



Sri Indu

College of Engineering & Technology

UGC Autonomous Institution

Recognized under 2(f) & 12(B) of UGC Act 1956,

NAAC, Approved by AICTE &

Permanently Affiliated to JNTUH



NAAC
NATIONAL ASSESSMENT AND
ACCREDITATION COUNCIL



HANDOUT

IV Year I Semester

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

ACADEMIC YEAR 2025-2026

EXPERT SYSTEMS

SYLLABUS

BR22 – B.TECH. – CSE(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)				
SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY				
(An Autonomous Institution under UGC, New Delhi)				
B.Tech. - IV Year – I Semester		L	T	P
		3	0	0
Professional Elective – IV				
(R22AID4144) EXPERT SYSTEMS				
Course Objectives: 1. Understand the basic techniques of artificial intelligence. 2. Understand the Non-monotonic reasoning and statistical reasoning. Course Outcomes: 1. Apply the basic techniques of artificial intelligence. 2. Discuss the architecture of an expert system and its tools. 3. Understand the importance of building an expert systems. 4. Understand various problems with an expert systems. UNIT - I Introduction to AI programming languages, Blind search strategies, Breadth-first – Depth-first – Heuristic search techniques Hill Climbing – Best first – A Algorithms AO* algorithm – game trees, Min- max algorithms, game playing – Alpha-beta pruning. UNIT - II Knowledge representation issues predicate logic – logic programming Semantic nets- frames and inheritance, constraint propagation; Representing Knowledge using rules, Rules-based deduction systems. UNIT - III Introduction to Expert Systems, Architecture of expert systems, Representation and organization of knowledge, Basics characteristics, and types of problems handled by expert systems. UNIT - IV Expert System Tools: Techniques of knowledge representations in expert systems, knowledge engineering, system-building aids, support facilities, stages in the development of expert systems. UNIT - V Building an Expert System: Expert system development, Selection of the tool, Acquiring Knowledge, Building process. Problems with Expert Systems: Difficulties, common pitfalls in planning, dealing with domain experts, difficulties during development. TEXT BOOKS: 1. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw-Hill, New Delhi. 2. Waterman D.A., “A Guide to Expert Systems”, Addison Wesley Longman. REFERENCE BOOKS: 1. Stuart Russel and other Peter Norvig, “Artificial Intelligence – A Modern Approach”, Prentice-Hall. 2. Patrick Henry Winston, “Artificial Intelligence”, Addison Wesley. 3. Patterson, Artificial Intelligence & Expert System, Prentice Hall India, 1999. 4. Hayes-Roth, Lenat, and Waterman: Building Expert Systems, Addison Wesley. 5. Weiss S.M. and Kulikowski C.A., “A Practical Guide to Designing Expert Systems”, Rowman & Allanheld, New Jersey.				
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	SRI INDU COLLEGE OF ENGG & TECHLESSONPLAN (Regulation :R22) Department of AIML			Prepared onRev1: Page:1 of 3
	Sub.Code &Title	R22AID4144 & Expert Systems		
	AcademicYear:2025-26	Year/Sem	IV/I	
	Faculty Name &Designation	M. SWATHI REDDY, ASSTPROF.		

Unit/Item No.	Topic(s)	Book Reference	Page(s)		Teaching Methodology	Proposed No.of Periods	Actual Date of Handled	CO/RBT
			From	To				
UNIT I								
I	Introduction to AI programming languages					12		
1.1	Introduction AI	T1	4	7	Black board	01		CO1/L1
1.2	Introduction to AI programming languages	T1	7	10	Black board	01		CO1/L3
1.3	Blind search strategies	T1	25	30	Black board	03		CO1/L2
1.4	Breadth-first – Depth-first	T1	50	72	Black board	01		CO1/L1
1.5	Heuristic search techniques	T1	50	72	Black board	03		CO1/L2
1.6	Hill Climbing – Best first	T1	52	60	Black board	01		CO1/L3
1.7	A Algorithms AO* algorithm	T1	60	64	Black board	02		CO1/L3
1.8	game tress	T1	68	72	Black board	02		CO1/L3
1.9	Min- max algorithms	T1	233	236	Black board	01		CO1/L3
1.10	game playing – Alpha-beta pruning.	T1	236	240	Black board	02		CO1/L3
Review		Signature of the HOD/Coordinator						
Unit/Item No.	Topic(s)	Book Reference	Page(s)		Teaching Methodology	Proposed No.of Periods	Actual Date of Handled	CO/RBT
			From	To				
UNIT-II								
II	Knowledge representation					12		
2.1	Introduction	T1	79	82	Black board	01		CO2/L1
2.2	Knowledge representation issues	T1	86	96	Black board	01		CO2/L2
2.3	predicate logic	T1	99	103	Black board	01		CO2/L1
2.4	logic programming Semantic nets - frames	T1	188	200	Black board	02		CO2/L2
2.5	inheritance	T1	150	157	Black board	02		CO2/L3
2.6	constraint propagation	T1	138	142	Presentation	03		CO2/L6
2.7	Representing Knowledge using rules	T1	129	134	Black board	02		CO2/L4
2.8	Rules-based deduction systems	T1	174	179	Black board	01		CO2/L4

