CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M. Tech. – 2nd** Branch: **Computer Science & Engg**
Subject: **Artificial Intelligence** Code: **5109211(022)**
Total Theory Periods: **40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
Minimum number of class test to be conducted**:** 02

COURSE OBJECTIVES:

1. To impart intelligent systems in e-learning, e-commerce, tele-medicine, automation and bio-technology industries
2. To impart an expert system using appropriate knowledge based software tools
3. Explore the current scope, potential, limitations, and implications of intelligent systems
4. Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural Networks and other machine learning models
5. Experiment with a machine learning model for simulation and analysis

Unit- 1 Overview of Artificial Intelligence:
Definition and Importance of Knowledge - Knowledge Based Systems - Representation of Knowledge - Knowledge Organization - Knowledge Manipulation, and Acquisition of Knowledge– Introduction to LISP – PROLOG – Syntax and Functions.

Unit- 2 Dealing with Inconsistencies and Uncertainties:
Introduction. Truth Maintenance Systems - Default Reasoning and the Closed World Assumption - Predicate Completion and Circumscription - Modal and Temporal Logics

Unit-3 Search and Control Strategies
Introduction - Preliminary Concepts - Examples of Search Problems - Uninformed or Blind Search - Informed Search - Searching And-Or Graphs. Matching Techniques: Introduction - Structures Used in Matching - Measures for Matching - Matching Like Patterns - Partial Matching

Unit- 4 Knowledge Representation
Syntax and Semantics for Propositional logic - Syntax and Semantics for FOPL - Properties of Well Formed Formula - Conversion to Clausal Form - Inference Rules, The Resolution Principle - No deductive Inference Methods - Representations Using Rules – Probabilistic Reasoning: Introduction - Bayesian Probabilistic Inference - Possible World Representations – Dumpster Shafer Theory

Unit-5 Knowledge Organization and Management
Introduction - Indexing and Retrieval Techniques - Integrating Knowledge in Memory - Memory Organization Systems. Expert Systems: Introduction - Rule Based System Architecture – Non Production System Architecture - Dealing with uncertainty - Knowledge Acquisition and Validation - Knowledge System Building Tools

COURSE OUTCOMES: On completion of course the student should be able to:

1. Design, build, and implement an expert system and to provide solutions to real world problems
2. Demonstrate fundamental understanding of artificial intelligence (AI) and expert systems
3. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning
4. Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
5. Demonstrate proficiency in applying scientific method to models of machine learning.

Text Book:

1. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems, Second Edition PHI Learning”, 2009.
2. Principles of Artificial Intelligence by Nils J.Nilsson, Narosa Publishing house.

Reference Book:

1. E. Rich & K. Knight,” Artificial Intelligence”, Third Edition, TMH, New Delhi, 2008.
2. S. Russell and P. Norvig, “Artificial Intelligence: A Modern Approach,” Prentice Hall

CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M. Tech. – 2nd** Branch: **Computer Science & Engg**
Subject: **Advanced Machine Learning** Code: **5109212(022)**
Total Theory Periods: **40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
Minimum number of class test to be conducted**: 02**

COURSE OBJECTIVES:

1. To explore the fundamental concepts of Ensemble Methods.
2. To understand the basic concepts in the specification of Unsupervised Learning.
3. To understand the mining of frequent pattern and association rule principles.
4. To understand the concepts of Link analysis.
5. To understand the Case Studies.

UNIT 1: Ensembles Methods

Bagging & boosting and its impact on bias and variance, C5.0 boosting, Random Forest, Gradient Boosting Machines and XGBoost.

UNIT 2: Unsupervised learning: Clustering Algorithms:

Basic Concepts and Methods: Cluster analysis, Distance measures, Partitioning Methods: K-means, K-medoids; Hierarchical Clustering Methods: Agglomerative & Divisive; Density Based Methods, Model-Based Methods, Measuring Clustering Performance parameters.

UNIT 3: Mining Frequent Patterns, Associations, and Correlations

The Market-Basket Model, Market Baskets and the A-Priori Algorithm, Improving the Efficiency of Apriori, A Pattern-Growth Approach for Mining Frequent Item sets-FP Growth Algorithm, Limited-Pass Algorithms, Counting Frequent Items in a Stream.

