

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (ARTIFICIAL INTELLIGENCE)
COURSE STRUCTURE AND SYLLABUS(R19)

EFFECTIVE FROM ACADEMIC YEAR 2020 - 21 ADMITTED BATCH

I YEAR ISEMESTER

Course Code	Course Title	L	T	P	Credits
Professional Core – I	Artificial Intelligence and Intelligent Systems	3	0	0	3
Professional Core – II	Statistical Foundations for Artificial Intelligence	3	0	0	3
Professional Elective – I	1. Advanced Data Structures 2. Machine Learning 3. Ad-hoc and Sensor Networks	3	0	0	3
Professional Elective – II	1. Cognitive Systems 2. Game Theory and Applications 3. Computer Vision	3	0	0	3
Lab – I	Artificial Intelligence and Intelligent Systems Lab	0	0	4	2
Lab – II	*Professional Elective- I Lab	0	0	4	2
	Research Methodology & IPR	2	0	0	2
Audit – I	Audit Course – I	2	0	0	0
	Total	16	0	8	18

Professional Elective- I and Professional Elective- I Lab must be of same course.

I YEAR IISEMESTER

Course Code	Course Title	L	T	P	Credits
Professional Core – III	Deep Learning	3	0	0	3
Professional Core – IV	Speech Information Processing	3	0	0	3
Professional Elective – III	1. Big Data Analytics 2. Functional Programming 3. Internet of Things	3	0	0	3
Professional Elective – IV	1. Reinforcement Learning 2. Machine Translation 3. Cyber Security	3	0	0	3
Lab – III	Deep Learning Lab	0	0	4	2
Lab – IV	*Professional Elective-III Lab	0	0	4	2
	Mini Project with Seminar	0	0	4	2
Audit – II	Audit Course – II	2	0	0	0
	Total	14	0	12	18

Professional Elective- III and Professional Elective- III Lab must be of same course.

II YEAR I SEMESTER

Course Code	Course Title	L	T	P	Credits
Professional Elective – V	1. Blockchain Technologies 2. Computational Neuro Science 3. Natural Language Processing and Chat bots	3	0	0	3
Open Elective	Open Elective	3	0	0	3
Dissertation	Dissertation Work Review – II	0	0	12	6
	Total	6	0	12	12

II YEAR II SEMESTER

Course Code	Course Title	L	T	P	Credits
Dissertation	Dissertation Work Review – III	0	0	12	6
Dissertation	Dissertation Viva-Voce	0	0	28	14
	Total	0	0	40	20

Note:For Dissertation Work Review - I, Please refer 7.8 in R19 Academic Regulations.

Audit Course I & II:

1. English for Research PaperWriting
2. Disaster Management
3. Sanskrit for TechnicalKnowledge
4. Value Education
5. Constitution ofIndia
6. Pedagogy Studies
7. Stress Management by yoga
8. Personality Development Through Life EnlightenmentSkills

Open Electives:

1. IPR in Artificial Intelligence
2. Fault Tolerance Systems
3. Intrusion Detection Systems
4. Digital Forensics
5. Optimization Techniques
6. Cyber Physical Systems
7. Graph Analytics

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech.(Artificial Intelligence) - I Year I Semester

ARTIFICIAL INTELLIGENCE AND INTELLIGENT SYSTEMS (PC- I)

Pre-Requisites: UG level course in Mathematics, Data Structures

Course Objectives:

- To impart knowledge about Artificial Intelligence.
- To give understanding of the main abstractions and reasoning for intelligent systems.
- To enable the students to understand the basic principles of Artificial Intelligence in various applications.

Course Outcomes: After completion of course, students would be able to:

- Solve basic AI based problems.
- Define the concept of Artificial Intelligence.
- Apply AI techniques to real-world problems to develop intelligent systems.
- Select appropriately from a range of techniques when implementing intelligent systems.

UNIT - I

Introduction: Overview of AI problems, AI problems as NP, NP-Complete and NP Hard problems. Strong and weak, neat and scruffy, symbolic and sub-symbolic, knowledge-based and data-driven AI.

UNIT -II

Search Strategies: Problem spaces (states, goals and operators), problem solving by search, Heuristics and informed search, Minmax Search, Alpha-beta pruning. Constraint satisfaction (backtracking and local search methods).

UNIT - III

Knowledge representation and reasoning: propositional and predicate logic, Resolution and theorem proving, Temporal and spatial reasoning. Probabilistic reasoning, Bayes theorem. Totally-ordered and partially-ordered Planning. Goal stack planning, Nonlinear planning, Hierarchical planning.

UNIT - IV

Learning: Learning from example, Learning by advice, Explanation based learning, Learning in problem solving, Classification, Inductive learning, Naive Bayesian Classifier, decision trees. Natural Language Processing: Language models, n-grams, Vector space models, Bag of words, Text classification. Information retrieval.

UNIT - V

Agents: Definition of agents, Agent architectures (e.g., reactive, layered, cognitive), Multi-agent systems- Collaborating agents, Competitive agents, Swarmsystems and biologically inspired models. Intelligent Systems: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition. Key Application Areas: Expert system, decision support systems, Speech and vision, Natural language processing, Information Retrieval, Semantic Web.

Reference Books:

1. Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair, Tata McGraw Hill.
2. Introduction to Artificial Intelligence and Expert Systems by Dan W. Patterson, Pearson Education.
3. Artificial Intelligence: A Modern Approach by S. Russell and P. Norvig, Prentice Hall

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year I Semester

STATISTICAL FOUNDATIONS OF ARTIFICIAL INTELLIGENCE (PC- II)

Pre-Requisites: UG level course in Mathematics, Probability and Statistics

Course Objectives:

- The course provides comprehensive introduction to probabilistic graphical models.

Course Outcomes: After completion of course, students would be able to:

- To model problems using graphical models
- Design inference algorithms
- Learn the structure of the graphical model from data.

UNIT - I

Fundamentals: Introduction to regression and classification, Formalizing a learning task, experience, reward, Gaussian noise and linear least-square fit, A taste of Bayesian learning, Hypothesis, prior and posterior distributions, Posterior distribution and prediction, Point estimates of posterior e.g. MAP Minimum description length and MAP, Back to regression: linear least-square with square regularizer.

UNIT -II

Linear least square demo, Ridge penalty, Lasso and its quadratic program, Contrast between Ridge and Lasso, model sparsity, From regression to classification, Loss functions for classification and regression

"True loss" and various approximations, Square loss and its limitations, Choice of discriminant functions

Class density and class discrimination, Discriminants for multivariate Gaussian densities

UNIT - III

Eigen-SVD connection, SVD demo with low-rank plus noise matrix, Connection between SVD and (regularized) least square, Principal Component Analysis, Linear discriminants and fitting criteria Hill-climbing, step size, and Newton method, Derivation of the Perceptron from gradient descent considerations, Kernel regression and kernel density estimation

UNIT - IV

Basic SVMQP for separable problems, scilab, Inseparable problems and hinge loss, Smooth approximations to hinge loss, direct primal optimization, Primal-dual, Gordan's theorem, KKT necessary conditions, Lagrangiansaddlepoint, Dual and Lagrangian, dualizing basic SVM

UNIT - V

Dual QP optimization, Using non-linear kernels with the dual formulation, Dual with kernels, scilab demo

Lagrangian support vector machines, Lagrangian and proximal support vector machines, Finite Newton optimization

TextBooks:

1. The Elements of Statistical Learning, Hastie, Tibshirani, Friedman
2. Pattern Classification, 2nd Edition, Duda, Hart and Stork, Wiley-Interscience

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year I Semester

ADVANCED DATA STRUCTURES (Professional Elective- I)

Pre-Requisites: UG level course in Data Structures

Course Objectives:

- The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- Students should be able to understand the necessary mathematical abstraction to solve problems.
- To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
- Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes: After completion of course, students would be able to:

- Understand the implementation of symbol table using hashing techniques.
- Understand the implementation of symbol table using hashing techniques.
- Develop algorithms for text processing applications.
- Identify suitable data structures and develop algorithms for computational geometry problems.

