Artificial Intelligence

Course Title: Artificial Intelligence **Credit: 3**
Course No: CSIT.312 **Number of period per week: 3+3**
Nature of the Course: Theory + Lab **Total hours: 45+45**
Year: Third, Semester: Fifth
Level: B. Sc. CSIT

1. Course Introduction

The course introduces the ideas and techniques underlying the principles and design of artificial intelligent systems. The course covers the basics and applications of AI, including: design of intelligent agents, problem solving, searching, knowledge representation systems, probabilistic reasoning, neural networks, machine learning and natural language processing.

2. Objectives

The main objective of the course is to introduce concepts of Artificial Intelligence. The general objectives are to,

- learn about computer systems that exhibit intelligent behavior
- design intelligent agents
- identify AI problems and solve the problems
- design knowledge representation and expert systems
- design neural networks for solving problems
- identify different machine learning paradigms

3. Specific Objectives and Contents

Specific Objectives	**Contents**
• Understands basics of artificial intelligence, its history • Understand different fields influencing study of AI • Understand the application areas of AI	**Unit I: Introduction (3 Hrs)** 1.1. Artificial Intelligence (AI), AI Perspectives: acting and thinking humanly, acting and thinking rationally 1.2. History of AI 1.3. Foundations of AI 1.4. Applications of AI
• Understand components of intelligent agents • Design intelligent agents for various problems • Explore different environment	**Unit II: Intelligent Agents (4 Hrs)** 2.1. Introduction of agents, Structure of Intelligent agent, Properties of Intelligent Agents 2.2. Configuration of Agents, PEAS description of Agents 2.3. Types of Agents: Simple Reflexive, Model Based, Goal Based, Utility Based. 2.4. Environment Types: Deterministic, Stochastic, Static,

types where an intelligent agent can work	Dynamic, Observable, Semi-observable, Single Agent, Multi Agent
• Design state space representation for real world problems • Identify problems that can be expressed in terms of search problems or logic problems, and translate them into the appropriate form, and know how they could be addressed using an algorithmic approach. • Understand different heuristic and blind search techniques.	**Unit III: Problem Solving by Searching (9 Hrs)** 3.1. Definition, Problem as a state space search, Problem formulation, Well-defined problems, 3.2. Solving Problems by Searching, Search Strategies, Performance evaluation of search techniques 3.3. Uninformed Search: Depth First Search, Breadth First Search, Depth Limited Search, Iterative Deepening Search, Bidirectional Search 3.4. Informed Search: Greedy Best first search, A* search, Hill Climbing, Simulated Annealing 3.5. Game playing, Adversarial search techniques, Mini-max Search, Alpha-Beta Pruning. 3.6. Constraint Satisfaction Problemss and Search
• Understand and design knowledge representations using different knowledge representation techniques • Represent Knowledge using object based approaches • Construct Propositional Logic (PL) Systems and understand inference techniques in PL. • Construct statements in Predicate Logic and understand inference techniques in Predicate Logic Reasoning • Understand and analyze uncertain knowledge systems and their representations using Probabilistic Reasoning • Explore the fundamental idea of fuzzy sets and logic	**Unit IV: Knowledge Representation (14 Hrs)** 4.1. Definition and importance of Knowledge, Issues in Knowledge Representation, Knowledge Representation Systems, Properties of Knowledge Representation Systems. 4.2. Types of Knowledge Representation Systems, Structured Knowledge Representation Systems: Semantic Nets, Frames, Conceptual Dependencies and Scripts 4.3. Unstructured Knowledge Representation Systems: Rule Based Systems, Propositional Logic, Predicate Logic 4.4. Propositional Logic(PL): Syntax, Semantics, Formal logic-connectives, truth tables, tautology, validity, well-formed-formula, Inference using Resolution, Backward Chaining and Forward Chaining 4.5. Predicate Logic: FOPL, Syntax, Semantics, Quantification, Inference with FOPL: By converting into PL (Existential and universal instantiation), Unification and lifting, Inference using resolution 4.6. Uncertain Knowledge, Knowledge Representation in Uncertain Domain, Statistical Reasoning using Probability, Bayes' Rule and its use, Bayesian/Causal/Belief networks, Reasoning in belief networks 4.7. Fuzzy Logic
• Understand the basic theory	**Unit V: Machine Learning (5 Hrs)**

