ANDHRA KESARI UNIVERSITY ::ONGOLE

Model Syllabus for 4-Year UG Honours in B.Sc. (Artificial Intelligence) as Major in consonance with Curriculum framework w.e.f. AY 2025-26

COURSE STRUCTURE (for Semester I to VI)

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	I	1	Computer Fundamentals and Office Automation	3	3
			Computer Fundamentals and Office Automation Lab	2	1
		2	Mathematical Foundation for AI	4	4
	II	3	Python Programming and Data Structures	3	3
			Python programming and Data Structure Lab	2	1
		4	Artificial & Computational Intelligence	3	3
			Artificial & Computational Intelligence Lab	2	1
II	III	5	Statistical Foundation of AI	3	3
			Statistical Foundation of AI Lab	2	1
		6	DBMS	3	3
			DBMS Lab	2	1
		7	Exploratory Data Analysis & Data Visualization	3	3
			Exploratory Data Analysis & Data Visualization Lab	2	1
	IV	8	Data Science with R	3	3
			Data Science with R Lab	2	1
		9	Foundation of ML & Supervised Learning	3	3
			Foundation of ML & Supervised Learning lab	2	1
		10	Robotics Principles & Embedded systems	3	3
			Robotics Principles & Embedded systems Lab	2	1
III	V	11	Unsupervised & Reinforcement Learning	3	3
			Unsupervised & Reinforcement Learning Lab	2	1

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
		12 A	Neural networks & Deep Learning	3	3
			Neural networks & Deep Learning Lab	2	1
			OR		
		12 B	Big Data Technologies	3	3
			Big Data Technologies Lab	2	1
			OR		
		12 C	Robotics Kinematics & Dynamics	3	3
			Robotics Kinematics & Dynamics Lab	2	1
		13 A	Natural Language Processing	3	3
			Natural Language Processing Lab	2	1
			OR		
		13 B	Cloud computing for Data Science	3	3
			Cloud computing for Data Science Lab	2	1
			OR		
		13 C	Additive Manufacturing & IoT	3	3
			Additive Manufacturing & IoT Lab	2	1
	VI	14 A	Conversational AI	3	3
			Conversational AI Lab	2	1
			OR		
		14 B	Time Series Analysis & Forecasting	3	3
			Time Series Analysis & Forecasting Lab	2	1
			OR		
		14 C	Robot Operating System	3	3
			Robot Operating System Lab	2	1
		15 A	Applications of Natural Language Processing	3	3
			Applications of NLP Lab	2	1
			OR		
		15 B	Data Engineering & MLOps	3	3
			Data Engineering & MLOps	2	1
			OR		
		15 C	Advanced AI Automation & Robotics	3	3
			Advanced AI Automation & Robotics Lab	2	1

V. [illegible]
Lect. in. computer science
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Note: In the III Year (during the V and VI Semesters), students are required to select a pair of electives from one of the **THREE** specified domains. **For example: if set 'A' is chosen, courses 12 to 15 to be chosen as 12 A, 13 A, 14 A and 15 A.** To ensure in-depth understanding and skill development in the chosen domain, students must continue with the same domain electives in both the V and VI Semesters.

SEMESTER-I

COURSE 1: COMPUTER FUNDAMENTALS AND OFFICE AUTOMATION

Theory **Credits: 3** **3 hrs/week**

Course Objectives

1. **Understand foundational computing concepts**, including number systems, the evolution of computers, block diagrams, and generational progress.
2. **Develop knowledge of computer architecture**, focusing on system organization and networking fundamentals.
3. **Acquire practical skills in document creation**, formatting, and digital presentations using word processing tools.
4. **Gain proficiency in spreadsheet operations**, such as data entry, formulas, functions, and charting techniques.
5. **Introduce data visualization and basic modelling principles**, fostering analytical thinking in structuring and interpreting data sets.

