CE357: ARTIFICIAL INTELLIGENCE

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	**4**
Marks	100	50	150	

Pre-requisite courses:

- Linear algebra (vectors, matrices, derivatives)
- Calculus.
- Basic probability theory.
- Python programming.

Outline of the course:

Sr No.	Title of the unit	Minimum number of hours
1.	Fundamental concepts	04
2.	Heuristic Search Techniques Problems, Problems Space and Search, Heuristic Search Techniques	08
3.	Knowledge Representation and Logic	05
4.	Reasoning	06
5.	Weak Slot-And-Filler Structure, Game Playing and Planning	06
6.	Natural Language Processing (NLP), Text Analytics and Neural Networks	08
7.	Advanced Topics	08
	Total hours (Theory) :	45
	Total hours (Lab) :	30
	Total hours :	75

Detailed Syllabus:

1	**Fundamental concepts**	**04 hours**	**10%**
	The History of Artificial Intelligence, The AI Problems, AI Techniques, Applications of AI, Strong AI vs Weak AI, The Turing Test, Agents and Environments, The concept of Rationality, The Nature of Environments and the Structure of Agents.		

2	**Problems, Problems Space and Search, Heuristic Search Techniques**	**08 hours**	**18%**
	Defining the Problems as a State Space Search, Production Systems, Problem Characteristics, Production System Characteristics, Issues in The Design of Search Programs, Generate-And-Test, Hill Climbing, Simulated Annealing, Best-First Search, A*, AO*, Branch and Bound Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.		
3	**Knowledge Representation and Logic**	**05 hours**	**12%**
	Knowledge Representations and Mappings, Approaches to Knowledge Representation., Issues in Knowledge Representation, Representing Knowledge using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching, Control Knowledge. Logic: Instance and ISA Relationship, Computable Functions and Predicates, Resolution.		
4	**Reasoning**	**06 hours**	**12%**
	Symbolic Reasoning Under Uncertainty and Statistical Reasoning: Introduction to Non-monotonic Reasoning. Statistical Reasoning: Probability and Bayes' Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic.		
5	**Weak Slot-And-Filler Structure, Game Playing and Planning**	**06 hours**	**12%**
	Weak Slot-And-Filler Structure: Semantic Nets, Frames. Game Playing: The MiniMax Search Procedure, Adding Alpha-Beta Cutoffs, Additional Refinements, Iterative, Deepening. Planning: Blocks World, STRIPS, Constraint Satisfaction, Basics of Probabilistic Planning.		
6	**Natural Language Processing (NLP), Text Analytics and Neural Networks**	**08 hours**	**18%**
	NLP and Text Analytics: Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse and Pragmatic Processing, Text Analytics, Text pre-processing, Bag of Words, Word Cloud, Machine Translation, sentiment analysis. Neural Networks: Introduction: Simple Perceptron, Hopfield Network, Learning in Neural Network, Application of Neural Networks, Recurrent Networks, Deep Neural Network, Convolution Network, Restricted Boltzmann machine, Transfer learning		
7	**Advanced Topics**	**08 hours**	**18%**
	Optimization Techniques: Genetic Algorithm (GA), Ant Colony Optimization (ACO), Particle Swarm Optimization (PSO), Tabu Search, Introduction to topics like Computer Vision, Expert		

	Systems, Big data, Neuro Computing, Robotics, Web Search.		

Course Outcome (COs):

At the end of the course, the students will be able to

CO1	Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.
CO2	Apply these techniques in applications, which involve perception, reasoning and learning.
CO3	Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
CO4	Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
CO5	Demonstrate proficiency-developing applications in an 'AI language', expert system shell, or data-mining tool.
CO6	Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	1	1	1	1	-	-	2	2	2	3
CO2	2	2	-	-	-	-	-	1	2	1	1	1	2	-
CO3	3	1	1	-	-	1	1	-	-	-	-	-	2	-
CO4	3	2	3	3	-	-	-	1	2	2	2	2	3	3
CO5	3	2	2	2	3	2	2	-	-	-	-	-	2	-
CO6	2	1	1	-	-	3	-	-	-	-	2	2	3	3

Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
If there is no correlation, put "-"

Recommended Study Material:

- **Text Books:**

1. "Artificial Intelligence" -By Elaine Rich and Kevin Knight (2nd Edition) Tata Mcgraw-Hill.
2. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Ed., Prentice Hall, 2009. Can also use 2nd Ed., Pearson Education International, 2003.
3. Introduction to Prolog Programming by Carl Townsend.

- **Reference Books:**

1. Artificial Intelligence and Expert System by D.W. Patterson, PHI
2. Introduction to Applied Fuzzy Logic by Ahmed Abraham, PHI
3. Nils Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann, 1998.
4. David Poole, Alan Mackworth, Artificial Intelligence: Foundations for Computational Agents, Cambridge Univ. Press, 2010.
5. Artificial Intelligence & design of expert systems, Lager, Benjamin/Cummings.
6. Artificial Intelligence - An Engineering Approach, Schalkoff R. J., McGraw-Hill.
7. Expert Systems: Theory & Practice, Jean-Louis Ermine, Prentice-Hall India,1997.
8. Programming with PROLOG" –By Klocksin and Mellish.

❖ **Web Material:**

1. http://stanford.edu/~cpiech/cs221/
2. https://www.expertsystem.com/examples-natural-language-processing-systems-artificial-intelligence/
3. https://www.linkedin.com/pulse/sentiment-analysis-cognitive-computing-jaish-mathews
4. https://www.johanahlen.info/en/2017/04/text-analytics-and-sentiment-analysis-with-microsoft-cognitive-services/

❖ **Software:**

1. Python
2. SWI Prolog