VISION OF THE DEPARTMENT:

The Department of Information Science and Technology pledges to educate students with conceptual knowledge and technical skills to forge ahead in the field of IT, while inculcating deep moral and ethical values to achieve excellence, by providing a vibrant academic and research environment in collaboration with industry.

MISSION OF THE DEPARTMENT:

1. To inculcate in students, a firm foundation in theory and practice of IT skills coupled with the thought process for disruptive innovation and research methodologies, to keep pace with emerging technologies.
2. To provide a conducive environment for all academic, administrative, and interdisciplinary research activities using state-of-the-art technologies.
3. To produce graduates and doctorates, who will enter the workforce as productive IT engineers, researchers, and entrepreneurs with necessary soft skills, and continue higher professional education with competence in the global market.
4. To enable seamless collaboration with the IT industry and Government for consultancy and sponsored research.
5. To cater to cross-cultural, multi-national and demographic diversity of students.
6. To educate the students on the social, ethical, and moral values needed to make significant contributions to society.
1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO# | Programme Educational Objectives
---|---
1 | To prepare students to excel in research and to succeed in Information Technology Profession by adapting to the rapid advances in new emerging technologies through rigorous post-graduate education.
2 | To provide students with a solid foundation in mathematical, scientific, and computing fundamentals required to develop IT solutions to real-world problems of Industries, Businesses and Society.
3 | To train students with multimedia computing knowledge and creative thinking to comprehend, analyze, design innovative products with immersive user experience.
4 | To inculcate leadership qualities, teamwork, and effective communication skills in students for successful professional growth.
5 | To be aware of and practice ethical codes and guidelines and contribute to sustainable development of society.

2. PROGRAMME OUTCOMES (POs): After going through the two years of study, our M. Tech Information Technology (Specialization in Artificial Intelligence and Data Science) Graduates will exhibit the ability to:

PO# | Programme Outcome
---|---
1 | An ability to independently carry out research/investigation and development work to solve practical problems.
2 | An ability to write and present a substantial technical report/document.
3 | An ability to demonstrate a degree of mastery over Artificial Intelligence and Data Science.
4 | An ability to apply multimedia tools and techniques to provide simple, and elegant solutions to complex real-world problems in multidisciplinary domains.
5 | An ability to become a leader/entrepreneur/software developer and developer in the domain of Artificial Intelligence and Data Science.
6 | An ability to work individually and in teams with social obligation, ethical and environmental consciousness.

3. PROGRAMME SPECIFIC OUTCOMES (PSOs):

1. Ability to apply programming principles and practices for the design of software solutions in an AI-enabled world of business and social activities.
2. Ability to identify the resources to build and manage the IT infrastructure using AI and Data science to solve real-world problems with an understanding of the Tradeoffs involved in the design choices.
3. Ability to plan, design and execute projects for the development of intelligent systems with a focus on the future.
4. PEO / PO Mapping

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*Audit course is optional

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*Audit course is optional
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   - Credits: 4

2. Program Elective IV  
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   - Total contact periods: 5  
   - Credits: 4

3. Program Elective V  
   - Category: PEC  
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**PRACTICALS**

4. DS5311 Dissertation I  
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**TOTAL**  

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**PRACTICALS**

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**ELECTIVES III, IV, V**

**LIST OF OPEN ELECTIVE COURSES (OEC)**
*(out of 6 courses one course must be selected)*

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LIST OF AUDIT COURSES (AC)

Registration for any of these courses is optional to students

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OBJECTIVES:

- This course provides a sound and rigorous treatment of the basic principles for a proper understanding of the subject matter and for confidence in applying these principles to practical problem solving.
- This course provides a solid undergraduate foundation in both probability theory and mathematical statistics and at the same time provides an indication of the relevance and importance of the theory in solving problems in the real world.
- To introduce the basic concepts of one dimensional and two-dimensional Random Variables.
- To provide information about Estimation theory, Correlation, Regression and Testing of hypothesis.
- To enable the students to use the concepts of multivariate normal distribution and principal components analysis.

UNIT I  ONE DIMENSIONAL RANDOM VARIABLES  12

UNIT II  TWO DIMENSIONAL RANDOM VARIABLES  12
Joint distributions – Marginal and Conditional distributions – Functions of two-dimensional random variables – Regression Curve – Correlation.

UNIT III  ESTIMATION THEORY  12

UNIT IV  TESTING OF HYPOTHESIS  12
Sampling distributions – Type I and Type II errors – Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT V  MULTIVARIATE ANALYSIS  12

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:

1. Use the appropriate and relevant, fundamental, and applied mathematical and statistics knowledge and methodologies in solving practical problem.
2. Bring together and flexibly apply knowledge to characterize, analyse and solve a wide range of problems.
3. Understand the balance between the complexity/accuracy of the
mathematical/statistical models used and the timeliness of the delivery of the solution.
4. Steeped in research methods and rigor.
5. Develop critical thinking based on empirical evidence and the scientific approach to knowledge development.
6. To know the relevance of Probability and Statistics for Data science

REFERENCES:

IF5151 ADVANCED DATA STRUCTURES AND ALGORITHMIC L T P C
3 0 0 3

OBJECTIVES:

• To understand the usage of algorithms in computing.
• To understand and learn the algorithm design techniques.
• To learn and use hierarchical data structures and its operations.
• To learn the usage of graphs and its applications.
• To study about NP Completeness of problems.

UNIT I ALGORITHMS IN COMPUTING 9

Suggested Activities:
• Flipped classroom on divide & conquer strategy (Merge Sort, Quick Sort).
• External learning – Solving recurrence relations using Master’s method.
• Formulation of recurrence relations for various recursive algorithms (such as Tower of Hanoi, Staircase problem).
• Assignment on finding order of growth for exponent and logarithmic time algorithms.

Suggested Evaluation Methods:
• Assignments on formulation of recurrence relations, Master’s method, finding order of growth for algorithms.
UNIT II   ALGORITHM DESIGN TECHNIQUES  

Suggested Activities:
- Flipped classroom on basics of algorithm design strategies.
- Assignment on applying suitable algorithm design technique for solving real time problems/scenario such as Checkerboard/Sequence Alignment/Puzzle Solving/Data Compression.
- Assignment on analysis of time complexity for memorization algorithms and Huffman Coding.

Suggested Evaluation Methods:
- Assignments on Knapsack problems.
- Quizzes on algorithm design strategies.
- Demonstration for practical learning.

UNIT III   HIERARCHICAL DATA STRUCTURES  

Suggested Activities:
- Flipped classroom on AVL trees and binary heap concepts.
- External learning – Fibonacci heap operations.
- Assignment on choosing and apply a suitable tree/heap structure for solving a given real time problem/scenario such as the implementation of trees/heaps/PDF document creation.
- Assignment on analysis of time complexity for B-Trees and Binomial Heaps.

