INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING (AI & ML)

DEFINITION AND TERMINOLOGY

Course Title	**ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS**				
Course Code	ACAC06				
Program	B.Tech				
Semester	V	AI &ML			
Course Type	Core				
Regulation	IARE - UG20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Dr M.Nagaraju, Assistant Professor				

COURSE OBJECTIVES:

The students will try to learn:

I	Gain a historical perspective of AI and its foundations.
II	Become familiar with basic principles of AI toward problem solving, inference, knowledge representation, and learning.
III	Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
IV	Experience AI development tools such as Prolog (AI language), expert system shell, and/or data mining tool.
V	Explore the current scope, potential, limitations, and implications of intelligent systems.

COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Summarize** knowledge representation and issues in AI and Related fields.	Understand
CO 2	**Demonstrate** knowledge reasoning with predicate logic and inference rules in the presence of incomplete and/or uncertain information.	Understand

CO 3	**Choose** Heuristic, Adversarial search and game playing algorithms for addressing a particular AI problem and implement the selected strategy.	Apply
CO 4	**Experiment with** uncertainty issues by using statistical and symbolic reasoning approaches.	Apply
CO 5	**Compare** subfields and applications of AI such as planning, learning, and expert systems in specific domain problems.	Understand
CO 6	**Extend** knowledge representation with the help of AI languages and tools to solve complex problems.	Understand

DEFINITION AND TERMINOLOGY:

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MODULE I		
INTRODUCTION OF AI AND KNOWLEDGE REPRESENTATION		
1	**Define Artificial Intelligence?**	CO 1
	Artificial Intelligence is a way of making a computer, computer controlled robot or a software think intelligently in the similar manner the intelligent humans think.	
2	**What is natural language processing?**	CO 1
	The machines's ability to perform conversational tasks, such as recognizing what is said to it, understanding the intended meaning and responding intelligibly.	
3	**What is natural language Generation?**	CO 1
	This refers to the process by which a machine turns structured data into text or speech that humans can understand	
4	**What is natural language Understanding?**	CO 1
	As a subset of NLP, this deals with helping machines to recognize the intended meaning of language, taking into account its subtle nuances and any grammatical errors	
5	**Define the term Robotics?**	CO 1
	It is nothing but focusing on the design and manufacturing of robots that exhibit and/or replicate human intelligence and actions.	
6	**Define the term Algorithm**	CO 1
	It is a set of rules that a machine can follow to learn how to do a task.	
7	**Why is Heuristic technique used?**	CO 1
	It a computer science technique designed for quick, optimal, solution-based problem solving.	
8	**What is a Support Vector Machine?**	CO 1
	In machine learning support-vector machines are supervised learning models with associated learning models with associated learning algorithms that anlayze data for classification and regression analysis..	

9	**What is Artificial Neural Network?**	CO 1
	This is a computer system designed to function like the human brain.	
10	**What is Markov Decision Process?**	CO 1
	It is a discrete time stochastic control process. It provides a mathematical framework for modeling decision making in situations where outcomes are partly under the control of a decision maker.	
11	**What is Image recognition?**	CO 1
	It isthe process of identifying or detecting an object or feature of an object in an image or video.	
12	**What is Pattern recognition?**	CO 1
	It is automated recognition of patterns found in data.	
13	**What is Optical character recognition?**	CO 1
	It is conversion of images of text (typed, handwritten, or printed) either electronically or mechanically, into machine-encoded text.	
14	**What is cognitive science?**	CO 1
	It is interdisciplinary, scientific study of the human reasoning, emotions, language, perception, attention, and memory.	
15	**Why is Turing test performed?**	CO 11
	It is for determining whether a computer is capable of Human intelligence or not.	
16	**Define AI-General Problem Solving?**	CO 1
	It is a process of generating solutions from observed or given data using indirect or model based methods. GPS in principle can solve any formalized symbolic problems such as theorems proof and geometric problems and chess playing.	
17	**What is State Space Search?**	CO 1
	A State Space represents a problem in terms of states and operators that changes states. A state space consists of representation of states the system can be in, a set of operators that can changes one state into another state, an initial state, and a set of final states.	
18	**Define Production Systems?**	CO 1
	Production Systems provide appropriate structures for performing and describing search process. It includes four basic components like a set of rules that describes the operation to be performed, an established database of current facts, a control strategy that specfies the order in which the rules will be compared, and a rule firing module.	
19	**How to identify good search process?**	CO 1
	The secret of a good search routine is to generate only those nodes that are likely to be useful, rather than having a precise tree.	

