**Sixteen Week Plan**

**Department of Computer Science**

**Faculty of Computing & Information Technology**

**Hafiz Hayat Campus, University of Gujrat**

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|  | | **Title** | | **Artificial Intelligence** | | | |
|  | | **Code** | | **CS-329** | | | |
|  | | **Credit hours** | | **4.0** | | | |
|  | | **Prerequisite** | | CS courses that include topics of general computing, data structures and algorithms. Familiarity with at least one programming language and environment. | | | |
|  | | **Category** | | Core | | | |
|  | | **Course Description** | | This course will introduce the basics of artificial intelligence (AI), its scope and application domain. The course will cover topics such as knowledge representation and reasoning formalisms, propositional logic, search methods, learning paradigms, automated reasoning, knowledge based systems, knowledge application and machine learning techniques and some of deep learning techniques etc. | | | |
|  | | **Aims & Objectives** | | * To introduce the principles of AI methods. * To equip students with the developments, justifications, implementation, and use of representational, formalism and search methods. * To provide an opportunity to students to learn methods most useful under complex computational uncertain, and vague situations. | | | |
|  | | **Learning Outcomes** | | * Enabling students to study advanced courses in the field such as machine learning, neural networks, text and data mining. * Demonstrate the ability to apply AI and Computational Intelligence techniques to a variety of research and application projects. | | | |
|  | | **Text Book** | | * Artificial Intelligence: A modern approach. Russell and Norvig, 3rd edition Pearson Education Series in AI | | | |
|  | | **Reference Books**  **&**  **Material** | | * Luger, George & Stubblefield, William, Artificial Intelligence: Structures and Strategies for Complex Problem Solving (6th ed.), * Mathematical Methods in Artificial Intelligence. (Edward A. Bender). * Principals of Artificial Intelligence and Expert Systems Development. (David W. Rolston) * Nils J Nilson, Artificial Intelligence – A New Synthesis, Morgan Kaufman Publishers, Elsevier, USA. * Patrick Henry Winston, Artificial Intelligence, Third Edition, Pearson Education Series in AI. | | | |
|  | | **Grading Breakup and Policy** | | Assignment(s): 10% Quizzes: 5%  Project: 10% Midterm Examination: 25% Final Examination: 50% | | | |
|  | | **Plagiarism Policy:** | | Collaboration and group work is encouraged but each student is required to submit his/her own contribution(s). Your writings must be your own thoughts. Cheating and plagiarism will not be tolerated and will be referred to the HoD & Dean for appropriate action(s). | | | |
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| Week# | Lecture # | | **TOPICS** | | **Source**  (**Book, Chapter No)** | Recommendationsfor LearningActivities (Mention Assignments, Test, Case Study, Projects, Lab Work or Reading Assignments) |  |
| **01** | **01** | | **Introduction:** History, Applications and Future | | A) Chapter 1 |  |  |
| **02** | | **Intelligent Agents:** Agents and environments, Rationality, Agent Types | | B) Chapter 2 |  |  |
| **02** | **03, 04** | | **Knowledge Representation with AI applications:** Propositional Logic, Predicate Calculus | | B) Chapter 2  A) Chapter 7 |  |  |
| **03** | **05,06** | | **Problem solving through Search Methods:**   * + Introductions   + State Space Search     - Depth First Search     - Breath first search | | 1. Chapter 3   B) Chapter 3 |  |  |
| **04** | **07,08** | | **Problem solving through informed search:**   * Heuristically Informed Methods * Hill Climbing, Beam Search   **Problem solving through informed search:**   * Best First Search A\*Procedure | | A) Chapter 3 |  |  |
| **05** | **09,10** | | **Problem solving through informed search:**   * Adversarial Search * Min-Max Procedure * Static Evaluation Function * Alpha Beta Pruning | | A) Chapter 4,5 |  |  |
| **06** | **11** | | **Expert systems:**  Introduction to Expert Systems, Knowledge Base Expert System Their Types and Application, | | A) Chapter 7 |  |  |
| **12** | | **Expert Systems:**  Working of Expert Systems with its different components, Typical examples, its benefits, the down side, Developing an Expert System, Identifying the problem | | A) Chapter 8,9 |  |  |
| **07** | **13,14** | | **Reasoning in uncertain situations:**  Fuzzy System: Fuzzy Set Theory, Fuzzy Inference | | A) Chapter 9 |  |  |
| **08** | **15,16** | | **Machine learning: Symbol-based**  Supervised Learning: Decision Tree   * Information Theory   Feature Selection   * Entropy * Information Gain   **Highly-branching attributes**   * Gain Ratio for Attribute Selection (C4.5)   **Alternative to avoid selecting attributes with large –domains**   * Gini Index   Handling continuous attributes  Avoid overfitting in classification  Decision Pruning | | A) Chapter 10 |  |  |
|  |  | | **Mid Term Exam** | |  |  |  |
| **09** | **17,18** | | **Unsupervised learning:** Clustering (KNN) | | A) Chapter 10 |  |  |
| **10** | **19,20** | | **Reinforcement Learning:**   * Passive and Active Reinforcement Learning * Q-Learning | | A) Chapter 10 |  |  |
| **11** | **21,22** | | **Machine Learning: Connectionist**  **Neural Network:** Introduction to Artificial Neural Networks (ANN), ANN Applications  Neural Network: Topologies of ANN, Single Layer perception (SLP). | | A) Chapter 11 |  |  |
| **12** | **23,24** | | **Back Prop algorithms:** Multi Layer Perception (MLP), Back Prop Algorithm  Neural Network: Implementation for AND, OR, XOR | | A) Chapter 12 |  |  |
| **13** | **25,26** | | **Machine Learning: Genetic and Emergent**  Genetic Algorithm: Introduction to Evolutionary Computing, Genetic Algorithm (GA)  Genetic Algorithm: Applications of Genetic Algorithm and its examples , Genetic operators (Crosse over and Mutation) and its applications | | A) Chapter 12 |  |  |
| **14** | **27,28** | | **Machine Learning: Genetic and Emergent**  Particle Swarm Optimization (PSO): Introduction to Swarm Intelligence (SI), Particle Swarm Optimization (PSO), Pseudo Code and Example | | A) Chapter 12 |  |  |
| **15** | **29,30** | | **Machine Learning: Probabilistic**   * **Hidden Markov Models (HMMs)** * Joint Distribution of an HMM   Chain Rule and HMMs   * Filtering / Monitoring * **Dynamic Bayesian Networks and Learning** * Handling Uncertainty * Bayesian Theorem Basic   + Bayesian Approach for Continuous Variables | | A) Chapter 13 |  |  |
| **16** | **31,32** | | **Introduction to Deep Learning:**  Convolutional Neural Networks   * Convolutional Operations * ReLU Layer * Pooling * Flattening * Full Connection * Example walkthrough   Recurrent Neural Networks   * Activation Functions * Vanishing Gradient * Long-Short Term Memory   + LSTM architecture   + Example walkthrough | | Handouts |  |  |
| **Final Exam** | | | | | | |  |
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