificial Intelligence and discuss its applications.	7	1	K2
b) Explain the A* algorithm with an example.	7	2	K3

(OR)

2. a) Solve the water jugs problem	7	2	K3
✓ Given two jugs of 4 liters and 3 liters respectively, fill the 4-liter jug with 2 liters of water.			
✓ Find a good heuristic.			
✓ Perform Hill-climbing II Search.			
b) Explain state-space representation in problem-solving	7	1	K2

UNIT-II

3. a) Describe the Minimax algorithm and its significance in game playing.	7	3	K2
b) Solve the following Cryptarithmic puzzle:	7	3	K3

CP**+ IS****+ FUN****-----****= TRUE****(OR)**

4. a) Consider the following game tree with Minimax values. Apply the Alpha-Beta Pruning technique and determine the final value at the root node. Indicate which branches are pruned and explain why.	7	3	K3
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Game Tree:

- The tree consists of **MAX** and **MIN** levels.
- **MAX** nodes try to maximize the score, while **MIN** nodes try to minimize it.
- The leaf node values are given.

(MAX)

/ \

A B

/ \ / \

C D E F

/\ /\ /\ /\

3 5 6 9 1 2 0 4

b) What is Means-End Analysis? Explain with an example.	7	2	K2
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UNIT-III

5. a) Discuss different approaches to knowledge representation. 7 4 K2
b) What is a script? Write a script for an online shopping scenario. 7 4 K3

(OR)

6. a) Explain Conceptual Dependencies with an example. 7 4 K2
b) Represent the following knowledge using semantic nets: 7 4 K3
- Ram is a doctor.
 - Ram lives in Delhi.
 - Sunil is a teacher.
 - Sunil lives in Mumbai.
 - Ram treated Sunil's illness.
 - Sunil thanked Ram.

UNIT-IV

7. a) Explain Bayesian probability theory. 7 5 K2
b) Define Certainty Factor. Discuss its significance in AI. 7 5 K2

(OR)

8. a) Explain Bayesian Belief Networks. 7 5 K2
b) Consider the following propositions, and assume our task is to identify the patient's disease using Dempster-Shafer theory. 7 5 K3
- Patient has spots
 - Patient has measles
 - Patient has high fever
 - Patient has Rocky Mountain Spotted Fever
 - Patient has previously been inoculated against measles
 - Patient was recently bitten by a tick
 - Patient has an allergy

(a) What is Θ ?

(b) Define a set of m functions that describe the dependencies among sources of evidence and elements of Θ ?

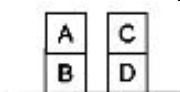
(c) Suppose we have observed spots, fever, and a tick bite. In that case, what is our Bel ($\{\text{Rocky Mountain Spotted Fever}\}$)?

UNIT-V

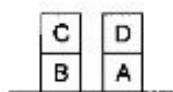
9. a) Explain the goal stack planning approach with an example. 7 5 K2
b) Describe the architecture of an expert system with a neat diagram. 7 5 K2

(OR)

10. a) Consider the following Block World Planning Problem. 7 5 K3
- (a) Show how STRIPS would solve this problem
- (b) Show how TWEAK would solve this problem
- (c) Did these processes produce optimal plans? If not, could they be modified to do.



start: $\text{ON}(C, B) \wedge$
 $\text{ON}(D, A) \wedge$
 $\text{ONTABLE}(B) \wedge$
 $\text{ONTABLE}(A) \wedge$
 ARMEMPTY



goal: $\text{ON}(C, B) \wedge$
 $\text{ON}(D, A) \wedge$
 $\text{ONTABLE}(B) \wedge$
 $\text{ONTABLE}(A)$