Course Outcomes

1. At the End of the Course, The Students will be able to **explain different number systems**, the historical evolution of computers, and identify key components in a block diagram.
2. Learners will demonstrate **basic blocks of a computer and fundamental networking knowledge.**
3. Learners will create professional-level documents and **design visually appealing presentations** using word processing software and presentation software.
4. Learners will manipulate data within spreadsheets, apply formulas, and **generate accurate summaries and visualizations.**
5. Learners will apply data modelling techniques to **analyze, organize, and represent data effectively** in various scenarios.

Unit 1. Number Systems, Evolution , Block Diagram and Generations:

Number Systems: Binary, Decimal, Octal, Hexadecimal; conversions between number systems.

Evolution of Computers: History from early mechanical devices to modern-day systems.

Block Diagram of a Computer: Components like Input Unit, Output Unit, Memory, CPU (ALU + CU).

Generations of Computers: First to Fifth Generation – technologies, characteristics, examples.

Unit 2. Basic organization and N/W fundamentals:

Computer Organization: Functional components – Input/Output devices, Storage types, Memory hierarchy.

Types of Computers: Micro, Mini, Mainframe, and Supercomputers.

Networking Fundamentals: Definition, need for networks, types (LAN, WAN, MAN), topology (Star, Ring, Bus).

Internet Basics: IP Address, Domain Name, Web Browser, Email, WWW.

Unit 3. Word Processing and presentations:

Word Processing Basics: Using MS Word/Google Docs – formatting, styles, tables, mail merge.

Presentation Tools: Using PowerPoint/Google Slides – slide design, animations, transitions.

Applications: Creating resumes, reports, brochures, and presentations.

Keyboard Shortcuts

Unit 4. Spreadsheet Basics:

Spreadsheet Concepts: Understanding rows, columns, cells in tools like MS Excel/Google Sheets, cell referencing.

Functions and Formulae: SUM, AVERAGE, IF, COUNT.

Charts and Graphs: Creating visual representations

Data Handling: Sorting, filtering, conditional formatting.

Text Functions: LEFT, RIGHT, MID, LEN, TRIM, CONCAT, TEXTJOIN

Advanced Functions: **Logical**: IF, AND, OR, IFERROR, **Lookup**: VLOOKUP, HLOOKUP, XLOOKUP, INDEX, MATCH

Unit 5. Data Analysis and Visualization:

Conditional Formatting: Custom rules, Color scales, Icon sets, Data bars

Data Analysis Tools: Pivot Tables and Pivot Charts, Data Validation (Drop-downs, Input Messages, Error Alerts), What-If Analysis: Goal Seek, Scenario Manager, Data Tables

Charts and Dashboards: Creating Interactive Dashboards, Using slicers with Pivot Tables,Combo Charts and Sparklines

Productivity Tips: Using Named Ranges, Freeze Panes, Split View

Textbooks:

1. **Fundamentals of Computers,** Reema Thareja, Oxford University Press, Second Edition
2. **Fundamentals of Computers**, V. Rajaraman – PHI Learning
3. **Introduction to Computers** by Peter Norton – McGraw Hill
4. **Microsoft Office 365 In Practice** by Randy Nordell – McGraw Hill Education

References:

1. **Excel 2021 Bible** by Michael Alexander, Richard Kusleika – Wiley
2. **Networking All-in-One For Dummies** by Doug Lowe – Wiley
3. **Microsoft Official Docs and Training**: https://learn.microsoft.com
4. **Google Workspace Learning Center**: https://support.google.com/a/users/

Activities:

Outcome: At the End of the Course, The Students will be able to **explain different number systems**, the historical evolution of computers, and identify key components in a block diagram.

Activity: Create a digital poster or infographic comparing number systems (binary, decimal, octal, hexadecimal) and illustrating the timeline of computer generations with key innovations.