	SRI INDU COLLEGE OF ENGG & TECH LESSON PLAN (Regulation :R22) Department of AIML						Prepared on Rev1: Page:2 of 3		
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	Academic Year:2025-26			Year/Sem			IV/I		
	Faculty Name & Designation			M. SWATHI REDDY, ASST PROF.					
Review			Signature of the HOD/Coordinator						
Unit/I tem no	Topic(s)	Book Referenc e	Page(s)		Teaching Methodolog y	Proposed No.of Periods	Actual Date of Handled	CO/RBT	
			From	To					
UNIT III									
III	Introduction to Expert Systems					14			
3.1	Introduction	T2	1	12	Black board	02		CO3/L2	
3.2	Architecture of expert systems	R1	5	15	Black board	02		CO3/L1	
3.3	Representation of Knowledge	T1	129	134	Black board	01		CO3/L4	
3.4	organization of knowledge	T1	135	140	Black board	02		CO3/L3	
3.5	Basics characteristics	T1	142	160	Black board	02		CO4/L2	
3.6	types of problems	R1	20	32	Black board	02		CO4/L4	
3.7	problems handled by expert systems	R1	32	39	Black board	01		CO4/L2	
Review			Signature of the HOD/Coordinator						
Unit/Ite mno	Topic(s)	Book Referenc e	Page(s)		Teaching Methodolog y	Proposed No.of periods	Actual Date of Handled	CO/RBT	
			From	To					
UNIT IV									
IV	Expert System Tools					13			
4.1	Introduction	T2	80	96	Black board	01		CO5/L1	
4.2	Techniques of knowledge representations in ES	T1	97	105	Black board	02		CO5/L2	
4.3	Knowledge engineering	T1	86	95	Black board	02		CO5/L3	
4.4	system-building aids	T2	135	141	Black board	03		CO5/L3	
4.5	support facilities	T2	150	159	Black board	02			
4.6	stages in the development of expert systems	T1	160	168	Black board	03			
Review			Signature of the HOD/Coordinator						

LIST OF TEXT BOOKS AND REFERENCES

TEXTBOOKS:

- T1. Elain Rich and Kevin Knight, —Artificial Intelligencel, Tata McGraw-Hill, New Delhi
T2. Waterman D.A., —A Guide to Expert Systemsll, Addison Wesley Longman

REFERENCEBOOKS:

1. Patrick Henry Winston, —Artificial Intelligencel, Addison Wesley Martin
2. Patterson, Artificial Intelligence & Expert System, Prentice Hall India, 1999.

WEB LINK:

<https://www.youtube.com/watch?v=9CGpoOQSU5w>

<https://www.youtube.com/watch?v=s8awRI6bwJo>

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LIST OF POWERPOINT PRESENTATION

S No	Topic Name	No. Of Slides
1	Expert Systems	21 Slides(PPT1)
2	Knowledge Acquisition	8 Slides(PPT2)

Batch. No	Assignment Questions	Register Number	Course outcome	Level
1.	1. Discuss the Breadth First Search technique with the help of an example. 2. Explain the adoption of Alpha-Beta pruning for a two player in detail. 3. Differentiate propositional & predicate logic. 4. Explain in detail about frames representation. 5. Write short notes on Expert systems?	22D41A6601 To 22D41A6605	CO1 CO1 CO2 CO2 CO3	2 4 2 2 1
2.	1. Write the limitations of DFS and BFS strategies? 2. Explain in detail about A* algorithm. 3. State Representation of facts in predicate logic? 4. Explain Rule-Based deduction systems. 5. Explain the various stages of expert system development?	22D41A6606 To 22D41A6612	CO1 CO1 CO2 CO2 CO3	1 4 5 2 2
3.	1. Discuss the following heuristic search techniques. Explain the algorithm with the help of an example. Best-first search 2. What is game Tree, Explain with one Algorithm? 3. What are frames? How do they differ from semantic nets. 4. Discuss about Knowledge Representation Issues in detail. 5. Write short notes on Expert systems?	22D41A6613 To 22D41A6617	CO1 CO1 CO2 CO2 CO3	2 3 1 2 1

4	1. What is uninformed search? What are the various types of uninformed search algorithms? 2. Illustrate the Blind search strategies? 3. Discuss about Knowledge Representation Issues in detail 4. Define syntactic analysis with an example? 5. What is the use of expert system building tool	22D41A6618 To 22D41A6622	CO1 CO1 CO2 CO2 CO3	1 5 2 2 3
5	1.ExplainA*Algorithm.		CO1	4

	2. How the Alpha-Beta pruning algorithm works?	22D41A6623 To	CO1	2
	3. Define FOL with an example.	22D41A6627	CO2	1
	4. Write short notes on constrain Propagation.		CO2	1
	5.What is the role of user interface in Expert systems?		CO3	2
6.	1. Differentiate between Exhaustive Search and Heuristic search?	22D41A6628 To	CO1	4
	2. What is Min-Max algorithm? Explain the working of Min-Max algorithm.	22D41A6632	CO1	3
	3. Write short notes on Inheritance?		CO2	4
	4. Explain in detail about semantic nets with its types and application with suitable examples.		CO2	3
	5. Explain the role of knowledge engineer?		CO3	3
7.	1. Discuss the Breadth First Search technique with the help of an example.	22D41A6633 To 22D41A6637	CO1	2
	2. How many types of Heuristic searches?		CO1	2
	3. Explain Semantic net with an example.		CO2	4
	4. Explain in detail about frames representation		CO2	2
	5. Write short notes on Expert systems?		CO3	1
8	1. Write the limitations of DFS and BFS strategies?	22D41A6638 to 22D41A6642	CO1	1
	2. What is Heuristic search technique? Explain the algorithm with the help of Hill climbing?		CO1	2
	3. Write short notes on Inheritance.		CO2	3
	4. Explain in detail about frames representation.		CO2	2
	5. Differentiate Expert and Non-expert?		CO3	4