- b) List and explain various expert system shells and tools. 7 5 K2

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		<u>UNIT-I</u>	Marks	CO	BTL
1.	a)	Outline the complete data science process, from problem definition to deployment, and explain the importance of each step?	7	CO1	2
	b)	Explain how NumPy supports data processing through conditional logic and sorting. Write a short code example that uses where(), a Boolean method, and sort() to manipulate an array?	7	CO1	2
(OR)					
2.	a)	Demonstrate the process of Exploratory Data Analysis (EDA) in detail, including its purpose and techniques used. Why is EDA critical before building models?	7	CO1	2
	b)	Demonstrate with examples how to create NumPy ndarrays using at least three different methods. Discuss the advantages of using ndarrays over traditional Python arrays?	7	CO1	2
<u>UNIT-II</u>					
3.	a)	Demonstrate overview of the pandas library, including its architecture and key features. How does it support data analysis workflows?	7	CO2	2
	b)	Compare and contrast the pandas Series and DataFrame data structures. Include examples of how each can be created and used to store data?	7	CO2	2
(OR)					
4.	a)	Discover the role of Index objects in pandas. How do they enhance the functionality of Series and DataFrames? Provide an example of modifying an index?	7	CO2	4
	b)	Demonstrate the process of reindexing in pandas?	7	CO2	2
<u>UNIT-III</u>					
5.	a)	What are the key elements involved in an effective threat modeling process?	7	CO3	1
	b)	Identify and describe the elementary blocks of IoT security that can mitigate these vulnerabilities?	7	CO3	3
(OR)					
6.	a)	Compare JSON data with traditional text formats like CSV?	7	CO3	2
	b)	Examine the process of web scraping XML and HTML data using Python?	7	CO3	4
<u>UNIT-IV</u>					
7.	a)	Explain various data transformation techniques, including removing duplicates and replacing values?	7	CO4	2
	b)	Distinguish different methods to handle missing or redundant data while merging datasets?	7	CO4	4
(OR)					
8.	a)	How can reshaping and pivoting be used for better data organization? Illustrate with examples?	7	CO4	1
	b)	What is hierarchical indexing? Explain how it helps in reshaping data with examples?	7	CO4	1
<u>UNIT-V</u>					
9.	a)	Explain how scatter plots can be used to analyze relationships between two variables. Provide a use case with code?	7	CO5	2
	b)	Compare and contrast line plots and bar plots with appropriate use cases and examples?	7	CO5	2
(OR)					
10.	a)	What are histograms and density plots? Explain their differences with examples?	7	CO5	1
	b)	Apply pandas' built-in plotting functions simplify data visualization? Provide examples?	7	CO5	3

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UNIT-I

- | | | Marks | CO | BTL |
|-------|--|-------|----|-----|
| 1. a) | Explain about soil classification based on formation and forces acting on it. | 07 | 01 | K2 |
| b) | A soil sample has a void ratio 0.65 and specific gravity of 2.60. Determine dry unit weight and saturated unit weight. | 07 | 01 | K3 |

(OR)

- | | | | | |
|-------|---|----|----|----|
| 2. a) | Derive the equation: $r_d = \frac{(1-n_a)G\gamma_w}{(1+wG)}$ | 07 | 01 | K2 |
| b) | Explain in detail the IS soil classification for coarse grained soil. | 07 | 01 | K2 |

UNIT-II

- | | | | | |
|-------|--|----|----|----|
| 3. a) | Explain Darcy's Law and its significance in soil permeability. What are the factors affecting the permeability of soils? | 07 | 02 | K2 |
| b) | A 25 m long earthen dam has a depth of water = 10 m. The coefficient of permeability of the soil is 5×10^{-5} m/s. The length of the flow path through the dam is 30 m. Determine the seepage discharge through the dam per meter length. | 07 | 02 | K3 |

(OR)

- | | | | | |
|-------|--|----|----|----|
| 4. a) | Explain the procedure of a Falling Head Permeability test for calculating the coefficient of permeability of a given soil. | 07 | 02 | K2 |
| b) | A falling head permeability test was conducted on a silty soil sample with a cross-sectional area of 50 cm ² and a length of 200 mm. The initial head was 400 mm, and it dropped to 150 mm in 8 minutes. The standpipe has a diameter of 5 mm. Calculate the coefficient of permeability (k). | 07 | 02 | K3 |

UNIT-III

- | | | | | |
|-------|---|----|----|----|
| 5. a) | Explain the concept of effective stress in soils. How does it differ from total stress and pore water pressure? | 07 | 03 | K2 |
| b) | A clay layer lies below a 5 m thick sand layer. The water table is 3 m below the surface, and the unit weight of sand is 18 kN/m ³ . | 07 | 03 | K3 |

Determine:

- Total stress, pore water pressure, and effective stress at a depth of 3 m, 5 m, and 8 m.
- How do these values change if the water table rises to the ground surface?