Evaluation Method: Rubric-based assessment of the poster presentation on a 10-point scale focusing on:

- Accuracy of number system conversions
- Correct identification of block diagram components
- Visual organization and creativity

Outcome: Learners will demonstrate **basic blocks of a computer and fundamental networking knowledge.**

Activity: Design a concept map showing the internal architecture of a computer and types of networks (LAN, WAN, MAN), including devices and topologies.

Evaluation Method: Checklist-based peer review and instructor validation:

- Completeness of the map
- Correctness of networking concepts

- Use of appropriate terminology
- Logical flow and structure of the map

Outcome: Learners will create professional-level documents and **design visually appealing presentations** using word processing software and presentation software.

Activity: Prepare a formal report (e.g., project proposal) in a word processor and present it using a slide deck with transitions, embedded media, and design elements.

Evaluation Method: Performance-based evaluation using a 10-point scoring scale:

- Formatting and structure of the document
- Presentation aesthetics and clarity
- Communication skills during presentation

Outcome: Learners will manipulate data within spreadsheets, apply formulas, and generate accurate summaries and visualizations.

Activity: Analyze a dataset (e.g., student scores or sales data) using spreadsheet software. Apply formulas (SUM, AVERAGE, IF, VLOOKUP) and create relevant charts.

Evaluation Method: Practical test with a rubric:

- Correct use of formulas
- Accuracy of data summarie

Outcome: Learners will apply data modelling techniques to **analyze, organize, and represent data effectively** in various scenarios.

Activity: Prepare an interactive dashboard for a given data set using EXCEL.

Evaluation Method: Evaluation of the dashboard on a 10-point scoring scale:

- Presentation aesthetics and clarity
- Interactiveness
- Communication skills during presentation

SEMESTER-I

COURSE 1: COMPUTER FUNDAMENTALS AND OFFICE AUTOMATION

Practical **Credits: 1** **2 hrs/week**

List of Experiments:

1. Demonstration of Assembling and Dessembling of Computer Systems.
2. Identify and prepare notes on the type of Network topology of your institution.
3. Prepare your resume in Word.
4. Using Word, write a letter to your higher official seeking 10-days leave.
5. Prepare a presentation that contains text, audio and video.
6. Using a spreadsheet, prepare your class Time Table.
7. Using a Spreadsheet, calculate the Gross and Net salary of employees(Min 5) considering all the allowances.
8. Generate the class-wise and subject-wise results for a class of 20 students. Also generate the highest and lowest marks in each subject.
9. Using IF, AND, OR, and IFERROR to Automate Grade Evaluation.
    a. Create a table of student scores in different subjects.
    b. Use IF to assign grades (A/B/C/Fail).
    c. Use IFERROR to handle missing scores or invalid data.
10. *Employee Database Search Using VLOOKUP, HLOOKUP, XLOOKUP, INDEX, and MATCH*
    a. Create a database of employees (Name, ID, Department, Salary).
    b. Implement VLOOKUP to search by employee ID.
    c. Use HLOOKUP to extract department heads by role.
    d. Apply XLOOKUP for more flexible searches.
    e. Use INDEX + MATCH as an alternative to VLOOKUP.
11. Sales Report Analysis Using Pivot Tables and Charts
    a. Use a dataset of product sales (Product, Region, Date, Quantity, Revenue).
    b. Create Pivot Tables to summarize data by region/product.
    c. Insert Pivot Charts for visual analysis (e.g., bar, line).
    d. Add slicers to make the dashboard interactive.
12. Designing a Data Entry Form with Drop-downs and Input Rules
    a. Create a student registration form.
    b. Add drop-down lists for course selection using Data Validation.

c. Add input messages to guide users.
d. Add error alerts for wrong entries.