UNIT 4: Link Analysis

Link Analysis: Introduction to Link Analysis, PageRank using point distribution, Page Rank using Random walk, , Hubs and Authorities.

UNIT 5: Case Studies

Case Study - 1 -Based on Ensembles Methods; Case Study - 2 - Based on clustering algorithms,
Case Study - 3 -Based on Market Baskets Analysis

COURSE OUTCOMES: On completion of course the student should be able to:

1. Apply ensemble techniques on real-world applications.
2. Apply and select appropriate clustering algorithms for solving real-world problems.
3. Implement Market basket Models for Recommendation system.
4. Able to select appropriate Page Rank algorithms for solving a particular group of real-world problems.
5. Able to develop models for the real-world problems.

Text Books

1. Data Mining Concepts and Techniques. Jiawei Han, Micheline Kamber and Jian Pei. Morgan Kaufmann Publishers is an imprint of Elsevier.
2. Machine Learning in Action. Peter Harrington, Manning Publications, 2012.
3. Introduction to Machine Learning (3e), Ethem Alpaydin, MIT Press.

Reference Books

1. Python Machine Learning Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow. Sebastian Raschka, Vahid Mirjalili, Packt Publishing, 2017.
2. Foundations of Machine Learning(2e), Mohri Mehryar, Afshin Rostamizadeh, and Ameet Talwalkar,MIT Press.

CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M. Tech.-2nd**
Subject: **Deep Learning**
Total Theory Periods: **40**
Total Marks in End Semester Exam. : **100**
Minimum number of class to be conducted**: 02**

Branch: **Computer Science & Engg**
Code: **5109213(022)**
Total Tutorial Periods: **12**

COURSE OBJECTIVES:

1. To introduce students to the basic concepts and techniques of Deep Learning.
2. To become familiar with Neural Network.
3. To develop skills of using recent Deep learning software for solving practical problems.
4. To become familiar with Dimensionality reduction Techniques.
5. Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.

UNIT 1: Introduction to Deep Learning: history of deep learning, deep learning success stories, Neural Network Basics, mcculloch pitts neuron, thresholding logic, perceptron's, perceptron learning algorithm; Perspectives and Issues in deep learning framework.

UNIT 2: Multi-Layer Network and Optimization Technique:
multilayer perceptron's (MLPS), representation power of MLPS, sigmoid neurons, feed forward neural networks, activation function, loss function, optimizers used in Deep neural network, eigenvalues and eigenvectors.

UNIT 3: Dimension Reduction and Regularization:
principle component analysis and its interpretations, auto encoders and relation to pca, regularization, bias variance tradeoff, leaning rate, dropout layer, better weight initialization methods, batch normalization.

UNIT 4: Convolutional Neural Network and Recurrent Neural Network:
Architecture of a CNN, convolution operation, pooling operation, padding, stride, filter. RNN Model, Different types of RNN, GRU, LSTM.

UNIT 5: Natural Language Processing:
Text Preprocessing & NLP, Analyzing Sentence Structure, Text Classification, Word Embedding,
In-Class Project: Sentiment Analysis in social media, Chat-bot.

COURSE OUTCOMES: On completion of course the student should be able to:

1. Gain knowledge about basic concepts of Deep Learning.
2. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
3. Understand the concepts of cross-validation and regularization; be able to use them for estimation of algorithm parameters.
4. Recognize the characteristics of Deep Learning that make it useful to real-world problems.
5. Design application using Deep Learning techniques.

Text Books

1. J.Patterson, A.Gibson, Deep Learning, (1e), O'Reilly Publication, 2018.
2. Goodfellow I., Bengio Y, Deep Learning (Adaptive Computation and Machine Learning series),(1e), MIT Press, 2017.
3. Shai Shalev-Shwartz , Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms, (3e), Cambridge University Press, 2015.