UNIT - I

Dictionaries: Definition, Dictionary, Abstract Data Type, Implementation of Dictionaries.

Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT - II

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.

UNIT - III

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

UNIT - IV

Text Processing: String Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem

UNIT - V

Computational Geometry: One Dimensional Range Searching, Two-Dimensional Range Searching, constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees. Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem

Reference Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year I Semester

MACHINE LEARNING (Professional Elective - I)

Course Objectives:

- To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
- To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning.
- To explore Deep learning technique and various feature extraction strategies.

Course Outcomes: After completion of course, students would be able to:

- Extract features that can be used for a particular machine learning approach in various IOT applications.
- To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
- To mathematically analyse various machine learning approaches and paradigms.

UNIT - I

Introduction to Machine Learning: Problems, data, and tools, Visualization tools, Decision Tree Learning, Artificial Neural Networks, Bayesian Learning, Deep Learning, Instance-Based Learning,

UNIT – II

Regression Techniques: Linear regression, SSE, gradient descent, closed form, normal equations, features, Overfitting and complexity, training, validation, test data, Classification problems, decision boundaries, nearest neighbor methods, Probability and classification, Bayes optimal decisions, Naive Bayes and Gaussian class-conditional distribution

UNIT - III

Linear classifiers: Bayes Rule and Naive Bayes Model, Logistic regression, online gradient descent, Kernel Methods, Radial Basis Function Networks, Support Vector Machines, Genetic Algorithms, Reinforcement Learning

UNIT - IV

Ensemble methods: Bagging, random forests, boosting
Unsupervised learning: clustering, k-means, hierarchical agglomeration

UNIT - V

Latent space method: PCA, Text representations, naive Bayes and multinomial models, clustering and latent space models, VC-dimension, structural risk minimization, margin methods and support vector machines (SVM), Machine Learning Applications.

TextBooks:

1. Introduction to Machine Learning by Ethem Alpaydin, PHI Learning.
2. Machine Learning: An Algorithmic Perspective by Stephen Marsland, Chapman and Hall/CRC.
3. Pattern Recognition and Machine Learning by Christopher M. Bishop, Springer.
4. Machine Learning by Tom Mitchell, McGraw Hill Education

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year I Semester

AD-HOC AND SENSOR NETWORKS(Professional Elective - I)

Prerequisites: Computer Networks

Course Objectives:

- To understand the concepts of sensor networks
- To understand the MAC and transport protocols for adhoc networks
- To understand the security of sensor networks
- To understand the applications of adhoc and sensor networks

UNIT - I:

Introduction to Ad Hoc Wireless Networks: Characteristics of MANETs, Applications of MANETs, Challenges. Routing in MANETs: Topology-based versus Position-based approaches, Topology based routing protocols, Position based routing, Other Routing Protocols.

UNIT - II:

Data Transmission InMANETs: The Broadcast Storm, Multicasting, Geocasting TCP over Ad Hoc Networks: TCP Protocol overview, TOP and MANETs, Solutions for TOP over Ad Hoc

UNIT - III:

Basics of Wireless Sensors and Applications: The Mica Mote, Sensing and Communication Range, Design issues, Energy consumption, Clustering of Sensors, Applications
Data Retrieval In Sensor Networks: Classification of WSNs, MAC layer, Routing layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

UNIT - IV:

Security: security in ad-hoc wireless networks, key management, secure routing cooperation in MANETs, intrusion detection system. Sensor network platforms and tools: Sensor network hardware, sensor network programming challenges, Node-Level software Platforms

UNIT - V:

Operating system-TinyOS Imperative language: nesC, Dataflow style language: TinyGALS, Node-level Simulators, ns-2 and its sensor networks extension, TOSSIM.

Text Books:

1. Ad Hoc and Sensor Networks — Theory and Applications, Car/osCorderlo Dharma R Aggarwal, World Scientific Publications /Cambridge University Press, March 2006
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp 2009.

Reference Books:

1. Adhoc Wireless Networks — Architectures and Protocols, C.Siva Ram Murthy, B.S.Murthy, Pearson Education, 2004
2. Wireless Sensor Networks — Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010
3. Wireless Ad hoc Mobile Wireless Networks — Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008.
4. Ad hoc Networking, Charles E.Perkins, Pearson Education, 2001.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year I Semester

COGNITIVE SYSTEMS (Professional Elective - II)

Prerequisites: Probability theory

Course Objectives:

- To provide an understanding of the central challenges in realizing aspects of human cognition.
- To provide a basic exposition to the goals and methods of human cognition.
- To develop algorithms that use AI and machine learning along with human interaction and feedback to help humans make choices/decisions.
- To support human reasoning by evaluating data in context and presenting relevant findings along with the evidence that justifies the answers.

Course Outcomes:

- Understand what cognitive computing is, and how it differs from traditional approaches.
- Plan and use the primary tools associated with cognitive computing.
- Plan and execute a project that leverages cognitive computing.
- Understand and develop the business implications of cognitive computing.

UNIT - I

Introduction to Cognitive Science: Understanding Cognition, IBM's Watson, Design for Human Cognition, Augmented Intelligence, Cognition Modeling Paradigms: Declarative/ logic-based computational cognitive modeling, connectionist models of cognition , Bayesian models of cognition, a dynamical systems approach to cognition

UNIT - II

Cognitive Models of memory and language, computational models of episodic and semantic memory, modeling psycholinguistics

UNIT - III

Cognitive Modeling: modeling the interaction of language, memory and learning, Modeling select aspects of cognition classical models of rationality, symbolic reasoning and decision making

UNIT - IV

Formal models of inductive generalization, causality, categorization and similarity, the role of analogy in problem solving, Cognitive Development Child concept acquisition. Cognition and Artificial cognitive architectures such as ACT-R, SOAR, OpenCog, CopyCat, Memory Networks

UNIT - V

DeepQA Architecture, Unstructured Information Management Architecture (UIMA), Structured Knowledge, Business Implications, Building Cognitive Applications, Application of Cognitive Computing and Systems

TextBooks:

1. The Cambridge Handbook of Computational Psychology by Ron Sun (ed.), Cambridge University Press.
2. Formal Approaches in Categorization by Emmanuel M. Pothos, Andy J. Wills, Cambridge University Press.

3. Cognition, Brain and Consciousness: Introduction to Cognitive Neuroscience by Bernard J. Bears, Nicole M. Gage, Academic Press.
4. Cognitive Computing and Big Data Analytics by Hurwitz, Kaufman, and Bowles, Wiley

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year I Semester

GAME THEORY AND APPLICATIONS (Professional Elective - II)

Prerequisites: Graph Theory

Course Objectives:

- To teach students some strategic considerations to take into account making their choices.
- To learn basic concepts of game theory.
- To apply game theoretic models to real world problems

Course Outcomes:

- Solve strategic games between two and more agents in non-cooperative scenario.
- Analyze and solve both simultaneous-moves and sequential-moves games.
- Learn different methods to solve games.

UNIT - I

Introduction: games and decisions, Games Strategies, Costs and Payoff, Basic Solution Concepts, Finding equilibria and Learning in Games

UNIT - II

Zero-Sum Games: secure strategy, Maximin, Maximax, and Minimax Regret Solvability, value of a game. Normal form games: dominance, iterated dominance, Nash equilibrium. N-player games, mixed strategy nash equilibria.

UNIT - III

Graphical Games: Computing Nash, equilibria in Tree Graphical Games, Graphical Games and correlated Equilibria. Extensive form games: subgame perfection, sequential equilibrium, Stackelberg Model of Duopoly, Buying Votes, Committee Decision-Making. Bargaining: Rubinstein bargaining, Nash bargaining.

UNIT - IV

Repeated Games: Folk theorem and repeated prisoner's dilemma. Tacit collusion. Incomplete information games: Bayesian equilibrium, higher order beliefs.

