Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: V**
Subject: Machine Learning **Subject Code: C127571(022)**
Total Theory Periods: 40 **Total Tutorial Periods: 10**
No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**
ESE Duration: Three Hours, Maximum Marks in ESE: 100 **Minimum Marks in ESE: 35**

UNIT-I: INTRODUCTION

Machine Learning Fundamentals –Types of Machine Learning - Supervised, Unsupervised, Reinforcement- The Machine Learning process. Terminologies in ML- Testing ML algorithms: Overfitting, Training, Testing and Validation Sets-Confusion matrix -Accuracy metrics- ROC Curve- Basic Statistics: Averages, Variance and Covariance, The Gaussian- The Bias-Variance trade off- Applications of Machine Learning.

UNIT-II: SUPERVISED LEARNING

Regression: Linear Regression – Multivariate Regression- Classification: Linear Discriminant Analysis, Logistic Regression- K-Nearest Neighbor classifier. Decision Tree based methods for classification and Regression- Ensemble methods.

UNIT-III: UNSUPERVISED LEARNING

Clustering- K-Means clustering, Hierarchical clustering - The Curse of Dimensionality –Dimensionality Reduction - Principal Component Analysis - Probabilistic PCA- Independent Components analysis

UNIT-IV: ARTIFICIAL NEURAL NETWORKS AND KERNEL MACHINES

Perceptron- Multilayer perceptron- Back Propagation – Initialization, Training and Validation Support Vector Machines(SVM) as a linear and non-linear classifier - Limitations of SVM

UNIT-V: PROBABILISTIC GRAPHICAL MODELS

Bayesian Networks - Learning Naive Bayes classifiers-Markov Models – Hidden Markov Models Sampling – Basic sampling methods – Monte Carlo -Reinforcement Learning

TEXT BOOKS:

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
2. Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, CRC Press, 2009.
3. SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, “Machine Learning”, Pearson Education, 2018.
4. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2011.

REFERENCE BOOKS:

1. Andreas C. Muller, “Introduction to Machine Learning with Python: A Guide for Data Scientists”, O'Reilly, 2016.
2. Sebastian Raschka, “Python Machine Learning”, Packt Publishing, 2015.
3. Hastie, Tibshirani, Friedman, “The Elements of Statistical Learning: Data Mining, Inference, and Prediction”, 2nd Edition, Springer, 2017.
4. EthemAlpaydin, “Introduction to Machine Learning”, 2nd revised edition, MIT Press, 2010.

E BOOKS:

1. https://www.ibm.com/downloads/cas/GB8ZMQZ3

MOOC:

1. https://www.edx.org/course/machine-learning-fundamentals-2
2. https://www.coursera.org/learn/machine-learning

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: V**
Subject: Predictive Modeling and Analytics **Subject Code: C127572(022)**
Total Theory Periods: 40 **Total Tutorial Periods: 10**
No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**
ESE Duration: Three Hours, Maximum Marks in ESE: 100 **Minimum Marks in ESE: 35**

UNIT-I: DATA PREPARTION
Introduction – Predictive Analytics in the Wild – Exploring Data types and associated Techniques - Complexities of data - Applying Models: Models and simulation, Categorizing Models, Describing, summarizing data, and decisions – Identify similarities in Data: Data Clustering, converting Raw Data into a Matrix, Identify K-groups in Data.

UNIT-II: DATA CLASSIFICATION – PART I
Background – Exploring Data classification process - Using Data Classification to predict the future: Decision tree, Algorithm for generating Decision Trees, Support Vector Machine.

UNIT-III: DATA CLASSIFICATION – PART II
Ensemble Methods to Boost Prediction Accuracy: Naive Bayes Classification Algorithm, The Markov Model, Linear Regression, Neural Networks – Deep learning.

UNIT-IV: DATA PREDICTION
Adopt predictive analytics - Processing data: identifying, cleaning, generating, reducing dimensionality of data – Structuring Data – Build predictive model: develop and test the model.

UNIT-V: DATA VISUALIZATION
Introduction to visualization tool – Evaluate the data – visualize Model's Analytical Results: hidden grouping, data classification results, outliers, decision trees, prediction – Novel visualization in Predictive Analytics.

TEXT BOOKS:
1. Anasse Bari, Mohamed Chaouchi, Tommy Jung, "Predictive Analytics For Dummies", Wiley Publisher, 2nd Edition, 2016.