(OR)

6. a) What is Newmark's Influence Chart? Explain its applications in determining stress distribution under footings. 07 03 K2
- b) A point load of 100 kN is applied at the ground surface. Determine the vertical stress at a depth of 2.5 m directly below the load. Calculate the stress at a depth of 2 m and a horizontal distance of 1.5 m from the load. 07 03 K3

UNIT-IV

7. a) Differentiate between IS Light and IS Heavy Compaction Tests. 07 04 K2
- b) A compaction test gives the following results: 07 04 K3

Water Content (%)	6	10	14	18	22
Dry Unit Weight (kN/m ³)	16.5	17.8	18.9	18.5	17.5

Plot the compaction curve and determine OMC and MDD.

(OR)

8. a) Explain Terzaghi's One-Dimensional Consolidation Theory. What are its assumptions and limitations? 07 04 K2
- b) A building imposes an additional pressure of 200 kN/m² on a 10 m thick clay layer. The clay has a coefficient of volume compressibility (m_v) of 0.0002 m²/kN. Determine the expected settlement of the clay layer. 07 04 K3

UNIT-V

9. a) Explain in detail the Unconfined Compression Test for finding the shear strength of a given soil. 07 05 K2
- b) A direct shear test was conducted on a cohesive soil, yielding the following results: 07 05 K3
- Normal stress (σ) = 100 kN/m²
 - Shear stress at failure (τ) = 50 kN/m²
- Determine the cohesion (C) and angle of internal friction (ϕ).

(OR)

10. a) Compare Consolidated Drained (CD), Consolidated Undrained (CU), and Unconsolidated Undrained (UU) tests. 07 05 K2
- b) An unconfined compression test on a clay sample gave an unconfined compressive strength of 100 kN/m². Determine the cohesion (C) of the clay sample. 07 05 K3

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		Marks	CO	Blooms Level
<u>UNIT-I</u>				
1.	a) Explain any three object-oriented programming principles with examples?	7M	1	K2
	b) Explain scope and life time of variables with suitable example code?	7M	1	K1, K2
(OR)				
2.	a) Discuss the different data types in Java. Explain the difference between primitive and reference data types, and give examples for each.	7M	1	K2
	b) What are variables in Java? Explain different types of variables	7M	1	K2
<u>UNIT-II</u>				
3.	a) Explain about Class and Object with Suitable Example	7M	2	K2
	b) Explain Overloading Methods and Overloading Constructors with examples	7M	2	K3
(OR)				
4.	a) What are constructors in Java? Explain the role of constructors in object initialization.	7M	2	K2
	b) What are static methods in Java? How do static methods differ from instance methods?	7M	2	K2
<u>UNIT-III</u>				
5.	a) Discuss about different forms of inheritance with an example	7M	3	K2
	b) Discuss multilevel inheritance with an example	7M	3	K3
(OR)				
6.	a) How does polymorphism allow for the calling of methods on objects of different types through a common reference?	7M	3	K2
	b) What is the difference between method overloading and method overriding in Java? Explain	7M	3	K2
<u>UNIT-IV</u>				
7.	a) Explain to implement Interfaces with an example program?	7M	4	K3
	b) How to create and import a package? Explain with an example	7M	4	K2
(OR)				
8.	a) Explain the concept of access protection in Java with respect to packages.	7M	4	K2
	b) Explain the process of importing packages in Java. Discuss the difference between importing a single class and importing all classes from a package.	7M	4	K2
<u>UNIT-V</u>				
9.	a) What is an Exception? Explain Exception handling mechanism.	7M	5	K2
	b) What is multithreading and explain how to create a thread with an example program.	7M	5	K2
(OR)				
10.	a) Discuss the lifecycle of a thread and the different states a thread can go through during its execution.	7M	5	K2
	b) What are thread priorities in Java, and how do they affect the scheduling of threads?	7M	5	K2

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UNIT-I

Marks CO BTL

1. a) Represent the decimal number 5137 in BCD, Hexa decimal and Excess-3 codes. 7 1 L1
- b) Encode data bits 1101 into the 7-bit even parity Hamming code. 7 1 L2

(OR)

2. a) Perform the subtraction with the following unsigned binary numbers by taking 2's complement of the subtrahend. 7 1 L2
- i) $100 - 11000$ ii) $11010 - 10000$
- b) The state of a 12-bit register is 010110010111. What is its content if it represents: 7 1 L1
- i) three decimal digits in BCD
- ii) three decimal digits in Excess-3 code

UNIT-II

3. a) Expand and simplify the following expressions using De Morgan's theorem: 7 2 L2
- i) $F(A, B, C) = (A + B)'(ABC)'(A'C)'$
- ii) $F(A, B, C) = [(AB + B'C) + (BC' + A'B)]'$
- b) Simplify the Boolean function using K-map. 7 2 L4
- $F(A, B, C, D) = \sum m(1, 2, 5, 6, 8, 10, 12, 14) + \sum d(3, 4, 13, 15)$

