KCG
COLLEGE OF TECHNOLOGY
AFFILIATED TO ANNA UNIVERSITY | AUTONOMOUS

Unit I

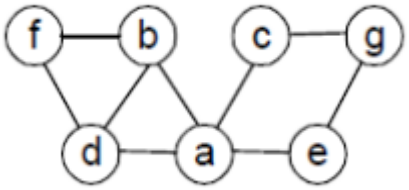
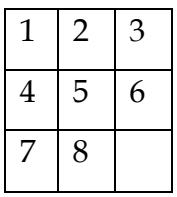
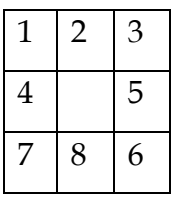
	COMPUTER SCIENCE AND ENGINEERING		
	23CS402 ARTIFICIAL INTELLIGENCE		
	First		
QNo	**Questions**	**COs**	**Bloom's Level**
1.	What are the main goals AI seeks to achieve in performing tasks that traditionally require human intelligence?	CO1	K1
2.	Give the definition of an Intelligent agent and state the need of it.	CO1	K1
3.	Define Turing test. Why is the Turing Test considered a significant milestone in the history of Artificial Intelligence?	CO1	K2
4.	What are the four approaches used for AI?	CO1	K1
5.	AI systems in autonomous vehicles process visual information from sensors like cameras and LiDAR. What is this process called, and why is it important for self-driving cars?	CO1	K2
6.	What is the potential risk of AI in the future?	CO1	K1
7.	Write the characteristics of intelligent/Rational agent.	CO1	K1
8.	List types of agent program or agent types.	CO1	K1
9.	What is simple reflex agent? Give one example.	CO1	K1
10.	What is the difference between goal based agent and utility based agent?	CO1	K1
11.	A robot vacuum detects obstacles and adjusts its path accordingly. Which characteristic of intelligent agents does this behaviour illustrate, and how?	CO1	K2
12.	What are the steps involved in problem-solving in AI?	CO1	K1
13.	What is Search tree and State -Space In algorithm?	CO1	K1
14.	Why Search strategies are mostly used in problem solving?	CO1	K1
15.	What is PEAS?	CO1	K1
16.	A factory uses robots to assemble parts on a production line. These robots must adapt to new types of parts without being explicitly reprogrammed for each variation. What type of learning should be incorporated into the AI agents to enable this?	CO1	K2

17.	You have to design an AI agent to play a strategy board game. The agent must be able to look ahead, plan moves, and adjust strategy dynamically based on the current state of the game. Which type of agent should you design and why?	CO1	K2
18.	A recommendation system on a streaming platform adjusts its suggestions based on user preferences. How does this system apply the concept of "goal-oriented behavior" in AI?	CO1	K2
19.	What is Agent program?	CO1	K1
20.	List down the pros and cons of any two typical agents.	CO1	K1
21.	A self-driving car has to choose between two paths: one is shorter but more congested, and the other is longer but clearer. How could an AI agent assess and make the decision on which path to take?	CO1	K2
22.	Intelligent agents are characterized by autonomy. How does autonomy benefit AI systems in environments like autonomous vehicles?	CO1	K2
	Part – B		
1.	Explain in detail about the types of agent with diagram.	CO1	K2
2.	Write in detail about Intelligent Agents and its characteristics.	CO1	K2
3.	Describe the various properties of the task environment in AI with example.	CO1	K2
4.	Give PEAS description of the task environment for any 7 agent types.	CO1	K2
5.	You are given two jugs: • **Jug 1** can hold 4 liters of water. • **Jug 2** can hold 3 liters of water. The task is to measure exactly **2 liters** of water using these two jugs. You are allowed to: • Fill a jug completely from the well. • Empty a jug. • Pour water from one jug to the other until one is either full or empty. Find a solution for the above AI problem and describe the various steps involved in solving it.	CO1	K2

6.	You are tasked with designing an AI system for a robot that will work in a warehouse. The robot's primary task is to move packages from one location to another within the warehouse. The robot must navigate obstacles, avoid collisions, and pick up and drop off packages at specific locations based on commands from a central system. There are different types of agents that can be used for this purpose, each with unique capabilities. **Consider the following agents for this robot:** a. **Reflex Agent** b. **Model-based Reflex Agent** c. **Goal-based Agent** d. **Utility-based Agent** e. **Learning Agent** Based on the type of agent would be most suitable for this warehouse robot, and why? Discuss the strengths and limitations of each agent type in the context of this scenario.	CO1	K3
7.	Explain the future of AI in detail.	CO1	K2
8.	Consider the following problems with respect to the seven problem characteristics and solve. (1) 8-puzzle problem (2) Towers of Hanoi (3) Vacuum world with 2 cell	CO1	K3