UNIT - V

Auctions and Mechanism Design: Basic auctions, voting, Vickrey-Clarke-Groves Auction. Cryptography and Game theory: cryptographic influence on game theory and Game theoretic influence on cryptography

TextBooks:

1. A Course in Game Theory by M. J. Osborne & A. Rubinstein, MIT Press.
2. Algorithmic Game Theory by N. Nisan, T. Rougharden, E. Tardos and V. V. Vazirani, Cambridge University Press.
3. Game Theory and Applications by Tatsurolchiishi, Abraham Neyman and Yair Tauman, Elsevier.
4. Essentials of Game Theory: A Concise, Multidisciplinary Introduction by K. Leyton-Brown and Y. Shoham, Morgan & Claypool Publishers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year I Semester

COMPUTER VISION (Professional Elective - II)

Prerequisites: Graph Theory

Course Objectives:

- To study the development of algorithms and techniques to analyze and interpret the visible world around us.
- Be familiar with both the theoretical and practical aspects of computing with images.
- To understand the basic concepts of Computer Vision.
- Understand the geometric relationships between 2D images and the 3D world.
- Ability to apply the various concepts of Computer Vision in other application areas.

Course Outcomes:

- Understand the fundamental problems of computer vision.
- Implement various techniques and algorithms used in computer vision.
- Analyze and evaluate critically the building and integration of computer vision algorithms.
- Demonstrate awareness of the current key research issues in computer vision

UNIT - I

Digital Image Formation and low-level processing: Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

UNIT - II

Depth estimation and Multi-camera views: Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.

Feature Extraction: Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

UNIT - III

Image Segmentation: Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.

Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

UNIT - IV

Motion Analysis: Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

UNIT - V

Shape from X: Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.

Applications: CBIR, CBVR, activity recognition, computational photography, biometrics, stitching and document processing. Recent Trends: 3-D Printing, 3-D sensing, simultaneous location and mapping, GPU, edge-computing, augmented reality, virtual reality cognitive models, fusion and super resolution.

TextBooks:

1. Computer Vision: Algorithms and Applications by Richard Szeliski, Springer-Verlag.
2. Computer Vision: A Modern Approach by D. A. Forsyth and J. Ponce, Pearson Education.
3. Multiple View Geometry in Computer Vision by Richard Hartley and Andrew Zisserman, Cambridge University Press.
4. Introduction to Statistical Pattern Recognition by K. Fukunaga, Academic Press, Morgan Kaufmann.
5. Digital Image Processing by R.C. Gonzalez and R.E. Woods, PHI.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year I Semester

ARTIFICIAL INTELLIGENCE AND INTELLIGENT SYSTEMS LAB

Course Objectives:

- To provide skills for designing and analyzing AI based algorithms.
- To enable students to work on various AI tools.
- To provide skills to work towards solution of real-life problems

Course Outcomes:

- Elicit, analyze and specify software requirements.
- Simulate given problem scenario and analyze its performance.
- Develop programming solutions for given problem scenario.

List of Programs

1. Installation and working on various AI tools viz. Python, R tool, GATE, NLTK, MATLAB, etc.
2. Data preprocessing and annotation and creation of datasets.
3. Learn existing datasets and Treebanks
4. Implementation of searching techniques in AI.
5. Implementation of Knowledge representation schemes.
6. Natural language processing tool development.
7. Application of Machine learning algorithms.
8. Application of Classification and clustering problem.
9. Working on parallel algorithms.
10. Scientific distributions used in python for Data Science - Numpy, scify, pandas, scikitlearn, statmodels, nltk.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year I Semester

ADVANCED DATA STRUCTURES LAB(Professional Elective – I Lab)

Prerequisites: A course on Computer Programming & Data Structures

Course Objectives:

- Introduces the basic concepts of Abstract DataTypes.
- Reviews basic data structures such as stacks andqueues.
- Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs, andB-trees.
- Introduces sorting and pattern matchingalgorithms.

Course Outcomes:

- Ability to select the data structures that efficiently model the information in aproblem.
- Ability to assess efficiency trade-offs among different data structure implementations or combinations.
- Implement and know the application of algorithms for sorting and patternmatching.
- Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, andB-trees.

List of Programs

1. Write a program to perform the followingoperations:
 - a) Insert an element into a binary searchtree.
 - b) Delete an element from a binary searchtree.
 - c) Search for a key element in a binary searchtree.

2. Write a program for implementing the following sortingmethods:
 - a) Mergesort
 - b)Heapsort
 - c) Quicksort

3. Write a program to perform the followingoperations:
 - a) Insert an element into a B-tree.
 - b) Delete an element from a B-tree.
 - c) Search for a key element in a B-tree.

4. Write a program to perform the followingoperations:
 - a) Insert an element into a Min-Maxheap
 - b) Delete an element from a Min-Maxheap
 - c) Search for a key element in a Min-Maxheap

5. Write a program to perform the followingoperations:
 - a) Insert an element into a Lefiisttree
 - b) Delete an element from a Leftisttree
 - c) Search for a key element in a Leftisttree

6. Write a program to perform the followingoperations:
 - a) Insert an element into a binomialheap
 - b) Delete an element from a binomialheap.
 - c) Search for a key element in a binomialheap

7. Write a program to perform the followingoperations:

- a) Insert an element into aAVLtree.
 - b) Delete an element from aAVL searchtree.
 - c) Search for a key element in aAVL searchtree.
8. Write a program to perform the followingoperations:
- a) Insert an element into a Red-Blacktree.
 - b) Delete an element from a Red-Blacktree.
 - c) Search for a key element in a Red-Blacktree.
9. Write a program to implement all the functions of a dictionary usinghashing.
10. Write a program for implementing Knuth-Morris-Pratt pattern matchingalgorithm.
11. Write a program for implementing Brute Force pattern matchingalgorithm.
12. Write a program for implementing Boyer pattern matchingalgorithm.

Text Books:

1. Fundamentals of Data structures in C, E. Horowitz, S. Sahniand Susan Anderson Freed, 2nd Edition, UniversitiesPress
2. Data Structures Using C – A.S. Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson education.
3. Introduction to Data Structures in C, Ashok Kamthane, 1st Edition, Pearson.

Reference Books:

1. The C Programming Language, B.W. Kernighan, Dennis M. Ritchie, PHI/PearsonEducation
2. C Programming with problem solving, J.A. Jones & K. Harrow, DreamtechPress
3. Data structures: A Pseudocode Approach with C, R.F. Gilberg And B. A. Forouzan, 2nd Edition, CengageLearning.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year I Semester

MACHINE LEARNING LAB(Professional Elective – I Lab)

Course Objective:

- The objective of this lab is to get an overview of the various machine learning techniques and can able to demonstrate them using python.

Course Outcomes: After the completion of the “Machine Learning” lab, the student can able to:

- Understand complexity of Machine Learning algorithms and their limitations;
- Understand modern notions in data analysis-oriented computing;
- Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;
- Be capable of performing experiments in Machine Learning using real-world data.

List of Experiments

- The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Baye’s rule in python to get the result. (Ans:15%)
- Extract the data from database using python
- Implement k-nearest neighbours classification using python
- Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3 centroids)

VAR1	VAR2	CLASS
1.713	1.586	0
0.180	1.786	1
0.353	1.240	1
0.940	1.566	0
1.486	0.759	1
1.266	1.106	0
1.540	0.419	1
0.459	1.799	1
0.773	0.186	1

- The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

medium skiing design single twenties no -
 >highRisk high golf trading married forties yes
 ->lowRisk

low speedway transport married thirties yes -
 >medRisk medium football banking single
 thirties yes ->lowRisk high flying media
 married fifties yes ->highRisk

low football security single twenties no -
 >medRisk medium golf media
 single thirties yes ->medRisk medium golf
 transport married forties yes ->lowRisk high
 skiing banking single thirties yes -
 >highRisk low golf unemployed married

forties yes ->highRisk

Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `medRisk' in the dataset?

6. Implement linear regression using python.
7. Implement Naïve Bayes theorem to classify the English text
8. Implement an algorithm to demonstrate the significance of genetic algorithm
9. Implement the finite words classification system using Back-propagation algorithm

Text Books:

1. Machine Learning – Tom M. Mitchell, MGH
2. Fundamentals of Speech Recognition By Lawrence Rabiner and Biing – Hwang Juang.

