**COURSE PLAN**

For

**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (23CS301PC206)**

Course Coordinator : Dr. Arpita Baronia

Course Instructors :

1. Mohammed Sallauddin
2. Dr. ELN Kiran kumar
3. Dr. Mohammed Ali
4. Dr. N. Venkatesh
5. D. Ranjith
6. Dr. Nafisuddin Khan
7. Dr. Ratnesh Ranjan
8. Dr. R.S. Dubey
9. Dr. Pramod Patro

Course Type : Core

Semester and Year : III Sem and II year

L-T-P : 3-0-2

Credits : 4

School : School of CS & AI

Department : Department of CSE

Course Level : UG

**School of Computer Science and Artificial Intelligence**



SR University,

Warangal

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**DEPARTMENT PROGRAM OUTCOMES (POS) AND PROGRAM SPECIFIC OUTCOMES (PSOS)**

**Program Educational Objectives (PEOs)**

1. Program Educational Objectives (PEO) 1: Ability to solve diverse and complex computer science and engineering problems across a broad range of domains.
2. Program Educational Objectives (PEO) 2: Pursue a career in the field of computer science and engineering.
3. Program Educational Objectives (PEO) 3: Pursue higher education and/or professional development courses for life-long learning.
4. Program Educational Objectives (PEO) 4: Support community building activities to improve the quality of life.

**Program Outcomes (POs) and Program Specific Outcomes (PSOs)**

**Program Outcome (PO) 1:** Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.

**Program Outcome (PO) 2:** Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**Program Outcome (PO) 3:** Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

**Outcome (PO) 4:** Investigate complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**Program Outcome (PO) 5:** Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

**Program Outcome (PO) 6:** The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**Program Outcome (PO) 7:** Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**Program Outcome (PO) 8:** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**Program Outcome (PO) 9:** Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**Program Outcome (PO) 10:** Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

**Program Outcome (PO) 11:** Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**Program Outcome (PO) 12:** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**Program Specific Outcome** (PSO) 1: Apply mathematical foundations, algorithmic principles, and theoretical computer science in the modeling and design of computer based systems in way that demonstrates comprehension of the tradeoffs involved in design choices.

**Program Specific Outcome (PSO) 2:** Apply design and development principles in the construction of software systems of varying complexity.

## COURSE CONTEXT

|  |  |  |  |
| --- | --- | --- | --- |
| School | school of computer science and artificial intelligence | Department | CSE |
| Degree | B. tech | Core | Jan–April,2024 |

1. **COURSE BRIEF**

|  |  |  |  |
| --- | --- | --- | --- |
| Course title | Artificial Intelligence and Machine Learning | Pre-Requisites | Probability, linear algebra, data structures & algorithms |
| Course code | 23CS301PC206 | Total credits | 04 |
| Course type | Core | L-T-P format | 3-0-2 |

## COURSE SUMMARY

Artificial Intelligence (AI) is a broad field in computer science dedicated to creating intelligent machines that can emulate human-like cognitive functions. It encompasses a spectrum of technologies and techniques aimed at enabling machines to perform tasks traditionally requiring human intelligence. AI includes areas such as machine learning, natural language processing, computer vision, and expert systems. Machine Learning (ML), a subset of AI, is a specialized approach where algorithms and models are developed to allow computers to learn from data and improve their performance without being explicitly programmed. ML encompasses various paradigms, including supervised learning, unsupervised learning, and reinforcement learning.

## COURSE-SPECIFIC LEARNING OUTCOMES (CO)

At the end of the course the students will be able to

CO1: Understand the basic concepts of AI / Intelligent Systems

CO2: Comprehend basic Intelligent Systems Representation, Reasoning and Processing techniques.

CO3: Analyze the performance of Machine learning techniques.