Reference Books:

4. A. Ravindran, K. M. Ragsdell , and G. V. Reklaitis , ENGINEERING OPTIMIZATION: Methods and Applications , John Wiley & Sons, Inc. , 2016.
5. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M. Tech-2nd** Branch: **Computer Science & Engg.**
Subject: **Big Data Analytics** Code: **5109214(022)**
Total Theory Periods: **40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
Minimum number of class to be conducted**: 02**

COURSE OBJECTIVES:

1. To explore the fundamental concepts of big data analytics.
2. To learn to analyze the big data using intelligent techniques.
3. To understand the applications using Map Reduce Concepts.
4. To introduce programming tools PIG & HIVE in Hadoop echo system.

Unit 1: Introduction to Big Data Analytics

Introduction to big data: Introduction to Big Data, Distributed Systems, Big Data and its Importance, Big data Use cases, Analyzing Big Data, Sources of Big Data, Characteristics of Big Data, Drivers of BDA, Types of Data, Structured vs. Unstructured Data, Differences Between Traditional DWDM and BDA, Limitations of Traditional RDBMS to Store and Analyses Big Data, Data science, Definition and Concepts, Data Wrangling, Data Mugging, Data Jujitsu. Tools – Hadoop Hands-on.

UNIT 2: Practice in Analytics

ZooKeeper - Race Condition, Zookeeper- Deadlock, Hands-on, How does election happen - Paxos Algorithm; **HDFS**- Why HDFS, HDFS – Name Node & Data Nodes, Advance HDFS Concepts (HA, Federation),Hands-on with HDFS (Upload, Download, Set Rep); **YARN**- YARN - Why not existing tools, YARN - Evolution from MapReduce 1.0, Resource Management: YARN Architecture.

UNIT 3: MapReduce

MapReduce - Understanding Sorting, Word Frequency Problem - Without MR, Map Reduce: Map task, Grouping by key, The Reduce tasks and Combiner, Word Frequency Problem - Using MR; Algorithms Using MapReduce: Matrix-Vector Multiplication by MapReduce, Multiple Reducer, Writing MapReduce Code Using Java.

UNIT 4: Processing Data with Hive

Analyzing Data with Pig: Pig - Introduction, Pig - Modes, Example - NYSE Stock Exchange, Concept - Lazy Evaluation.
Hive - Introduction, Hive - Data Types, Loading Data in Hive (Tables), Example: Movielens Data Processing, Advance Concepts: Views;

UNIT 5: Case Studies

Case Study – A Project on Sentiment Analysis.

COURSE OUTCOMES: On completion of course the student should be able to:

1. Design efficient algorithms for mining the data from large volumes.
2. Analyze the HADOOP and Map Reduce technologies associated with big data analytics.
3. Understand the fundamentals of various big data analytics techniques
3. Explore on Big Data applications Using Pig and Hive.
5. Build a complete business data analytics solution.

Reference Books:

1. EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, (1e), John Wiley & Sons, 2015.
2. Minelli, Michael, Michele Chambers, and Ambiga Dhiraj. Big data, big analytics: emerging business intelligence and analytic trends for today's businesses, (1e), John Wiley & Sons, 2012.
3. Bahga, Arshdeep and Vijay Madisetti, Big data science & analytics: A hands-on approach, (1e), VPT, 2016.

CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M. Tech.-2nd** Branch: **Computer Science & Engg.**
Subject: **Principle of Soft Computing** Code: **5109231(022)**
Total Theory Periods: 40 Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
Minimum number of class to be conducted**: 02**

COURSE OBJECTIVES:

1. Artificial Intelligence, Various types of production systems, characteristics of production systems
2. Neural Networks, architecture, functions and various algorithms involved
3. Fuzzy Logic, Various fuzzy systems and their functions
4. Genetic algorithms, its applications and advances

UNIT 1: Overview of Soft Computing:
Difference between Soft and hard computing, Brief descriptions of different components of soft computing including Artificial intelligence systems Neural networks, fuzzy logic, genetic algorithms. Artificial neural networks Vs Biological neural networks, ANN architecture, Basic building block of an artificial neuron, Activation functions

UNIT 2: Artificial Intelligence:
Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non-monotonic reasoning, forward Reasoning, backward reasoning

UNIT 3: Neural Network:
Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference b/w ANN and human brain, characteristic and applications of ANN, single layer network.