Suggested Evaluation Methods:
- Assignments on binomial heap operations.
- Quizzes on AVL trees, binary heaps, time complexity of trees.
- Demonstration of practical learning.

UNIT IV   GRAPH ALGORITHMS  
Suggested Activities:
- Flipped classroom on basics of graphs and graph operations.
- External learning – Applications of graphs and DFS.
- Analysis of time complexity for Dijkstra’s algorithm and Floyd Warshall algorithm.
- Practical – To choose and apply a suitable graph algorithm for solving a real time problem/scenario such as network routing/shortest path updation in maps/relationship mining in graphs

Suggested Evaluation Methods:
- Assignments on analysis of time complexity for Dijkstra’s algorithm and Floyd Warshall algorithm.
- Quizzes on graph operations.
- Demonstration of practical learning.

UNIT V NP-COMPLETE AND NP – HARD 9

Suggested Activities:
- Flipped classroom on basics of approximation algorithms.
- External learning – Subset sum problem.
- Assignments on solving traveling salesman problem using approximation technique.
- Exploration of any two NP-complete problems with proofs.

Suggested Evaluation Methods:
- Assignments on NP-complete problems with proofs, traveling salesman problem using approximation techniques.
- Quizzes on approximation algorithms.

OUTCOMES:
On completion of the course, the students will be able to:
1. Apply suitable algorithms in real time computing.
2. Apply suitable design strategies to solve problems in an efficient manner.
3. Apply suitable hierarchical data structures to solve practical problems.
4. Design algorithms using graph structures to solve real-life problems.
5. Solve NP Complete problems efficiently.
6. Design data structures and algorithms that are appropriate for real time problems.

REFERENCES:
OBJECTIVES:

- To know the fundamental concepts of data science.
- To study various programming tools for data science.
- To apply analytics on stream data.
- Get a know-how in math and programming which is required for data science applications.
- To understand various advanced content delivery, streaming, and cloud services.
- To learn the basic and advanced features of visualizing streaming data.

UNIT I  INTRODUCTION
Introduction to Data Science - Overview of Data - Sources of Data - Types of Data - Small Data and Big Data - Data collection methods - Surveys - Interviews - Log and Diary data - User studies in Lab and Field - Web Scraping - Public datasets - Data cleaning - Tools for Data Science

Suggested Activities
- Survey of Python tools for data science
- External Learning : Web scraping

Suggested Evaluation Methods
- Quiz on python tools
- Seminar on web scraping

UNIT II  DESCRIPTIVE DATA ANALYSIS
Dataset Construction - Sampling of data - Stem and Leaf Plots - Frequency table - Time Series data - Central Tendency Measures of the location of data - Dispersion measures - Correlation analysis - Data reduction techniques - Principal Component analysis - Independent component analysis – Hypothesis testing – Statistical Tests

Suggested Activities:
- Flipped classroom on qualitative and quantitative datasets
- Tutorial on Sampling and Frequency
- Problem solving using central tendency measures
- Tutorial on Data reduction techniques
Suggested Evaluation Methods:
- Quiz on the type of datasets
- Assignment on determining central tendency measures
- Programming exercise on correlation analysis on a large set of data

UNIT III  DATA VISUALIZATION  9
Overview of python libraries matplotlib and seaborn - Histogram - Kernel density estimate plots - Box and violin plots - Regression plots - Heatmaps - Clustered matrices - Three-Dimensional plot - Surface and Contour plot - Geographic data visualization.

Suggested Activities:
- Tutorial on the different types of plots
- Representation of data from Unit II in different types of graphs
- Analysis and inference from the graph

Suggested Evaluation Methods:
- Quiz on the different types of visualization methods
- Programming assignment on the different plots

UNIT IV  MODEL CONSTRUCTION AND MODEL EVALUATION  9
Overview of Machine learning concepts – Model construction using regression and Classification models - Linear regression and multiple regression models - KNN classification models - Comparison models - Training Data construction - Normalization - Cross-validation techniques - Accuracy metrics for evaluation of models - Contingency table, ROC curve, Precision-recall curves - A/B testing

Suggested Activities:
- Implement linear regression models using python
- Implementation of KNN models
- Construct a contingency table for classifier evaluation

Suggested Evaluation Methods:
- Seminar on Regression models
- Quiz on evaluation measures

UNIT V  DATA SCIENCE APPLICATIONS  9
Banking - Fraud Detection, Personalized Services, Finance-Tax Evasion, Stock Market;
Suggested Activities:
- Survey of AI Applications
- Role of AI in healthcare

Suggested Evaluation Methods:
- Seminar on AI in Banking
- Seminar on AI in Marketing

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course, the students will be able to:
- Be able to clearly explain the data collection methods.
- Collect, investigate, clean, munge, and alter data.
- Use Data Visualization techniques to explore data.
- Use regression and classification models and evaluate it.
- Use Python-based toolkits to create data science applications.
- Implement suitable data science applications.

REFERENCES:
4. https://www.coursehero.com/study-guides/introstats1/

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OBJECTIVES:
- To know the underlying structure behind intelligence mathematically.
- To know the logical implications in computational intelligence.
- To understand the reasoning and learning methods based on Bayes model
- To know the automated learning techniques.
- To explore Artificial Intelligence techniques in real–time scenarios.

UNIT I INTELLIGENT AGENTS AND SEARCH TECHNIQUES

Suggested Activities:
- Analysis of different Searches with computational complexity
- Game search of examples like Tic-Tac-Toe
- Real world example analysis for Constraint Satisfaction Problem

Suggested Evaluation Methods:
- Assignment on intelligent agents and PEAS formulation.
- Quizzes on agents
- Programming assignment on search techniques
- Programming assignment on Game search

UNIT II KNOWLEDGE AND REASONING

Suggested Activities:
- Flipped classroom on Boolean logic
- In class activity - solve puzzles using proposition logic
- Tutorial on Knowledge representation and Ontological engineering

Suggested Evaluation Methods:
- Exercises on propositional logic inference mechanisms
- Assignment on first order logic formulation from English statements and vice versa
- Exercises on forward chaining, backward chaining, and resolution
- Exercises on application of logic in Semantic networks

UNIT III BAYESIAN NETWORKS
Directed Graphical Models – Bayesian Networks – Exploiting Independence Properties – From Distributions to Graphs – Inference in Graphical Models - Bayes model - Generative and
Discriminative model - Maximum-likelihood parameter learning: Continuous models - Bayesian parameter learning - Bayesian linear regression

Suggested Activities:
- Flipped classroom on the fundamentals of probability
- Exercises on Gaussian distribution
- Tutorial on Naive Bayes classifier using numerical data
- Programming activities on Bayes model implementation

Suggested Evaluation Methods:
- Tutorial – Inference methods.
- Assignments on Bayesian network.
- Quizzes on basics of probability and Bayes rule.
- Practical – Programming exercises for HMM

UNIT IV  Decision Making/ Decision Process


Suggested Activities:
- Flipped classroom on decision process.
- Assignments on derivation of value iteration.