CO4: Build AI projects to solve societal problems.

|  |
| --- |
| **Course Articulation Matrix** |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | PO/  PSO  CO | PO  1 | PO  2 | PO  3 | PO  4 | PO  5 | PO  6 | PO  7 | PO  8 | PO  9 | PO  10 | PO  11 | PO  12 | PSO  1 | PSO  2 | | CO1 | 2 | 2 |  |  |  |  |  |  |  |  |  |  | 1 |  | | CO2 | 1 | 2 |  | 3 |  |  |  |  |  |  |  |  | 2 |  | | CO3 |  |  |  | 3 |  |  |  |  |  |  |  |  | 2 |  | | CO4 |  |  |  | 3 |  | 3 |  |  |  |  |  |  |  | 3 | | Mapping Target Level | **1.5** | **2** |  | **3** |  | **3** |  |  |  |  |  |  | **1.8** | 3 | |

**Course Outcome 1(CO1):** Understand the basic concepts of AI / Intelligent Systems

**Program Outcome (PO) 1:** Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.

**Program Outcome (PO) 2:** Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**Program Specific Outcome** (PSO) 1: Apply mathematical foundations, algorithmic principles, and theoretical computer science in the modeling and design of computer based systems in way that demonstrates comprehension of the tradeoffs involved in design choices.

**Course Outcome (CO)2** Comprehend basic Intelligent Systems Representation, Reasoning and Processing techniques**.**

**Program Outcome (PO) 1:** Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.

**Program Outcome (PO) 2:** Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**Program Outcome (PO) 4:** Investigate complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**Program Specific Outcome** (PSO) 1: Apply mathematical foundations, algorithmic principles, and theoretical computer science in the modeling and design of computer based systems in way that demonstrates comprehension of the tradeoffs involved in design choices.

**Course Outcome 3 (CO3):** Analyze the performance of Machine learning techniques.

**Program Outcome (PO) 4:** Investigate complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**Program Specific Outcome** (PSO) 1: Apply mathematical foundations, algorithmic principles, and theoretical computer science in the modeling and design of computer based systems in way that demonstrates comprehension of the tradeoffs involved in design choices.

**Course Outcome 4 (CO4):** Build AI projects to solve societal problems.

**Program Outcome (PO) 4:** Investigate complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions..

**Program Outcome (PO) 6:** The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**Program Specific Outcome (PSO) 2:** Apply design and development principles in the construction of software systems of varying complexity.

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## DETAILED SYLLABUS

**UNIT I (7 Hrs)**

Introduction to Artificial Intelligence, Why Artificial Intelligence, Proposing and evaluating AI applications, AI challenges, Intelligent Agents.

**Problem Solving-** Solving Problems by Searching- Agents, Example Problems, Search Algorithm- Informed (Heuristic) Search Strategies.

**UNIT II (8 Hrs)**

**Adversarial Search and Games**- Game Theory, Optimal Decisions in Games Heuristic Alpha Beta Tree Search, Stochastic Games, Limitations of Game Search Algorithms. Genetic Algorithms.

**UNIT III (8 Hrs)**

**Overview of Expert System**- Rule Based Expert System, Case Based and Hybrid Systems

**Introduction to Machine Learning concepts -** Linear Regression, Multiple Linear Regression. Logistic Regression, K–Nearest Neighbour, Decision Trees, Baye's Theorem, Support vector machine

**UNIT IV (7 Hrs)**

**Clustering:** K–Means, Hierarchical and Density based clustering

**Ensemble Methods:** Ensemble Classifiers, Bucket of Models, Bagging & boosting and its impact on bias and variance, Random forest, Gradient Boosting Machines.

**UNIT V (6 Hrs)**

Introduction to Neural Network, Deep Learning, Reinforcement Learning, Natural Language and Computer Vision , Philosophy, Ethics, and Safety of AI - The Limits of AI and The Future of AI.

**Awareness on libraries** - Python Libraries - Pandas, Numpy, MatplotLib, Pyplot and NLPK, Other Python ML related libraries such as Scikit-learn, Keras, and TensorFlow.

## STUDIOWORK /LABORATORY EXPERIMENTS

1. Introduction to python libraries
2. Implementation of A\* algorithm
3. Implementation of Alpha-beta search
4. Implement a linear regression model using a library like Scikit-learn in Python. Train the model on the training set and evaluate its performance on the testing set using metrics like Mean Squared Error (MSE)
5. Implement a logistic regression model using a library like Scikit-learn in Python
6. Implement KNN using a library like Scikit-learn. Train the model on the training set and evaluate its accuracy on the testing set.
7. Implement an SVM classifier using a library like Scikit-learn. Experiment with different kernel functions (linear, polynomial, or radial basis function) and observe their impact on the model's performance.
8. Implement an DT classifier and DT regression using a library like Scikit-learn.
9. Implement Random Forest classifier
10. Implement K-means clustering and ensemble methods like Random Forest to analyze their impact on bias and variance.
11. Implement AdaBoost for a binary classification task and observe its impact on model performance.
12. Apply Gradient Boosting for a regression task and assess its ability to capture complex relationships.