(OR)

4. a) Realize EX-NOR using minimum number of NOR gates. 7 2 L3
- b) Using the Quine-McCluskey method, minimize the function 7 2 L4
- $F(A, B, C, D) = \sum (7, 9, 12, 13, 14, 15) + d(4, 11)$

UNIT-III

5. a) What is the importance of a carry look ahead adder? Explain its operation for 4 bit addition with neat diagrams. 7 3 L3
- b) Design a 4 x 2 Encoder using logic gates. 7 3 L4
- (OR)
6. a) Implement a Full adder using NAND gates. 7 3 L2
- b) A combinational circuit is specified by the following three Boolean functions: 7 3 L4
- $$F_1 = \sum m(0, 3, 4); F_2 = \sum m(1, 2, 7); F_3 = \prod M(0, 1, 2, 4)$$
- Implement the circuit with a decoder and external OR gates.

UNIT-IV

7. a) Convert D flip-flop to JK flip-flop. 7 4 L2
- b) Illustrate the operation of a bidirectional shift register with mode control input. 7 4 L3
- (OR)
8. a) Sketch the circuit of JK flip-flop using NAND gates and explain its operation. 7 4 L2
- b) Illustrate the operation of 4 bit ring counter with the help of timing diagram. 7 4 L3

UNIT-V

9. a) Design a Full-Adder using a PLA. Show the PLA table. 7 5 L4
- b) Realize $F = \sum m(1, 4, 7, 9, 12, 15)$ using a PROM. 7 5 L2
- (OR)
10. a) Implement $F_1 = X'Y' + XYZ' + Y'Z$ and $F_2 = X'Y + Y'Z + XYZ + X'Z'$ using PAL. 7 5 L2
- b) Design a 3 bit Binary to Gray code converter using PROM. 7 5 L4

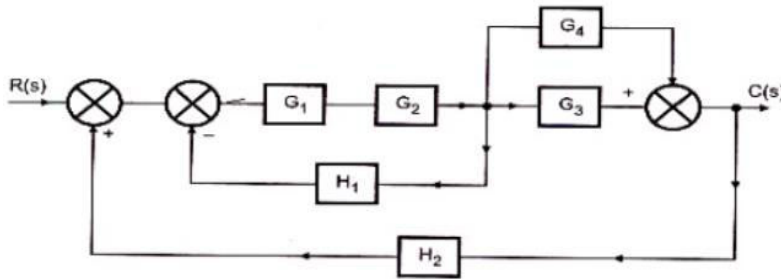
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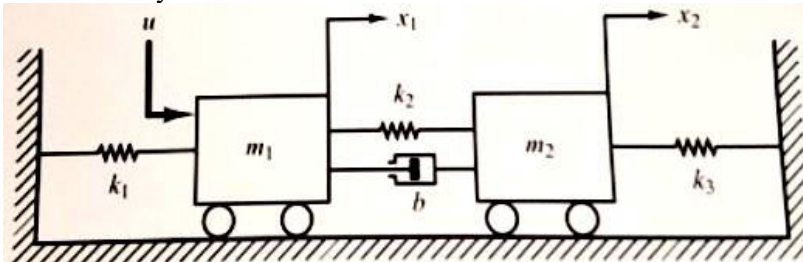
UNIT-I

- | | Marks | CO | Blooms Level |
|--|-------|----|---------------|
| 1. a) Explain the effects of feedback on the following characteristics of a control system:
(i) Sensitivity, (ii) Accuracy, (iii) Stability | 06 | 1 | Understanding |
| b) Obtain the transfer function $C(s)/R(s)$ by using block diagram reduction. | 08 | 1 | Applying |



(OR)

- | | | | |
|--|----|---|------------|
| 2. a) Identify whether the following systems are open-loop or closed-loop, and justify your answer:
(i) Automatic washing machine, (ii) Cruise control in a car, (iii) Home water heater system | 04 | 1 | Evaluating |
| b) (i) Obtain the transfer functions $X_1(s)/U(s)$ and $X_2(s)/U(s)$ of the mechanical system shown below. | 10 | 1 | Applying |