9	1. Discuss the Depth First Search technique with the help of an example.	22D41A6643 To 22D41A6647	CO1	2
	2. Explain the adoption of Alpha-Beta pruning for a two player in detail.		CO1	2
	3. Write short notes on Rule-Based deduction systems.		CO2	1
	4. State Representation of facts in predicate logic?		CO2	5
	5. Define knowledge base.		CO3	1
10.	1. What is Heuristic search technique? Explain the algorithm with the help of Hill climbing?	22D41A6648 to 22D41A6652	CO1	2
	2. Explain the AO* Algorithm?		CO1	3
	3. What are various techniques to represent the knowledge?		CO2	1
	4. What are the rules to representing knowledge?		CO2	5
	5. Write the advantages of Expert systems		CO3	1
11.	1. Write the advantages of Expert systems.	22D41A6653 To 22D41A6657	CO1	5
	2. How the Alpha-Beta pruning algorithm works?		CO1	2
	3. Define syntactic analysis with an example?		CO2	2
	4. Differentiate propositional & predicate logic.		CO2	4
	5. What are the limitations of Expert systems?		CO3	1
12.	1. What is game Tree, Explain with one Algorithm?	22D41A6658 to 22D41A6662	CO1	3
	2. What is Exhaustive and Heuristic search techniques, Explain with example?		CO1	1
	3. Define FOL with an example.		CO2	1
	4. Explain Rule-Based deduction systems		CO2	2
	5. With an Architectural diagram explain how expert systems works?		CO3	2
13.	1. How many types of Heuristic searches?	22D41A6663 to 22D41A6664 & 23D45A6601 To 23D45A6603	CO1	2
	2. What are the limitations of Min-Max algorithm?		CO1	1
	3. Write short notes on Inheritance.		CO2	4
	4. Explain Rule-Based deduction systems.		CO2	2
	5. Design an expert system for travel recommendation and discuss its roles.		CO3	5

14.	1. Differentiate between inflectional and derivational based Morphology	23D45A6604 to 23D45A6606	CO1	4
	2. Write a summery on Natural Language Processing.		CO1	6
	3. Briefly explain various parsing algorithms.		CO2	5
	4. What multilingual issues are faced in syntax analysis?		CO2	3
	5. What are the applications of semantic parser?		CO3	1

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QUESTION BANK WITH BLOOMS TAXONOMY LEVEL (BTL)

(1. Remembering 2. Understanding 3. Applying 4. Analyzing 5. Evaluating 6. Creating)

UNIT I			
Multiple Choice Questions		BT Level	Course Outcome
#1C-1	Which of the following is commonly used for AI programming due to its symbolic processing capabilities? a) C++ b) Prolog c) JavaScript d) HTML	1	C01
#1C-2	Which programming language is known for its extensive libraries and support in AI and machine learning? a) Python b) COBOL c) BASIC d) Pascal	4	C01
#1C-3	What is a key characteristic of blind search strategies? a) Use domain-specific knowledge b) Do not use any domain knowledge c) Use heuristic functions d) Optimize based on cost	3	C01
#1C-4	Which of the following is a blind search algorithm? a) A* Search b) Hill Climbing c) Breadth-First Search d) Best-First Search	1	C01
#1C-5	In Breadth-First Search (BFS), nodes are expanded based on: a) Depth level from the root b) Heuristic values c) Cost from the start node d) Random order	3	C01
#1C-6	Depth-First Search (DFS) uses which data structure typically? a) Queue b) Stack c) Priority Queue d) Hash Table	2	C01
#1C-7	Which search technique uses an evaluation function to choose the next node? a) Blind search	1	C01

	b) Heuristic search c) BFS d) DFS		
#1C-8	Hill Climbing search is prone to which problem? a) Exhaustive search b) Getting stuck in local maxima c) Infinite loops in trees d) Using excessive memory	6	C01
#1C-9	Best-First Search chooses the next node based on: a) The node closest to the start b) The node with the best heuristic estimate c) The node deepest in the tree d) The node with the highest cost so far	2	C01
#1C-10	What does the A algorithm combine in its evaluation function?* a) Only the cost from the start node b) Only the heuristic estimate to the goal c) The cost from the start node plus the heuristic estimate to the goal d) Random selection of nodes	1	C01
#1C-11	The AO algorithm is used primarily for:* a) Searching in graphs without cycles b) Searching AND-OR graphs with multiple sub problems c) Solving shortest path problems only d) Simple blind search	1	C01
#1C-12	The Minimax algorithm is used in: a) Uninformed search problems b) Single-player games c) Two-player zero-sum games d) Optimization problems only	2	C01
#1C-13	Alpha-beta pruning helps to: a) Increase the number of nodes evaluated b) Decrease the number of nodes evaluated without affecting the result c) Ignore opponent moves d) Simplify heuristic evaluation	3	C01
#1C-14	In a game tree, the MAX player tries to: a) Minimize the score b) Maximize the score c) Randomly select moves d) Avoid pruning	1	C01
#1C-15	What is the primary purpose of the evaluation function in game playing AI? a) To decide the next move based on the entire game tree b) To estimate the utility of a game state without exploring the full tree c) To store previous moves d) To generate random moves	4	C01

	Filling The Blank Questions		
1F-1	_____ and Prolog are two major programming languages used in artificial intelligence.	2	C01
1F-2	_____ search explores all possible nodes at the present depth before moving to the next level.	4	C01
1F-3	_____ search follows a single branch of the tree as deep as possible before backtracking.	1	C01
1F-4	In blind search, the search is done _____ any domain-specific knowledge.	1	C01
1F -5	_____ search strategies use problem-specific knowledge to find	3	C01

	solutions more efficiently.		
1F -6	In _____ climbing , the algorithm selects the neighbor node with the highest value.	1	C01
1F -7	_____ search expands the most promising node based on a heuristic function.	1	C01
1F -8	The A* algorithm uses a combination of cost from start node (g(n)) and estimated cost to goal (h(n))	2	C01
1F -9	The AO* algorithm is used for searching in _____ graphs where solutions can be combinations of AND and OR nodes.	6	C01
1F -10	A _____ tree represents the possible moves in a two-player game scenario.	1	C01
1F -11	The _____ algorithm is used in game playing to minimize the possible loss for a worst-case scenario.	3	C01
1F -12	In the Min-max algorithm , the Max player tries to _____ the utility value.	5	C01
1F -13	In contrast, the Min player tries to _____ the utility value.	1	C01
1F -14	_____ pruning is used to eliminate branches in the game tree that do not need to be explored.	2	C01
1F -15	Alpha-beta pruning improves the efficiency of the _____ algorithm by reducing the number of nodes evaluated.	2	C01