Reference Book:

1. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year I Semester

ADHOC AND SENSOR NETWORKS LAB (Professional Elective – I Lab)

Course Outcomes:At the end of this course, students will be able to

- Implement the advanced digital modulation techniques.
- Design Convolutional encoder and decoder for error control coding techniques.
- Calculate path loss for Free space, Okumura and Hata models for outdoor propagation.
- Comprehend Cellular concepts of GSM and CDMA networks.
- Simulate RAKE receiver for CDMA with MATLAB.

List of Experiments:

1. FSK Modulation and Demodulation technique.
2. QPSK Modulation and Demodulation technique.
3. DQPSK Modulation and Demodulation technique
4. 8-QAM Modulation and Demodulation technique.
5. Implementation of Convolutional Encoder and Decoder.
6. Simulation of the following Outdoor Path loss propagation models using MATLAB.
 - a. Free Space Propagation model
 - b. Okumura model
 - c. Hata model
7. Simulation of Adaptive Linear Equalizer using MAT LAB software.
8. Measurement of call blocking probability for GSM &CDMA networks using Netsim software.
9. Study of GSM handset for various signalling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).
10. Study of transmitter and receiver section in mobile handset and measure frequency band signal and GMSK modulating signal.
11. Simulation of RAKE Receiver for CDMA communication using MAT LAB software.
12. Simulate and test various types of PN codes, chip rate, spreading factor and processing gain on performance of DSSS in CDMA.
13. Simulate and test the 3G Network system features using GSM AT Commands. (Features of 3G Communication system: Transmission of voice, video calls, SMS, MMS, TCP/IP, HTTP, GPS)
14. Modelling of communication system using Simulink.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year I Semester

RESEARCH METHODOLOGY & IPR

Prerequisite: None

Course Objectives:

- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

Course Outcomes: At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasize the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT- I:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT- II:

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT- III:

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT- IV:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT- V:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

Reference Books:

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners".
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
3. Mayall, "Industrial Design", McGraw Hill, 1992.
4. Niebel, "Product Design", McGraw Hill, 1974.
5. Asimov, "Introduction to Design", Prentice Hall, 1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
7. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year II Semester

DEEP LEARNING (PC – III)

Course Objectives:

- To build the foundation of deep learning.
- To understand how to build the neural network.
- To enable the students develop successful machine learning concepts.

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- Learn the fundamental principles of deep learning.
- Identify the deep learning algorithms for various types of learning tasks in various domains.
- Implement deep learning algorithms and solve real-world problems.

UNIT - I

Introduction: Feed forward Neural networks, Gradient descent and the back propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. ReLU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout

UNIT - II

Convolutional Neural Networks: Architectures, convolution / pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Autoencoders, Variational Auto-encoders, Adversarial Generative Networks, Auto-encoder and DBM Attention and memory models, Dynamic Memory Models

UNIT - III

Applications of Deep Learning to Computer Vision: Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention models for computer vision tasks

UNIT - IV

Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove, Evaluations and Applications in word similarity

UNIT - V

Analogy reasoning: Named Entity Recognition, Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs

Text Books:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models by D. Koller, and N. Friedman, MIT Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year II Semester

SPEECH INFORMATION PROCESSING (PC – IV)

Course Objectives:

- To understand the concept of speech processing.
- To build speech based systems.
- To analyze the performance of speech processing systems.

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- The mechanism of human speech production and perception.
- Each component of speech recognition systems.
- The importance of probabilistic modeling in speech recognition.
- Build a speech recognition system.

UNIT - I

Introduction: Speech and Language, Speech analysis, Speech coding, speech production models, speech analysis and analysis-synthesis systems, Mechanisms and Models of the Human Auditory System

UNIT - II

Linear Predictive Coding (LPC) Analysis: Speech recognition, Graphical models, Hidden Markov models, Recognition and training algorithms, Language models

UNIT - III

Search Algorithms: Optimization, adaptation, Noise robustness, Digital Coding of Speech. Message Synthesis from Stored Human Speech Components. Phonetic Synthesis by Rule. Speech Synthesis from Textural or Conceptual Input

UNIT - IV

Introduction to Automatic Speech Recognition: Template Matching. Stochastic Modeling. Practical

Techniques for Improving Speech Recognition and Performance, Automatic Speech Recognition for Large Vocabularies. Speaker Recognition and other Para-linguistic Technologies. Human Auditory System. Digital Coding of Speech.

UNIT - V

Phonetics Synthesis by Rule: Introduction Automatic Speech Recognition, Discriminative training for speech recognition, Speech recognition applications, Speech synthesis, voice conversion, Speaker recognition

Text Books:

1. Digital Speech Processing: Synthesis, and Recognition by Sadaoki Furui, CRC Press.
2. Speech Synthesis and Recognition by Wendy Holmes, CRC Press.
3. Audio Signal Processing and Coding by Andreas Spanias, Ted Painter and Venkatraman Atti, Willey.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year II Semester

BIG DATA ANALYTICS (PE - III)

Course Objectives:

- To understand the Big Data Platform and its Use cases
- Apply analytics on Structured and Unstructured Data.
- Acquire the knowledge and working on Big Data platforms

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- Describe and analyze various Big Data platforms.
- Develop Big Data Solutions using Hadoop Eco System.
- Apply Machine Learning Techniques using R.

UNIT - I

Introduction to Big Data: Types of Digital Data, Introduction to Big Data, Big Data Analytics, Relational Databases & SQL, Data Cleansing and Preparation, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analyzing Data with Hadoop, Hadoop Streaming, IBM Big Data Strategy, InfosphereBigInsights and Big Sheets.

UNIT - II

HDFS (Hadoop Distributed File System): The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives

UNIT - III

Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures. Map Reduce, Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features

UNIT - IV

Hadoop Eco System Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions

UNIT - V

Hbase: HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL, Data Analytics with R, Big Data Analytics with BigR

Text Books:

1. Data Science for Business by F. Provost and T. Fawcett, O'Reilly Media.
2. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics by Bill Franks, John Wiley & Sons.
3. Hadoop: The Definitive Guide by Tom White, O'reilly Media.
4. Big Data and Business Analytics by Jay Liebowitz, Auerbach Publications, CRC Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year II Semester

FUNCTIONAL PROGRAMMING (PE - III)

Course Objectives

- Understand the concepts and terms used to describe languages that support the imperative, functional, object-oriented, and logic programming paradigms.
- Solve problems using the functional paradigm.
- Solve problems using the object-oriented paradigm.
- Solve problems using the logic programming paradigm.

Course Outcomes:At the end of the course the student will be able to:

- Write programs in a functional style.
- Reason formally about functional programs.
- Use polymorphism and higher-order functions.
- Reason about the time and space complexity of programs.

UNIT - I

Functional Programming: Introduction, Differences between Functional Programming and Object Oriented Programming, concepts of functional programming, Functional Programming in Python: Introduction to Python, Built-in Functions, Dictionary Methods, String Methods, LIST/ARRAY Methods, Tuple Methods, Set Methods

UNIT - II

Python Exceptions, File Handling, Tuple Methods, Defining Iteration, Conditional Iterations, Random Module, Math Module, CMathModule, Python File I/O

UNIT - III

Python Sending Mail, Python CSV, Python OOP Concepts, Python Iterators, Python Generators, Python Decorators, Python Database Connections

UNIT - IV

Introduction to Haskell and Laziness, Structure, Modularity, Maintainability, Polymorphism, higher order functions, strings & characters, lazy evaluation, Data Types using Patterns

UNIT - V

LISP Programming: Basic LISP Programming, Data Types, Functions, Editing, Loading, Compiling LISP Programs, Control Structures: Recursions and Conditionals, LISTS, SETS, Structural Recursion with LISTS, Symbols

Text Books:

1. The Haskell School of Expression: Learning Functional Programming through Multimedia, Paul Hudak.
2. Functional Programming in Python, David Mertz, O'Reilly Media.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year II Semester

INTERNET OF THINGS (PE - III)

Course Objectives:

- To introduce the terminology, technology and its applications.
- To introduce the concept of M2M (machine to machine) with necessary protocols.
- To introduce the Python Scripting Language which is used in many IoT devices.
- To introduce the Raspberry PI platform, that is widely used in IoT applications.
- To introduce the implementation of web-based services on IoT devices.