underlying the machine learning. • Understand a range of machine learning algorithms along with their strengths and weaknesses	5.1. Introduction to Machine Learning , Concepts of Learning, Importance of Machine Learning 5.2. Learning From Examples, Explanation Based Learning, Learning by Analogy, Learning by Simulating Evolution (Genetic Algorithm)
• Understand neural computing as an alternative knowledge acquisition/representation paradigms, • Explain its basic principles and their relationship to neurobiological models • Describe a range of neural computing techniques and their application areas. • Understand the neural network learning paradigms	**Unit VI: Learning with Neural Networks (5 Hrs)** 6.1. Introduction, Biological Neural Networks Vs. Artificial Neural Networks (ANN), Mathematical Model of ANN, Types of ANN: Feed-forward, Recurrent, Single Layered, Multi-Layered, Application of Artificial Neural Networks 6.2. Learning by Training ANN, Supervised vs. Unsupervised Learning, Hebbian Learning, Perceptron Learning, Back-propagation
• Explore and Build Components of Expert System • Understand basics of NLP and Machine Vision.	**Unit VII: Applications of AI (5 Hrs)** 7.1. Expert Systems, Development of Expert Systems 7.2. Natural Language Processing: Natural Language Understanding and Natural Language Generation, Steps of Natural Language Processing 7.3. Machine Vision Concepts

Evaluation System

Undergraduate Programs							
External Evaluation	**Marks**	**Internal Evaluation**	**Weightage**	**Marks**	**Practical**	**Weightage**	**Mark**
End semester examination	60	Assignments	20%	20	Practical Report copy	25%	20
(Details are given in the separate table at the end)		Quizzes	10%		Viva	25%	
		Attendance	20%		Practical Exam	50%	
		Internal Exams	50%				
Total External	60	Total Internal	100%	20		100%	20
Full Marks 60+20+20 = 100							

External evaluation

1. **End semester examination:**
   It is a written examination at the end of the semester. The questions will be asked covering all the units of the course. The question model, full marks, time and others will be as per the following grid.

2. **External Practical Evaluation:**
   After completing the end semester theoretical examination, practical examination will be held. External examiner will conduct the practical examination according to the above mentioned evaluation. There will be an internal examiner to assist the external examiner. Three hours time will be given for the practical examination. In this examination Students must demonstrate the knowledge of the subject matter.

Full Marks: 100, Pass Marks: 45, Time: 3 Hrs

Nature of question	Total questions to be asked	Total questions to be answered	Total marks	Weightage
Group A: multiple choice*	20	20	20×1 = 20	60%
Group B: Short answer type questions	8	6	6×8 = 48	60%
Group C: Long answer type questions	3	2	2×16 =32	60%
			100	100%

Each student must secure at least 50% marks in internal evaluation in order to appear in the end semester examination. Failed student will not be eligible to appear in the end semester examinations.

Internal evaluation

Assignment: Each student must submit the assignment individually. The stipulated time for submission of the assignment will be seriously taken.

Quizzes: Unannounced and announced quizzes/tests will be taken by the respective subject teachers. Such quizzes/tests will be conducted twice per semester. The students will be evaluated accordingly.

Attendance in class: Students should regularly attend and participate in class discussion. Eighty percent class attendance is mandatory for the students to enable them to appear in the end semester examination. Below 80% attendance in the class will signify NOT QUALIFIED (NQ) to attend the end semester examination.

Presentation: Students will be divided into groups and each group will be provided with a topic for presentation. It will be evaluated individually as well as group-wise. Individual students have to make presentations on the given topics.

Mid-term examination: It is a written examination and the questions will be asked covering all the topics in the session of the course.

Discussion and participation: Students will be evaluated on the basis of their active participation in the classroom discussions.

Instructional Techniques: All topics are discussed with emphasis on real-world application. List of instructional techniques is as follows:

- Lecture and Discussion
- Group work and Individual work
- Assignments
- Presentation by Students
- Quizzes
- Guest Lecture

Students are advised to attend all the classes and complete all the assignments within the specified time period. If a student does not attend the class(es), it is his/her sole responsibility to cover the topic(s) taught during that period. If a student fails to attend a formal exam/quiz/test, there won't be any provision for re-exam. Unless and until the student clears one semester he/she will not be allowed to study in the following semesters.

Laboratory Work

Student should write programs and prepare lab sheet for most of the units in the syllabus. Majorly, students should practice design and implementation intelligent agents and expert systems. Students are advised to implement various search techniques for solving problems, as well as Neural Networks, Genetic Algorithms for solving practical problems of AI. Students are advised to use LISP, PROLOG, JAVA. However, nature of programming can be decided by the instructor. The lab work should be practiced for minimum of 3 lab hours per week.

Prescribed Text

1. **Stuart Russel and Peter Norvig**, *Artificial Intelligence A Modern Approach*, Pearson

References

2. **George F. Luger**, *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*, Benjamin/Cummings Publication
3. **E. Rich, K. Knight, Shivashankar B. Nair**, *Artificial Intelligence,* Tata McGraw Hill.
4. **D. W. Patterson**, *Artificial Intelligence and Expert Systems*, Prentice Hall.
5. **P. H. Winston**, *Artificial Intelligence*, Addison Wesley.