

25MAMT401	INTELLIGENT AGENTS AND EXPERT SYSTEMS	Category	L	T	P	R	Credit	Year of Introduction
		VAC	4	0	0	0	4	2025

Preamble: This course provides an in-depth understanding of intelligent agents and expert systems, emphasizing agent rationality, reasoning under uncertainty, learning-enabled adaptation, and knowledge-based system design. The course bridges classical AI foundations and modern intelligent decision-making systems.

Prerequisite: DCM 205 Discrete Mathematics, ALP 105 Algorithm Thinking Python

Course Outcomes: After the completion of the course, the student will be able to:

CO	Course Outcomes	Knowledge Level
CO 1	Explain intelligent agent concepts, environments, and architectures to understand rational behavior in intelligent systems.	K2 Understand
CO 2	Apply knowledge representation and reasoning techniques to construct rule-based expert system solutions.	K3 Apply
CO 3	Explain learning and adaptation mechanisms in intelligent agents and apply them to improve system performance.	K3 Apply
CO 4	Apply expert system and hybrid intelligent system principles to solve real-world decision-support problems.	K3 Apply

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	-	1	-	-
CO2	3	2	2	2	-	-	-	-	-	-	2	-	-
CO3	2	2	1	2	-	-	-	-	-	-	2	-	-
CO4	3	2	3	2	-	-	-	-	-	-	3	-	-
Avg	2.50	1.75	1.75	1.75	-	-	-	-	-	-	2.00	-	-

Mapping of course outcomes with Knowledge and Attitude Profile (WK)

	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	*	*	*	*	*			*	
CO2	*	*	*	*	*			*	
CO3	*	*	*	*	*			*	
CO4	*	*	*	*	*			*	

Wks Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*		*	*	*			*	

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	40	60	2.5 hrs

Continuous Internal Evaluation Pattern:

Attendance	: 5 marks
Continuous Assessment Test	: 20 marks
Continuous Assessment Assignment	: 15 marks

SYLLABUS

Module 1 (12 hrs)

Intelligence as rational action and goal-directed behavior. Historical evolution of intelligent systems and agent-based AI. Intelligent agents vs traditional software systems. Agent environments: observability, determinism, episodic vs sequential, static vs dynamic. Agent architectures: simple reflex, model-based, goal-based, and utility-based agents. Performance measures and rationality. Contemporary applications of intelligent agents in autonomous and decision-support systems.

Module 2 (15 hrs)

Nature and role of knowledge in expert systems. Formal knowledge representation models: Propositional and predicate logic foundations, Production systems and rule conflict resolution, Ontologies and semantic modelling. Reasoning mechanisms: Soundness and completeness of inference, Rule-based inference strategies. Constraint-based and heuristic reasoning. Uncertainty handling in expert systems. Explanation and justification of intelligent decisions.

Module 3 (15 hrs)

Learning as adaptive improvement in intelligent agents. Search, optimization, and hypothesis refinement. Knowledge revision and belief updating. Agent–environment interaction and reward-driven adaptation. Feedback loops and self-improving systems. Stability, convergence, and performance trade-offs. Role of experience and data in adaptive intelligent behavior.

Module 4 (14 hrs)

Expert system architecture and development life cycle. Knowledge acquisition bottleneck and elicitation techniques. Inference engines: control strategies and execution models. Explanation facilities and user trust. Agent-based expert systems. Hybrid intelligent systems: Symbolic reasoning combined with learning-based models. Motivation for hybridization in complex environments. Case studies in healthcare diagnostics, industrial decision systems, and intelligent advisory platforms.

Text Books:

1. Luger, G. F. (2009). *Artificial intelligence: Structures and strategies for complex problem solving* (6th ed.). Pearson Education.
2. Russell, S., & Norvig, P. (2021). *Artificial intelligence: A modern approach* (4th ed.). Pearson Education.
3. Negnevitsky, M. (2011). *Artificial intelligence: A guide to intelligent systems* (3rd ed.). Pearson Education.

Reference Books:

1. Giarratano, J. C., & Riley, G. D. (2005). *Expert systems: Principles and programming* (4th ed.). Thomson Course Technology.
2. Poole, D. L., & Mackworth, A. K. (2017). *Artificial intelligence: Foundations of computational agents* (2nd ed.). Cambridge University Press.
3. Nilsson, N. J. (1998). *Artificial intelligence: A new synthesis*. Morgan Kaufmann.

END SEMESTER EXAMINATION – MODEL QUESTION PAPER

Course Code	25MAMT401
Course Name	INTELLIGENT AGENTS AND EXPERT SYSTEMS
Max. Marks: 60	Duration: 2.5 Hours

Part A (Answer all questions. Each question carries 3 marks)				
Qn No	Question	Marks	CO	BL
1.	Explain intelligent agents vs traditional software systems with examples.	3	CO1	L2
2.	Describe agent architectures: simple reflex, model-based, goal-based, and utility-based agents.	3	CO1	L2
3.	Explain propositional and predicate logic as knowledge representation models in expert systems.	3	CO2	L2
4.	Describe uncertainty handling mechanisms in expert systems.	3	CO2	L2
5.	Explain search and hypothesis refinement as learning mechanisms in intelligent agents.	3	CO3	L2
6.	Describe stability, convergence, and performance trade-offs in intelligent agent learning.	3	CO3	L2
7.	Explain the expert system architecture and development life	3	CO4	L2

	cycle.			
8.	Describe a case study of hybrid intelligent systems in healthcare diagnostics.	3	CO4	L3

Part B (Answer any one full question from each Module. Each carry 9 marks)				
Qn No.	Question	Marks	CO	BL
Module I				
9.a	Explain agent environments: observability, determinism, episodic vs sequential, and static vs dynamic. Describe performance measures and rationality.	5	CO1	L2
9.b	Describe the contemporary applications of intelligent agents in autonomous and decision-support systems.	4	CO1	L2
OR				
10	Explain intelligence as rational action and goal-directed behavior. Compare intelligent agents and traditional software systems with suitable examples.	9	CO1	L2
Module II				
11.a	Explain production systems, rule conflict resolution, ontologies, and semantic modelling in expert systems.	5	CO2	L2
11.b	Describe constraint-based and heuristic reasoning. Explain how uncertainty is handled in expert systems.	4	CO2	L3
OR				
12	Explain the soundness and completeness of inference and rule-based inference strategies. Discuss explanation and justification of intelligent decisions.	9	CO2	L2
Module III				
13	Explain learning as adaptive improvement in intelligent agents. Describe agent-environment interaction, reward-driven adaptation, and the role of feedback loops in self-improving systems.	9	CO3	L2
OR				
14.a	Explain knowledge revision and belief updating in intelligent agents with examples.	5	CO3	L2
14.b	Describe the role of experience and data in adaptive intelligent behavior.	4	CO3	L3
Module IV				

15.a	Explain inference engines: control strategies and execution models. Describe explanation facilities and user trust in expert systems.	5	CO4	L2
15.b	Describe hybrid intelligent systems: symbolic reasoning combined with learning-based models. Explain the motivation for hybridization in complex environments.	4	CO4	L3
OR				
16	Explain the knowledge acquisition bottleneck and elicitation techniques. Discuss case studies in healthcare diagnostics and industrial decision systems.	9	CO4	L3