20	**Define Search Control Strategies?** The search strategy is evaluated along with several dimensions like completeness, time complexity, space complexity, and optimality. In general search proceeds with different types of search control strategies.	CO 1
MODULE II		
FIRST ORDER LOGIC AND INFERENCE		
1	**What is Predicate Logic?** It is a powerful language that develops information about the objects in a more easy way and can also express the relationship between those objects.	CO 2
2	**What is Quantifier?** Quantifier is an operator that specifies how many individuals in the domain of discourse satisfy an open formula.	CO 2
3	**Define Bias and its diadvantage?** Assumptions made by a model that simplify the process of learning to do its assigned task.	CO 2
4	**What is Big Data?** Datasets that are too large or complex to be used by traditional data processing applications.	CO 2
5	**How is Bounding Box?** It is commonly used in image or video tagging, this is an imaginary box drawn on an image. The contents of the box are labeled to help a model recognize it as a distinct type of object.	CO 2
6	**What is Unification?** Unification is an algorithmic process of solving equations between symbolic expressions.	CO 2
7	**What is Conjunctive normal form?** Conjunctive normal form (CNF) is an approach to Boolean logic that expresses formulas as conjunctions of clauses with an AND or OR.	CO 2
8	**What is Disjunctive normal form?** Disjunctive normal form (DNF) is a canonical normal form of a logical formula consisting of a disjunction of conjunctions.	CO 2
9	**What is structured Data?** It is a clearly defined data with easily searchable patterns.	CO 2
10	**What is Forward Chaining?** A method in which a machine must work from a problem to find a potential solution. By analyzing a range of hypotheses, the AI must determine which are relevant to the problem	CO 2

11	**What is Backward Chaining?** It is an inference method described colloquially as working backward from the goal. It is used in automated theorem provers, inference engines, proof assistants, and other artificial intelligence applications.	CO 2
12	**Define ELIZA?** ELIZA is an early natural language processing computer program Created to demonstrate the superficiality of communication between humans and machines.	CO 2
13	**How areConflict resolution strategies useful?** Conflict resolution strategies are used in production systems in artificial intelligence,such as in rule-based expert systems,to help in choosing which production rule to fire.	CO 2
14	**What is Meta-knowledge ?** Meta-knowledge is knowledge about knowledge. The term is used to describe things such as tags,models and taxonomies that describe knowledge.	CO 2
15	**What is SOAR?** SOAR is a general architecture for building intelligent systems.	CO 2
16	**Define Predicate Instance?** The predicate instance is a binary one, whose first argument is an object and whose second argument is a class to which the object belongs.	CO 2
17	**What is Declarative Representation?** Declarative Representation is one in which knowledge is specified, nut the use to which that knowledge is to be put is not given.	CO 2
18	**What is Procedural Representation?** A Procedural Representation is one in which the control information that is necessary to use the knowledge is considered to be embedded in the knowledge is considered to be embedded in the knowledge itself.	CO 2
19	**Define Logic Programming?** Logic Programming is a programming language paradigm in which logical assertions are viewed as programs.	CO 2
20	**Define Bidirectional Search?**	CO 2
	Describing the search process as both forward from the start and backward from the goal simultaneously until two paths meet somewhere in between.	

MODULE III		
SEARCH TECHNIQUES		
1	**Why is Breadth first search used?** Breadth first search is a graph traversal algorithm that starts traversing the graph from root node and explores all the neighbouring nodes.	CO 3
2	**Why is Depth-first search used?** Depth-first search is a recursive algorithm for traversing a tree or graph data structure.	CO 3
3	**Why is Heuristic search used?** Heuristic Search is a computer science technique designed for quick, optimal, solution-based problem solving.	CO 3
4	**What is Tower of hanoi ?** Tower of hanoi is mathematical game puzzle where we have three pile (pillars) and n numbers of disk.	CO 3
5	**What isCryptarithmetic Problem** Cryptarithmetic Problem is a type of constraint satisfaction problem where the game is about digits and its unique replacement either with alphabets or other symbols.	CO 3
6	**What is State Space Search?** It is a process used in the field of computer science,including artificial intelligence(AI), in which successive configurations or states of an instance are considered,with the intention of finding a goal state with a desired property.	CO 3
7	**What is constraint satisfaction ?** Constraint satisfaction is the process of finding a solution to a set of constraints that impose conditions that the variables must satisfy.	CO 3
8	**What is Means–ends analysis (MEA)** Means–ends analysis (MEA) is a problem solving technique used commonly in Artificial Intelligence (AI) for limiting search in AI programs.	CO 3
9	**What is perturbation theory ?** perturbation theory comprises mathematical methods for finding an approximate solution to a problem.	CO 3
10	**How is Gradient descent algorithm used?** Gradient descent is a first-order iterative optimisation algorithm for finding a local minimum of a differentiable function	CO 3
11	**What is meant bySearch-driven analytics?** Search-driven analytics give anyone the ability to gain insights from data and make faster, better decisions.	CO 3