Suggested Evaluation Methods:
- Tutorial – Observable MDP.
- Assignments on policy iteration.
- Practical – Programming exercises on planning with MDP.

UNIT V  AI APPLICATIONS

Learning AI model deployment - Containers - Dockers - Discussion of AI Applications - Natural Language Processing - Chatbots - Dialog Flow - Image Classification - Robotics - Model deployment with containers such as Docker.

Suggested Activities:
- Flipped classroom on theoretical study of learning methods
- Assignment on solving problem in statistical learning
- Practical – Programming exercises using Python/ other programming languages.

Suggested Evaluation Methods:
- Tutorial – Learning methods.
- Assignments on statistical methods in learning.
- Quizzes on learning methods.
- Practical – Programming exercises on Statistical learning.
PRACTICAL EXERCISES:
1. Search implementation on BFS and DFS with computational complexity
2. Search implementation on Greedy and A* algorithm
3. Implementation of Game search
4. Programming exercises on inference using proposition/predicate logic
5. Implementation of Bayes network
6. Implementation of bandit problem
7. Programming exercises on statistical learning
8. Implementation of ensemble learning with multiple learning models
9. Implementation of reinforcement learning in a chosen scenario
10. Chatbot development with Dialogflow

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Relate the type of agents and environments in the real-world scenarios
2. Analyze different search techniques with computational complexity
3. Understand the working of Bayesian techniques to solve AI problems
4. Use the decision-making process to solve simple and complex problems
5. Understand the different learning techniques
6. Apply relevant AI techniques in the real-world applications

REFERENCES:
4. NPTEL Artificial Intelligence Course by Prof. Dasgupta – http://nptel.ac.in/courses/106105079/2
5. https://cloud.google.com/dialogflow

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OBJECTIVES:
To impart knowledge and skills required for research and IPR:
● Problem formulation, analysis, and solutions.
● Technical paper writing / presentation without violating professional ethics
● Patent drafting and filing patents.

UNIT I RESEARCH PROBLEM FORMULATION 6
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 LITERATURE REVIEW 6
Effective literature studies approaches, analysis, plagiarism, and research ethics.

UNIT III TECHNICAL WRITING /PRESENTATION 6
Effective technical writing, how to write a report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee.

UNIT IV INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR) 6

UNIT V INTELLECTUAL PROPERTY RIGHTS (IPR) 6

OUTCOMES:
1. Ability to formulate research problem
2. Ability to carry out research analysis
3. Ability to follow research ethics
4. Ability to understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
5. Ability to understand about IPR and filing patents in R & D.

REFERENCES:
IF5161 ADVANCED DATA STRUCTURES AND ALGORITHMS

LABORATORY

OBJECTIVES:
- To learn the design strategies of various algorithms.
- To learn how to analyze the complexities of algorithms.
- To learn and understand the usage of advanced tree structures.
- To familiarize with the usage of heap structures.
- To understand the usage of graph structures and spanning trees.

LIST OF EXPERIMENTS:

Implement the following programs using C/ Python:
1. Iterative and recursive algorithms and its complexity analysis.
2. Merge sort algorithm analysis using divide and conquer approach.
3. Quick sort algorithm using randomized algorithmic approach.
5. Activity selection and Huffman coding using greedy approach.
7. Basic heaps operations.
8. Binomial heap operations.
9. Representation of graphs and graph traversals.
10. A spanning tree for a given graph using Prim’s algorithm.
11. Shortest path of a given graph using Dijkstra’s algorithm and Bellman Ford algorithm.
12. All pair shortest path of a given graph using Floyd Warshall’s algorithm.

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Design and implement iterative and recursive algorithms with minimum complexity.
2. Design and develop efficient algorithms for practical problems by adopting suitable algorithm design strategies.
3. Design and implement basic and advanced data structures extensively.
4. Apply suitable hierarchical data structures based on real time problems.
5. Design algorithms using graph structures.
6. Implement real world applications by proper usage of data structures and algorithms

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DS5111 DATA SCIENCE LABORATORY

OBJECTIVES:
- To understand the usage of computational toolkits
- To understand the mathematical foundations of data science
- To know the descriptive and inferential data analytics
- To have a bird’s eye view of machine learning algorithms

LIST OF EXPERIMENTS:
1. Installation of toolkits such as NLTK and libraries such as NumPy, Scikit-learn, TensorFlow and Matplotlib
2. Working with arrays and tensors using NumPy and TensorFlow
3. Construction a statistical model and visualizing it using Matplotlib
4. Correlation analysis on a real-world dataset
5. Regression analysis on a real-world dataset
6. Construction of a logistic regression model for a real-world dataset
7. Construction of a simple KNN classifier for a real-world dataset
8. Exploratory analysis with different visualization methods

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Work with different toolkits and libraries of AI/ML in python
2. Apply mathematical concepts of linear algebra, probability in Data Science/ AI
3. Perform descriptive analytics in data science problems
4. Work with inferential statistics
5. Understand the functions of different machine learning algorithms
6. Solve analytics problems using different statistical techniques

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DIRECTOR
OBJECTIVES:
- To develop simple Java programs using object-oriented concepts.
- To program using files and threads for concurrent operations.
- To design attractive GUI using framework.
- To create more dynamic web pages using CSS, JavaScript, and AJAX.
- To develop mobile based web applications in cloud environment.

LIST OF EXPERIMENTS:
1. Simple Java programs using arrays and lists.
2. Implementing Inheritance and Polymorphism concepts in java.
4. Simple GUI application development using applet and SWING.
5. Developing java multithreading programs for concurrent operations.
6. Implementing file handling in Java.
7. Implementing Java generics and collections.
8. Developing Client Server network application using java sockets.
9. Dynamic web page creation using JavaScript, CSS, jQuery and AJAX.
10. Developing servlet application with JDBC access.
11. Implementing Session management in JSP.
13. Developing Android application for location-based service.
14. Developing cloud-based web application.

TOTAL: 30 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Implement object-oriented concepts using Java language
2. Develop GUI application by including I/O streams and threads.
3. Create web pages with proper client-side features.
4. Design dynamic web pages with server-side and other technologies.
5. Develop simple android based mobile application.
6. Deploy web applications in a cloud-based environment.
OBJECTIVES:

- To understand the concepts of machine learning.
- To appreciate Regression and Information-Based classification algorithms.
- To know the concepts of Neural networks and SVM.
- To understand the theoretical and practical aspects of Probabilistic Graphical Models.
- To appreciate the concepts of clustering algorithms.