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved.
- Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules.
- Market forecast for IoT devices with a focus on sensors.
- Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi.

UNIT - I

Introduction to Internet of Things- Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT Enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

UNIT - II

IoT and M2M- Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCONF, YANG- NETCONF, YANG, SNMP NETOPS

UNIT - III

IoT Physical Devices and Endpoints- Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins.

UNIT - IV

Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors

Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor

UNIT - V

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

Text Books:

1. Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madiseti, Universities Press, 2015, ISBN: 9788173719547.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.
3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year II Semester

REINFORCEMENT LEARNING (PE - IV)

Course Objectives:

- Learn how to define RL tasks and the core principals behind the RL, including policies, value functions.
- Understand and work with tabular methods to solve classical control problems.
- Recognize current, advanced techniques and applications in RL.

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- Understand imitation learning tasks and solutions.
- Learn how to define RL tasks and the core principals behind the RL, including policies, value Functions.
- Understand and work with tabular methods to solve classical control problems.

UNIT - I

Reinforcement Learning Primitives: Introduction, Basics of RL, Defining RL Framework, Probability Basics: Probability Axioms, Random Variables, Probability Mass Function, Probability Density Function, Cumulative Distribution Function and Expectation. Introduction to Agents, Intelligent Agents – Problem Solving – Searching, Logical Agents.

UNIT - II

Markov Decision Process and Dynamic Programming: Markov Property, Markov Chains, Markov Reward Process (MRP), Bellman Equations for MRP, Dynamic Programming: Policies (Evaluation, Improvement, Iteration, Value Iteration), Asynchronous Dynamic Programming, Generalized Policy Iteration.

UNIT - III

Monte Carlo Methods and Temporal Difference Learning: Monte Carlo- Prediction, Estimation of Action Values, Control and Control without Exploring Starts, Off-Policy Control, Temporal Difference Prediction: TD(0), SARSA: On-Policy TD control, Q-Learning: Off-Policy TD control, Games

UNIT - IV

Deep Reinforcement Learning: Deep Q-Networks, Double Deep-Q Networks (DQN, DDQN, Dueling DQN, Prioritized Experience Replay), Introduction to Policy-based Methods, Vanilla Policy Gradient, REINFORCE Algorithm and Stochastic Policy Search, Asynchronous Actor Critic and Asynchronous Advantage Actor Critic (A2C, A3C), Advanced Policy Gradient (PPO, TRPO, DDPG).

UNIT - V

Multi Agent in RL: Multi-Agent Learning, Meta-learning, Partially Observable Markov Decision Process, Ethics in RL, Applying RL for Real-World Problems

Text Books:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An Introduction", Second Edition, MIT Press, 2019.
2. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach.", Pearson Education Limited, 2016.
3. Michael Wooldridge, "An Introduction to Multi Agent Systems", John Wiley, 2002.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year II Semester

MACHINE TRANSLATION (PE - IV)

Course Objectives:

- To teach students machine translation approaches.
- To evaluate the performance of machine translation Systems.
- To develop translation models for Indian Languages.

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- Understand machine translation system.
- Explain, apply, and assess manual and automatic evaluation methods for machine translation.
- Build their own translation model using existing tools for machine translation.

UNIT - I

Introduction: Automating knowledge acquisition for machine translation, Basic probability theory, ngram language models, smoothing techniques for language modeling Absolute discounting and KneserNey smoothing. Language Modeling Probability, language models, and conditional language models, Very large language models. Word alignment and the expectation maximization algorithm

UNIT - II

MT Evaluation: BLEU, Google Translate and Bing Translator. Introduction to Moses, Corpus Acquisition from Internet, Latent-variable translation models, Phrase-based translation and decoding, Statistical phrase-based translation

UNIT - III

The complexity of phrase alignment problems: Relationship to EBMT, Phrase extraction, Estimating phrase translation probabilities and the problem of overfitting. Phrase re-ordering models. Phrase-based decoding. k-best lists. Maximum entropy. Minimum error-rate training. Perceptron, max-margin methods. System combination. Syntax-based translation, Hierarchical and syntax-based M, Synchronous CFG

UNIT - IV

Estimating rule probabilities and the problem of overfitting: Extracting synchronous TSGs from tree, tree data and the problem of non-isomorphism. CKY decoding. CKY with an n-gram language model. Binarization. K-best lists. Decoding with lattices. Source-side tree decoding. Syntax-based language models. Semantics-based translation

UNIT - V

Neural Probabilistic Language Models: Conditional neural language models, large vocabulary Language modeling, large vocabulary translation modeling, Effective Approaches to Attention-based Neural Machine Translation, Incorporating Structural Alignment Biases into an Attentional Neural Translation Model and Sequence-to-sequence Models

Text Books:

1. Statistical Machine Translation by Philipp Koehn, Cambridge University Press.
2. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
3. Linguistic Fundamentals for Natural Language Processing by Emily Bender, Morgan & Claypool.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year II Semester

CYBER SECURITY (PE - IV)

Course Objectives:

- To familiarize various types of cyber-attacks and cyber-crimes.
- To give an overview of the cyber laws.
- To study the defensive techniques against cyber-attacks.

Course Outcomes: The students will be able to understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.

UNIT - I

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy

UNIT - II

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing

UNIT - III

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones

Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops

UNIT - IV

Cyber Security: Organizational Implications: Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations

Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals

UNIT - V

Cybercrime: Examples and Mini-Cases

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

TextBooks:

1. Nina Godbole and SunitBelapure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Olson, CRC Press.
2. Cyber Security Engineering, A practical approach for systems and software Assurance, Nancy R. Mead, Carol C. Woody, Pearson Education.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year II Semester

DEEP LEARNING LAB

Course Objectives:

- To provide exposure of working on Deep learning.
- To design and implement solutions for real life problems.

Course Outcomes:

- Simulate/implement given problem scenario and analyze its performance.
- Design solutions for real life problems.

List of Programs

1. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
2. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
3. Write a program to construct a skip gram model using NLP
4. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Python ML library classes/API.
5. Write a program to implement Continuous Bag of Words Model using KNN Algorithm (using Python).
6. Build a model that takes an image as input and determines whether the image contains a picture of a dog or a cat.
7. Use CIFAR-10 dataset and build an image classification model that will be able to identify what class the input image belongs to.
8. Implement a Human Face Recognition Model and determine the accuracy in detecting the bounding boxes of the human face.
9. Build an image classification model to detect if the person has cancer or not.
10. Build a chatbot to identify the context the user is asking and then provide it with the relevant answer.

Text Books:

1. Deep Learning by Ian Goodfellow, YoshuaBengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models by D. Koller, and N. Friedman, MIT Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year II Semester

BIG DATA ANALYTICS LAB (Professional Elective – III Lab)

Course Objectives:

- The purpose of this course is to provide the students with the knowledge of Big data Analytics principles and techniques.
- This course is also designed to give an exposure of the frontiers of Big data Analytics.

Course Outcomes:

- Ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools.
- Ability to program using HADOOP and Map reduce, NOSQL.
- Ability to understand importance of Big Data in Social Media and Mining.

List of Programs:

1. Perform setting up and Installing Hadoop in its two operating modes:

- Pseudo distributed,
- Fully distributed.

Use web based tools to monitor your Hadoop setup.

Implement the following file management tasks in Hadoop:

- Adding files and directories
- Retrieving files
- Deleting files

Benchmark and stress test an Apache Hadoop cluster

2. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

Find the number of occurrence of each word appearing in the input file(s)

Performing a MapReduce Job for word search count (look for specific keywords in a file)

Stop word elimination problem:

Input:

- A large textual file containing one sentence per line
- A small file containing a set of stop words (One stop word per line)

Output:

- A textual file containing the same sentences of the large input file without the words appearing in the small file. Buyer event analytics using Cassandra on suitable product sales data.

3. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented.

Data available at: <https://github.com/tomwhite/hadoopbook/tree/master/input/ncdc/all>.

(Dataset Only)

- Find average, max and min temperature for each year in NCDC data set?
- Filter the readings of a set based on value of the measurement, Output the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.

4. Using Power Pivot (Excel) Perform the following on any dataset

- a. Big Data Analysis
- b. Big Data Charting

5. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.

6. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.

TextBooks:

1. Big Data Analytics, SeemaAcharya, SubhasiniChellappan, Wiley 2015.
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Michael Minelli, Michehe Chambers, 1stEdition, AmbigaDhiraj, Wiely CIO Series, 2013.
3. Hadoop: The Definitive Guide, Tom White, 3rdEdition, O"Reilly Media, 2012.
4. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1stEdition, IBM Corporation, 2012.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year II Semester
FUNCTIONAL PROGRAMMING LAB (Professional Elective – III Lab)

Course Objectives:

- To be able to introduce core programming basics and program design with functions using functional programming languages.
- To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.

Course Outcomes:

- Student should be able to understand the basic concepts scripting and the contributions of Functional Programming Languages.
- Ability to explore python especially the object-oriented concepts, and the built in objects of Python.

List of Programs

1. Write a program to demonstrate different number data types in Python.
2. Write a program to perform different Arithmetic Operations on numbers in Python.
3. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
4. Write a python script to print the current date in the following format "Sun May 29 02:26:23 IST 2017"
5. Write a program to create, append, and remove lists in python.
6. Write a program to demonstrate working with tuples in python.
7. Write a program to demonstrate working with dictionaries in python.
8. Write a python program to find largest of three numbers.
9. Write a Python program to convert temperatures to and from Celsius, Fahrenheit. [Formula : $c/5 = f-32/9$]
10. Write a Python program to construct the following pattern, using a nested for loop


```
*
  **
 ***
****
*****
****
***
**
*

```
11. Write a Python script that prints prime numbers less than 20.
12. Write a python program to find factorial of a number using Recursion.
13. Write a program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is a right triangle (Recall from the Pythagorean Theorem that in a right triangle, the square of one side equals the sum of the squares of the other two sides).
14. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
15. Write a python program to define a module and import a specific function in that module to another program.

Text Books:

1. The Haskell School of Expression: Learning Functional Programming through Multimedia, Paul Hudak.
2. Functional Programming in Python, David Mertz, O'Reilly Media.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - I Year II Semester

INTERNET OF THINGS LAB (Professional Elective – III Lab)

Course Objectives:

- To provide exposure of working on Big Data Analytics platforms.
- To design and implement solutions for real life problems.

List of Programs

1. Connect an LED to GPIO pin 25 and control it through command line.
2. Connect an LED to GPIO pin 24 and a Switch to GPIO 25 and control the LED with the switch.
3. Create a traffic light signal with three colored lights (Red, Orange and Green) with a duty cycle of 5-2-10 seconds.
4. Create a door lock application using a reed switch and magnet and give a beep when the door is opened.
5. Control a 230V device (Bulb) with Raspberry Pi using a relay.
6. Create an application that has three LEDs (Red, Green and white). The LEDs should follow the cycle (All Off, Red On, Green On, White On) for each clap (use sound sensor).
7. Build a model to control the DC motor speed and direction using raspberry pi. Using the model control the speed of a fan according to the weather outside.
8. Implement a facial recognition system in Python and then if the person exists in the database then we give him entry inside the door.
9. Implement weather reporting system that uses sensors to measure the temperature, humidity, and rain. Control a 230V device using a threshold temperature, using temperature sensor.
10. Implement a fire detection system that will alert the owner of the building, home, etc and will also report directly to the fire department so that immediate actions can be taken.

Text Books:

1. Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madiseti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.
3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 9789352133895

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - II Year I Semester

BLOCKCHAIN TECHNOLOGIES (PE - V)

Course Objectives:

- To Introduce block chain technology and Cryptocurrency

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- Learn about research advances related to one of the most popular technological areastoday.

UNIT - I

Introduction: Block chain or distributed trust, Protocol, Currency, Cryptocurrency, How a Cryptocurrency works, Crowdfunding.

UNIT - II

Extensibility of Blockchain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Blockchain Environment.

UNIT - III

Blockchain Science: Gridcoin, Folding coin, Blockchain Genomics, Bitcoin MOOCs.

UNIT - IV

Currency, Token, Tokenizing, Campuscoin, Coindrop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency

UNIT - V

Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations.

Text Book:

1. Blockchain Blue print for Economy by Melanie Swan.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - II Year I Semester

COMPUTATIONAL NEUROSCIENCE (PE - V)

Course Objectives:

- A survey of common modeling techniques, methods for extending traditional techniques

Course Outcomes: Students would be able to

- Acquired an introductory understanding of the basic principles of computational neuroscience (including extensions to parallel distributed processing (PDP), connectionist, and artificial neural network models).
- Relate the formal properties of such models to known biological mechanisms as well as to behavioral phenomena, and they will possess intellectual tools for modifying such models in the light of new psychological and neuroscientific findings.

UNIT - I

Neural Encoding I: Introduction, Spike Trains and Firing Rates, What Makes a Neuron Fire?, Spike-Train Statistics, The Neural Code

Neural Encoding II: Introduction. Estimating Firing Rates, Introduction to the Early Visual System, Reverse-Correlation Methods: Simple Cells, Static Nonlinearities: Complex Cells, Receptive Fields in the Retina and LGN, Constructing V1 Receptive Fields

UNIT - II

Neural Decoding: Encoding and Decoding, Discrimination, Population Decoding, Spike-Train Decoding

Information Theory: Entropy and Mutual Information, Information and Entropy Maximization, Entropy and Information for Spike Trains

UNIT - III

Model Neurons I: Introduction, Electrical Properties of Neurons, Single-Compartment Models, Integrate-and-Fire Models, Voltage-Dependent Conductances, The Hodgkin-Huxley Model, Modeling Channels, Synaptic Conductances, Synapses on Integrate-and-Fire Neurons

Model Neurons II: Levels of Neuron Modeling, Conductance-Based Models, The Cable Equation, Multi-compartment Models

UNIT - IV

Network Models: Introduction, Firing-Rate Models, Feedforward Networks, Recurrent Networks, Excitatory-Inhibitory Networks, Stochastic Networks

Plasticity and Learning: Introduction, Synaptic Plasticity Rules, Unsupervised Learning, Supervised Learning

UNIT - V

Classical Conditioning and Reinforcement Learning: Introduction, Classical, Static Action Choice, Sequential Action Choice

Representational Learning: Introduction, Density Estimation, Causal Models for Density Estimation

TextBooks:

1. Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems, Peter Dayan, L.F. Abbott, MIT Press.
2. Computational Neuroscience-A Comprehensive Approach, Chapman & Hall/CRC.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - II Year I Semester

NATURAL LANGUAGE PROCESSING AND CHATBOTS (PE - V)

Course Objectives:

- To learn about the concepts and principles of natural language processing.
- To explore both theoretical and practical issues of natural language processing.
- To develop skills of finding solutions and building software using natural language processing techniques.

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- Understand concept of natural language processing.
- Understand various research issues in natural language processing.
- Apply various tools and techniques in natural language processing.

UNIT - I

Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models

Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches

UNIT - II

Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues

UNIT - III

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software

Predicate: Argument Structure, Meaning Representation Systems, Software

Discourse Processing: Cohension, Reference Resolution, Discourse Cohension and Structure

UNIT - IV

Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Crosslingual Language Modeling

UNIT - V

Chatbots: Introduction to Chatbot, Types of Chatbots, Chatbots work on Pattern Recognition and Set of Algorithms, Designing and Training a Chatbot. Chatbots in Machine Learning, Natural Language Processing and Artificial Intelligence, Customer Service, E-Commerce, Chatbots V/S Apps, Banking, Healthcare

TextBooks:

1. Speech and Language Processing by Daniel Jurafsky and James H. Martin, Prentice Hall.
2. Language as a Cognitive Process by T. Winograd, Addison-Wesley
3. Natural Language Understanding by James Allen, the Benajmins/Cummings
4. Chatbots – An Introduction and Easy Guide to Making Your Own, Oisin Muldowney.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - II Year I Semester

IPR IN ARTIFICIAL INTELLIGENCE (Open Elective)

Course Objectives:

- To explain the art of interpretation and documentation of research work
- To explain various forms of intellectual property rights
- To discuss leading International regulations regarding Intellectual Property Rights

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- Document the research outcome of the work carried out in the area of Artificial Intelligence.
- Generate Copyright or patent in the area of Artificial Intelligence.