UNIT 4: Fuzzy Logic:
Fuzzy set theory, Fuzzy set versus crisp set, crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions; Fuzzy rule base system: Fuzzy propositions, formation, decomposition & aggregation of fuzzy Rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.

UNIT 5: Genetic Algorithms:
Basic concepts, encoding, fitness function, reproduction-Roulette wheel, Boltzmann, tournament, rank, and steady state selections, Convergence of GA, Applications of GA case studies. Introduction to genetic programming- basic concepts.

COURSE OUTCOMES: On completion of course the student should be able to:

1. Learn about soft computing techniques and their applications
2. Understand and analyze various AI algorithms
3. Understand perceptron and counter propagation networks
4. Define the fuzzy based systems
5. Analyze the genetic algorithms and their applications

Text Books

1. R. Rajasekaran and G. A and Vijayalakshmi Pa, Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications, Prentice Hall of India
2. D. E. Goldberg, Genetic Algorithms in Search, Optimisation, and Machine Learning, Addison-Wesley

Reference Books

1. L. Fausett, Fundamentals of Neural Networks, Prentice Hall
2. T. Ross, Fuzzy Logic with Engineering Applications, Tata McGraw Hill

CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M. Tech-2nd** Branch: **Computer Science & Engg.**
Subject: **Recommended System** Code: **5109232(022)**
Total Theory Periods: **40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
Minimum number of class to be conducted**: 02**

COURSE OBJECTIVES:

1. To understand the basic concepts behind recommender systems
2. Explain a variety of approaches for building recommender systems
3 To understand the various evaluation technics in recommended systems
4. Describe applications of recommender systems in various domains

UNIT 1: Introduction to Recommender Systems:
Non-Personalized and Content-Based -- Introducing Recommender Systems, Non-Personalized and Stereotype-Based Recommenders, Content-Based Filtering;

UNIT 2: Nearest Neighbour Collaborative Filtering:
User-User Collaborative Filtering Recommenders, Item-Item Collaborative Filtering Recommenders, Advanced Collaborative Filtering Topics;

UNIT 3: Recommender Systems:
Evaluation and Metrics--Basic Prediction and Recommendation Metrics, Advanced Metrics and Offline Evaluation, Online Evaluation. Evaluation Design;

UNIT 4: Matrix Factorization and Advanced Techniques:
Matrix Factorization, Hybrid Recommenders.

UNIT 5: Case Study:
Case Studies - Based on Recommender Systems.

COURSE OUTCOMES: On completion of course the student should be able to:

1. To learn major concepts of and techniques for building and evaluating recommender systems.
2. To learn the variety of typical recommendation approaches including collaborative filtering.
3. To learn the uses of matrix factorization in recommended systems.
4. Build recommended systems.

Reference Books:

1. K.Falk, Practical Recommender Systems, (1e), Manning Publication, 2017.
2. B.Chen, D.Agarwal, Statistical Methods for Recommender Systems", (1e), Cambridge University Press, 2015

CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M. Tech – 2nd** Branch: **Computer Science & Engg.**
Subject: **Web Intelligence & Analytics** Code: **5109233(022)**
Total Theory Periods: **40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : 1**00**
Minimum number of class to be conducted: 0**2**

COURSE OBJECTIVES:

1. To understand the fundamentals of Web analytics.
2. To learn how to use and deploy web/social/mobile analytics.
3. To understand the uses of Geo-social data in real world.
4. To learn the importance of segmentation process and explain why it is a useful analytical technique.

UNIT 1: Introduction:
Web Analytics, Web Analytics 1.0 vs. 2.0 Framework (Clickstream, Multiple Outcomes Analysis, Experimentation and Testing, Voice of Customer, Competitive Intelligence, Insights).

UNIT 2: Working Of Web Analytics:
Basic Concepts, Basic Segmentation, Intermediate Metrics, Custom Metrics, and Calculated Metrics.

UNIT 3: Data Types of Web Analytics:
Web Data and Other Types of Data, Also Basic Dashboards, Reports to Deliver Web Analytics. Web Analytics Ecosystem and Deploying It in Industry What To Measure.