UNIT I INTRODUCTION

Suggested Activities:

- Implement Find-S algorithm
- External Learning - Overfitting and Underfitting

Suggested Evaluation Methods:

- Quiz on machine learning concepts.
- Seminar on version spaces
- Quiz of python tools available for implementing machine learning applications

UNIT II SUPERVISED LEARNING - I
Linear Regression – Multiple variable regression – Logistic regression – Regularization techniques - LASSO, Ridge and Elastic Net Regression - Decision Tree Learning- ID3 - C4.5 – CART

Suggested Activities:

- Practical – Implement ID3 algorithm
- Seminar - Decision tree design techniques
Suggested Evaluation Methods:
- Quiz on Regression models
- Group discussion on basics of classification and regression.

UNIT III SUPERVISED LEARNING II
Neural Networks – Perceptron - Feed-Forward Networks for binary and multi-class classification-
Forest - Boosting – AdaBoost.

Suggested Activities:
- Practical – Develop an SVM model for a two-class problem, whose training points are
distributed in a 2D plane and improve the performance of the model by applying kernel
methods.
- Practical – Implement a bagging and boosting approach for some case studies.
- Practical – Implement a Perceptron and Multi-Layer Perceptron model.

Suggested Evaluation Methods:
- Quiz on SVM and Kernel methods.
- Evaluation of the practical implementations of neural network models using the
appropriate test dataset.
- Group discussion on Ensemble methods.

UNIT IV PROBABILISTIC GRAPHICAL MODELS
Introduction to Graphs – Inference in Graphical Models – Markov Models – Hidden Markov
Models – Inference – Learning - Generalization – Undirected Graphical Models – Markov Random
Fields – Conditional Independence Properties – Parameterization of MRFs – Conditional Random
Fields - Classification using HMM.

Suggested Activities:
- Assignment on solving the numerical problem using HMM.

Suggested Evaluation Methods:
- Group discussion on graphcal models.

UNIT V UNSUPERVISED LEARNING
Clustering– K-means – Hierarchical Clustering – EM – Mixtures of Gaussians — Model Selection
for Latent Variable Models – Evaluation of Clustering methods

Suggested Activities:
- Implement k means algorithm for a data set.

Suggested Evaluation Methods:
- Tutorial on model selection and validation.
- Evaluation of the practical implementation using an appropriate test set.

PRACTICAL EXERCISES:
1. Develop an application that makes predictions from data using Linear Regression.
2. Develop an application that makes predictions from data using Logistic Regression.
3. Implement a classifier using ID3 and CART algorithms.
4. Develop a system to implement a classifier using SVM
5. Implement a classifier using Neural Networks.
6. Develop a system that can extract the word from the given sentences using the Hidden Markov model.
7. Develop a system that can automatically group articles by similarity using K–Means Clustering.
8. Implement EM algorithm for clustering.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:

1. Disseminate the basic concepts of machine learning and apply simple linear models.
2. Implement probabilistic discriminative and generative algorithms for an application and analyze the results.
3. Implement a neural network model for an appropriate application using an available tool.
4. Use a tool to implement typical clustering algorithms for different types of applications.
5. Design and implement an HMM for a sequence model type of application and implement a PGM for any real time application using an open-source tool.
6. Identify applications suitable for different types of machine learning with suitable justification.

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OBJECTIVES:
- To understand the computational approaches to Analytical Modeling
- To understand the need and application of Map Reduce.
- To understand the various analytical algorithms applicable to Big Data.
- To learn about techniques to analyze and interpret streaming data.
- To learn how to handle large data sets in main memory.
- To learn the various similar items mining and clustering techniques applicable to Big Data.

UNIT I  INTRODUCTION TO BIG DATA AND LARGE-SCALE FILES


Suggested Activities:
- Case studies on real world data mining problems
- Solving numerical problems in sampling, hypothesis testing
- Converting traditional relational algebraic operations to equivalent map reduce tasks

Suggested Evaluation Methods:
- Student assignment on hypothesis testing
- Group presentation on big data applications with societal need
- Quiz

UNIT II  SIMILAR ITEMS


Suggested Activities:
- Case studies on real world similar items mining
- Solving numerical problems using distance/similarity measures, nearest neighbor search and locality sensitive functions

Suggested Evaluation Methods:
- Student assignment on similar items mining
- Provide data sets in Cartesian coordinate system and apply distance measures and compare and contrast all metrics
- Quiz

UNIT III  MINING DATA STREAMS


Suggested Activities:
- Case studies about usage of stream analytics in popular search engines
- Solving simple numerical problems involving moments and skewness, counting distinct elements
Suggested Evaluation Methods:
- Assignment: Given a problem scenario identify suitable stream analytical technique(s)
- Quiz

UNIT IV Link Analysis and Frequent Itemsets
9

Suggested Activities:
- Discussion involving implementation of page rank algorithm and its effectiveness
- Real time Case studies about link analysis and market basket analysis
- Solving numerical problem on frequent itemset mining using Apriori algorithm and its variations

Suggested Evaluation Methods:
- Create groups and provide different transactional data to identify frequent itemsets and association rules and do peer evaluation
- Quiz

UNIT V Clustering
9

Suggested Activities:
- Solving numerical problems on clustering techniques
- Case studies and discussion about real time recommendation systems

Suggested Evaluation Methods:
- Mini projects involving real time stream data and clustering
- Quiz

PRACTICAL EXERCISES
30
1. Download and Install R and Python. Explore the various packages, in-build methods, and commands for performing descriptive data analysis.
2. Download and install Hadoop in Windows and Linux environments.
3. Write and implement simple word count problems and matrix multiplication using map reduce functions.
4. Write map reduce methods for implementing various relational algebraic expressions and compare its time complexity.
5. Write a python program for implementing the nearest neighbor search algorithm.
6. Write map reduce functions for calculating the following from real-time stream data: (i) filtering for elements with specific values or property, (ii) counting distinct words from a distributed text corpus.
7. Write and implement a program in python for estimating 1st, 2nd and nth order moments from a sample stream data.
8. Implement a page-rank algorithm for a sample set of web pages collected from web logs.
9. Write a program for finding frequent k-itemsets from a given transactional data set in any programming language. Implement the same using map-reduce function in Hadoop environment. Compare and analyze the running time of both the algorithms.
10. Write and implement the following clustering algorithms: (i) k-mean, (ii) DIANA, (iii) CURE and (iv) ProClus using sample data sets collected from UCI repository.

TOTAL: 75 PERIODS

OUTCOMES:
Upon Completion of the Course, the Student will be able to
1. Design algorithms by employing Map Reduce technique for solving Big Data problems.
2. Identify similarities using appropriate measures.
3. Point out problems associated with streaming data and handle them.
4. Discuss algorithms for link analysis and frequent itemset mining.
5. Design solutions for problems in Big Data by suggesting appropriate clustering techniques.
6. Identify apt big data framework and techniques for real world problems.

