Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-5 (B.Tech)

Subject: Artificial Intelligence- BETCE15314

Type of course: Professional Core and Professional Elective Courses

Prerequisite: Basic knowledge of calculus, linear algebra, probability, and programming (preferably Python and Prolog) is required. Familiarity with logic, search algorithms, and AI concepts will be beneficial.

Rationale:

This course provides a comprehensive introduction to Artificial Intelligence, focusing on key concepts, algorithms, and real-world applications. Students will explore foundational topics such as problem-solving strategies, knowledge representation, and logic-based reasoning. Key areas like search algorithms (BFS, DFS, A*), heuristic methods, and constraint satisfaction problems will be covered in detail. The course also includes advanced topics such as game theory, AI planning, and expert systems, with practical applications in domains like medical diagnosis and fault detection. Through hands-on projects, including building AI systems for games and expert systems, students will gain valuable experience in implementing AI algorithms, designing intelligent systems, and solving complex problems. The course emphasizes both theoretical understanding and practical problem-solving skills, preparing students to address real-world challenges in Artificial Intelligence.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Sr. No	Course content	Hrs.	% Weightage
1	**Introduction to Artificial Intelligence** Overview of AI: Definition, history, and evolution, Intelligent systems and their categorization, Components of AI programs, Sub-areas of AI: Machine learning, NLP, robotics, Applications of AI: Case studies and real-world uses	6	10%
2	**Problem Solving with AI** State-space search, Problem formulation, Uninformed search: BFS, DFS, DLS, IDDFS, Heuristic-based strategies: Greedy search, A*, Constraint satisfaction problems	9	15%
3	**Knowledge Representation** Knowledge representation: Semantic networks, frames, Propositional and predicate logic, Inference mechanisms: Forward chaining, Backward chaining	15	20%
4	**Game Playing and Planning** Introduction to game theory, Minimax algorithm, Alpha-beta pruning, Game playing, Planning in AI: Goal stack and hierarchical planning. Practical Activity: Build a simple AI for a game like N-Queen or Tic-Tac-Toe.	9	15%
5	**Expert Systems** Overview of expert systems, Components and development phases, Knowledge representation techniques, Evaluation, and real-world applications. Practical Activity: Design a small expert system for a domain like medical diagnosis or fault detection.	12	25%
6	**Prolog Programming** Introduction to Prolog, Basics: Facts, rules, and queries, Backtracking, Recursion, Lists, arrays, and property lists	9	15%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Exploring AI in Real Life:** Students will select a real-world AI application individually (e.g., AI in healthcare, self-driving cars, or recommendation systems) and analyze how it works, its benefits, and challenges. They will prepare a PowerPoint (PPT) presentation and upload it on the GMIU Web Portal.	10

2	**AI-Powered Data Insights:** Students will choose a dataset individually of their interest (e.g., weather data, sales data, or sports statistics) and apply basic AI techniques such as classification or clustering using any tool (e.g., Python, Excel). They will submit their findings in a PDF report on the GMIU Web Portal.	10
3	**Logic Programming with Prolog:** Students will design and implement a simple Prolog-based knowledge system in group of 2 (e.g., an intelligent assistant, family relationship model, or rule-based decision system). They will upload their Prolog code, sample queries, and a brief explanation of how the system works in a PDF document on the GMIU Web Portal.	10
	Total	30

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	**Remembrance (R)**	**Understanding (U)**	**Application (A)**	**Analyze (N)**	**Evaluate (E)**	**Create (C)**
Weightage	20%	20%	15%	15%	15%	15%

Course Outcome:

After learning the course, the students should be able to:	
CO1	Understand the fundamentals of Artificial Intelligence, its history, evolution, and the categorization of intelligent systems and their applications in real-world case studies.
CO2	Formulate AI-based problems and apply search algorithms like BFS, DFS, and heuristic-based strategies (Greedy search, A*) to solve them effectively.
CO3	Analyze and implement knowledge representation techniques such as semantic networks, frames, propositional and predicate logic, and inference mechanisms like forward and backward chaining.
CO4	Apply AI techniques in game playing using algorithms like Minimax and Alpha-beta pruning, and develop basic AI planning models using goal stack and hierarchical planning Strategies.
CO5	Develop expert systems and Prolog programs using knowledge representation techniques and Prolog features to solve real-world AI problems.

List of Practical

Sr. No	Descriptions	Unit No	Hrs.
1	Implement a program to demonstrate AI components, categorization of intelligent systems, and applications in real-world case studies.	1	2
2	Implement a search algorithm (BFS, DFS, or DLS) to solve a state-space problem, such as maze navigation or robot path finding.	2	2
3	Design and implement heuristic-based search strategies like Greedy search or A* for solving shortest-path problems.	2	2
4	Develop a constraint satisfaction solver for a problem like Sudoku or N-Queens.	2	2
5	Implement knowledge representation using semantic networks or frames and demonstrate reasoning with forward or backward chaining.	3	4
6	Create a system using propositional and predicate logic to represent And infer knowledge in a given domain.	3	2
7	Build an AI to play a simple game like Tic-Tac-Toe using the Minimax algorithm with Alpha-beta pruning optimization.	4	4
8	Implement a planning algorithm (e.g., goal stack or hierarchical Planning) for solving the blocks-world problem or similar planning problems.	4	2
9	Design and develop an expert system prototype for a domain like medical diagnosis or fault detection using a suitable knowledge Representation method.	5	4
10	Write Prolog programs using facts, rules, and queries to perform logical reasoning tasks.	6	2
11	Implement recursion and backtracking in Prolog to solve a problem Such as finding paths in a graph.	6	2
12	Combine Prolog programming techniques to create a small expert system or logic-based problem-solving program.	6	2
		Total	30

Instructional Method:

The course combines traditional and modern teaching methods, including demonstrations, role play, quizzes, brainstorming, and MOOCs (NPTEL/SWAYAM).

Students will engage with online tutorials, e-courses, and virtual labs to explore AI concepts like state-space search, knowledge representation, and Prolog.

Evaluation includes assignments, quizzes, projects, and a final practical/viva exam assessing AI implementation, expert system design, and problem-solving skills.

Reference Books:

[1] Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig

[2] Introduction to Artificial Intelligence by Wolfgang Ertel

[3] Prolog Programming for Artificial Intelligence by Ivan Bratko

[4] Artificial Intelligence: Structures and Strategies for Complex Problem Solving by George F. Luger

[5] Building Expert Systems by Frederick Hayes-Roth, Donald A. Waterman, and Douglas B. Lenat