UNIT II

QNo	Questions	Cos	Bloom's Level
1	What is Search Strategy in AI?	CO2	K1
2	Differentiate the uninformed search strategies in terms of their evaluation criteria.	CO2	K1
3	List the pros and cons of DFLS	CO2	K1
4	Tabulate the pros and cons of Uniform Cost Search.	CO2	K1
5	Define Greedy best first search.	CO2	K1
6	What do you meant by memory bounded search?	CO2	K1
7	Define Genetic algorithms and list the steps.	CO2	K1
8	Differentiate uniformed and informed search?	CO2	K1
9	Define Local Search and optimization algorithms.	CO2	K1

10	What do you meant by Simulated Annealing?	CO2	K1
11	Define Constraint satisfaction problem?	CO3	K1
12	Compare the different techniques of CSP	CO3	K1
13	List out the advantages of Local search algorithms	CO3	K1
14	List out the drawbacks of Local search algorithms	CO3	K1
15	What do you meant by Simulated Annealing?	CO3	K1
16	Define Local Search and optimization algorithms.	CO3	K1
17	List the types of local search algorithms.	CO3	K1
18	Define Genetic algorithms and list the steps.	CO3	K1
19	Give two examples of real-world problems that can be modeled as CSPs.	CO3	K1
20	How does constraint propagation help in reducing the search space?	CO3	K1
	Part – B		
1	Write the algorithms and solve the following using BFS and DFS and list their evaluation criteria. Initial State - a ;Goal State – g 	CO2	K2
2	Explain in detail about Greedy best first search.	CO2	K2
3	Describe the A* Search algorithm with suitable example.	CO2	K2
4	Explain Backtracking search for CSP with example in detail.	CO3	K2
5	Write about Hill climbing algorithm with example in detail.	CO3	K3
6	Explain the algorithm for Simulated annealing in detail.	CO3	K3
7.	Analyze a heuristic function for solving the 8-puzzle problem. Compare and contrast different heuristics.	CO2	K4
8.	Analyze genetic algorithms on the following specifications  **Initialstate**  **Goal state** • **Population size**: 10 individuals	CO3	K4

	• **Maximum generations**: 1000 • **Crossover rate**: 70% (probability of crossover) **Mutation rate**: 5% (probability of mutation)		

UNIT III

QNo	Questions	COs	Bloom's Level
1.	What is First-Order Logic(FOL) and give its basic components?	CO4	K1
2.	Give the role of Interpretation in FOL.	CO4	K1
3.	Write the syntax of Sentence, atomic sentence and complex sentence in Backus Naur Form.	CO4	K2
4.	Define Term and semantics of Term.	CO4	K1
5.	What is the difference between propositional logic and predicate logic?	CO4	K1
6.	Classify the three kinds of Symbols in FOL. Give their examples.	CO4	K2
7.	Give the role of Interpretation in FOL.	CO4	K2
8.	Define Term and semantics of Term.	CO4	K1
9.	Define Quantifiers and list their types.	CO4	K1
10.	Given the atomic sentence "Married(John, Elizabeth)", analyze what this sentence asserts. What does the predicate symbol "Married" represent, and who do the terms "John" and "Elizabeth" refer to?	CO4	K2
11	Define Unification	CO4	K1
12	Analyze the complex sentence "Brother(Richard, John) ∧ King(Richard)". What logical relationship does the conjunction (∧) describe, and when would this sentence be true?	CO4	K2
13	Define Forward chaining .Where is it used?	CO4	K1
14	What are the drawbacks of forward and backward chaining?	CO4	K1
15	What is backward chaining and where is it used?	CO4	K1
16	What is meant by Resolution?	CO4	K1
17	Define the two types of inference rules for quantifiers.	CO4	K2