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DS5211 AI APPLICATIONS LABORATORY

OBJECTIVES:
- To understand the working of version control system in continuous integration, delivery, and deployment
- To familiarize with MLOPS cycle
- To build an end-to-end ML application

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Director
LIST OF EXPERIMENTS:
1. Working with version control system such as Git on a machine learning code
2. Working with Kubernetes
3. Development of ML training model
4. Creation of user interface for the trained model
5. Working with KubeFlow or other equivalent tools
6. Deployment of ML application using Kubeflow and version control system
7. Monitoring of deployed ML application
8. Hyper parameter tuning
9. Development of application with additional settings
10. Deployment and monitoring

TOTAL: 30 PERIODS

COURSE OUTCOMES
On completion of the course, the students will be able to:
1. Work with version control system
2. Develop a learning model
3. Work with containers
4. Work with MLOPS tool
5. Deploy and monitor the ML model
6. Create an end-to-end ML application using MLOPS

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DS5001  ARTIFICIAL LIFE AND ROBOTICS  L T P C
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OBJECTIVES:
- To understand artificial life in terms of Artificial Intelligence systems.
- To understand the fundamentals of Robotics in computing.
- To study Robotic sensors and path planning.
- To learn the usage of Robotics in Computer Vision and Robot programming.
- To understand the real time applications of Robotics.
- To gain in-depth knowledge of Artificial Intelligence and Robotics.

UNIT I  ARTIFICIAL LIFE
The Artificial Life - Roots of Artificial Intelligence - Introduction - Building Artificial Systems -
Behavior systems – Emergent behavior- Approaches for Designing the Behavior Programs - Modeling Adaptive Autonomous Agents - Characteristics of Agent Architectures - Example Autonomous Agents

Suggested Activities:
- Flipped classroom on basics of artificial life and autonomous agents.
- External learning - applications of autonomous agents.
- Assignment on artificial life route towards AI.
- Exploration on current research in Artificial Life.

Suggested Evaluation Methods:
- Quizzes on behavior systems.
- Assignment on adaptive autonomous agents in the real world.

UNIT II INTRODUCTION TO ROBOTICS


Suggested Activities:
- Flipped classroom on basics of Robotics.
- External learning - Current applications and future trends of Robotics.
- Assignment on Machine and Human intelligence.
- Exploration on Collaborative Robots.

Suggested Evaluation Methods:
- Quizzes on fundamentals of Robotics
- Assignment on Scope and Importance of Robotics in real world.

UNIT III ROBOTIC SENSORS AND TRAJECTORY PLANNING


Suggested Activities:
- Flipped classroom on different types of sensors
- External learning - Real world applications of trajectory planning
- Assignment - Sensors used in obstacle avoiding Robot. Demonstrate advantages and disadvantages.
- Exploration on Mobile Robots.

Suggested Evaluation Methods:
- Assignments on applications of Robotic sensors
- Practical Learning - Determine movement speed and direction of robot using sensors
UNIT IV  COMPUTER VISION IN ROBOTICS AND ROBOT PROGRAMMING

Image representation - Picture coding - Object recognition and categorization - Depth measurement with vision systems- Robot guidance with vision systems. Robot control sequencing - Robot programming languages - Sample programs - Artificial Intelligence and robot programming

Suggested Activities:
- Flipped classroom on basics of Computer Vision and Robot programming
- External Learning - To estimate depth with vision systems
- Assignments on applications of object recognition using Robotics
- Practical - To analyse different Robot programming languages based on real time applications

Suggested Evaluation Methods:
- Quizzes on basics of OpenCV
- Assignments on different Robot programming languages.
- Demonstration of practical learning on Robot programming.
- Practical Learning - Object detection using Mobile Robots

UNIT V  ROBOTICS APPLICATIONS


Suggested Activities:
- Flipped classroom on applications of Robotics.
- External learning - Humanoid Robotics
- Assignment - Study the impact of Robots in industries.
- Exploration on current and future technologies of Robotics and automation.

Suggested Evaluation Methods:
- Assignments on Futuristic trends of Robotics
- Quizzes on Cognitive Robotics
- Practical demonstration on design of chatbots.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Design and implement an intelligent autonomous agent for problem solving.
2. Demonstrate and illustrate the fundamentals of Robotics.
3. Develop robotic design with proper navigation to solve real time problems.
4. Apply programmable automation in different subfields of robotics.
5. Develop vision-based systems for robot guidance.
6. Design and implement a robot for few real time applications.
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DS5002 STANDING ANALYTICS

OBJECTIVES:
- To know the fundamental concepts of streaming technology and data analytics.
- To study various analytics on stream data.
- To learn fundamental streaming data analysis.
- To understand various advanced content delivery, streaming, and cloud services.
- To learn the basic and advanced features of visualizing streaming data.

UNIT I STREAMING TECHNOLOGY

Suggested Activities:
- External learning - Associated Technologies and Applications.
- Assignments on Video encoding, Audio encoding, Preprocessing, Stream serving, Live webcast.

Suggested Evaluation Methods:
- Quiz on all topics covered in Streaming and Associated Technologies
- Evaluating the assignments on video and audio compression.

**UNIT II  STREAM ANALYTICS**


**Suggested Activities:**

- Case studies on the usage of stream analytics in popular search engines.
- External learning - Real time sentiment analysis, stock market predictions.
- Assignments on solving simple numerical problems involving moments and skewness

**Suggested Evaluation Methods:**

- Evaluating the assignment on a given a problem scenario identify suitable stream analytical technique(s).
- Quiz on all topics covered in stream analytics.

**UNIT III  STREAMING DATA ANALYSIS**

Data-Flow Management in Streaming Analysis -Processing Streaming Data - Exploratory Data analysis –Graphical Presentation of Data -Storing Streaming Data-Delivering Streaming Metrics -Exact Aggregation and Delivery -Statistical Approximation of Streaming Data -Approximating Streaming Data with Sketching -Beyond Aggregation - Data Analysis Using R

**Suggested Activities:**

- Practical - Perform univariate analysis on UCI datasets.
- Solve numerical problems in correlation and regression using sample real time data.
- Practical - Implement univariate, bivariate and multivariate analysis using R Studio.
- Given a data set, explore the features using data analysis in R.