Match The Following Questions

1M-1	1. Prolog	A. Object-oriented AI development tool	a)		
	2. Java	B. Used for symbolic processing			
	3. LISP	C. Logic programming for AI	2	C01	
	4. Python	D. Popular for AI due to libraries like NumPy			
1M-2	1. Uniform Cost Search	A. Uses no heuristic information	b)		
	2. Depth-First Search	B. Explores nodes based on cost	3	C01	
	3. Breadth-First Search	C. May go infinitely deep without goal			
	4. Uninformed Search	D. Explores all nodes at one level before going deeper			
1M-3	1. A* Algorithm	A. Picks steepest ascent to reach peak	c)		
	2. Greedy Search	B. Chooses lowest estimated cost to goal only			
	3. Hill Climbing	C. Uses $g(n) + h(n)$ to find optimal path	2	C01	
	4. Best-First Search	D. Selects node with best heuristic evaluation			
1M-4	1. Alpha-Beta Pruning	A. Determines optimal strategy assuming perfect play	d)		
	2. Utility Function	B. Prunes unnecessary branches in game tree	1	C01	
	3. Game Tree	C. Models all possible moves in games			
	4. Min-Max Algorithm	D. Assigns value to game outcomes			

1M-5	1. AO* Algorithm	A. Used in decision trees with AND/OR nodes	e)	
	2. Heuristic Function	B. Estimates cost from a given node to goal	2	CO1
	3. Game Playing	C. Competes against intelligent opponent	)	
	4. Evaluation Function	D. Assesses quality of game state	i)	
5 MARKS QUESTIONS				
1D-1	What is AI? What are the applications of AI?		1	CO1
1D-2	What is uninformed search? What are the various types of uninformed search algorithms?		1	CO1
1D-3	Write AO* algorithm and briefly discuss the various observations about algorithm? (Dec-23)		2	CO1
1D-4	Differentiate between Exhaustive Search and Heuristic search?		4	CO1
1D-5	Discuss about A* search Algorithm with an example. (Nov-24)		5	CO1
1D-6	Write the limitations of DFS and BFS strategies?		1	CO1
1D-7	Explain about Hill Climbing search with an example. (Nov-24)		1	CO1
1D-8	Explain MINI MAX Algorithm.		2	CO1
1D-9	What are the limitations of Min-Max algorithm?		1	CO1
1D-10	How the Alpha-Beta pruning algorithm works?		2	CO1
1D-11	Write in detail about the constraint satisfaction procedure with example? (Dec-23)		1	CO1
1D-12	Illustrate how to define a problem as a state space search with example? (Dec-23)		4	CO1
1D-13	Comment on the performance issue of Depth-first and Breadth-first search technique. (April-24)		2	CO1
1D-14	What are the problems encountered during hill climbing and explain the ways available to deal with these problems? (Dec- 23)		1	CO1
1D-15	Solve the crypt arithmetic problem SEND+MORE=MONEY. (Apr-24)		2	CO1
UNIT-II				
Multiple Choice Questions			BT Level	Course Outcome
2C-1	Predicate logic differs from propositional logic because it includes: a) Only true/false variables b) Quantifiers and predicates with arguments c) Only AND, OR, NOT operators d) No variables		2	CO2
2C-2.	Which of the following is a universal quantifier in predicate logic? a) $\exists$ (Exists) b) $\forall$ (For all) c) $\Rightarrow$ (Implies) d) $\neg$ (Not)		2	CO2
2C-3.	In logic programming, a program consists mainly of: a) Objects and classes b) Facts and rules c) Functions and procedures d) Neural networks		1	CO2
2C-4.	Semantic nets represent knowledge as:		5	CO2

	a) Rules and conditions b) Nodes (concepts) and edges (relationships) c) Algebraic equations d) Plain text sentences		
2C-5.	Which relation in semantic nets is used to show hierarchy or “is-a” relationship? a) Instance-of b) Part-of c) Is-a d) Cause-of	3	CO2
2C-6.	Semantic nets are mainly used for: a) Representing numerical data b) Representing relationships between concepts c) Representing procedural knowledge d) Representing low-level hardware details	2	CO2
2C-7.	Frames are similar to: a) Logic formulas b) Semantic networks but organized as structured objects with slots and values c) Neural networks d) Decision trees	6	CO2
2C-8.	Inheritance in frames allows: a) Copying slots from parent to child frames b) Only numeric values to be passed down c) Changing the structure of the parent frame d) No reuse of knowledge	4	CO2
2C-9.	Default values in frames can be overridden by: a) Subclasses or child frames b) The root frame only c) Facts outside the frame system d) Constraints only	5	CO2
2C-10.	Constraint propagation is a technique used to: a) Infer values of variables based on constraints among them b) Search through game trees c) Represent objects and classes d) Optimize heuristic search	3	CO2
2C-11.	Constraint satisfaction problems involve: a) Finding variable assignments that satisfy all constraints b) Finding the maximum value of a function c) Searching with heuristics d) Building semantic nets	2	CO2
2C-12.	Rules in knowledge representation typically have the form: a) IF condition THEN action b) Always TRUE statements c) Purely numerical expressions d) Random facts	1	CO2
2C-13.	In rule-based systems, forward chaining means: a) Starting from goals and working backward b) Starting from facts and applying rules to infer new facts c) Ignoring all rules d) Applying only the last rule in the system	3	CO2
2C-14.	Backward chaining in rule-based systems involves: a) Starting from facts to infer conclusions b) Starting from a goal and working backward to find supporting facts c) Randomly applying rules	4	CO2