18	Write FOL for the below sentence "If someone is a mother, then they are a parent."	CO4	K1
19.	Consider the existential quantifier sentence "∃x (Scholar(x) ∧ Teaches(x))". How would this be interpreted in a model where some individuals are scholars and others are teachers?	CO4	K2
20.	Consider the sentence "∃x,y (Loves(x,y) ∧ (x≠y))". What does this statement assert about love between two distinct individuals, and why is the condition x≠y crucial to this expression?	CO4	K2
21	In the kinship domain, suppose the following facts are added to the knowledge base: • TELL(KB, Male(Richard)) • TELL(KB, Female(Elizabeth)) • TELL(KB, Spouse(Richard, Elizabeth)) Now, ask the query: ASK(KB, Husband(Richard, Elizabeth)) Based on the knowledge base, what would be the answer to this query? Tell how the knowledge base evaluates the query.	CO4	K2
22	State the Generalized Modus Ponens rule.	CO4	K2
	Part – B		
1.	In a family structure, you need to represent various relationships, such as parent-child, sibling, and spouse relationships, using **First-Order Logic (FOL)**. Consider the following facts in your knowledge base: **Assertions**: • **Male(John)**: John is male. • **Female(Mary)**: Mary is female. • **Parent(John, Alice)**: John is a parent of Alice. • **Parent(Mary, Alice)**: Mary is a parent of Alice. • **Spouse(John, Mary)**: John and Mary are married. **General Rules**: • **Mother(x, y) ⇔ (Female(x) ∧ Parent(x, y))**: A person x is the mother of y if x is female and x is a parent of y. • **Father(x, y) ⇔ (Male(x) ∧ Parent(x, y))**: A person x is the father of y if x is male and x is a parent of y. • **Sibling(x, y) ⇔ (Parent(p, x) ∧ Parent(p, y) ∧ x ≠ y)**: Two people x and y are siblings if they share at least one parent and are not the same person. i. **Define the predicates** and **write the assertions** in FOL	CO4	K3

	for the given facts and rules. a. Represent gender, parent-child, and spouse relationships. b. Define the **Mother**, **Father**, and **Sibling** predicates using FOL. ii. **Query** the knowledge base using FOL to determine the following: a. Who are Alice's parents? b. Is Alice John's mother or father? c. Who are Alice's siblings? iii. **Extend the knowledge base**: a. Add a new assertion: Parent(John, Bob) and Female(Bob). How does this change the information about Bob's relationships in the knowledge base? b. After adding these new facts, query the knowledge base to find out whether Bob has siblings and, if so, who they are. iv. **Discuss the challenges** in using First-Order Logic (FOL) to represent kinship relationships in a family, specifically focusing on the complexity of representing extended families, handling incomplete information, and reasoning about these relationships.		
2	State the Wumpus world problem and describe how the knowledge base for the Wumpus World would be represented using first-order logic. Specifically: i. Define the predicates that represent the world's state, including agent location, pit location, Wumpus location and percepts. ii. Explain how to represent the perceptions of the agent in terms of logical axioms. Provide a brief explanation of how the knowledge base supports reasoning about safe actions for the agent.	CO4	K2
3	In the process of knowledge engineering for digital circuits, a knowledge engineer is tasked with creating a knowledge base (KB) for a one-bit full adder circuit. The goal is to represent the functionality and structure of the circuit, including the different gates, terminals, and signal values. The full adder consists of:	CO4	K2

	• 3 input terminals (A, B, and Carry-in). • 2 output terminals (Sum and Carry-out). • 2 XOR gates, 2 AND gates, and 1 OR gate. The knowledge base will represent the circuit components and their behaviour using logical predicates. Using the following predicates and functions, write a set of logical assertions to represent the components of the one-bit full adder circuit: • Gate(g): g is a gate. • Type(g, t): gate g is of type t (AND, OR, XOR). • Signal(t): signal value at terminal t. • Connected(t1, t2): terminal t1 is connected to terminal t2. i. Define the components of the circuit (gates, terminals, and their types). ii. Encode the connectivity of the circuit (how gates and terminals are connected). iii. Write the logical axioms for the behavior of the AND, OR, and XOR gates.		
4.	i. Consider a vocabulary with the following symbols: **Occupation(p, o):** ***Predicate***. Person p has occupation o. **Customer (p1, p2):** ***Predicate***. Person p1 is a customer of person p2. **Boss(p1, p2):** ***Predicate***. Person p1 is a boss of person p2. **Doctor , Surgeon, Lawyer , Actor :** ***Constants*** denoting occupations. **Emily, Joe:** ***Constants*** denoting people. Use these symbols to write the following assertions in first- order logic: a. Emily is either a surgeon or a lawyer. b. Joe is an actor, but he also holds another job. c. All surgeons are doctors. d. Joe does not have a lawyer (i.e., is not a customer of any lawyer). e. Emily has a boss who is a lawyer. There exists a lawyer all of whose customers are doctors. g. Every surgeon has a lawyer. ii. Complete the following about logical sentences:	CO4	K2