**Suggested Evaluation Methods:**

- Evaluating assignments on Graphical Presentation of Data.
- Evaluating assignment on univariate, bivariate and multivariate analysis.
- Demonstrate implementation of univariate, bivariate and multivariate analysis using R Studio.
- Evaluating assignment on Statistical Approximation of Streaming Data.
- Evaluating assignment on Approximating Streaming Data with Sketching

**UNIT IV  ADVANCED CONTENT DELIVERY, STREAMING, AND CLOUD SERVICES**

Cloud-Based Content Delivery and Streaming-Live Streaming Ecosystems -Practical Systems for Live Streaming - Efficiency of Caching and Content Delivery in Broadband Access Networks - Anycast Request Routing for Content Delivery Networks - Cloud-Based Content Delivery to Home Ecosystems -Mobile Video Streaming
Suggested Activities:
- Flipped classroom on Live Streaming Ecosystems.
- External learning - Anycast Request Routing for Content Delivery Networks

Suggested Evaluation Methods:
- Implementation demonstration of Mobile Video Streaming
- Implementation demonstration of practical exercises.
- Mini project (individual) - Cloud-Based Content Delivery to Home Ecosystems

UNIT V VISUALIZING STREAMING DATA

Suggested Activities:
- Case studies on Streaming Data for Visualization
- Design and develop Streaming Data Dashboard-Machine Learning and Streaming Data Visualization

Suggested Evaluation Methods:
- Mini Project (Group) - Real time data collection, storing, implement analytical techniques and result projection.

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand and apply various analytics on stream data.
2. Understand the fundamental concepts of streaming technology and data analytics.
3. Comprehend and work with streaming data analysis techniques.
4. Implement suitable data analysis for stream data.
5. Understand various advanced content delivery, streaming, and cloud services.
6. Describe and implement the basic and advanced techniques for visualizing streaming data.

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OBJECTIVES:
- Study the morality and ethics in AI
- Learn about the Ethical initiatives in the field of artificial intelligence
- Study about AI standards and Regulations
- Study about social and ethical issues of Robot Ethics
- Study about AI and Ethics- challenges and opportunities

UNIT I
INTRODUCTION
Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust

Suggested Activities:
- Flipped classroom on Live Streaming to show how AI changes the environment and lifestyle.
- External learning - AI impact on human psychology

Suggested Evaluation Methods:
- Assignment on case studies to identify AI impact on normal human activities
- Group discussion to evaluate individual opinion and understanding on AI ethics

UNIT II
ETHICAL INITIATIVES IN AI
International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles, Warfare and weaponization.

Suggested Activities:
- Flipped classroom on international ethics and ethical harms.
- External learning - Robots in any other field than healthcare and war field for human assistance.

Suggested Evaluation Methods:
- Implementation demonstration of any simple AI application with ethics
- Assignment on robots used in warfare and weaponization to show how ethics are implemented in Robots

UNIT III
AI STANDARDS AND REGULATION
Suggested Activities:
- Flipped classroom on Autonomous systems.
- Group discussion on ethically driven robots in usage.
- External learning for study about the design of autonomous systems.

Suggested Evaluation Methods:
- Implementation demonstration of Autonomous system for human daily usage
- Submit case study on standard for machine readable personal privacy terms.

UNIT IV ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS


Suggested Activities:
- Flipped classroom on Roboethics.
- External learning on taxonomy of Roboethics

Suggested Evaluation Methods:
- Assignment on ethical issues in an ICT society
- Case study on Roboethics with its social implications.

UNIT V AI AND ETHICS- CHALLENGES AND OPPORTUNITIES

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI.

Suggested Activities:
- Flipped classroom on societal issues and applications of AI.
- Group discussion on applications of AI in industries

Suggested Evaluation Methods:
- Mini project on social-responsibility ethical decision-making system.

OUTCOMES:
On completion of the course, the students will be able to
1. Learn about morality and ethics in AI
2. Acquire the knowledge of real time application ethics, issues, and its challenges.
3. Understand the ethical harms and ethical initiatives in AI

TOTAL: 45 PERIODS
4. Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems
5. Understand the concepts of Roboethics and Morality with professional responsibilities.
6. Learn about the societal issues in AI with National and International Strategies on AI

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DS5004 COGNITIVE COMPUTING

OBJECTIVES:
- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models of cognition.
UNIT I  PHILosophy, PSYCHOLOGY AND NEUROsCIENCE  9


Suggested Activities:
- Flipped classroom on logic and sciences in the mind.
- Case study on how philosophy (western and eastern), psychology and neuroscience (Thought process in normal persons, children and differently-abled) helps in cognition.
- Mind map of cognition with various attributes such as mind, logic, information processing.
- Discussion and debate on cognition.

Suggested Evaluation Methods:
- Quiz on logic and sciences in the mind.
- Active discussion on the case study and how the factors such as learning and Memory affect cognition.
- Essay writing on how various factors influence cognition.

UNIT II  COMPUTATIONAL INTELLIGENCE  9


Suggested Activities:
- Flipped classroom on knowledge-based systems.
- Mind map on different methods of cognition in computational domain.
- Discussion on the influence of human cognition systems with a link to computational domain.

Suggested Evaluation Methods:
- Quiz on knowledge-based systems.
- Collaborative wiki editing of computational tools linking with cognition.
- Essay writing on the computational cognitive systems with the background of human cognitive systems.

UNIT III  PROBABILISTIC PROGRAMMING LANGUAGE  9


Suggested Activities:
- Flipped classroom on JavaScript libraries.
- Exploring the existing mathematical models.
- Practical - Programming the common mathematical functions using PPL.
Suggested Evaluation Methods:
- Quiz on the basics of JavaScript and WebPPL.
- Practical - Programming assignment on developing miniature programs using WebPPL for inference mechanisms.
- Evaluation of the programming assignments.

UNIT IV IMPLEMENTING THE INFERENCE MODELS OF COGNITION

Suggested Activities:
- Flipped classroom on dependence.
- Perform sample calculation of models manually.

Suggested Evaluation Methods:
- Quiz on statistical dependence
- Practical - Automate the mathematical functions through WebPPL.
- Practical - Programming assignments on analyzing data through cognitive models with WebPPL.
- Evaluation of the programming assignments.

UNIT V IMPLEMENTING THE LEARNING MODELS OF COGNITION

Suggested Activities:
- Flipped classroom on mixture models.
- Perform sample calculation of models manually.

Suggested Evaluation Methods:
- Quiz on mixture models.
- Practical - Programming assignment on learning models for continuous functions.
- Evaluation of the programming assignments.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course, the students will be able to:

1. Understand the underlying theory behind cognition.
2. Connect to the cognition elements computationally.
3. Implement mathematical functions through WebPPL.
4. Develop a cognitive inference model.
5. Develop a cognitive learning model.
6. Analyze the cognitive learning models.

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DS5005 AGENT BASED SYSTEMS L T P C

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OBJECTIVES:
- To explore the structure of agents
- To know about the learning mechanisms of agents
- To understand the communication and cooperation within agents
- To develop intelligent agent systems
- To know about various agent applications

UNIT I INTRODUCTION

Suggested Activities:
- Flipped classroom on Architectures of intelligent agents.
- Discussion on modes of instructions to agents.

Suggested Evaluation Methods:
- Quiz on Architectures of intelligent agents.
- Assignment on Instructions to agents.
UNIT II LEARNING IN AGENTS

Suggested Activities:
- Flipped classroom on Agent Reasoning methods.
- Construction of production rules.