UNIT 4: Segmentation in Web Analytics:
Tracking, Visualization of Data, Acquisition and Conversions. Tracking Of Mobile Visitors, Other Web Analytics Reports and Visualizations. Third-Party Data and Comscore, Cohort Analysis and User Explorer. Geo-Social Data, Capstone Work.

Unit-5 Case Study
Case Studies - Based on Web Analytics

COURSE OUTCOMES: On completion of course the student should be able to:

1. Describe the various web analytics processes
2. Identify the challenges faced by businesses in getting the right data
3. Implement Web Analytics in IT industry
4. Analyze the Geo-Social data and their applications

Reference Books:

1. Avinash Kaushik, *Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity*, (2e), John Wiley & Sons, 2018.
2. Tom Tullis, Bill Albert, *Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics*, (2e), Morgan Kaufmann, July 2013.
3. Jim Sterne, *Social Media Metrics: How to Measure and Optimize Your Marketing Investment*, (1e), John Wiley & Sons, 2010.
4. Brian Clifton, *Advanced Web Metrics with Google Analytics*, (3e), John Wiley & Sons, 2012.

CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M. Tech-2nd** Branch: **Computer Science & Engg.**
Subject: **Artificial Intelligence Lab – II** Code: **5109221(022)**
Total Marks in End Semester Exam. : **75** Total Lab Periods: **40**

Course Objective:

1. To provide a strong foundation of fundamental concepts in Artificial Intelligence
2. To provide a basic exposition to the goals and methods of Artificial Intelligence
3. To enable the student to apply these techniques in applications which involve perception, reasoning and learning

List of Experiments (to be performed using PROLOG/LISP/PYTHON)

1. Write simple fact for the statements using PROLOG
2. Write a program to solve the Monkey Banana problem
3. Write a program to solve 4-Queen problem
4. Write a program to solve traveling salesman problem.
5. Write a program to solve water jug problem using LISP
6. WAP in turbo prolog for medical diagnosis and show the advantage and disadvantage of green and red cut
7. Write a python program to implement simple Chatbot
8. Write a python program to implement Breadth first search Traversal
9. Write a program to implement Hangman game using python
10. Write a program to implement Tic-Tac-Toe game using python

Course Outcome:

1. Apply various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction)
2. Understand the fundamentals of knowledge representation, inference and theorem proving using AI tools
3. Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information
4. Ability to apply knowledge representation, reasoning, and machine learning techniques to real-world problems
5. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning

List of equipments:

1: Pentium computer with latest configuration, like Core i5 and above having 8/16 GB RAM, Graphics Card 2/4 GB, 256 SSD and 1-TB HDD.

2: Anaconda Python 3.7, Spyder for Python, LISP/ PROLOG.

Recommended books: "Artificial Intelligence"

CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M. Tech – 2nd** Branch: **Computer Science & Engg.**
Subject: **Advanced Machine Learning Lab–II** Code: **5109222(022)**
Total Marks in End Semester Exam. : **75** Total Lab Periods: **40**

Course Objectives:

1. To introduce basic machine learning techniques.
2. To develop the skills in using recent machine learning software for solving practical problems in high-performance computing environment.
3. To develop the skills in applying appropriate supervised, semi-supervised or unsupervised learning algorithms for solving practical problems.

List of Experiments

1. Exercises to solve the real-world problems using the following machine learning methods:
    1. Linear Regression
    2. Logistic Regression
    3. Multi-Class Classification
    4. Neural Networks
    5. Support Vector Machines
    6. K-Means Clustering & PCA
2. Develop programs to implement Anomaly Detection Systems.
3. Implement GPU computing models to solving some of the problems mentioned in Problem1.

Course Outcomes: Students will be able to:

1. Implement and apply machine learning algorithms to solve problems.
2. Select appropriate algorithms for solving a of real-world problems
3. Use machine learning techniques in high-performance computing environment

List of equipment's:

1: Pentium computer with latest configuration, like Core i5 and above having 8/16 GB RAM, Graphics Card 2/4 GB, 128 / 256 SSD or above and 1-TB HDD.

2: Anaconda Python 3.7, Spyder/ Jupyter notebook for Python, R -4.0 or above, RStudio for R

Recommended books: Introduction to Python, The R Book, Machine Learning with Python