UNIT - I

Introduction: Defining the Research Problem in AI, Reviewing the literature in AI, Research Design, Data Collection, Validation, Interpretation and Report Writing, LaTeX tool, presentation preparation, History and theory of AI Regulation.

UNIT - II

AI and Copyright: Authorship, Ownership and Infringement, Automated Copyright Enforcement. AI, Data and Big Data, Ownership and Protection, Patenting AI.

UNIT - III

AI-generated Inventions: Inventiveness and Ownership, AI and Patent Enforcement, Trade Secrets, and Product Innovation, Autonomous Driving, AI and Blockchain. The Concept, Intellectual Property System in India, World Intellectual Property Organization.

UNIT - IV

Right of Priority: Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs.

UNIT - V

Patents: Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Enforcement of Intellectual Property Rights, UNSECO.

Text Books:

1. Professional Programme Intellectual Property Rights, Law and Practice, the Institute of Company Secretaries of India, Statutory Body under an Act of Parliament.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - II Year I Semester

FAULT TOLERANCE SYSTEMS (Open Elective)

Course Objectives:

- To know the different advantages and limits of fault avoidance and fault tolerance techniques.
- To impart the knowledge about different types of redundancy and its application for the design of computer system being able to function correctly even under presence of faults and data errors.
- To understand the relevant factors in evaluating alternative system designs for a specific set of requirement.
- To understand the subtle failure modes of "fault-tolerant" distributed systems.

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- Become familiar with general and state of the art techniques used in design and analysis of fault tolerant digital systems.
- Be familiar with making system fault tolerant, modeling and testing, and benchmarking to evaluate and compare systems.

UNIT - I

Introduction to Fault Tolerant Computing: Basic concepts and overview of the course; Faults and their manifestations, Fault/error modeling, Reliability, availability and maintainability analysis, System evaluation, performance reliability tradeoffs.

UNIT - II

System level fault diagnosis: Hardware and software redundancy techniques. Fault tolerant system design methods, Mobile computing and Mobile communication environment, Fault injection methods.

UNIT - III

Software fault tolerance: Design and test of defect free integrated circuits, fault modeling, built in self-test, data compression, error correcting codes, simulation software/hardware, fault tolerant system design, CAD tools for design for testability.

UNIT - IV

Information Redundancy and Error Correcting Codes: Software Problem. Software Reliability Models and Robust Coding Techniques, Reliability in Computer Networks Time redundancy. Re execution in SMT, CMP Architectures, Fault Tolerant Distributed Systems, Data replication.

UNIT - V

Case Studies in FTC: ROC, HP Non Stop Server. Case studies of fault tolerant systems and current research issues.

Text Books:

1. Fault Tolerant Computer System Design by D. K. Pradhan, Prentice Hall.
2. Fault Tolerant Systems by I. Koren, Morgan Kaufman.
3. Software Fault Tolerance Techniques and Implementation by L. L. Pullum, Artech House Computer Security Series.
4. Reliability of Computer Systems and Networks: Fault Tolerance Analysis and Design by M. L. Shooman, Wiley.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - II Year I Semester

INTRUSION DETECTION SYSTEMS (Open Elective)

Course Objectives:

- To understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise.
- To apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems.
- To analyze intrusion detection alerts and logs to distinguish attack types from false alarms

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- Explain the fundamental concepts of Network Protocol Analysis and demonstrate the skill to capture and analyze network packets.
- Use various protocol analyzers and Network Intrusion Detection Systems as security tools to detect network attacks and troubleshoot network problems.

UNIT - I

The state of threats against computers, and networked Systems-Overview of computer security solutions and why they Fail-Vulnerability assessment, firewalls, VPN's -Overview of Intrusion Detection and Intrusion Prevention, Network and Host-based IDS

UNIT - II

Classes of attacks - Network layer: scans, denial of service, penetration Application layer: software exploits, code Injection-Human layer: identity theft, root Access-Classes of Attackers-Kids/hackers/sop Hesitated Groups-Automated: Drones, Worms, Viruses

UNIT - III

A General IDS model and taxonomy, Signature-based Solutions, Snort, Snort rules, Evaluation of IDS, Cost sensitive IDS

UNIT - IV

Anomaly Detection Systems and Algorithms-Network Behavior Based Anomaly Detectors (rate based)-Host-based Anomaly Detectors-Software Vulnerabilities-State transition, Immunology, Payload Anomaly Detection

UNIT - V

Attack trees and Correlation of alerts- Autopsy of Worms and Botnets-Malware Detection Obfuscation, polymorphism- Document vectors.Email/IM security Issues-Viruses/Spam-From signatures to thumbprints to zero-day Detection-Insider Threat issues.

Text Books:

1. The Art of Computer Virus Research and Defense, Peter Szor, Symantec Press ISBN 0-321-30545-3.
2. Crimeware, Understanding New Attacks and Defences, Markus Jakobsson and Zulfikar Ramzan.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - II Year I Semester

DIGITAL FORENSICS (OPEN ELECTIVE)

Course Objectives:

- Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
- Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
- Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools
- E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- Understand relevant legislation and codes of ethics.
- Computer forensics and digital detective and various processes, policies and procedures.
- E-discovery, guidelines and standards, E-evidence, tools and environment.
- Email and web forensics and network forensics.

UNIT - I

Digital Forensics Science: Forensics science, computer forensics, and digital forensics.

Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics.

UNIT - II

Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, importance of criminal investigation.

UNIT - III

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement

UNIT - IV

Computer Forensics: Prepare a case, begin an investigation, understand computer forensics workstations and software, conduct an investigation, Complete a case, Critique a case,

Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

UNIT - V

Mobile Forensics: Mobile forensics techniques, mobile forensics tools.

Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008. Recent trends in mobile

forensic technique and methods to search and seizure electronic evidence

Text Books:

1. John Sammons, The Basics of Digital Forensics, Elsevier.
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - II Year I Semester

OPTIMIZATION TECHNIQUES (OPEN ELECTIVE)

Course Objectives:

- Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
- Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
- Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools
- E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- Understand relevant legislation and codes of ethics.
- Computer forensics and digital detective and various processes, policies and procedures.
- E-discovery, guidelines and standards, E-evidence, tools and environment.
- Email and web forensics and network forensics.

UNIT - I

Single Variable Non-Linear Unconstrained Optimization: One dimensional Optimization methods, Uni-modal function, elimination methods, Fibonacci method, golden section method, interpolation methods – quadratic & cubic interpolation methods.

UNIT - II

Multi variable non-linear unconstrained optimization: Direct search method – Univariate method – pattern search methods – Powell's- Hook -Jeeves, Rosenbrock search methods- gradient methods, gradient of function, steepest decent method, Fletcher Reeves method, variable metric method.

UNIT - III

Linear Programming: Formulation – Sensitivity analysis. Change in the constraints, cost coefficients, coefficients of the constraints, addition and deletion of variable, constraints. Simulation – Introduction – Types- steps – application – inventory – queuing – thermal system

UNIT - IV

Integer Programming: Introduction – formulation – Gomory cutting plane algorithm – Zero or one algorithm, branch and bound method Stochastic programming: Basic concepts of probability theory, random variables- distributions-mean, variance, correlation, co variance, joint probability distribution- stochastic linear, dynamic programming.