13. Monthly Budget Planning using Goal Seek and Scenario Manager
    a. Create a simple personal budget (income, expenses, savings).
    b. Use Goal Seek to determine income needed to save a desired amount.
    c. Use Scenario Manager to compare different budgeting scenarios (best/ worst/ realistic case).
    d. Create a one-variable Data Table to analyze how different expenses affect savings.
14. Dashboard Creation Using Combo Charts, Sparklines & Slicers
    a. Use existing sales or attendance data.
    b. Insert combo charts (e.g., column + line).
    c. Add sparklines to show trends.
    d. Use slicers with Pivot Tables to control dashboard elements.
    e. Finalize and format for interactivity.

SEMESTER-I

COURSE 2: MATHEMATICAL FOUNDATION FOR AI

Theory **Credits: 4** **4 hrs/week**

Course Objectives

1. Develop a strong foundation in linear algebra, set theory, and functions essential for AI.
2. Understand and solve systems of linear equations using matrix methods.
3. Gain knowledge of eigenvalues, eigenvectors, and matrix diagonalization.
4. Learn fundamental concepts of probability and statistics for data analysis.
5. Explore functions and their applications relevant to AI problem-solving.

Course Outcomes

1. Solve complex linear algebra problems including matrix properties.
2. Apply set theory rigorously and compute eigenvalues/eigenvectors for intermediate examples.
3. Understand differentiation rules and solve constrained optimization problems.
4. Calculate probabilities in varied scenarios and explore discrete random variables.
5. Analyze data using comprehensive statistical measures and interpret visualizations.

Unit 1: Basic Linear Algebra and Systems of Linear Equations

Vectors and matrices: basics and operations (addition, multiplication, transpose, inverse)

Elementary row operations: row swapping, scalar multiplication, row addition

Row Echelon Form (REF), Reduced Row Echelon Form (RREF), Rank of matrix

System of linear equations: coefficient and augmented matrix representation

Types of solutions: unique, infinite, no solution

Gaussian elimination method using REF and back substitution

Unit 2: Set Theory and Eigen Concepts

Sets, subsets, set operations (union, intersection, difference, complement), Venn diagrams, Cartesian products

Relations and functions: definitions and properties, linear transformations, Eigenvalues, eigenvectors, characteristic polynomial, Diagonalization of matrices and symmetric matrices

Unit 3: Functions and their Properties

Definition, types of functions (polynomial, rational, exponential, logarithmic), Domain, range, and inverses of functions, Composition of functions, Continuity and basic limits, Graphical representation of functions, Maxima & Minima of functions.

Unit 4: Vector Differentiation

Vector differentiation –ordinary – derivatives of vectors – Differentiability – Gradient – Divergence - Curl operators - Directional derivatives of functions

Unit 5: Fundamentals of Probability & Basic Statistics

Probability: Concept of Uncertainty, Axioms and rules of probability, Conditional probability and independence, Law of total probability and Bayes' theorem

Measures of central tendency: Mean, Median, Mode

Measures of dispersion: range, interquartile range, variance, standard deviation

Introduction to correlation and covariance

Data representation: histograms, bar charts, scatter plots

Textbooks and References

1. Mathematics for Machine Learning, M. P. Deisenroth, A. A. Faisal, C. S. Ong, Cambridge University Press, 2020.

2. Introductory Linear Algebra, Howard Anton, Wiley.

3. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Wiley.

4. Discrete Mathematics and its Applications, Kenneth H. Rosen, McGraw Hill.

5. Online Resources: Khan Academy, MIT OpenCourseWare (Linear Algebra, Probability, Statistics, Functions).

Activities:

Unit 1

Activity: Solve advanced linear equation systems using elementary row operations; explore matrix rank with concrete examples; interpret solutions graphically.

Evaluation Method: Assess problem-solving accuracy, clarity of solution process, and ability to classify solution types.

Unit 2

Activity: Practice set theory problems including Venn diagrams, unions, intersections; compute eigenvalues/eigenvectors for 3x3 matrices; perform matrix diagonalization exercises.

Evaluation Method: Evaluate completeness of set operations, correctness of eigen computations, and accuracy in diagonalization.