	d) Avoiding any inference				
2C-15	Which of the following is a disadvantage of rule-based systems? a) They can handle uncertain knowledge easily b) They require explicit rules for all knowledge c) They do not support modularity d) They cannot infer new knowledge	5	C02		
	Filling The Blank Questions				
2F-1	_____ logic is a formal system used to represent facts and relationships in AI.	2	C02		
2F-2	In logic programming , programs are expressed in terms of facts and _____.	2	C02		
2F-3	A _____ net is a graphical representation of knowledge using nodes and labeled arcs.	1	C02		
2F-4	Frames are data structures that represent stereotyped situations with _____ for attributes	1	C02		
2F-5	_____ in frames allows child frames to inherit properties from parent frames.	4	C02		
2F-6	Constraint propagation involves spreading constraints from one variable to another to reduce the _____ of possible values.	1	C02		
2F-7	Knowledge can be represented using _____, which specify actions to be taken when certain conditions hold.	5	C02		
2F-8	A rule-based deduction system applies _____ to infer new knowledge from existing facts and rules.	6	C02		
2F-9	_____ logic extends propositional logic by including quantifiers like "for all" and "there exists".	3	C02		
2F-10	In logic programming, _____ resolution is a common inference method used for proving queries.	1	C02		
2F-11	Semantic nets can represent _____ relations such as "is-a" and "part-of".	2	C02		
2F-12	Frames can include _____ procedures, which are actions triggered when certain conditions on slots are met.	2	C02		
2F-13	_____ propagation helps in solving problems like scheduling and constraint satisfaction problems.	4	C02		
2F-14	Rules in rule-based systems are often structured as _____- then statements.	4	C02		
2F-15	The main advantage of using rule-based deduction systems is their ability to separate _____ knowledge from control knowledge.	2	C02		
	Match The Following Questions				
2M-1		List I	List II	2	C02
		1. Predicate Logic	A. Universal or existential operators in logic		
		2. Logic Programming	B. Prolog is an example		
		3. Atomic Sentence	C. Formal method to represent knowledge using facts		
		4. Quantifiers	D. A simple predicate without logical connectives		
2M-2		List I	List II	1	C02
		1. Semantic Network	A. An attribute or property in a frame		
		2. Frame	B. Graph-based knowledge representation		
		3. Slot	C. Passing properties from a parent to subclasses		
		4. Inheritance	D. Structure for representing stereotypical situations		

2M-3		List I 1. Constraint 2. Domain 3. Arc Consistency 4. Constraint Propagation	List II A. Each value in one variable's domain satisfies another B. A rule limiting possible values of a variable C. Set of possible values a variable can take D. Enforcing restrictions across variables	2	CO2
2M-4		List I 1. Rule-based System 2. Forward Chaining 3. Backward Chaining 4. Inference Engine	List II A. Applies rules to draw conclusions B. Starts from known facts and applies rules C. Uses IF-THEN rules to encode knowledge D. Starts from goal and works backward	1	CO2
2M-5		List I 1. Deduction 2. Knowledge Base 3. Expert System 4. Rule	List II A. Stores rules and facts B. IF condition THEN action format C. Emulates human decision-making using rules D. Deriving conclusions from general rules	3	CO2

5 MARKS QUESTIONS

2D-1	What are various techniques to represent the knowledge?	1	CO2
2D-2	What are frames? How do they differ from semantic nets?	1	CO2
2D-3	What is the difference between declarative and procedural knowledge?	4	CO2
2D-4	Differentiate the propositional & FOL logic. (Dec-23)	1	CO2
2D-5	Write short notes on constrain Propagation.	1	CO2
2D-6	Differentiate the propositional & predicate logic.	4	CO2
2D-7	What are the rules to representing knowledge?	5	CO2
2D-8	How can you represent knowledge using rules and explain Rule-Based deduction systems. (Apr-24)	4	CO2
2D-9	Discuss about Knowledge Representation Issues in detail	2	CO2
2D-10	Explain in detail about frames representation. (Apr-24)	3	CO2
2D-11	Develop the conceptual dependency graph for the following sentences. a) I gave the man a book b) John run yesterday. (Nov-24)	4	CO2
2D-12	Explain in detail about semantic nets with its types and application with suitable examples. (Dec-23)	5	CO2
2D-13	Write algorithm for Propositional Resolution and Unification algorithm. (Apr-24)	3	CO2
2D-14	Explain Rule-Based deduction systems. (Nov-24)	2	CO2
2D-15	State Representation of facts in predicate logic?	5	CO2

UNIT-III			
Multiple Choice Questions		BT Level	Course Outcome
3C-1	An expert system is primarily designed to: a) Perform routine calculations b) Emulate the decision-making ability of a human expert c) Manage databases d) Generate random numbers	1	CO3
3C-2	Expert systems mainly help in: a) Low-level hardware control b) Complex problem solving requiring expert knowledge c) Graphic design d) Simple data entry	2	CO3
3C-3	The knowledge base in an expert system contains: a) User interface code b) Facts and rules derived from experts c) Database schemas d) Network protocols	1	CO3
3C-4	The inference engine in an expert system: a) Stores facts and data b) Applies logical rules to the knowledge base to deduce new information c) Handles user input and output d) Manages network communication	2	CO3
3C-5	The user interface in an expert system is used to: a) Store knowledge b) Facilitate communication between the user and the system c) Perform reasoning d) Manage the knowledge base	1	CO3
3C-6	Explanation facilities in expert systems: a) Provide reasons for the conclusions reached b) Modify the knowledge base c) Store raw data d) Connect to external devices	2	CO3
3C-7	Knowledge in expert systems is often represented as: a) Rules, frames, semantic nets, or logic statements b) Raw data tables only c) Source code only d) Binary machine code	1	CO3
3C-8	Frames in expert systems help in: a) Representing structured knowledge with attributes and values b) Representing unstructured text only c) Storing numerical data exclusively d) Managing memory directly	2	CO3
3C-9	Rule-based knowledge representation follows which form? a) IF condition THEN action b) Assign values to variables c) Random assignment d) Pure arithmetic calculations	1	CO4
3C-10	One key characteristic of expert systems is: a) They learn from data automatically like machine learning models b) They provide explanations for their reasoning c) They operate only on numerical data d) They cannot be modified after creation	3	CO4