UNIT - V

Geometric Programming: Polynomials – arithmetic – geometric inequality – unconstrained G.P constrained G.P (\leq TYPE ONLY) Non-traditional optimization Techniques: Genetic Algorithms Particle Swarm Optimization (PSO)

Text Books:

1. Optimization theory & Applications, S.S. Rao, New Age International.
2. Engineering Optimization-Kalyan Deb, PHI.
3. Optimization Techniques theory and practice, M. C. Joshi, K. M. Moudgalya/ Narosa Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - II Year I Semester

CYBER PHYSICAL SYSTEMS (Open Elective)

Course Objective: To learn about design of cyber-physical systems

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- Understand the core principles behind CPS
- Identify safety specifications and critical properties
- Understand abstraction in system designs
- Express pre- and post-conditions and invariants for CPS models.

UNIT - I

Introduction to Cyber-Physical Systems: Cyber-Physical Systems (CPS) in the real world, Basic principles of design and validation of CPS, Industry 4.0, AutoSAR, IIOT implications, Building Automation, Medical CPS

UNIT - II

CPS Platform components: CPS HW platforms - Processors, Sensors, Actuators, CPS Network – WirelessHart, CAN, Automotive Ethernet, CPS Sw stack – RTOS, Scheduling Real Time control tasks.

UNIT - III

Principles of Automated Control Design: Dynamical Systems and Stability Controller Design Techniques, Stability Analysis: CLFs, MLFs, stability under slow switching, Performance under Packet drop and Noise, Matlab toolboxes – Simulink

UNIT - IV

Stateflow CPS implementation: From features to software components, Mapping software components to ECUs, CPS Performance Analysis - effect of scheduling, bus latency, sense and actuation faults on control performance, network congestion Formal Methods for Safety Assurance of Cyber-Physical Systems.

UNIT - V

Formal Analysis: Flow pipe construction, reachability analysis Analysis of CPS Software: Weakest Pre-conditions, Bounded Model checking, CPS SW Verification: Frama-C, CBMC Secure Deployment of CPS: Attack models, Secure Task mapping and Partitioning, State estimation for attack detection Automotive Case study: Vehicle ABS hacking Power Distribution Case study: Attacks on SmartGrids.

Text Books:

1. Raj Rajkumar, Dionisio De Niz, and Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional.
2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press, 2015.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. (Artificial Intelligence) - II Year I Semester

GRAPH ANALYTICS (Open Elective)

Course Objectives:

- To explore the concept of Graphs and related algorithms.
- To learn new ways to model, store, retrieve and analyze graph-structured data.
- To be aware of advanced concepts in graph analytic techniques and its applications.

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

- Explore the graph analytic techniques and its applications.
- Model a problem into a graph database and perform analytical tasks over the graph in a scalable manner.
- Apply Graph theoretical techniques in massive networks.

UNIT - I

Introduction and Application of Large-scale Graph: Characteristics, Complex Data Sources - Social Networks, Simulations, Bioinformatics; Categories- Social, Endorsement, Location, Co-occurrence graphs; Graph Data structures, Parallel, Multicore and Graph Algorithms

UNIT - II

Basic and Advanced Large-scale Graph Analysis: Parallel Prefix & List Ranking, Link Analysis, Page Ranking Algorithms; Parallel BFS, Spanning Tree, Connected Components, Minimum Spanning Tree Matroid Algorithms, Social Networking Algorithms.

UNIT - III

Dynamic Parallel Algorithms - Streaming Data Analysis - Data Structures for Streaming Data - Tracking Clustering Coefficients - Tracking Connected Components - Anomaly Detection, Massive Graphs in Computational Biology, Genome Assembly.

UNIT - IV

Distributed Computation for Massive Data Sets: Spectral, Modularity-based Clustering, Random Walks; Large Graph Representation and Implementation- V-Graph Representation, Map Reduce, Surfer, Graph Lab.

UNIT - V

Advanced Topics: Power Law Distribution, Game-Theoretic Approach, Rank Aggregation and Voting Theory, Recommendation Systems, Social network analysis: case study - Facebook, LinkedIn, Google+, and Twitter.

Text Books:

1. Matthew O. Jackson, "Social and Economic Networks", Princeton University Press, 2010.
2. Stanley Wasserman, Katherine Faust, "Social Network Analysis: Methods and Applications", (Structural Analysis in the Social Sciences), Cambridge University Press, 1995.
3. Tanja Falkowski, "Community Analysis in Dynamic Social Networks", (Dissertation), University Magdeburg, 2009.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (Artificial Intelligence)

ENGLISH FOR RESEARCH PAPER WRITING (Audit Course - I & II)

Prerequisite: None

Course objectives: Students will be able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT-I:

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT-II:

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-III:

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT-IV:

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT-V:

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

TEXT BOOKS/ REFERENCES:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books).
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (Artificial Intelligence)

DISASTER MANAGEMENT (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to

- learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches,
- planning and programming in different countries, particularly their home country or the countries they work in

UNIT-I:

Introduction:

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Disaster Prone Areas in India:

Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT-II:

Repercussions of Disasters and Hazards:

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-III:

Disaster Preparedness and Management:

Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-IV:

Risk Assessment Disaster Risk:

Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

UNIT-V:

Disaster Mitigation:

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

TEXT BOOKS/ REFERENCES:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (Artificial Intelligence)

SANSKRIT FOR TECHNICAL KNOWLEDGE (Audit Course - I & II)

Prerequisite: None

Course Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcomes: Students will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

UNIT-I:

Alphabets in Sanskrit,

UNIT-II:

Past/Present/Future Tense, Simple Sentences

UNIT-III:

Order, Introduction of roots,

UNIT-IV:

Technical information about Sanskrit Literature

UNIT-V:

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TEXT BOOKS/ REFERENCES:

1. "Abhyaspustakam" – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi.
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication.
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (Artificial Intelligence)

VALUE EDUCATION (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Course outcomes: Students will be able to

- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

UNIT-I:

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

UNIT-II:

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

UNIT-III:

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness.

UNIT-IV:

Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT-V:

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation, Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

TEXT BOOK/ REFERENCE:

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (Artificial Intelligence)

CONSTITUTION OF INDIA (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

UNIT-I:

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working),
Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT-II:

Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III:

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions.

UNIT-IV:

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT-V:

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

TEXT BOOKS/ REFERENCES:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (Artificial Intelligence)

PEDAGOGY STUDIES (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes: Students will be able to understand:

- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT-I:

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

UNIT-II:

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT-III:

Evidence on the effectiveness of pedagogical practices, Methodology for the indepth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-IV:

Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes

UNIT-V:

Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

TEXT BOOKS/ REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeamong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? *International Journal Educational Development*, 33 (3): 272–282.
5. Alexander RJ (2001) *Culture and pedagogy: International comparisons in primary education*. Oxford and Boston: Blackwell.
6. Chavan M (2003) *Read India: A mass scale, rapid, 'learning to read' campaign*.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (Artificial Intelligence)**

STRESS MANAGEMENT BY YOGA (Audit Course - I & II)

Prerequisite: None

Course Objectives:

- To achieve overall health of body and mind
- To overcome stress

Course Outcomes: Students will be able to:

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

UNIT-I:

Definitions of Eight parts of yog. (Ashtanga)

UNIT-II:

Yam and Niyam.

UNIT-III:

Do's and Don't's in life.

- i) Ahinsa, satya, astheya, bramhacharya and aparigraha
- ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT-IV:

Asan and Pranayam

UNIT-V:

- i) Various yog poses and their benefits for mind & body
- ii) Regularization of breathing techniques and its effects-Types of pranayam

TEXT BOOKS/ REFERENCES:

1. 'Yogic Asanas for Group Training-Part-I': Janardan Swami Yogabhyasi Mandal, Nagpur.
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (Artificial Intelligence)

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(Audit Course - I & II)

Prerequisite: None

Course Objectives:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcomes: Students will be able to

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

UNIT-I:

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)

UNIT-II:

Neetisatakam-Holistic development of personality

- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT-III:

Approach to day to day work and duties.

- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT-IV:

Statements of basic knowledge.

- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

UNIT-V:

- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

TEXT BOOKS/ REFERENCES:

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.