Subject Code: 01CT0616

Subject Name: Artificial Intelligence

B.Tech. Year – III (Semester VI)

Objective: Artificial intelligence (AI) is a research field that studies how to realize the intelligent human behaviours on a computer. The ultimate goal of AI is to make a computer that can learn, plan, and solve problems autonomously. The main purpose of this course is to provide the most fundamental knowledge to the students so that they can understand the purpose of AI.

Credits Earned: 04 Credits

Course Outcomes:

After the course, the students will be able to:

1. Understand the appropriate technique and algorithm for reasoning and developing the solution within an AI problem domain [Understand]
2. Identify the appropriate representation of the AI problem or domain model [Understand]
3. Compare the performance of the AI system or component [Evaluate]
4. Analyse the gaps and improve the research quality for an existing AI problem [Analyse]
5. Develop the solution for an existing AI problem using the concepts of Neural Nets, NLP, Game Theory, Recommendation System and Reinforcement Learnings. [Apply]

Pre-requisite of course: Programming using Python, Probability, Linear Algebra, Algorithms

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal (I)	Viva (V)	Term work (TW)	
3	0	2	4	50	30	20	25	25	150

Contents:

Unit	Topics	Hours
1	**Introduction to AI:** What is AI, Foundations of AI, History of AI, Risks and Benefits of AI, Intelligent Agents-reactive, deliberative, goal-driven, utility-driven, and learning agents, Good Behaviour: The concept of Rationality, Nature of Environment, Structure of Agents, Criteria For Success	2

2	**Solving Problems by Searching:** Search problems and solution, Search Algorithms- Best-first search, Breadth-first search, Depth First Search, Dijkstra's algorithm, Bidirectional search, Redundant paths, State spaces and search, Heuristic Search Strategies- Hill climbing ,Local Maxima	3
3	**Finding Optimal Path** Brute Force, Branch and Bound, A*, Admissibility of A*, Iterative Deepening A*, Algorithm AO*, Pruning the OPEN and CLOSED List	3
4	**Constraint Satisfaction Problems** Constraint Propagation: Inference in CSPs- Node consistency, Arc consistency, Path consistency, K-consistency ,Global constraints, Sudoku	3
5	**Knowledge representation** The Schema, Frames, Inheritance in taxonomies, Conceptual Graphs, Using Predicate logic- representing facts in logic, functions and predicates, Agents, Facets of knowledge, Resolution in propositional logic and predicate logic, Question Answering	4
6	**Machine Learning** Types of Dataset, Types of Learning, Prediction, Classification, Generation, Regression and Clustering approach, Feature Extraction and Scaling, Loss Function	5
7	**Deep Learning:** Simple Feedforward Network, Computation Graphs for Deep Learning, Activation Functions, Convolutional Network¸ Recurrent Neural Networks, Unsupervised Learning and Transfer Learning, Applications	7
8	**Reinforcement Learning** Learning from Rewards, Active and Passive Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, Applications of Reinforcement Learning	6
9	**Natural Language Processing** Language Models, Lemmatization, Stemming, Parsing, Word Embeddings, Topic Modeling, Learning texts- Keyword Extraction, Summarizing, Text Ranking	7
10	**Recommender Systems** Recommendation Systems, Factorization Algorithms, SVD, Collaborative Filtering-User based and Item Based, Content-based recommendation- Discovering features of documents	6
11	**Game Theory** What is Game Theory, Applications, Types of Game theory, Nash Equilibrium, Mixed Strategy Nash Equilibrium, Bayesian Games	3
11	**Philosophy, Ethics, and Safety of AI** The Limits of AI, Can Machines Really Think?, The Ethics of AI, The Future of AI	1
	Total Hours	**50**

Suggested Textbooks/Reference books:

1. Deepak Khimani, A first course in Artificial Intelligence, Tata McGraw-Hill
2. Russell, S.J. and Norvig, P., Artificial Intelligence: A Modern Approach, Pearson Education
3. "Artificial Intelligence" -By Elaine Rich And Kevin Knight (2nd Edition) Tata Mcgraw-Hill
4. G.Luger, W.A. Sttubblefield, "Artificial Intelligence", Addison-Wesley Longman
5. N.P. Padhy "Artificial Intelligence and Intelligent Systems", Oxford University Press

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyse	Evaluate	Create
10%	10%	40%	20%	10%	10%

Suggested List of Experiments:

1. Implement simple feed-forward network
2. Implement Sequential modelling network
3. Implement the neural network with feed-back system
4. Implement the code for RNN
5. Implement the code for LSTM
6. Implement the code for the image processing
7. Implement the code for CNN
8. Implement the basic code for word embeddings of NLP
9. Implement the code for textrank for keyword extraction
10. Implement the code for textrank for text summarization
11. Implement the code for topic modelling of LDA
12. Implement the recommendation system to recommend movie to users
13. Implement the recommendation system to recommend items to users
14. Implement the content based and collaborative based filtering of recommendation system
15. Implement the snake and ladder game using reinforcement learning
16. Implement the Nash Equilibrium theorem using Game Theory concept
17. Implement the BFS, DFS and Dijkstra's shortest path algorithm
18. Implement the Sudoku game using the concept of CSPs
19. Write a program to implement Tic-Tac-Toe game problem.
20. Write a program to Implement A* Algorithm.

Instructional Method:

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
c. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources/Web-Resources:

1. http://www.journals.elsevier.com/artificial-intelligence/
2. https://www.technologyreview.com/s/534871/our-fear-of-artificial-   intelligence/
3. http://www.sanfoundry.com/artificial-intelligence-mcqs-inductive-logic-unification-lifting-1/