CBCS SCHEME

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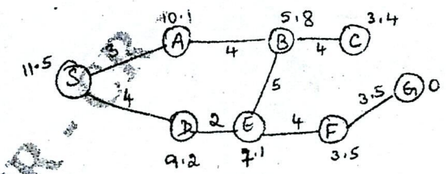
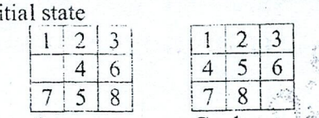
BCS515B

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Artificial Intelligence

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.	Explain Alan Turing's significant contribution to artificial intelligence and give a brief introduction to the Turing Test in AI.	10	L2	CO1
	b.	Define agent, agent function and agent program. Explain with a neat diagram how agent interacts with environment through sensors and actuators.	10	L1	CO1
		OR			
Q.2	a.	List the types of Agents. Explain Goal Based and utility based agent with neat diagram.	10	L2	CO1
	b.	Compare and contrast between i) Deterministic and Stochastic ii) Static and Dynamic iii) Episodic and Sequential iv) Fully observable and partially observable. Give example for each of the nature of environment given above.	10	L2	CO1
		Module – 2			
Q.3	a.	Explain the tree search and graph search algorithms.	10	L2	CO2
	b.	Explain problems solving agents along with algorithm and illustrate the incremental formulation of 8-Queens problem.	10	L2	CO2
		OR			
Q.4	a.	List and explain the criteria to measure the performance of search strategies.	10	L2	CO2
	b.	Explain Breadth first search technique as a problem solving strategy with its benefits and shortcomings.	10	L2	CO2
		Module – 3			
Q.5	a.	Explain A* algorithm for shortest path and apply the same for the below graph.  Fig Q5(a)	10	L3	CO3

	b.	Apply heuristic search algorithm on the given 8 puzzle problem to reach the goal state from the initial state  	10	L3	CO3
		OR			
Q.6	a.	Define knowledge based agent. Outline the knowledge based agent program.	10	L1	CO3
	b.	Define Propositional Logic. Explain syntax and semantics.	10	L1	CO3
		Module – 4			
Q.7	a.	Explain first order logic with its syntax in BNF form.	10	L2	CO4
	b.	Explain Quantifiers. Differentiate between Universal and Existential Quantifier.	10	L2	CO4
		OR			
Q.8	a.	Illustrate Kinship Domain with an example.	10	L2	CO4
	b.	Illustrate unification algorithm used for reasoning with example.	10	L2	CO4
		Module – 5			
Q.9	a.	Outline the backward chaining algorithm for definite clauses. Construct a proof tree to prove that "west is a criminal".	10	L2	CO5
	b.	Apply Resolution for "west is a criminal" and "curiosity killed the cat" example.	10	L3	CO5
		OR			
Q.10	a.	Define Planning. Explain block world problem for the following start state and End state.  	10	L2	CO5
	b.	Illustrate how planning graph data structure can be used to give a better heuristic for a planning problem.	10	L2	CO5

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VTU BCS515B - Artificial Intelligence

Complete Detailed Solutions (Dec 2025 / Jan 2026)

MODULE 1

Q1(a) Turing's Contribution to AI

Alan Turing introduced the Turing Machine (1936), which formalized computation and laid the foundation of computer science. In 1950, he proposed the Turing Test in his paper 'Computing Machinery and Intelligence'. The test evaluates whether a machine can exhibit intelligent behavior indistinguishable from a human through conversation. If a judge cannot reliably distinguish between human and machine responses, the machine is said to demonstrate intelligence.

Q1(b) Agent, Agent Function, Agent Program

An Agent is an entity that perceives its environment using sensors and acts upon that environment using actuators. Agent Function maps percept history to actions: f: P* $\rightarrow$ A. Agent Program is the implementation of the agent function running on a physical architecture.

Q2(a) Types of Agents

1. Simple Reflex Agent – Acts on current percept. 2. Model-Based Agent – Maintains internal state. 3. Goal-Based Agent – Acts to achieve goals. 4. Utility-Based Agent – Maximizes utility. 5. Learning Agent – Improves performance over time.

Environment Types: Deterministic vs Stochastic, Static vs Dynamic, Episodic vs Sequential, Fully Observable vs Partially Observable.

MODULE 2

Q3(a) Tree Search vs Graph Search

Tree Search does not store explored states and may revisit nodes. Graph Search stores explored states to avoid repetition. Graph search is more memory intensive but avoids infinite loops.

Q4(a) Performance Measures of Search

1. Completeness – Finds solution if exists. 2. Optimality – Finds best solution. 3. Time Complexity – Nodes generated. 4. Space Complexity – Memory used.

Breadth First Search (BFS)

BFS expands nodes level by level using a FIFO queue. Complete and optimal for unit step cost. Time & Space Complexity: O(b^d).

MODULE 3

Q5(a) A* Algorithm

A* evaluation function: f(n) = g(n) + h(n). g(n) = path cost from start to n. h(n) = heuristic estimate to goal. If heuristic is admissible and consistent, A* is optimal.

Algorithm: 1. Initialize OPEN with start node. 2. Loop until goal found: - Select node with minimum f(n). - Expand node. - Update costs. 3. Return optimal path.

MODULE 4

Q6(a) Knowledge-Based Agent

A knowledge-based agent contains: 1. Knowledge Base (facts + rules) 2. Inference Engine 3. Percept processing 4. Action selection Agent cycle: TELL(KB, percept) ASK(KB, query) Execute action

Q6(b) Propositional Logic

Syntax: Symbols, Connectives (¬, ∧, ∨, →, ↔). Semantics: Truth assignments. Entailment: KB ■ α means α is true in all models of KB.

Q7 Quantifiers

Universal (∀): True for all objects. Existential (∃): True for at least one object.

Unification

Unification finds substitution θ such that two expressions match. Example: Loves(x, y) and Loves(John, Mary) θ = {x/John, y/Mary}

MODULE 5

Backward Chaining

Goal-driven inference method. Start with goal → Find rules that conclude goal → Recursively prove premises.

Resolution Method

1. Convert sentences to CNF. 2. Apply resolution rule. 3. Derive empty clause → contradiction → proof complete.

Planning and Block World

Planning involves: Initial State, Goal State, Actions with Preconditions and Effects. Block World Example: Initial: On(A,B), On(B,Table) Goal: On(B,A) Use STRIPS operators to achieve goal.

Planning Graph improves heuristic estimation by building alternating layers of propositions and actions.