3C-11	Expert systems are generally: a) Inflexible and static b) Capable of handling uncertain or incomplete knowledge c) Always 100% accurate d) Limited to numerical computations only	4	CO4
3C-12	Expert systems typically operate in: a) Well-defined problem domains b) All possible problem areas c) Only hardware design d) Purely theoretical problems	3	CO4
3C-13	Expert systems are especially useful for: a) Routine, repetitive tasks b) Diagnostic problems like medical diagnosis or machine fault detection c) Video rendering d) Basic arithmetic	4	CO4
3C-14	Expert systems are NOT typically used for: a) Decision-making under uncertainty b) Complex problem-solving c) Tasks requiring common sense reasoning like everyday conversation d) Financial forecasting based on rules	3	CO4
3C-15	Which problem type is well-suited for expert systems? a) Problems with clear rules and heuristics b) Problems requiring real-time sensory input processing c) Tasks that involve creativity and emotion d) Basic input/output operations	5	CO4
Filling The Blank Questions			
3F-1	An _____ system is a computer program that mimics the decision-making ability of a human expert.	1	CO3
3F-2	The main components of an expert system architecture include the knowledge base, inference engine, and _____ system.	1	CO3
3F-3	The knowledge base stores facts and _____ about the domain.	2	CO3
3F-4	The _____ engine applies logical rules to the knowledge base to deduce new information or make decisions.	2	CO3
3F-5	Expert systems represent knowledge using various techniques such as rules, frames, and _____ nets	1	CO3
3F-6	A key characteristic of expert systems is their ability to explain _____ to the user.	2	CO3
3F-7	Expert systems are designed to solve _____ problems which require specialized knowledge.	1	CO3
3F-8	Expert systems often handle problems in domains like medical diagnosis, troubleshooting, and _____ planning.	2	CO3
3F-9	One characteristic of expert systems is that they handle _____ and incomplete information.	1	CO4
3F-10	The user interface of an expert system allows interaction between the system and the _____.	3	CO4
3F-11	Expert systems can be categorized into diagnostic , advisory, _____, and monitoring systems.	4	CO4
3F-12	The process by which the inference engine draws conclusions from the knowledge base is called _____.	3	CO4
3F-13	Expert systems differ from conventional programs by separating knowledge and _____.	4	CO4
3F-14	The maintenance of expert systems involves updating the knowledge base with new _____.	3	CO4
3F-15	One limitation of expert systems is their inability to learn and adapt _____ unless integrated with learning components.	6	CO4

	Match The Following Questions				
3M-1		1. Expert System	A. Can diagnose, analyze, and recommend	1	CO3
		2. AI-based System	B. Emulates decision-making of a human expert		
		3. Problem-solving System	C. Uses knowledge and inference to solve problems		
		4. Knowledge-intensive	D. Relies heavily on domain-specific knowledge		
3M-2		1. Knowledge Base	A. Justifies conclusions or actions taken	2	CO3
		2. Inference Engine	B. Applies logical rules to the knowledge base		
		3. User Interface	C. Stores domain-specific rules and facts		
		4. Explanation Facility	D. Allows interaction between user and system		
3M-3		1. Rules	A. Basic statements of truth in a knowledge base	1	CO4
		2. Semantic Nets	B. IF-THEN statements for reasoning		
		3. Frames	C. Graph structures showing relationships		
		4. Facts	D. Structured data for representing stereotypical situations		
3M-4		1. High Performance	A. Can explain reasoning and decisions	5	CO4
		2. Understandability	B. Can be updated with new knowledge		
		3. Responsiveness	C. Gives accurate and reliable solutions		
		4. Adaptability	D. Responds within acceptable time		
3M-5		1. Diagnostic Systems	A. Track system performance and raise alerts	6	CO4
		2. Planning Systems	B. Identify causes of problems		
		3. Monitoring Systems	C. Recommend best courses of action		
		4. Advisory Systems	D. Develop action sequences to achieve goals		
3D-1	Explain the various stages of expert system development?			1	CO3
3D-2	With an Architectural diagram explain how expert system works? (Nov-24)			2	CO3
3D-3	Write short notes on Expert systems?			1	CO3
3D-4	Design an expert system for travel recommendation and discuss its roles. (Apr-24)			3	CO3
3D-5	Explain the need and characteristics of expert system. Also discuss the expert system Architecture. (Dec-23)			2	CO3
3D-6	Compare the merits of artificial over human expertise?			4	CO3
3D-7	Explain the features of Expert system with neat sketch.(Apr-24)			5	CO3
3D-8	Elucidate the process of Organization of knowledge. (Nov-24)			2	CO4
3D-9	Explain the basic activities of Expert system. (Apr-24)			3	CO3
3D-10	Explain the players who involved in the Expert system building. (Apr-24)			5	CO3

3D-11	What are the problems in Expert systems? Explain in detail.	5	CO4
3D-12	Explain the role of knowledge engineer?	2	CO4
3D-13	Discuss Expert systems design examples.	4	CO4
3D-14	Explain in detail about Knowledge Acquisition and Meta-Knowledge in expert system.	3	CO4
3D-15	What are the types of problems solvable by Expert systems? Explain with neat sketch? (Dec-23)	5	CO4
UNIT IV			
Multiple Choice Questions			Course Outcome
4C-1	Which of the following is a common technique for knowledge representation in expert systems? a) Semantic nets b) Relational databases only c) Binary code d) Spreadsheet formulas	1	CO5
4C-2	Frames in expert systems represent knowledge as: a) Graphical user interfaces b) Structured objects with slots and slot values c) Pure logic formulas d) Raw data only	2	CO5
4C-3	Rule-based representation in expert systems follows which pattern? a) IF condition THEN action b) Arithmetic computation c) Data storage d) Network communication	1	CO5
4C-4	Knowledge engineering primarily involves: a) Designing the hardware for expert systems b) Acquiring, structuring, and representing expert knowledge c) Writing user manuals d) Coding in low-level languages	2	CO5
4C-5	A knowledge engineer's main role is to: a) Program the user interface b) Extract knowledge from human experts and formalize it c) Manage databases d) Develop network protocols	1	CO5
4C-6	System-building aids in expert systems include: a) Knowledge acquisition tools, editors, and debuggers b) Only compilers c) Hardware drivers d) Network tools	2	CO5
4C-7	Which tool helps in debugging expert system rules? a) Rule tracer b) Compiler c) Text editor d) Database manager	1	CO5
4C-8	Explanation facilities in expert systems provide: a) Reasons behind the system's conclusions b) Network connections c) Data backup d) User authentication	2	CO5
4C-9	The knowledge base management system (KBMS) is responsible for: a) Managing and updating the knowledge base	1	CO5