REFERENCE BOOKS:
1. Bertt Lantz, Machine Learning with R: Expert techniques for predictive modeling to solve all yourdata analysis problems, Pack Publisher, 2nd Edition, 2015.
2. Aurelien,"Hands-On Machine Learning with Scikit-Learn &TensorFlow", O'Reilly Publisher, 5thEdition, 2017.
3. Max Kuhn, Kjell Johnson, " Applied Predictive Modeling" Springer, 2013.

E BOOKS:
1. https://vuquangnguyen2016.files.wordpress.com/2018/03/applied-predictive-modeling-maxkuhn-kjell-johnson_1518.pdf
2. https://www.researchgate.net/publication/329873035_Prediction_Modeling_Methodology
3. https://www.memsql.com/releases/oreilly-predictive-analytics/

MOOC:
1. https://www.coursera.org/learn/predictive-modeling-analytics
2. https://www.edx.org/course/predictive-analytics
3. https://www.udemy.com/course/machinelearningandlogisticregression/

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: V**
Subject: Cryptography and Network Security **Subject Code: C127573(022)**
Total Theory Periods: 40 **Total Tutorial Periods: 10**
No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**
ESE Duration: Three Hours, Maximum Marks in ESE: 100 **Minimum Marks in ESE: 35**

UNIT–I: CLASSICAL ENCRYPTION TECHNIQUES
Symmetric cipher model, Steganography, Limitations of Perfect Secrecy, Shannon's Theorem.

UNIT–II: NUMBER THEORY
Prime numbers and factoring, modular arithmetic, computations in finite fields, Discrete logarithms.

UNIT–III: PRIVATE KEY ENCRYPTION SCHEMES AND BLOCK CIPHERS
Pseudorandom Functions and Permutations, Private-Key Encryption Schemes, DES – The Data Encryption Standard, Attacks on DES, Single-Round DES, Two-Round DES, Three-Round DES, Best Known Attacks on Increasing the Key size for DES, Modes of Operation

UNIT–IV: PUBLIC KEY ASYMMETRIC CRYPTOGRAPHY
Public-Key Problems and Mathematical Background, Diffie-Hellman Key Agreement, El-Gamal Encryption Scheme, RSA Encryption, Security of RSA, Hybrid Encryption , Attacks on RSA, Private and Public-Key, Timing Attacks, Elliptic Curve Cryptography.

UNIT–V: HASH FUNTIONS
Definition and Properties, Constructions of Collision-Resistant Hash Functions, Popular Uses of Collision-Resistant Hash Functions, Random Oracle Model. Hash algorithms: SHA-512. Message Authentication: Message Authentication Codes Definitions, Constructions of Secure Message Authenticate Codes, Practical Constructions of Message Authentication Codes.

UNIT–VI:DIGITAL SIGNATURE AND APPLICATIONS AND SECURITY AT TRANSPORT LAYER

Definitions, and Public-Key Infrastructure, Combining Encryption and Signatures – SignCryption, SSL Architecture, Protocols, SSL Message formats, Transport Layer Security, Kerberos Password Management.

TEXT BOOKS:

1. "Cryptography & Network Security" by William Stallings 4th Edition, 2006,Pearson Education Asia.
2. Kahate A, "Cryptography & Network Security", Tata McGraw Hill, 2004.

REFERENCE BOOKS:

1. "Applied Cryptology" by Schiner Bruce, John Wiley & Sons,2001.
2. "Introduction to Cryptography with Coding Theory" by Wade Trappe & Lawrence C Washington, New Jersey, Pearson Education,2006.
3. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security: Private Communication in a Public World", Prentice Hall of India PrivateLimited.
4. Behrouz A. Forouzan, "Cryptography and Network Security", McGrawHill

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: V**
Subject: Artificial Neural Networks **Subject Code: C127574(022)**
Total Theory Periods: 40 **Total Tutorial Periods: 10**
No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**
ESE Duration: Three Hours, Maximum Marks in ESE: 100 **Minimum Marks in ESE: 35**

UNIT-I: Introduction
Introduction to ANN Features, structure and working of Biological Neural Network, Trends in Computing Comparison of BNN and ANN.

UNIT-II: Fundamental Concepts
Fundamental concepts: neuron models and basic learning rules. Single layer neural networks. Multilayer neural networks and back-propagation.

