Maulana Abul Kalam Azad University of Technology, WB
(Formerly known as West Bengal University of Technology)
Syllabus of B.Sc. in Computer Science
Effective from academic session 2023-24
Semester-VI

Paper Name: Artificial Intelligence/ Artificial Intelligence Lab

Code: CS 601/ CS 691

Contact: 3L + 2P

Course Objective:

1: To study the idea of intelligent agents and search methods

2: To study about representing knowledge

3: To construct plans and method for generating knowledge

4: To study the concept of expert system

Unit 1: Introduction [2L]
Overview of Artificial intelligence- Problems of AI, History and evolution of AI, Foundation- logic, probability, cognitive science, Ai domains- Problem solving, learning, perception, language, AI vs Human intelligence, AI technique, Tic - Tac - Toe problem.

Unit 2: Intelligent Agents [2L]
Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learningagents.

Unit 3: Problem Solving [2L]
Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs,

Unit 4: Search techniques [5L]
Solving problems by searching: problem solving agents, searching for solutions; uniform search strategies: breadth firstsearch, depth first search, depth limited search.

Unit 5: Heuristic search strategies [6L]
Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, genetic algorithms; constraint satisfaction problems,local search for constraint satisfaction problems.

Unit 6: Adversarial search [4L]
Games, optimal decisions & strategies in games, the minimax search procedure.
Knowledge & reasoning, Knowledge representation issues, approaches to knowledge representation, issues in knowledge representation.

Unit 7: Using predicate logic [2L]
Representing simple fact in logic, computable functions & predicates, resolution.

Unit 8: Representing knowledge using rules [3L]
Propositional logic- Syntax, semantics, inference, Predicate logic- terms, functions,

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quantifiers, semantic network, frames, rule based systems and production systems, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge, knowledge acquisition bottleneck.

Unit 9: Probabilistic reasoning [3L]

Limitation of logic based reasoning, probability theory recap, Representing knowledge in an uncertain domain, the semantics of Bayesian networks- structure, conditional probabilities, inference, Decision theory- utility, expected value, Fuzzy sets & fuzzy logics-membership functions, linguistic variables, fuzzy rules, Application in diagnosis, risk management.

Unit 10: Planning [2L]

Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

Unit 11: Learning [3L]

Overview of Machine Learning: supervised, unsupervised, reinforcement, decision trees, KNN and simple classification models, Overview of Artificial neural network and Deep Learning, Processing: tokenization, morphological and syntactic analysis.

Unit 12: Expert Systems [2L]

Representing and using domain knowledge, expert system shells, and knowledge acquisition.

Artificial Intelligence Lab
Practical: Based on Theory

1) Basic knowledge of programming language like Prolog & Lisp.
2) Resolution using Python

Books:
1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Logic & Prolog Programming, Saroj Kaushik, New Age International
5. Expert Systems, Giarranto, VIKAS

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Paper Name: Python Programming

Code: CS 602/ CS 692

Contact: 3L + 2P

Course Objective:

1: Acquire the fundamental knowledge of Python.

2: Utilize Python programming language efficiently

3: Build a solid fundamental in Python programming, enabling them to write Python programming code independently

4: To develop a Python project.

Unit 1: Introduction [2L]
History, Features, Setting up path, working with Python, Basic Syntax, Python virtual machine, memory management of Python, Variable and Data Types, Tokens (Keywords, Identifiers, Literals, Operators and punctuations), Python comments line, Variables.

Unit 2: Data handling and Conditional Statements [4L]
Data types, Mutable and immutable types, Negative arithmetic numbers, evaluation of expression, type casting, If, If- else, Nested if-else, Looping, For, While, Nested loops Control Statements Break, Continue,

Unit 3: String and Character [3L]
Introduction, traversing the string, Pass StringManipulation Accessing Strings, membership operator, comparison operator, Unicode value of single character, Basic Operations, String slices, Function and Methods[len(), capitalize(), count(), find(), isalpha(), isalnum(), index(), isdigit(), isspace(), lower(), upper(), islower(), strip()]

Unit 4: Lists [3L]
Introduction, Accessing list, Operations, Working with lists, Function and Methods

Unit 5: Tuple [2L]
Introduction, Accessing tuples, Operations, Working, Functions and Methods

Unit 6: Dictionaries [2L]
Introduction, Accessing values in dictionaries, working with dictionaries,

Unit 7: Function [4L]
Properties Functions, Defining a function, Calling a function, Types of functions, Function Arguments, Anonymousfunctions, Global and local variables, recursive function using lambdas with filters(), lambdas with map().