Unit 3

Activity: Plot and analyze various types of functions (polynomial, exponential, logarithmic); solve problems on function composition and inverses; perform simple graphical interpretations.

Evaluation Method: Assess quality of function plots, conceptual clarity of compositions and inverses, and accuracy of graphical analyses.

Unit 4

Activity: Calculate conditional probabilities; simulate discrete probability distributions; apply Bayes' theorem in practical scenarios (e.g., medical testing, reliability analysis).

Evaluation Method: Evaluate correct application of probability laws and rules, and logical use of Bayesian inference.

Unit 5

Activity: Analyze sample datasets to calculate central tendency measures and dispersion; compute correlation coefficients; create histograms and scatter plots; interpret data insights.

Evaluation Method: Assess accuracy of statistical calculations, clarity and correctness of visual data representation, and quality of interpretation.

SEMESTER-II

COURSE 3: PYTHON PROGRAMMING AND DATA STRUCTURES

Theory **Credits: 3** **3 hrs/week**

Course Objectives

1. To introduce the fundamentals of Python programming, including environment setup, syntax, and core concepts.
2. To develop problem-solving skills using control flow, functions, and modules.
3. To provide knowledge of Python data structures, file handling, and exception handling for effective programming.
4. To impart object-oriented programming concepts and GUI development skills for building applications.

Course Outcomes (COs)

After successful completion of the course, students will be able to:

1. Explain the basic features, syntax, data types, and operators of Python programming.
2. Apply control flow constructs, functions, and modules to develop structured Python programs.
3. Demonstrate the use of sequences, sets, and dictionaries for effective data handling and manipulation.
4. Implement file handling techniques and apply exception handling mechanisms for robust applications.
5. Develop object-oriented and GUI-based applications using Python.

Unit 1: Basics of Python Programming:

Introduction to Python, Features of Python, Programming Modes - Interactive Mode & Script Mode, Identifiers, Naming Conventions, Keywords (Reserved Words), Built-in Data Types, Literals - Integer, Float, Complex, Boolean, String, Variables, Operators, Expressions, Assignment Statements, Input/Output Statements, Python Syntax (Lines, Comments, Indentation),

Operators & Operands, Classification of Operators - Arithmetic Operators, Relational Operators, Logical Operators, Bitwise Operators, Assignment, Augmented Assignment, Identity Operators, Expressions & Precedence Rules

Unit 2: Control Flow, Functions & Modules:

Control Flow - if Statement, if-else, if-elif-else. Iterative Statements – while, for, Nested Loops, Loop Control Statements – break, continue, pass; else with loops

Need for Functions, Defining & Invoking User-defined Functions, Return Statement, Function Input/Output Cases, Scope of Variables - Local, Global, Nested Functions, Function Arguments - Required, Positional, Default, Variable-length, main() Function, Documentation Strings, Recursive Functions, Anonymous Functions (Lambda), Library Functions

Modules - Import, from..import, Creating & Using Modules, Namespaces

Unit 3: Core Data Types and Python Collections

Strings: Representation, Indexing, Slicing, Immutability, Operators, Methods, Formatting

Lists: Creation, Indexing, Slicing, Mutability, Common Methods, List Comprehension

Tuples: Immutability, Operations, Tuple Assignment

Sets and Frozensets: Methods, Mathematical Operations, Comprehension

Dictionaries: Key-Value Structure, Methods, Traversal, Nested Dictionaries

Unit 4: File Handling, Exception Management & Object-Oriented Programming

File Handling: Types, Opening, Reading, Writing, Closing, CSV Files, OS/Pathlib

Error Types, Exception Handling: try-except, raise, User-defined Exceptions, Assertions