	b) Running user interface code c) Controlling hardware devices d) Encrypting data		
4C-10	The first stage in expert system development is: a) Implementation b) Knowledge acquisition c) Testing d) Deployment	3	CO5
4C-11	After knowledge acquisition, the next step typically is: a) Knowledge representation b) System maintenance c) Data entry d) Marketing	4	CO5
4C-12	System validation involves: a) Ensuring the expert system's conclusions are accurate and reliable b) Designing the user interface c) Writing the user manual d) Data storage optimization	3	CO5
4C-13	Deployment of an expert system involves: a) Installing and making the system available to end users b) Writing code for knowledge base c) Debugging rules only d) Designing hardware circuits	4	CO5
4C-14	Maintenance in expert systems means: a) Updating the knowledge base and system components as needed b) Running the inference engine c) Designing rules from scratch every time d) Ignoring user feedback	3	CO5
4C-15	Prototyping in expert system development helps to: a) Quickly develop an initial working version for testing and feedback b) Eliminate the need for knowledge acquisition c) Replace the final system entirely d) Avoid user involvement	5	CO5
Filling The Blank Questions			
4F-1	An expert system is a computer program that simulates the _____ of a human expert.	1	CO5
4F-2	_____ is the process of acquiring knowledge from domain experts and representing it in a usable form.	1	CO5
4F-3	In expert systems, _____ rules are commonly used for representing knowledge in the form of IF-THEN statements. Answer: production	2	CO5
4F-4	A _____ is a collection of facts and rules stored in an expert system.	2	CO5
4F-5	The _____ engine is responsible for applying logical rules to the knowledge base to derive conclusions.	1	CO5
4F-6	_____ reasoning works from general rules to specific conclusions.	2	CO5
4F-7	A popular knowledge representation technique used in expert systems is _____, where facts are represented as entities and relationships.	1	CO5
4F-8	Frames are data structures for representing _____ objects in an expert system.	2	CO5
4F-9	The process of refining and validating the expert system is known as _____.	1	CO5

4F-10	An expert system development cycle includes stages such as knowledge acquisition, _____, implementation, and testing.	3	CO5										
4F-11	A _____ is a software tool used to create expert systems without starting from scratch.	4	CO5										
4F-12	_____ systems are designed to support the knowledge engineer in building expert systems.	3	CO5										
4F13	The person who provides expertise to the knowledge engineer is known as the _____.	4	CO5										
4F14	_____ are user-friendly interfaces that help non-programmers interact with the expert system.	3	CO5										
4F15	In backward chaining, the system starts with a _____ and works backward to find supporting facts.	6	CO5										
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4M-4	<table><tr><td>1. Explanation Facility</td><td>A. Allows easy input and modification of rules</td></tr><tr><td>2. Knowledge Editing Tool</td><td>B. Identifies errors in knowledge base</td></tr><tr><td>3. Debugging Tool</td><td>C. Interacts with the end user</td></tr><tr><td>4. User Interface</td><td>D. Justifies the reasoning steps of the system</td></tr></table>		1. Explanation Facility	A. Allows easy input and modification of rules	2. Knowledge Editing Tool	B. Identifies errors in knowledge base	3. Debugging Tool	C. Interacts with the end user	4. User Interface	D. Justifies the reasoning steps of the system	5	CO5
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4M-5	<table><tr><td>1. Problem Identification</td><td>A. Select architecture, interfaces, and tools</td></tr><tr><td>2. Knowledge Acquisition</td><td>B. Define domain and goal of the system</td></tr><tr><td>3. System Design</td><td>C. Build the expert system shell and components</td></tr><tr><td>4. Implementation</td><td>D. Gather data and expertise</td></tr></table>		1. Problem Identification	A. Select architecture, interfaces, and tools	2. Knowledge Acquisition	B. Define domain and goal of the system	3. System Design	C. Build the expert system shell and components	4. Implementation	D. Gather data and expertise	6	CO4
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4D-1	Explain the concept of “knowledge engineering” in the context of expert systems. What are the key steps involved in knowledge engineering?	2	CO5									
4D-2	What are the primary techniques used for knowledge representation in expert systems? (Nov-24)	2	CO5									
4D-3	Discuss the types of tools available for expert system building? (Dec-23)	5	CO5									
4D-4	Describe some common system-building aids that are used in the development of expert systems.	1	CO5									
4D-5	How system building aids assist in the creation of expert systems?	5	CO5									
4D-6	What are the support facilities in the expert systems development? Give examples of support facilities and their roles?	2	CO5									
4D-7	What are the stages in the development of expert systems tools? (Apr-24)	3	CO5									
4D-8	What are the common challenges and limitations associated with the development and deployment of expert systems in real-world applications?	3	CO5									
4D-9	Explain the concept of inference engines in expert systems. How do inference engines work, and what is their role in the decision-making process?	2	CO5									
4D-10	Discuss the advantages and disadvantages of using rule-based as a knowledge representation technique in expert systems?	1	CO5									
4D-11	Explain the Components of a support environment for Expert system tools. (Apr-24)	2	CO5									
4D-12	What are the characteristics that make use of Expert systems appropriate? (Apr-24)	2	CO4									
4D-13	Explain the limitations of Expert system building tools. (Apr-24)	3	CO5									
4D-14	What are the knowledge representations supported by expert system tools? (Dec-23)	3	CO5									
4D-15	Explain the stages involved in the development of expert systems in Detail?	2	CO5									
UNIT V												