	a. Translate into *good, natural* English (no xs or ys!): ∀ x, y, l SpeaksLanguage(x, l) ∧ SpeaksLanguage(y, l) ⇒ Understands (x, y) ∧ Understands(y, x). **b.** Explain why this sentence is entailed by the sentence ∀ x, y, l SpeaksLanguage(x, l) ∧ SpeaksLanguage(y, l) ⇒ Understands (x, y). **c.** Translate into first-order logic the following sentences: (i) Understanding leads to friendship. (ii) Friendship is transitive. Define all predicates, functions, and constants you use.		
5.	Consider the following knowledge base: • ∀x (Employee(x) → HasWorkSchedule(x)) • ∀x(HasWorkSchedule(x) → WorksDuringDay(x) ∨ WorksDuringNight(x)) • ∀x(WorksDuringDay(x)→CanAttendMeetings(x)) • ∀x(WorksDuringNight(x)→ CanAttendNightMeetings(x)) • ∀x(CanAttendMeetings(x)→AvailableForTeamBuilding(x)) • ∀x(CanAttendNightMeetings(x)→AvailableForNightTeamBuilding(x)) • ∀x (AvailableForTeamBuilding(x) → TeamPlayer(x)) • ∀x(AvailableForNightTeamBuilding(x)→ NightTeamPlayer(x)) • Employee(Anna) • Employee(John) • Employee(Tom) • WorksDuringDay(Anna) • WorksDuringNight(John) • WorksDuringDay(Tom) Use forward chaining to determine and prove: a. Whether Anna, John, and Tom are "TeamPlayer(x)" or "NightTeamPlayer(x)". b. Show all the intermediate steps of the forward chaining process, deriving facts as you go. c. Clearly explain which facts are used to infer other facts and which rules are applied at each step. d. Conclude the status of each employee (whether they are a "TeamPlayer" or "NightTeamPlayer") based on the knowledge base.	CO4	K4
6.	Consider a first-order logical knowledge base that describes	CO4	K3

	worlds containing people, songs, albums (e.g., "Meet the Beatles") and disks (i.e., particular physical instances of CDs). The vocabulary contains the following symbols: **CopyOf (d, a):** ***Predicate.*** Disk d is a copy of album a. **Owns(p, d):** ***Predicate.*** Person p owns disk d. **Sings(p, s, a):** Album a includes a recording of song s sung by person p. **Wrote(p, s):** Person p wrote song s. **McCartney, Gershwin, BHoliday, Joe, EleanorRigby, TheManILove, Revolver :** ***Constants*** with the obvious meanings. Express the following statements in first-order logic: a. Gershwin wrote "The Man I Love." b. Gershwin did not write "Eleanor Rigby." c. Either Gershwin or McCartney wrote "The Man I Love." d. Joe has written at least one song. e. Joe owns a copy of *Revolver*. f. Every song that McCartney sings on *Revolver* was written by McCartney. g. Gershwin did not write any of the songs on *Revolver*. h. Every song that Gershwin wrote has been recorded on some album. (Possibly different i. songs are recorded on different albums.) j. There is a single album that contains every song that Joe has written. k. Joe owns a copy of an album that has Billie Holiday singing "The Man I Love." l. Joe owns a copy of every album that has a song sung by McCartney. (Of course, each different album is instantiated in a different physical CD.) m. Joe owns a copy of every album on which all the songs are sung by Billie Holiday.		
7.	i. Given the following knowledge base in first-order logic: • ∀x (Human(x) → Mortal(x))	CO4	K4