UNIT-III: Associative Memories
Associative memories Linear Association, Basic Concepts of recurrent Auto associative memory: retrieval algorithm, storage algorithm; By directional associative memory, Architecture, Association encoding & decoding, Stability.

UNIT-IV: Self Organizing Networks
Self organizing networks Un-supervised learning of clusters, winner-take-all learning, recall mode, Initialisation of weights, reparability limitations.

UNIT-V:
Auto encoders and adversarial networks**.** Deep Neural Networks.

REFERENCE BOOKS:
1. Artificial Neural Networks – B. Yegnanarayana Prentice Hall of India P Ltd 2005
2. Neural Networks in Computer Inteligance, Li Min Fu TMH 2003
3. Neural Networks -James A Freeman David M S Kapura Pearson Education 2004.
4. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: V**
Subject: Advanced Computer Network **Subject Code: C127531(022)**
Total Theory Periods: 40 **Total Tutorial Periods: 10**
No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**
ESE Duration: Three Hours, Maximum Marks in ESE: 100 **Minimum Marks in ESE: 35**

UNIT-I:
Computer Networks and the Internet: What is the Internet, The Network edge, The Network core, Access Networks and Physical media, ISPs and Internet Backbones, Delay and Loss in Packet-Switched Networks, History of Computer Networking and the Internet - Foundation of Networking Protocols: 5-layer TCP/IP Model, 7-Layer OSI Model, Internet Protocols and Addressing, Equal-Sized Packets Model: ATM - Networking Devices: Multiplexers, Modems and Internet Access Devices, Switching and Routing Devices, Router Structure.

UNIT-II:
The Link Layer and Local Area Networks: Link Layer: Introduction and Services, Error- Detection and Error-Correction techniques, Multiple Access Protocols, Link Layer Addressing, Ethernet, Interconnections: Hubs and Switches, PPP: The Point-to-Point Protocol, Link Virtualization, Routing and Internetworking: Network Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Intradomain Routing Protocols, Interdomain Routing Protocols, Congestion Control at Network Layer.

UNIT-III:
Logical Addressing: IPv4 Addresses, IPv6 Addresses - Internet Protocol: Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6, Multicasting Techniques and Protocols: Basic Definitions and Techniques, Intradomain Multicast Protocols, Interdomain Multicast Protocols, Node-Level Multicast algorithms, Transport and End-to-End Protocols: Transport Layer, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Mobile Transport Protocols, TCP Congestion Control, Application Layer: Principles of Network Applications, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP, Building a Simple Web Server.

UNIT-IV:
Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs) - Optical Networks and WDM Systems: Overview of Optical Networks, Basic Optical Networking Devices, Large-Scale Optical Switches, Optical Routers, Wavelength Allocation in Networks, Case Study: An All-Optical Switch.

UNIT-V:
VPNs, Tunneling and Overlay Networks: Virtual Private Networks (VPNs), Multiprotocol Label Switching (MPLS), Overlay Networks, VoIP and Multimedia Networking: Overview of IP Telephony, VoIP Signaling Protocols, Real-Time Media Transport Protocols, Distributed Multimedia Networking, Stream Control Transmission Protocol - Mobile A-Hoc Networks: Overview of Wireless Ad-Hoc Networks, Routing in Ad-Hoc Networks, Routing Protocols for Ad-Hoc Networks, Wireless Sensor Networks: Sensor Networks and Protocol Structures, Communication Energy Model, Clustering Protocols, Routing Protocols.

TEXT BOOKS:
1. Computer Networking: A Top-Down Approach Featuring the Internet, *James F. Kurose, Keith W.Ross*, Third Edition, Pearson Education, 2007
2. Computer and Communication Networks, *Nader F. Mir,* Pearson Education, 2007.