## TEXTBOOKS/LEARNING RESOURCES

## "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig., Year: 2022 (4th Edition)

## "Pattern Recognition and Machine Learning" by Christopher M. Bishop. Year: 2006.

## REFERENCE BOOKS/LEARNING RESOURCES

## 1. "Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili, Year: 2021 (3rd Edition)

## LECTURE WISE PLAN

|  |  |
| --- | --- |
| **No.** | **Content Planned** |
| 1 | Course structure / Handout assessment mechanism (30)  Importance of the course (20) |
| 2 | Introduction to Artificial Intelligence (AI) (30)  applications, and challenges (20) |
| 3 | Problem solving agents (20)  Understanding intelligent agents (30) |
| 4 | Agent properties (50) |
| 5 | Problem Solving by Searching (50) |
| 6 | Search Spaces (20)  Examples of problems in AI (30) |
| 7 | Informed Search Strategies: Heuristic Search Algorithms (20)  Best First Search (30) |
| 8 | A\* algorithm (50) |
| 9 | Introduction to Game Theory (50) |
| 10 | Optimal Decisions in Games (50) |
| 11 | Minimax Game Tree Algorithm(50) |
| 12 | Heuristic Alpha-Beta Tree Search (50) |
| 13 | Stochastic Games and their considerations (50) |
| 14 | Limitations of Game Search Algorithms (50) |
| 15 | Introduction to Genetic Algorithms for problem-solving (50) |
| 16 | Introduction to Genetic Algorithms for problem-solving (50) |
| 17 | Buffer class-1 |
| 18 | Rule-Based Expert Systems (25)  Case-Based Reasoning (25) |
| 19 | Hybrid Systems combining rule-based and case-based approaches (50) |
| 20 | Overview of machine learning (50) |
| 21 | Linear Regression (35)  Multiple Linear Regression (15) |
| 22 | Logistic Regression (50) |
| 23 | K–Nearest Neighbor (30)  Decision Trees (20) |
| 24 | Bayes' Theorem and Naive Bayes Classifier (50) |
| 25 | Introduction to Support Vector Machines (SVM) (50) |
| 26 | K–Means Clustering (50) |
| 27 | Hierarchical Clustering (50) |
| 28 | Density-Based Clustering (50) |
| 29 | Ensemble Classifiers (20)  Bucket of Models (30) |
| 30 | Bagging and Boosting (50) |
| 31 | Random Forest (50) |
| 32 | Gradient Boosting Machines (50) |
| 33 | Buffer class-2 |
| 34 | Deep Learning Concepts and Architectures (50) |
| 35 | Reinforcement Learning Fundamentals (50) |
| 36 | Natural Language Processing (50) |
| 37 | Computer Vision (50) |
| 38 | Philosophy, Ethics, and Safety of AI (50) |
| 39 | The Limits of AI and The Future of AI (50) |
| 40 | Buffer class-3 |
| 41 | Expert Talk |

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## LAB WISE PLAN

|  |  |
| --- | --- |
| **No.** | **Content Planned** |
| 1 | Introduction to python libraries |
| 2 | Implement A\* algorithm for the given graph |
| 3 | Implement alpha beta pruning algorithm for the given game |
| 4 | Implement a linear regression model using a library like Scikit-learn in Python. Train the model on the training set and evaluate its performance on the testing set using metrics like Mean Squared Error (MSE) |
| 5 | Implement a logistic regression model using a library like Scikit-learn in Python |
| 6 | Implement KNN using a library like Scikit-learn. Train the model on the training set and evaluate its accuracy on the testing set. |
| 7 | Implement an SVM classifier using a library like Scikit-learn. Experiment with different kernel functions (linear, polynomial, or radial basis function) and observe their impact on the model's performance. |
| 8 | Implement an DT classifier and DT regression using a library like Scikit-learn |
| 9 | Implement Random Forest classifier |
| 10 | Implement K-means clustering and ensemble methods like Random Forest to analyze their impact on bias and variance. |
| 11 | Implement AdaBoost for a binary classification task and observe its impact on model performance. |
| 12 | Apply Gradient Boosting for a regression task and assess its ability to capture complex relationships. |
| 13 | Buffer-1 |
| 14 | Buffer-2 |