OOP Concepts: Classes, Objects, Attributes, Methods, Constructor and Destructors

Encapsulation: Private and Public Members

Inheritance: Single, Multilevel, Multiple, Method Overriding

Unit 5: Abstract Data Structures and GUI Programming

Abstract Data Structures (ADTs): Concepts and Importance

Linked Lists: Definition, Types- Singly, Doubly, Circular; Node Structure, Insertion, Deletion, Traversal (Single Linked list implementation only)

Stacks: LIFO Principle, Implementation using List, Applications

Queues: FIFO Principle, Implementation using List, Priority Queues

GUI Programming with Tkinter: Widgets (Label, Button, Entry, Menu, Listbox, Canvas etc.), Event Handling, Building Simple GUI Apps

Textbooks:

1. Python Programming-An Object Oriented approach, Anita Goel, Universities Press
2. Python Programming using Problem Solving Approach Reema Thareja Oxford University Press 2020
3. Exploring Python, Budd T A, McGraw-Hill Education, 1st Edition, 2011.

Reference Book:

1. Python: The Complete Reference, Martin C. Brown, Mc Graw-Hill, 2018
2. Fundamentals of Python, Kenneth A. Lambert. (2019), First Programs,2nd Edition, CENGAGE Publication.

Activities:

Outcome: Explain the basic features, syntax, data types, and operators of Python programming.

Activity: Conduct a "Python Basics Lab" where students write small programs to demonstrate literals, variables, data types, and operators (e.g., swapping numbers, simple calculator).

Evaluation Method:

- Lab performance checklist (execution of 3 mini tasks)
- Short quiz with multiple-choice and fill-in-the-blanks on syntax, data types, and operators

Outcome: Apply control flow constructs, functions, and modules to develop structured Python programs.

Activity: Group activity - "Python Problem Solving Challenge": Students solve real-life problems (e.g., finding prime numbers, grade calculator, menu-driven calculator) using control structures, functions, and importing standard modules.

Evaluation Method:

- Code submission with proper use of functions/modules (20%)
- Viva-voce to explain logic and flow of control (40%)
- Unit test with scenario-based programming questions (40%)

Outcome: Demonstrate the use of sequences, sets, and dictionaries for effective data handling and manipulation.

Activity: Hands-on mini project – "Student Data Manager": Students create a program using lists, tuples, sets, and dictionaries to store and manipulate student records (e.g., marks, courses, hobbies).

Evaluation Method:

- Practical demo of program with at least 5 data operations (add, search, delete, update, traverse)
- Evaluation rubric for correctness, efficiency, and use of appropriate data structure

Outcome: Implement file handling techniques and apply exception handling mechanisms for robust applications.

Activity: Individual assignment - "File-Based Address Book": Students create a program to store, update, and retrieve data from files, with exception handling for invalid inputs or missing files.

Evaluation Method:

- Assessment of program correctness (file read/write, append, delete, exception handling)
- Short quiz with error-tracing and debugging questions (given code with errors, students identify and correct)

Outcome: Develop object-oriented and GUI-based applications using Python.

Activity: Mini Project – "Student Information System with GUI": Students design a simple Tkinter-based application with classes/objects for handling student data, including basic GUI widgets (Entry, Button, Listbox).

Evaluation Method:

- Project demo and presentation (50%)
- Rubric-based evaluation for OOP concepts (classes, inheritance, encapsulation) and GUI design (widgets, event handling) (30%)
- Peer review/feedback on usability (20%)