REFERENCES:

1. Data Communications and Networking, *Behrouz A. Forouzan*, Fourth Edition, Tata McGraw Hill, 2007
2. Guide to Networking Essentials, *Greg Tomsho,Ed Tittel, David Johnson,*Fifth Edition, Thomson.
3. An Engineering Approach to Computer Networking *, S.Keshav,* Pearson Education.
4. Campus Network Design Fundamentals, *Diane Teare, Catherine Paquet,* Pearson Education (CISCO Press)
5. Computer Networks, *Andrew S. Tanenbaum*, Fourth Edition, Prentice Hall.
6. The Internet and Its Protocols, A. Farrel, Elsevier.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: V**
Subject: Computational Complexity **Subject Code: C127532(022)**
Total Theory Periods: 40 **Total Tutorial Periods: 10**
No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**
ESE Duration: Three Hours, Maximum Marks in ESE: 100 **Minimum Marks in ESE: 35**

UNIT – I:
Computational Complexity: Polynomial time and its justification, Nontrivial examples of polynomial-time algorithms, the concept of reduction (reducibility), Class P Class NP and NP- Completeness, The P versus NP problem and why it's hard

UNIT - II:
Algorithmic paradigms: Dynamic Programming, Longest common subsequence, matrix chain multiplication, knapsack problem, Greedy – 0-1 knapsack, fractional knapsack, scheduling problem, Huffman coding, MST, Branch-and-bound – travelling sales person problem, 0/1 knapsack problem, Divide and Conquer, Merge sort, binary search, quick sort.

UNIT - III:
Randomized Algorithms: Finger Printing, Pattern Matching, Graph Problems, Algebraic Methods, Probabilistic Primality Testing, De-Randomization Advanced Algorithms.

UNIT - IV:
Graph Algorithms: Shortest paths, Flow networks, Spanning Trees; Approximation algorithms, Randomized algorithms. Approximation algorithms: Polynomial Time Approximation Schemes.

UNIT - V:
Advanced Data Structures and applications: Decision Trees and Circuits, B-Trees, AVL Trees, Red and Black trees, Dictionaries and tries, Maps, Binomial Heaps, Fibonacci Heaps, Disjoint sets, Union by Rank and Path Compression

TEXT BOOKS:

1. T. Cormen, C. Leiserson, R. Rivest and C. Stein, Introduction to Algorithms, Third Edition, McGraw-Hill, 2009.
2. R. Motwani and P. Raghavan, Randomized Algorithms, Cambridge University Press, 1995.
3. J. J. McConnell, Analysis of Algorithms: An Active Learning Approach, Jones & Bartlett Publishers, 2001.
4. D. E. Knuth, Art of Computer Programming, Volume 3, Sorting and Searching, Second Edition, Addison-Wesley Professional, 1998.
5. S. Dasgupta, C. H. Papadimitriou and U. V. Vazirani, Algorithms, McGraw-Hill, 2008.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: V**
Subject: Distributed Computing **Subject Code: C127533(022)**
Total Theory Periods: 40 **Total Tutorial Periods: 10**
No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**
ESE Duration: Three Hours, Maximum Marks in ESE: 100 **Minimum Marks in ESE: 35**

UNIT-I: INTRODUCTION
Introduction: Definition-Relation to Computer System Components, Motivation, Message, Passing Systems versus Shared Memory Systems, Primitives for Distributed Communication, Synchronous versus Asynchronous Executions, Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program, A Model of Distributed Executions, Models of Communication Networks, Global State of a Distributed System.

UNIT-II: LOGICAL TIME AND GLOBAL STATE
Logical Time: Physical Clock Synchronization: NTP, A Framework for a System of Logical Clocks, Scalar Time, Vector Time; Message Ordering and Group Communication: Message Ordering.
Paradigms, Asynchronous Execution with Synchronous Communication, Synchronous Program Order on Asynchronous System, Group Communication, Causal Order, Total Order; Global State and Snapshot Recording Algorithms: Introduction, System Model and Definitions, Snapshot. Algorithms for FIFO Channels.

UNIT-III: DISTRIBUTED MUTEX AND DEADLOCK
Distributed Mutual exclusion Algorithms: Introduction, Preliminaries, Lamport's algorithm, Ricart Agrawala's Algorithm, Token-Based Algorithms, Suzuki-Kasami's Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction, System Model, Preliminaries Models of Deadlocks, Chandy-Misra-Haas Algorithm for the AND model and OR Model.