Suggested Evaluation Methods:
- Quiz on Agent Reasoning.
- Assignment on reasoning through Constructed production rules.

UNIT III COMMUNICATION AND COOPERATION IN AGENTS
Software tools for ontology - OWL - XML - KIF - Speech acts - Cooperative Distributed Problem Solving - Task Sharing and Result Sharing - Result Sharing - Combining Task and Result Sharing - Handling Inconsistency - Coordination - Multi agent Planning and Synchronization

Suggested Activities:
- Flipped classroom software tools for ontology
- Discussion on Multi agents planning and synchronization.

Suggested Evaluation Methods:
- Assignment on software tools for ontology.
- Quiz on Multi agents planning and synchronization.

UNIT IV DEVELOPING INTELLIGENT AGENT SYSTEMS
Situated Agents: Actions and Percept’s - Proactive and Reactive Agents: Goals and Events - Challenging Agent Environments: Plans and Beliefs - Social Agents - Agent Execution Cycle - Deciding on the Agent Types - Grouping functionalities - Review Agent Coupling - Acquaintance Diagrams - Develop Agent Descriptors

Suggested Activities:
- Flipped classroom on Agent environments.
- Discussion on agent goals and events.

Suggested Evaluation Methods:
- Mind map on Agent Environments
- Case study with agent goals and events.

UNIT V APPLICATIONS
Agent for workflow and business process management - Mobile agents - Agents for distributed systems - agents for information retrieval and management - agents for electronic commerce - agent for human- computer interface - agents for virtual environments - agents for social simulation

Suggested Activities:
- Flipped classroom on agent applications.
- Discussion on mobile agents.

Suggested Evaluation Methods:
- Agent application case studies.
Quiz on mobile agents.

OUTCOMES:
On completion of the course, the students will be able to
- Build an architecture for intelligent agents.
- Apply the reasoning mechanisms of proposition and predicate logic to agents.
- Use the learning mechanisms for an artificial agent.
- Execute different communication and co-operation methodologies in a multi-agent setup.
- Distinguish the agent types.
- Develop intelligent agents’ applications.

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IF5081 INFORMATION RETRIEVAL

OBJECTIVES:
- To understand the basics of Information Retrieval with pertinence to modelling, Query operations and indexing.
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the various applications of Information Retrieval giving emphasis to Multimedia IR and Web Search.
- To understand the concepts of digital libraries.
- To learn the procedure for recommendation system.
UNIT I  INTRODUCTION

Suggested Activities:
- Install Lucene, LingPipe, and Gate.

Suggested Evaluation Methods:
- Group discussion on applications of vector space model.

UNIT II  PREPROCESSING

Suggested Activities:
- Construct manually a frequency table for the collection of documents after removing stop words.
- Index the frequency table using Latent semantic indexing techniques.

Suggested Evaluation Methods:
- Apply query document information and analyze manually the performance of the retrieval.

UNIT III  METRICS

Suggested Activities:
- Assignments on problems on precision and recall like the following:
  - An IR system returns 8 relevant documents and 10 non-relevant documents. There are a total of 20 relevant documents in the collection. What is the precision of the system on this search and what is its recall?

Suggested Evaluation Methods:
- Group discussion on metrics.

UNIT IV  CATEGORIZATION AND CLUSTERING

Suggested Activities:
- Categorize documents by topic using classifiers and build groups of self-organized documents using clustering algorithms.
Suggested Evaluation Methods:

- Analyze the algorithm by changing the input set

UNIT V EXTRATION AND INTEGRATION

Suggested Activities:

- External learning – Survey on recommendation process that takes place in various online shopping portals.

Suggested Evaluation Methods:

- Group discussion on recommendation process in a real time scenario.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:

1. Build an Information Retrieval system using the available tools.
2. Identify and design the various components of an Information Retrieval system.
3. Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.
4. Analyze the Web content structure.
5. Analyze the approaches used for recommendation systems.
6. Design an efficient search engine

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OBJECTIVES:

- Understand neural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

UNIT I  NATURAL LANGUAGE BASICS


Suggested Activities

- Flipped classroom on NLP
- Implementation of Text Preprocessing using NLTK
- Implementation of TF-IDF models

Suggested Evaluation Methods

- Quiz on NLP Basics
- Demonstration of Programs

UNIT II  TEXT CLASSIFICATION


Suggested Activities

- Flipped classroom on Feature extraction of documents
- Implementation of SVM models for text classification
- External learning: Text summarization and Topic models

Suggested Evaluation Methods

- Assignment on above topics
- Quiz on RNN, Transformers
- Implementing NLP with RNN and Transformers

UNIT III  QUESTION ANSWERING AND DIALOGUE SYSTEMS


Suggested Activities:

- Flipped classroom on language models for QA
- Developing a knowledge-based question-answering system
- Classic QA model development
Suggested Evaluation Methods
- Assignment on the above topics
- Quiz on knowledge-based question answering system
- Development of simple chatbots

UNIT IV TEXT-TO-SPEECH SYNTHESIS 9

Suggested Activities:
- Flipped classroom on Speech signal processing
- Exploring Text normalization
- Data collection
- Implementation of TTS systems

Suggested Evaluation Methods
- Assignment on the above topics
- Quiz on WaveNet, deep learning-based TTS systems
- Finding accuracy with different TTS systems

UNIT V AUTOMATIC SPEECH RECOGNITION 9

Suggested Activities:
- Flipped classroom on Speech recognition.
- Exploring Feature extraction
- Error rate prediction with different speech recognition

Suggested Evaluation Methods
- Assignment on the above topics
- Quiz on acoustic modelling
- Comparing error rates with different speech recognition systems

PRACTICAL EXERCISES 30
1. Implement NLP using RNN
2. Implement NLP using LSTM
3. Compare NLP accuracy using different deep learning methods
4. Implement different ranking algorithms
5. Design a chatbot with a simple dialog system
6. Convert text to speech and find accuracy
7. Design a speech recognition system and find the error rate

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
- Explain existing and emerging deep learning architectures for text and speech processing
- Apply deep learning techniques for NLP tasks, language modelling and machine
• Explain coreference and coherence for text processing
• Build question-answering systems, chatbots and dialogue systems
• Apply deep learning models for building speech recognition and text-to-speech systems
• Design an automatic speech recognition system

REFERENCES:
5. Steven Bird, Ewan Klein, and Edward Loper, “Natural language processing with Python”, O'REILLY.

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DS5007 REINFORCEMENT LEARNING L T P C 3 0 2 4

OBJECTIVES:
• To introduce a range of topics related to Reinforcement Learning and probability concepts.
• To gain knowledge on the Markov Decision Process.
• To understand the dynamic programming methods of Reinforcement Learning.
• To know about the Monte Carlo Prediction and Time Difference Learning.
• To gain knowledge on Function Approximation methods and Q-learning.

