GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: PG

Branch: Production

Subject Code: ME02000881

Subject Name: Artificial Intelligence & Neural Network

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	NIL
Rationale:	With the usage of Internet and World Wide Web increasing day by day, the field of AI and its techniques are being used in many areas which directly affect human life. Various techniques for encoding knowledge in computer systems such as Predicate Logic, Production rules, Semantic networks find application in real world problems. The fields of AI such as Game Playing, Natural Language Processing, and Connectionist Models are also important. Student should know some programming language for AI. Subject is designed to understand the principles of various Artificial Intelligence Methods. This subject aims for the student to acquire knowledge of the fundamentals AI techniques used in Mechanical/Production/Industrial Engineering.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Apply the search technique procedures to real world problems	U/A
2	Analyse the various types of logic and knowledge representation schemes	A
3	Understand various Game Playing techniques and apply them in programs.	U/A
4	Gain knowledge in AI Applications and advances in Artificial Intelligence	U/A
5	Use Prolog Programming language using predicate logic	A

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	30	20	150

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Course Content:

Content	No.of Hours	% of Weightage
Introduction : The AI Problems, The Underlying Assumption, AI techniques, The Level of The Model, Criteria For Success.	2	4
Problems, State Space Search & Heuristic Search Techniques : Defining Problems As A State Space Search, Production Systems, Problem Characteristics, Production System Characteristics, Issues In the Design Of Search Programs, Additional Problems. Generate-and-Test, Hill Climbing, Best-First Search, Problem - Reduction, Constraint Satisfaction, Means-Ends Analysis.	6	15
Knowledge Representation Issues : Representations And Mappings, Approaches To Knowledge Representation.	3	7
Using Predicate Logic : Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution.	2	4
Representing Knowledge Using Rules : Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching, Control Knowledge	2	4
Symbolic Reasoning Under Uncertainty : Introduction To Non- monotonic Reasoning, Logics For Non-monotonic Reasoning, Implementing issues, Implementation Depth first search, Breadth first search.	2	4
Statistical Reasoning : Probability And Bays' Theorem, Certainty Factors And Rule-Base Systems, Bayesian Networks, Dempster- Shafer Theory	3	7
Game Playing, Planning : Overview, Mini Max Search Procedure, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Reactive Systems	5	12
Natural Language Processing : Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking	3	7
Fuggy Logic: Fuzzy sets, Uncertainty considerations, Foundation of fuzzy system, Fuzzy relations, Fuzzification methods, Linguistic descriptions and their analytical forms, Defuzzification methods, Fuzzy logic in control and decision making applications, Hardware realization of the analog fuzzy logic controller	2	4

Expert system: Architecture of expert system, Rule based systems, Knowledge acquisition, Inference engine, Forward chaining, Backward chaining, Stages in development in expert system, Expert system tool, Difficulties in developing expert systems, Applications of expert system in manufacturing.	2	4
Connectionist Models : Hopefield Network, Neuron physiology, Artificial neurons and fundamentals of ANN, Learning in Neural Network, Features of ANN, ANN training algorithms, ANN applications in Mechanical Engineering., Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.	4	8
Modern AI: Introduction, Genetic Algorithms, Particle Swarm Optimization, Ant Colony Optimization, A* star algorithm	5	12
Introduction to Prolog : Introduction To Prolog: Syntax and Numeric Function, Basic List Manipulation Functions In Prolog, Functions, Predicates and Conditional, Input, Output and Local Variables, Iteration and Recursion, Property Lists and Arrays, Miscellaneous Topics, LISP and Other AI Programming Languages	4	8
Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	40	40	0	0	0

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) **Books:References:**

1. "Artificial Intelligence" -By Elaine Rich And Kevin Knight (2nd Edition) Tata Mcgraw-Hill
2. "Artificial Intelligence: A Modern Approach" -By Stuart Russel, Peter Norvig, PHI
3. "Introduction to Prolog Programming" -By Carl Townsend.
4. "PROLOG Programming For Artificial Intelligence" -By Ivan Bratko(Addison-Wesley)

5. "Programming with PROLOG" –By Klocksin and Mellish.

(b) Term Work

1. Write a program to implement Tic-Tac-Toe game problem.
2. Write a program to implement BFS (for 8 puzzle problem or Water Jug problem or any AI search problem) .

(b) Open-source software and website:
As per the course content and course outcome.

List of Laboratory/Learning Resources Required: Software Suggested Activities for Students:

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