Unit 8: Modules [4L]
Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Readingdata from keyboard, Opening and closing file, Reading and

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writing files, Functions

Unit 9: Numpy Array [4L]
Array indexing, slicing, sort, split, join, search, filter

Unit 10: File Handling [3L]
File open, read, read/write, write, close, rename, delete

Unit 11: Exception Handling [4L]
Exception, Exception Handling, exception clause, finally clause, User Defined Exceptions.

Unit 12: Class and Object: [4L]
Features of OOPs Programming, Creation of class, self-variable, Constructor, types of variable, namespace, types of methods(Instance method, class methods, static method) Inheritance: Constructor in inheritance, super(), Types of inheritance.

Books

1. Let Us Python - 3rd Edition: Python Is Future, Embrace It Fast by Aditya Kanetkar Yashavant Kanetkar
2. Python: The Complete Reference by Martin C. Brown
3. Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming by Eric Matthes
4. Automate the Boring Stuff with Python, 2nd Edition: Practical Programming for Total Beginners by AlSweigart
5. Python Programming: Using Problem Solving Approach by Reema Thareja

Python Programming Lab

Practical: Based on Theory

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Paper Name: Soft Computing

Code: CS 603

Contact: 3L+1T

Course Objective:

1: The unit cover rule base expert system, fuzzy system.

2: Artificial neural network, evolutionary computation.

3: Student acquire the knowledge of intelligent system and provide them with a working knowledge for building these system.

Course Contents:

Unit 1: Introduction to Soft Computing: [2L]

Introduction, Soft computing constituents and conventional AI, Components of Soft Computing and Traditional AI, Characteristics of Neuro-Fuzzy and soft computing

Unit2: Fuzzy Set Theory: [6L]

Fuzzy sets, Fuzzy set vs Crisp set, Crisp relation and fuzzy relation, Basic definitions and terminologies, Set-theoretic operations, Member function formulation and parameterization, more on union, intersection and complement

Unit 3: Fuzzy Rules, Fuzzy Reasoning and Fuzzy Inference System: [12L]

Fuzzy propositions, formation, decomposition and aggregation of fuzzy rules, fuzzy reasoning, Extension principle and fuzzy relations, Fuzzy if-then rules (including linguistic variables), Fuzzy reasoning, Fuzzy inference systems, Mamdani fuzzy model, Sugeno fuzzy model, Tsukamoto fuzzy model

Unit 4: Genetic Algorithms: [10L]

Fundamental, Basic components, working principle, encoding, fitness function, reproduction, Derivative free Optimization, Genetic Algorithms, Concepts of selection, crossover and mutation, Differential Evolution as modified GA, application and advances in GA, differences and similarities between GA and other traditional method.

Unit 5: Swarm-based optimization: [5L]

Particle Swarm Optimization- PSO Model, Global Best, Local Best, Velocity Update Equations, Position Update Equations.

Unit 6: Artificial Neural Network: [4L]

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Introduction to ANN, perceptrons and MLP, perceptron learning algorithms, adaline and madaline, back propagation multilayer perceptrons.

Text Book and Reference Book:

1. Neuro-Fuzzy and Soft Computing, Jang, Sun, Mizutani, PHI/Pearson Education
2. Genetic Algorithms: Search, Optimization and Machine Learning, Davis E. Goldberg, Addison Wesley, N.Y.
3. Swarm Intelligence Algorithms: A Tutorial, Adam Slowik, Ed: CRC Press, 2020.
4. Fuzzy Logic with Engineering Applications, Timothy J. Ross, McGraw-Hill.