12	**Define Meta Reasoning?**	CO 3
	Meta-Reasoning refers to the processes that monitor the progress of our reasoning and problem-solving activities and regulate the time and effort devoted to them.	
13	**What algorithms are called heuristic algorithms?**	CO 3
	The algorithms that use heuristic functions are called heuristic algorithms. These algorithms are not really intelligent but they appear to be intelligent because they achieve better performance.	
14	**What are Uninformed Search Algorithms?**	CO 3
	Uninformed search algorithms or Brute-force algorithms that performs the search through the search space all possible condidates for the solution checking whether each candidate satisfies the problems statement.	
15	**Define Heuristics?**	CO 3
	A heuristic is a method that improves the efficiency of the search process. These are like tour guides that hepl in the search process without sacrificing any claims to entirety that the process might previously had.	
16	**Define Means-Ends Analysis?**	CO 3
	The means -ends analysis process centers around finding the difference between current state and goal state. The problem space of means - ends analysis has an initial state and one or more goal state, a set of operate with a set of preconditions their application and difference functions that computes the difference between two state a(i) and s(j).	
17	**Define Heuristic Function?**	CO 3
	A heuristic function is a function that maps from problem state descriptions to measures of desirability, usually represented as numbers.	
18	**Define Generate and Test Algorithm?**	CO 3
	Generate-and-test search algorithm is a very simple algorithm that guarantees to find a solution if done systematically and there exists a solution.	
19	**Define Hill Climbing?**	CO 3
	Hill Climbing is heuristic search used for mathematical optimization problems in the field of Artificial Intelligence. Given a large set of inputs and a good heuristic function, it tries to find a sufficiently good solution to the problem.	
20	**Define Constraint Satisfaction?**	CO 6
	Many problems in AI can be considered as problems of constraint satisfaction, in which the goal state satisfies a given set of constraint. constraint satisfaction problems can be solved by using any of the search strategies.	

MODULE IV		
HANDLING UNCERTAINITY		
1	**Define Reasoning?** The reasoning is the mental process of deriving logical conclusion and making predictions from available knowledge, facts, and beliefs.	CO 4
2	**What is Monotonic Reasoning?** In monotonic reasoning, once the conclusion is taken, then it will remain the same even if we add some other information to existing information in our knowledge base.	CO 4
3	**What is non-monotoning reasoning?** A logic is non-monotonic if some conclusions can be invalidated by adding more knowledge.	CO 4
4	**What is Deductive reasoning?** Deductive reasoning is the form of valid reasoning, to deduce new information or conclusion from known related facts and information.	CO 4
5	**What is Inductive reasoning?** Inductive reasoning arrives at a conclusion by the process of generalization using specific facts or data.	CO 4
6	**What is Statistical reasoning?** Statistical reasoning is the way people reason with statistical ideas and make sense of statistical information.	CO 4
7	**Define Symbolic artificial intelligence?** Symbolic artificial intelligence is the term for the collection of all methods in artificial intelligence research that are based on high-level "symbolic" (human-readable) representations of problems, logic and search.	CO 4
8	**What is Default reasoning?** Default reasoning is a form of nonmonotonic reasoning where plausible conclusions are inferred based on general rules which may have exceptions (defaults).	CO 4
9	**Define Semantic AI?** Semantic AI is the combination of methods derived from symbolic AI and statistical AI.	CO 4
10	**How is autoepistemic logic useful?** The autoepistemic logic is a formal logic for the representation and reasoning of knowledge about knowledge.	CO 4
11	**Define Pruning?** Pruning is nothing but Overriding unnecessary and irrelevant considerations in AI systems.	CO 4
12	**Define Agent?** Agents are systems or software programs capable of autonomous, purposeful and reasoning directed towards one or more goals.	CO 4