Multiple Choice Questions			Course Outcome
5C-1	Which is the first step in developing an expert system? a) System testing b) Knowledge acquisition c) Tool selection d) Deployment	1	CO6
5C-2	Selecting the right tool for expert system development depends mainly on: a) Cost and available programming languages b) User interface design preferences only c) Hardware compatibility only d) The problem domain and knowledge representation needs	2	CO6
5C-3	Knowledge acquisition involves: a) Collecting raw data from databases b) Extracting expert knowledge and rules from domain experts c) Writing user manuals d) Designing system architecture	1	CO6
5C-4	The building process of an expert system typically includes: a) Knowledge acquisition, representation, implementation, and testing b) Only coding and testing c) Designing graphics d) Writing reports	2	CO6
5C-5	Prototyping in expert system development helps to: a) Skip knowledge acquisition b) Provide an early version for evaluation and refinement c) Avoid testing d) Replace the final system	1	CO6
5C-6	A common difficulty during expert system development is: a) Having too little data b) Capturing tacit knowledge from domain experts c) Lack of programming languages d) Too much hardware support	2	CO6
5C-7	One common pitfall in planning expert systems is: a) Underestimating the complexity of the knowledge domain b) Overestimating the speed of user input c) Ignoring user interface design d) Over-relying on databases	1	CO6
5C-8	Dealing with domain experts can be challenging because: a) Experts may not be available or may find it hard to articulate their knowledge b) Experts always provide complete knowledge easily c) Experts prefer programming the system themselves d) Experts dislike working with computers	2	CO6
5C-9	A difficulty during the development phase of expert systems is: a) Managing incomplete or uncertain knowledge b) Designing the hardware from scratch c) Running the system on a smart phone d) Avoiding the use of logic	1	CO6
5C-10	Overfitting the expert system to a narrow set of cases is: a) A strength of expert systems b) A common problem that limits generalizability	3	CO6

	c) Necessary for good performance d) Irrelevant to expert systems		
5C-11	During expert system building, validation means: a) Ensuring the system provides correct and reliable conclusions b) Writing user documentation c) Designing user interfaces d) Coding the inference engine	4	CO6
5C-12	One way to improve knowledge acquisition is by: a) Using interviews, questionnaires, and observation techniques b) Ignoring domain experts c) Using only pre-existing databases d) Avoiding feedback from users	3	CO6
5C-13	A major challenge when selecting tools for expert system development is: a) Choosing tools that support the required knowledge representation and reasoning methods b) Picking the most expensive tool c) Selecting tools without documentation d) Avoiding tools with graphical interfaces	4	CO6
5C-14	A major challenge when selecting tools for expert system development is: a) Choosing tools that support the required knowledge representation and reasoning methods b) Picking the most expensive tool c) Selecting tools without documentation d) Avoiding tools with graphical interfaces	3	CO6
5C-15	Expert systems may struggle with: a) Ambiguous, incomplete, or rapidly changing knowledge domains b) Well-defined rule-based problems c) Numerical calculations only d) Simple database queries	5	CO6
Filling The Blank Questions			
5F-1	An expert system is a computer program that simulates the _____ of a human expert.	1	CO6
5F-2	_____ is the process of acquiring knowledge from domain experts and representing it in a usable form.	1	CO6
5F-3	In expert systems, _____ rules are commonly used for representing knowledge in the form of IF-THEN statements.	2	CO6
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5F-8	Frames are data structures for representing _____ objects in an expert system.	2	CO6
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4. Poor Knowledge Coverage	D. Trying to solve too broad or complex a problem												

5M-5	<table><tr><th>List I</th><th>List II</th></tr><tr><td>1. Domain Expert Issues</td><td>A. Misunderstanding between developers and experts</td></tr><tr><td>2. Tacit Knowledge</td><td>B. Hard to trace logic in rule-based reasoning</td></tr><tr><td>3. Communication Gap</td><td>C. Hard-to-articulate knowledge not easily extracted</td></tr><tr><td>Debugging Complexity</td><td>D. Experts may be unavailable or uncooperative</td></tr></table>		List I	List II	1. Domain Expert Issues	A. Misunderstanding between developers and experts	2. Tacit Knowledge	B. Hard to trace logic in rule-based reasoning	3. Communication Gap	C. Hard-to-articulate knowledge not easily extracted	Debugging Complexity	D. Experts may be unavailable or uncooperative	6	CO6
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5D-1	Describe various stages of an expert system development? (Dec-23)	1	CO6											
5D-2	Explain the factors that should be considered when selecting a development tool for building an expert system?	2	CO6											
5D-3	Describe the process of acquiring knowledge for an expert system?	2	CO6											
5D-4	What is meant by high performance expert system? How it is used in research and in business? (Apr-24)	3	CO6											
5D-5	What are the methods and techniques can be used for knowledge acquisition?	5	CO6											
5D-6	Explain the tasks involved in building expert system? (Dec-23)	2	CO6											
5D-7	Compare the role of validation and verification in the development of expert systems?	4	CO6											
5D-8	List out the challenges encountered when planning the development of an expert system? (Dec-23) (Nov-24)	3	CO6											
5D-9	What are the strategies for effective collaboration between domain experts and system developers?	1	CO6											
5D-10	What are the common pitfalls that can occur during the development of expert systems?	2	CO6											
5D-11	Explain the issues involved in selecting the tool?	2	CO6											
5D-12	What are the techniques used for extracting knowledge from domain expert?	1	CO6											
5D-13	Explain Expert system works at universities and on the computer systems. (Apr-24)	2	CO6											
5D-14	Find the pitfalls in dealing with the domain expert, explain? (Dec-23)	4	CO6											
5D-15	Describe the process of Knowledge Acquisition. (Nov-24)	3	CO6											