UNIT-IV: CONSENSUS AND RECOVERY
Consensus and Agreement Algorithms: Problem Definition, Overview of Results, Agreement in a Failure-Free System (Synchronous and Asynchronous), Agreement in Synchronous Systems with Failures; Check pointing and Rollback Recovery: Introduction, Background and Definitions, Issues in Failure Recovery, Checkpoint-based Recovery, Coordinated Check pointing Algorithm, Algorithm for Asynchronous Check pointing and Recovery

UNIT-V: CLOUD COMPUTING
Definition of Cloud Computing, Characteristics of Cloud, Cloud Deployment Models, Cloud Service Models, Driving Factors and Challenges of Cloud, Virtualization, Load Balancing, Scalability and Elasticity, Replication, Monitoring, Cloud Services and Platforms: Compute Services, Storage Services, Application Services

TEXT BOOKS:

1. Kshemkalyani Ajay D, Mukesh Singhal, "Distributed Computing: Principles, Algorithms and Systems", Cambridge Press, 2011.
2. Mukesh Singhal, Niranjan G Shivaratri, "Advanced Concepts in Operating systems", McGraw Hill Publishers, 1994.

REFERENCES:

1. George Coulouris, Jean Dollimore, Time Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.
2. Pradeep L Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2007.
3. Tanenbaum A S, Van Steen M, “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.
4. Liu M L, “Distributed Computing: Principles and Applications”, Pearson Education, 2004.
5. Nancy A Lynch, “Distributed Algorithms”, Morgan Kaufman Publishers, 2003.
6. Arshdeep Bagga, Vijay Madisetti, “ Cloud Computing: A Hands-On Approach”, Universities Press, 2014.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: V**

Subject: Machine Learning Lab **Subject Code: C127591(022)**

Maximum Marks in ESE: 40

List of Experiments:-

1. Installation of Python Libraries/ MATLAB tools for Machine Learning
2. Data pre-processing using Python Machine Learning libraries/ MATLAB. Suggested reading: Introduction to Machine Learning - http://nptel.ac.in/courses/106106139/
3. Design a model to predict the housing price from Boston Dataset using Multivariate Linear Regression.
4. Build a classifier using Logistic Regression, k- Nearest Neighbor / Decision Tree to classify whether the given user will purchase a product or not from a social networking dataset.
5. Segment a customer dataset based on the buying behaviour of customers using K-means/Hierarchical clustering.
6. Dimensionality reduction of any CSV/image dataset using Principal Component Analysis.
7. Recognition of MNIST handwritten digits using Artificial Neural Network.
8. Build an email spam classifier using SVM.
9. Classify the given text segment as ‘Positive’ or ‘Negative’ statement using the Naive Bayes Classifier.
10. Predict future stock price of a company using Monte Carlo Simulation.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: V**

Subject: Predictive Modeling and Analytics Lab **Subject Code: C127592(022)**

Maximum Marks in ESE: 40

List of Experiments:-

1. Healthcare Analytics Case Study: Cancer survivability predictors
2. Social and Marketing Analytics Case Study: Tweets as predictors for the stock market

    Step 1- Collecting data

    Step 2 – Exploring and preparing the Data

1. Apply Decision tree classification model on Healthcare Analytics
2. Apply Support Vector Machine model on Social and Marketing Analytics

1. Apply Naive Bayes Classification Algorithm on Healthcare Analytics
2. Apply Linear Regression Algorithm on Social and Marketing Analytics

1. Develop and test the model for Healthcare Analytics
2. Develop and test the model for Social and Marketing Analytics

1. Visualize Data Classification results
2. Visualize the decision trees
3. Visualize the prediction

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: V**

Subject: Artificial Neural Networks Lab **Subject Code: C127593(022)**

Maximum Marks in ESE: 40

List of Experiments:-

1. Write a program to implement Perceptron.
2. Write a program to implement AND OR gate using Perceptron.
3. Write a program to perform the basic matrix operations.
4. Write a program to implement classification using Back propagation.
5. Write a MatLab/ Python Script containing four functions Addition, Subtraction, Multiply and Divide functions.
6. Write a program to implement classification of linearly separable Data with a perceptron.
7. To study Long Short Term Memory for Time Series Prediction.
8. To study Convolutional Neural Network and Recurrent Neural Network.
9. To study ImageNet, GoogleNet,ResNet convolutional Neural Networks.
10. Write a program to implement following activation function (i) purelin(n), (ii) binary threshold(hardlim(n) (iii) haradlims(n)) , (iv)Tansig(n) (v) logsig(n).
11. To study the use of Long Short Term Memory / Gated Recurrent Units to predict the stock prices based on historical data.