	• Human (Socrates) Prove the conclusion: Mortal (Socrates). a. Express the given knowledge base and the conclusion in Conjunctive Normal Form (CNF). b. Use the resolution method to prove whether the conclusion Mortal (Socrates) can be inferred from the knowledge base. c. Provide each step of the resolution process, showing how you resolve clauses step by step. d. Conclude whether the resolution proves the statement Mortal (Socrates) is valid. ii. Given the following knowledge base in first-order logic: • ∀x (Loves (x, y) → Loves (y, x)) • Loves (John, Mary) • ¬Loves (Mary, John) Determine whether the knowledge base is consistent. a. Convert the knowledge base into Conjunctive Normal Form (CNF). b. Use the resolution method to check if the knowledge base leads to a contradiction (i.e., unsatisfiability). c. Show each resolution step explicitly, demonstrating how unification is used to combine clauses and deduce whether a contradiction exists. d. State whether the knowledge base is consistent or not based on the resolution process.		
8.	Describe backward chaining and apply it for the following knowledge base: • ∀x (Athlete(x) → CanRun(x)) • ∀x (CanRun(x) → CanCompete(x)) • ∀x (CanCompete(x) → WinsMedals(x)) • ∀x (CanCompete(x) → NeedsTraining(x)) • ∀x (NeedsTraining(x) → HasCoach(x)) • Athlete(Michael) • Athlete(Jane) • HasCoach(Michael)	CO4	K2

	a. Use backward chaining to determine if Michael **WinsMedals**. b. Use backward chaining to determine if Jane **HasCoach**. c. Use backward chaining to determine if Jane **CanRun**. d. For each individual, show the steps you take to achieve the goals, listing the facts and rules applied, and explain why the backward chaining process leads to the given conclusions.		

KCG
COLLEGE OF TECHNOLOGY
AFFILIATED TO ANNA UNIVERSITY | AUTONOMOUS

UNIT IV

QNo	Questions	COs	Bloom's Level
1	What is the primary purpose of ontological engineering?	CO5	K1
2	List the difference between upper ontologies and domain-specific ontologies.	CO5	K2
3	What is a general-purpose ontology?	CO5	K1
4	Define the term "ontology" in the context of knowledge representation.	CO5	K1
5	How can ontological engineering be applied in a complex system like diagnosing a malfunction in a robot?	CO5	K2
6	How does ontological engineering help unify various areas of knowledge?	CO5	K2
7	What is a category in knowledge representation?	CO5	K1
8	Define inheritance in categories with an example.	CO5	K1
9	How does a taxonomy help organize categories in knowledge representation?	CO5	K2
10	What is the difference between discrete events and liquid (continuous) events in event calculus?	CO5	K2
11	What does the predicate Happens(e, i) represent in event calculus?	CO5	K1
12	What is the main objective of modeling mental objects and mental processes within intelligent agents?	CO5	K2
13	What is a propositional attitude, and how does it relate to an agent's reasoning process?	CO5	K2
14	Explain the difference between "knows" and "believes" in terms of propositional attitudes.	CO5	K2
15	What is modal logic, and how is it used to reason about knowledge and beliefs?	CO5	K2
16	What is the concept of logical omniscience, and why is it considered unrealistic for intelligent agents?	CO5	K2
17	How does inheritance work in semantic networks?	CO5	K2
18	Given the modal logic formula KLois[CanFly(Superman)], provide its meaning.	CO5	K2
19	How could an intelligent agent use propositional attitudes to reason about whether to ask another agent for help?	CO5	K2
20	If an agent knows that P implies Q, and knows P, what can we deduce about the agent's knowledge? Use the Deduction Axiom.	CO5	K2

21	How can the concept of "default reasoning" be applied when an agent assumes a car has four wheels until proven otherwise?	CO5	K2
22	If an agent believes that “birds fly” by default but encounters an exception where a bird cannot fly, how should the agent update its knowledge using default logic?	CO5	K2
23	How would a Truth Maintenance System (TMS) handle a situation where a belief is retracted and leads to the removal of other related conclusions?	CO5	K2
24	Given a semantic network where “John ∈ Person” and “Person ∈ Mammal,” how would you infer that John is a mammal?	CO5	K2
	Part – B		
1	Elaborate the representation of Categories in First order logic with suitable examples.	CO5	K2
2	Describe Mental Events and show how agents reason about and manipulate mental objects.	CO5	K2
3	Give Short notes on the two key approaches to organizing and reasoning about categories in knowledge representation.	CO5	K2
4	Discuss the role of default information in reasoning processes.	CO5	K2
5	Consider the Intelligent personal assistant that can autonomously categorize and process different types of user requests. The system needs to reason about categories (e.g., 'appointments', 'emails', 'reminders') and specific objects within those categories. i. Explain the way you would implement an ontology that allows the system to effectively distinguish between events (e.g., 'meeting' vs. 'reminder') and mental events (e.g., 'intent to schedule' vs. 'remembering a task')? ii. Discuss how reasoning systems for categories could support the assistant in making decisions and handling default information when faced with incomplete or uncertain data.	CO5	K2
6	Consider a healthcare diagnosis system, it’s essential to reason about medical conditions, symptoms, treatments, and patient history. The system needs to identify categories (e.g., 'diseases', 'symptoms', 'medications') and objects (e.g., 'patient', 'symptom severity'). Additionally, the system must handle events (e.g., 'new symptom onset') and mental events (e.g., 'diagnosis uncertainty' or 'doctor's confidence').	CO5	K2