SEMESTER-II

COURSE 3: PYTHON PROGRAMMING AND DATA STRUCTURES

Practical **Credits: 1** **2 hrs/week**

1. Basic Python Programs:
    a. Write a program to display basic details (name, roll number, department) using print() and demonstrate different literal types (int, float, string, boolean, complex).
    b. Write a program to perform arithmetic, relational, logical, bitwise, and assignment operations on given inputs.
2. Control Flow Practice
    a. Write a program to find the largest of three numbers using if-elif-else.
    b. Write a program to check whether a number is prime or not using loops.
    c. Write a program to illustrate the use of loop control statements (break, continue, pass).
3. Functions and Recursion
    a. Write a program to define a function to calculate factorial of a number (using recursion).
    b. Write a program to demonstrate different types of function arguments (default, positional, keyword, variable-length).
4. Write a program to illustrate string slicing, concatenation, repetition, and built-in methods.
5. Write a program to create a list of numbers, perform insertion, deletion, searching, sorting, and list comprehension.
6. Write a program to demonstrate tuple packing, unpacking, and immutability.
7. Write a program to implement set operations (union, intersection, difference, subset, superset).
8. Write a program to create a dictionary of student roll numbers and marks, and perform add, update, delete, and traversal operations.
9. Write a program to read and display count of vowels, consonants, digits, and spaces of a text file.
10. Write a program to copy the contents of one file into another file.
11. Write a program to read and process student marks from a CSV file (calculate average, highest, lowest).

12. Write a program to demonstrate exception handling using try-except-finally.
13. Write a program to create a class Student with attributes and methods to display details.
14. Write a program to demonstrate single and multilevel inheritance.
15. Implement stack (LIFO) and queue (FIFO) using lists.
16. Implement singly linked lists: node creation, insertion, deletion, traversal.
17. Write a Tkinter program with Label, Entry, and Button widgets to take user input and display it.
18. Write a Tkinter program to create a simple calculator application.

SEMESTER-II

COURSE 4: ARTIFICIAL & COMPUTATIONAL INTELLIGENCE

Theory **Credits: 3** **3 hrs/week**

Course Objectives

- Introduce foundational concepts and history of Artificial Intelligence (AI).
- Teach the PEAS framework and agent-based problem solving.
- Develop understanding of uninformed and informed search methods.
- Provide basic knowledge of machine learning concepts and computational intelligence.
- Instill awareness of ethical considerations in AI.
- Introduce logic programming fundamentals using Prolog as a practical tool.

Course Outcomes

Students completing this course will be able to:

- Explain basic AI terminology, agent models, and the PEAS framework.
- Formulate AI problems using search strategies and implement basic algorithms conceptually.
- Understand core machine learning categories and their applications.
- Describe computational intelligence approaches and their role in AI.
- Analyze ethical issues related to AI technologies.
- Write and execute simple Prolog programs demonstrating logic programming fundamentals.

Unit 1: Introduction to Artificial Intelligence and PEAS Framework

Introduction to AI: Definition, history, applications, and scope

The PEAS framework: Performance Measure, Environment, Actuators, Sensors, Examples of PEAS in real-world AI systems

Intelligent agents: Intelligent agents and their environments, **Types of intelligent agents:** Simple reflex, model-based, goal-based, utility-based, Agent architectures and rationality

Unit 2: Expert Systems

Definition and components of Expert Systems (Knowledge Base, Inference Engine, User Interface), Rule-based systems and knowledge representation, Examples of expert systems: medical diagnosis, decision support, Limitations and comparison with AI agents, Role and significance of expert systems in AI evolution

Unit 3: Search Strategies in AI

Problem-solving as search: problem formulation, states, actions, goal test, Traveller's problem

Uninformed (Blind) Search: Breadth-first search, Depth-first search, Uniform-cost search

Informed (Heuristic) Search: Greedy best-first search, A* algorithm

Applications of search in AI problems

Unit 4: Introduction to Machine Learning

What is machine learning, definitions, Types of learning: Supervised, Unsupervised, Reinforcement learning (basic ideas), classification, Regression , clustering and Association, Basic learning algorithms overview and applications

Unit 5: Computational Intelligence and Ethics in AI

Overview of computational intelligence (Basics of fuzzy logic, neural networks), Role of computational intelligence in AI, Ethics and societal challenges in AI, Responsible AI, fairness, transparency, and safety concerns

Unit 1: Introduction to AI, PEAS Framework & Intelligent Agents

Activities:

Interactive lecture with real-world AI examples

Group discussion on PEAS framework for different environments

Case study analysis of intelligent agents in everyday AI applications

Quiz on AI fundamentals and agent types

Outcomes:

Students will explain AI basics and describe the PEAS components.