UNIT-II

- | | | | |
|---|----|---|---------------|
| 3. a) A unity feedback system is characterized by an open loop transfer function $G(s) = K/s(s+3)$ then Determine the gain 'K' so that it will have a damping ratio 0.4. For this value of 'K' determine the settling time, peak overshoot and for a unit step input. | 07 | 2 | Applying |
| b) For a second-order system with a damping ratio ζ and natural frequency ω_n , derive the time-domain specifications such as rise time, peak time, and settling time. | 07 | 2 | Understanding |
- (OR)
- | | | | |
|---|----|---|---------------|
| 4. a) Explain Synchro transmitter and receiver pair with neat diagram | 07 | 2 | Remembering |
| b) Explain the effect of PD, PI controllers on a second order system | 07 | 2 | Understanding |

UNIT-III

5. a) Use the Routh stability criterion to solve the following questions. 04 3 Applying
- $S^5 + 6S^4 + 2S^3 + 12S^2 + S + 6 = 0$
- b) sketch the root locus for the system with the open-loop transfer function: 10 3 Applying

$$G(s) = \frac{K}{s(s+1)(0.2s+1)}$$

(OR)

6. a) Check the stability of the given characteristic equation using Routh's method 4 3 Applying
- $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$
- b) Sketch the root locus and its asymptotes for a unity feedback system for the transfer function 10 3 Applying

$$G(s) = \frac{K}{(s+2)(s+4)(s+6)}$$

UNIT-IV

7. For the given transfer function: 14 4 Applying

$$G(s) = \frac{10}{s(s+2)}$$

- (i) Sketch the Bode magnitude and phase plots.
(ii) Determine the gain margin and phase margin.
(iii) Find the crossover frequencies.

(OR)

8. For the given system 14 4 Applying

$$G(s) = \frac{100}{(s+5)(s+20)}$$

- (i) Draw the asymptotic Bode plot (magnitude and phase).
(ii) Find the gain crossover frequency and phase crossover frequency.
(iii) Determine whether the system is stable using Bode plot criteria.

UNIT-V

9. a) Convert the following transfer function into state-space 07 5 Applying

$$G(s) = \frac{1}{s^2 + 3s + 2}$$

representation:

- b) Find a state space model of the following differential equation and give the block diagram representation of the state model. 07 5 Applying

$$\frac{d^3y}{dt^3} + 5\frac{d^2y}{dt^2} + \frac{dy}{dt} + 2y = u(t)$$

(OR)

10. a) Define controllability and observability. Using the Kalman test, check if the given system is controllable and observable: 07 5 Applying

$$A = \begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}, B = \begin{bmatrix} 1 \\ 0 \end{bmatrix}, C = [0 \quad 1]$$

- b) Find a state space representation of the following transfer function. 07 5 Applying

$$G(s) = \frac{5}{s^2 + 4s + 6}$$

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<u>UNIT-I</u>		Marks	CO	BTL
1.	a) Explain various types of pattern allowances with neat sketches.	7	1	K2
	b) Explain permanent mould casting process with a neat sketch	7	1	K2
(OR)				
2.	a) Define castability and list the constituents of moulding sand.	7	1	K2
	b) Differentiate between open riser and blind riser.	7	1	K2
<u>UNIT-II</u>				
3.	a) Define welding and classify welding processes.	7	2	K2
	b) List and explain any three welding defects with sketches.	7	2	K2
(OR)				
4.	a) Explain SMAW process with a neat sketch.	7	2	K2
	b) Differentiate between soldering and brazing process.	7	2	K2
<u>UNIT-III</u>				
5.	a) Sketch and explain various kinds of roll stand arrangements	7	3	K2
	b) Write comparison between forward and backward extrusion?	7	3	K2
(OR)				
6.	a) Differentiate between Hot working and cold working.	7	3	K2
	b) Sketch and explain wire drawing operation briefly.	7	3	K2
<u>UNIT-IV</u>				
7.	a) Describe press forging. How does it differ from drop forging?	7	4	K2
	b) Explain with neat sketches the following forging operations:	7	4	K2
	a) Drawing out			
	b) Upsetting			
(OR)				
8.	a) Sketch and describe any two forging tools.	7	4	K2
	b) Explain the press work terminology with a neat sketch.	7	4	K2
<u>UNIT-V</u>				
9.	a) What are thermo plastic materials? How do they differ from thermosetting materials?	7	5	K2
	b) Explain Electro hydraulic forming process with a sketch.	7	5	K2
(OR)				
10.	a) With the help of neat sketch explain the processing of plastics by blow molding method	7	5	K2
	b) What is the principle of high-velocity forming? List the applications.	7	5	K2