	Explain the process of designing an ontological model for this system, and how can reasoning with default information support the system's decision-making process, especially when faced with default assumptions or conflicting data.		

KCG
COLLEGE OF TECHNOLOGY
AFFILIATED TO ANNA UNIVERSITY | AUTONOMOUS

UNIT V

QNo	Questions	COs	Bloom's Level
1	List the components of intelligent agent architecture.	CO6	K1
2	How does the layered architecture in intelligent agents help in decision-making?	CO6	K1
3	What role does perception play in the architecture of intelligent agents?	CO6	K1
4	Define the difference between a reactive and a deliberative agent architecture.	CO6	K1
5	List the role of a "blackboard architecture" in multi-agent systems.	CO6	K1
6	What is the role of a "belief-desire-intention" (BDI) model in intelligent agent architecture?	CO6	K1
7	What is the purpose of agent communication languages (ACL) in multi-agent systems?	CO6	K1
8	Enumerate how agent communication supports cooperation between agents.	CO6	K1
9	Give the difference between synchronous and asynchronous communication in agents.	CO6	K1
10	What is the role of a communicative act in agent communication?	CO6	K1
11	How does FIPA (Foundation for Intelligent Physical Agents)impact agent communication protocols?	CO6	K1
12	Give an example of a scenario where agent communication is critical for system efficiency.	CO6	K1
13	Write the importance of negotiation in multi-agent systems.	CO6	K1
14	What is the difference between distributive and integrative negotiation in multi-agent systems?	CO6	K1
15	How does the concept of bargaining power affect negotiation outcomes between agents?	CO6	K1
16	Give few points about a common strategy used by agents in negotiation scenarios.	CO6	K1
17	What are the main challenges agents face during negotiation in dynamic environments?	CO6	K1
18	How can agents use communication to enhance bargaining outcomes?	CO6	K1
19	How does argumentation contribute to decision-making in multi-agent systems?	CO6	K1
20	What is the difference between formal and informal argumentation in multi-agent systems?	CO6	K1
	Part – B		
1	Compare and contrast reactive and deliberative architectures in intelligent agents, giving examples of each.	CO6	K2
2.	Explain the importance of the BDI (Belief-Desire-Intention) model in intelligent agent architecture and its applications in multi-agent systems .	CO6	K2
3.	Explain the concept of a layered architecture in intelligent agents. Discuss how each layer interacts to	CO6	K2

	support decision- making and behavior in a multi-agent system.		
4.	Describe the role of Agent Communication Languages (ACLs) in multi-agent systems. How do ACLs facilitate agent coordination and cooperation?	CO6	K2
5.	Discuss the challenges involved in agent communication in dynamic environments and propose solutions that could improve communication efficiency in these scenarios.	CO6	K2
6.	Explain the significance of communication protocols like FIPA in agent systems, and analyze their role in standardizing agent interaction.	CO6	K2
7.	Explain the concept of negotiation in multi-agent systems and discuss how agents can use different negotiation strategies to reach mutually beneficial outcomes.	CO6	K2
8.	Compare distributive and integrative negotiation in multi-agent systems. Discuss the conditions under which each strategy would be most effective.	CO6	K2
9.	Describe how argumentation can be used to resolve conflicts between agents in a multi-agent system. Discuss the advantages of argumentation over traditional negotiation in conflict resolution.	CO6	K2
10.	Discuss the role of trust and reputation in multi-agent systems. How do agents use trust models to assess the reliability of other agents in a cooperative environment?	CO6	K2

Course Coordinator HoD Chief Auditor