## EVALUATION COMPONENTS

|  |  |
| --- | --- |
| **Components of Course Evaluation** | **Marks** |
| Mid Term Examination | 20 |
| End Term Examination | 40 |
| Continuous Lab Evaluation | 10 |
| Lab Exam | 20 |
| Quiz | 10 |

## PROPOSED INDUSTRY TALKS

## 

## Dr. Sourabh Srivastava in machine learning its advanced tools.

## 

## SOFTWARE/TOOLS USED

## GitHub: <https://github.com/kirankumareranki/AIML-2025>

## Proposed Case Studies

## 1. AI Supply Chain Optimization for Blood Platelets in NHS,UK [[link](https://kortical.com/case-studies/ai-supply-chain-blood-healthcare-nhs)] 2. Realtime prediction of Auto Failure using connected vehicle data [l[ink](https://kortical.com/case-studies/ford-predicting-failures-ai-example)]

## 3. Customer Feedback automation using NLP Speech Models [[link](https://kortical.com/case-studies/ai-nlp-customer-feedback-marketing)]

## 4. AI to Classify and Consolidate 35Million documents within 2mins [[link](https://www.datamatics.com/resources/case-studies/a-leading-american-bank-gets-its-35-million-documents-auto-classified-and-consolidated-within-2-weeks)]

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## ADVANCED RESEARCH TOPICS

## Machine learning with quantum computing, machine leaning in IOT

## ATTENDANCE POLICY

1. At least 75% attendance in the course is mandatory
2. A maximum of 5% shall be allowed under medical grounds and 5% on representing the University on official events outside like sports, hackathons, NCC, NSS etc.
3. Students with less than 65% of attendance shall be prevented from writing the final assessment.

## ACADEMIC DISHONESTY & PLAGIARISM

Plagiarism is "to offer work or ideas from another source as one's own, with or without authorization of the source author(s), directly by verbatim copying or by usage of any AI software" (i.e., with or without permission from the original author). In certain cases, authorization might be provided for the usage of other sources through written permission may not be considered as plagiarism. It is a serious academic offence which should be avoided, the following method will be adopted to evaluate plagiarism in submitted documents including assignments, material, class test content and other similar academic documents.

Level 1: Similarities up to 10% - Student will be asked to revise the document and resubmit for evaluation, once chance will be provided to revise.

Level 2: Similarities above 10% to 20%- Student will be warned and one chance will be provided to revise the document and resubmit.

Level 3: Similarities above 20% : If the plagiarism level is more than 20% student will get a Fail grade.

1. **INSTRUCTOR RESPONSIBLE FOR LECTURE PPTS PREPARATION**

Module 1: D. Ranjith,

Module 2: Dr. Mohammed Ali

Module 3: Dr. N. Venkatesh

Module 4: Dr. Nafisuddin Khan, Dr. R.S. Dubey

Module 5: Dr. Ratnesh Ranjan

1. **INSTRUCTOR RESPONSIBLE FOR PREPARATION OF LAB ASSIGNMENT**

1. Dr. Arpita Baronia

2. Dr. Ratnesh Ranjan

3. Dr. Nafisuddin Khan

4. Mohammed Salluddin

## ANY OTHER INSTRUCTOR WISE RESPONSIBILITY

1. LMS: Dr. ELN Kiran Kumar
2. Course File: D Ranjith
3. Invited Talks: Dr. Mohammed Ali
4. Case Study: Dr. ELN Kiran Kumar, Dr. Arpita Baronia
5. Slow Learner Activity: Dr. N Venkatesh
6. Fast Learner Activity: Mohammed Salluddin.
7. Continuous Lab Evaluation: Dr. Arpita Baronia
8. Quiz: Dr. Pramod Patro
9. Final Co-Po mapping: Dr. R.S. Dubey, Dr. Arpita