13	**Define Chatbot?** Chatbot is a program that is designed to communicate with people through text or voice commands in a way that mimics human-to-human.	CO 4
14	**Define Inheritance?** It is a basis for inheriting attribute values from a prototype description of a class to the individual entities that belongs to the class.	CO 4
15	**Define Minimal model?** A model is defined to be minimal if there are no other models in which fewer things are true.	CO 4
16	**Define Dependency-Directed Backtracking?** It is useful for conventional search programs and worth pointing out that although one of the big motivations for it is in handling nonmonotonic reasoning.	CO 4
17	**Define Assumption-Based Truth Maintenance System (ATMS)?** It is an alternative way of implementing nonmonotonic reasoning by pursing a single line of reasoning at a time and change the systems assumptions whenever necessary.	CO 4
18	**Define Bayesian Networks?** Bayesian Networks in which we preserve the formalism and rely instead on the modularity of the world we are trying to model.	CO 4
19	**Define Certainity Factor?** It is a measure of the extent to which the evidence that is described by the antecedent of the rule supports the conclusion that is given in the rules consequent.	CO 4
20	**Define Dempster-Shafer Theory?** It is the degree of belief that is warranted given the evidence and considers sets of propositions and assigns to each of them an interval in which the degree of belief must lie.	CO 4
MODULE V		
PLANNING, LEARNING AND EXPERT SYSTEMS		
1	**What is Hierarchy planning in AI ?** In artificial intelligence, hierarchical task network (HTN) planning is an approach to automated planning in which the dependency among actions can be given in the form of hierarchically structured networks.	CO 5
2	**Define Knowledge representation?** It is the method used to organize and formalize the knowledge in the knowledge base. It is in the form of IF-THEN-ELSE rules .	CO 5

3	**Define Knowledge Acquisition?** The success of any expert system majorly depends on the quality, completeness, and accuracy of the information stored in the knowledge base.	CO 5
4	**State the term Expert Systems?** An expert system is a computer program that is designed to solve complex problems and to provide decision-making ability like a human expert.	CO 5
5	**Define ONTOLOGY?** In AI, an ontology is a specification of the meanings of the symbols in an information system.	CO 5
6	**What is Rote learning?** It is a memorization technique based on repetition.	CO 5
7	**What Credit assignment problem?** It is the problem of determining the actions that lead to a certain outcome.	CO 6
8	**Define the term STRIPS?** The Standford Research Institute Problem Solver (STRIPS) is an automated planning technique that works by executing a domain and problem to find a goal.	CO 6
9	**DefineMYCIN?** MYCIN was an early backward chaining expert system that used artificial intelligence to identify bacteria causing severe infection.	CO 6
10	**What is Planning?** The planning in Artificial Intelligence is about the decision making tasks performed by the robots or computer programs to achieve a specific goal.	CO 6
11	**What is Non-linear planning?** This planning is used to set a goal stack and is included in the search space of all possible subgoal orderings. It handles the goal interactions by interleaving method.	CO 6
12	**What is Version space learning ?** Version space learning is a logical approach to machine learning specifically binary classification. Version space learning algorithms search a predefined space of hypothesis, viewed as a set of logical sentences.	CO 6
13	**Define Rule-Based Systems?** Rule-Based systems are systems that uses knowledge encoded in the form of production rules like if..then rules.	CO 6

14	**What is the use of I/O Interface?** The I/O interface permits the user to communicate with the system in a more natural way by permitting the use of simple selection menus or the use of a restricted language which is close to a natural language.	CO 6
15	**Define Associative Networks?** An associative network is a network made up of nodes connected by directed arcs. The nodes represent objects, attributes. concepts, or other basic entities, and the arcs, which are labeled, describe the relationship between the two nodes they connect.	CO 6
16	**Define Frame?** Frames are structured sets of closely related knowledge, such as an object or concept name, the object's main attributes and their corresponding values, and possibly some attached procedures (if-needed, if-added, if-removed procedures).	CO 6
17	**Define Blackboard?** Blackboard is a globally accessible database structure which contains the current problem state and information needed by the knowledge sources.	CO 6
18	**Define Control Information?** It is the information used by the control module to determine the focus of attention. This determines the next item to be processed.	CO 6
19	**Define Analogical Architectures?** Expert Sytems based on analogical architectures allows to solve new problems like humans, by finding a similar problem solution that is known and applying the known solution to the new problem, possibly with some modifications.	CO 6
20	**Define Neural Networks?** Neural Networks are large networks of simple processing elements or nodes which process information dynamically in response to external inputs.	CO 6

Course Coordinator:
Dr. M.Nagaraju

HOD CSE (AI &ML)