Students will identify types of intelligent agents and their roles.

Evaluation Method:

Quiz and participation: 10%

Assignment on PEAS and agent modeling: 10%

Unit 2: Expert Systems

Activities:

Lecture with multimedia explaining components of expert systems

Hands-on group activity designing rule-based systems for simple decision problems

Case study review of medical diagnosis expert systems

Class debate on limitations and advantages of expert systems

Outcomes:

Understand expert system architecture and knowledge representation.

Develop simple rule-based systems for decision making.

Analyze real-world expert system examples critically.

Evaluation Method:

Group assignment designing rule base: 15%

Written test on expert system concepts: 10%

Unit 3: Search Strategies in AI

Activities:

Demonstration of uninformed search algorithms

Interactive exercises formulating search problems

Simulation of heuristic search and A* algorithm

Problem-solving sessions applying search to puzzles

Outcomes:

Formulate search problems and apply uninformed and heuristic algorithms conceptually.

Explain the working and use cases of different search strategies.

Evaluation Method:

Problem formulation assignment: 10%

Class test on search algorithms: 10%

Unit 4: Basics of Machine Learning

Activities:

Video lectures on different machine learning paradigms

Simple data classification exercises/classification demos

Group presentations on various ML types and applications

Quiz on ML types and terminology

Outcomes:

Explain supervised, unsupervised, and reinforcement learning basics.

Identify sample use cases for machine learning.

Evaluation Method:

Quiz and presentation: 10%

Written assignment on ML overview: 5%

Unit 5: Computational Intelligence & Ethics

Activities:

Lecture introducing fuzzy logic, neural networks overview

Ethical dilemma discussions and case studies in AI technology

Role play on AI responsibility and fairness

Group project: Develop guidelines for responsible AI use

Outcomes:

Understand computational intelligence basics and ethical AI challenges.

Propose responsible AI practices for diverse scenarios.

Evaluation Method:

Participation in ethics discussions: 5%

Group project report and presentation: 15%

Recommended Textbooks and References

- Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition
- Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd Edition
- Michael Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems
- Ivan Bratko, Prolog Programming for Artificial Intelligence, 4th Edition
- Online resources: AI course materials from Coursera, NPTEL, GeeksforGeeks AI tutorials.

SEMESTER-II

COURSE 4: ARTIFICIAL & COMPUTATIONAL INTELLIGENCE

Practical **Credits: 1** **2 hrs/week**

Note: Experiments have to be conducted using Prolog

1. Introduction to Prolog Environment and Syntax
   - Setting up Prolog, understanding facts, rules, and queries.
2. Defining Simple Facts and Queries
   - Write and test simple facts like family relationships, likes/dislikes.
3. Creating Rules in Prolog
   - Define logical rules with conditions and test queries.
4. List Handling in Prolog
   - Write programs to manipulate lists (head, tail, concatenation).
5. Recursion in Prolog
   - Implement recursive relations such as factorial and Fibonacci.
6. Search and Backtracking
   - Demonstrate Prolog's backtracking with sample queries and control cuts.
7. Family Relationship Programs
   - Model family trees and query relationships like siblings, ancestors.
8. Solve the Eight Queens Problem
   - Classic AI problem solved using backtracking.
9. Implement Simple Arithmetic Operations
   - Addition, subtraction, multiplication using Prolog predicates.
10. Monkey and Banana Problem
    - Logic problem modeling and solution.
11. Basic Expert System Prototype
    - Write rules for a simple medical diagnosis or recommendation system.
12. Implement Search Algorithms (Conceptual)
    - Demonstrate basic search algorithms like best-first search using Prolog rules.