UNIT I INTRODUCTION TO REINFORCEMENT LEARNING 9
Suggested Activities:
- Installation of Code Standards and Libraries used in RL (Python/Keras/Tensorflow).
- Practical – Implement Tic-tac-toe and Armed Bandit Problem.

Suggested Evaluation Methods:
- Quiz on basic concepts of probability.

UNIT II MARKOV DECISION PROCESS

Suggested Activities:
- Practical – Develop Dynamic programming algorithms for solving MDPs, Policy Evaluation, Policy Iteration, Policy Improvement and Value Iteration.

Suggested Evaluation Methods:
- Evaluation of the practical implementation with appropriate input set.

UNIT III DYNAMIC PROGRAMMING FOR MDP

Suggested Activities:
- Practical – Monte Carlo Prediction, Monte Carlo Off-Policy Control with Importance Sampling and SARSA (On Policy TD Learning).

Suggested Evaluation Methods:
- Evaluation of the practical implementation with appropriate input set.

UNIT IV MONTE CARLO PREDICTION

Suggested Activities:
- Practical – Implement Q-Learning (Off Policy TD Learning), Q-Learning with Linear Function Approximation and Deep Q-Learning for Atari Games.

Suggested Evaluation Methods:
- Implementation evaluation by testing the code.

UNIT V FUNCTION APPROXIMATION
Getting started with the function approximation methods – Revisiting risk minimization – gradient descent from Machine Learning – Gradient MC and Semi-gradient TD(0) algorithms – Linear Methods – Eligibility trace for function Approximation – Control with function Approximation – Least squares, Experience replay in deep Q-Networks – Naive
REINFORCE algorithm – Bias and variance in Reinforcement Learning – Actor-Critic Methods.

**Suggested Activities:**
- Practical – Develop Policy Gradient: REINFORCE with Baseline, Actor Critic with Baseline, Actor Critic with Baseline for Continuous Action Spaces

**Suggested Evaluation Methods:**
- Evaluation of the practical implementation.

**PRACTICAL EXERCISES:**
1. Write a python program to implement Markov chain for simple prediction.
2. Write a python program to implement Markovian decision process
3. Write a python program to implement Q-Learning algorithm
4. Implement SARSA algorithm
5. Implement Monte-Carlo and Temporal learning algorithm
6. Implement A small GRID game with reinforcement learning

**OUTCOMES:**
On completion of the course, the students will be able to
3. Apply dynamic programming techniques on Markov decision process and Monte Carlo methods.
4. Implement Time difference learning for real world problems.
5. Apply Approximation methods of learning and Q-Learning Technique.
6. Understand the need for function approximation algorithms

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OBJECTIVES:
- To provide knowledge about computer vision algorithms.
- To understand the basic concepts of camera calibration, stereoscopic imaging, and higher-level image processing operations.
- To familiarize the student with the image processing facilities in MATLAB and its equivalent open-source tools like OpenCV.
- To appreciate the use of computer vision in Industrial applications and to understand the role of computer vision.
- To understand and implement Object detection and Object tracking Algorithms.

UNIT I  FUNDAMENTALS OF VISION

Suggested Activities:
- Installation of OpenCV.
- Numerical Problems on Filtering, Masking, Smoothing and sharpening.

Suggested Evaluation Methods:
- Quizzes on various camera models and its effect.
- Practical – Programming assignments on types of filters for different applications.

UNIT II  IMAGE SEGMENTATION and CAMERA CALLIBRATION

Suggested Activities:
- Flipped classroom on importance of segmentation.
- External learning – Various camera calibration methods.

Suggested Evaluation Methods:
- Quizzes on various segmentation methods.
- Practical – Programming assignments on edge and shape detection methods.

UNIT III  FEATURE DETECTION and TRACKING

Suggested Activities:
- Flipped classroom on various feature reduction methods.
- External learning – Optical flow algorithms.

Suggested Evaluation Methods:
- Quizzes on various feature detection methods.
- Practical – Programming assignments on object tracking algorithms.
UNIT IV SHAPE FROM CUES AND OBJECT DETECTION

Suggested Activities:
- Flipped classroom on pedestrian detection methods.
- Assignments on numerical problems on Shading and Texture Model based Vision.
- Assignments on numerical problems on AdaBoost and Random Decision Forests.

Suggested Evaluation Methods:
- Quizzes on methods to identify the shape of an object in an image.
- Practical – Programming assignments on algorithms and methods used for identification of objects.

UNIT V COMPUTER VISION APPLICATION
Emotion Recognition – Real Time Object Detection – Gesture Recognition – Face Detection

Suggested Activities:
- External learning – Exploring advancement in computer vision.
- Discussion on Emotion Recognition methods.

Suggested Evaluation Methods:
- Quizzes on various real time computer vision application.
- Group discussion on methods to solve the real-world problems in computer vision applications.

PRACTICAL EXERCISES:
1. Write a program in OpenCV/Matlab to implement low pass and high pass filters for noise removal.
2. Implement Image sharpening filters in OpenCV.
3. Implement Image segmentation algorithms like Hough Transform in OpenCV.
4. Implement SIFT and SURF feature extraction algorithms from Images to perform a simple image matching.
5. Implement Optical flow algorithms in OpenCV.
6. Implement a simple application for Gesture Detection in OpenCV.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
1. Have a clear impression of the breadth and practical scope of digital image processing and have arrived at a level of understanding that is the foundation for most of the work currently underway in this field.
2. Critically analyze the role of video in modern technologies.
3. Implement basic image and video processing algorithms.
4. Design and develop various applications that incorporate different techniques of Image and video processing.
5. Apply and explore new techniques in the areas of Image and video Processing.
6. Implement image and video-based applications

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DS5009 ARTIFICIAL NEURAL NETWORKS L T P C
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OBJECTIVES:
- To connect Biology with Computers
- To understand components of artificial neural networks
- To understand supervised learning network paradigms
- To understand RBF and Recurrent networks
- To understand unsupervised learning network paradigms

UNIT I INTRODUCTION TO NEURAL NETWORKS 9

Suggested Activities:
- Practical – installing Anaconda, a scientific python library which includes scikit-learn, all of its dependencies, matplotlib and more for building, debugging, testing, and executing neural network application

Suggested Evaluation Methods:
- Evaluation of practical implementation.
UNIT II  COMPONENTS OF ANN


Suggested Activities:
- Practical – Implement feed-forward network using Python Library.
- Practical – Implement the model by changing the activation functions

Suggested Evaluation Methods:
- Evaluation of the practical implementation.
- Tutorial – Solve the numerical problem on feed forward networks with various action functions.

UNIT III  SUPERVISED LEARNING


Suggested Activities:
- Practical – Implement backpropagation using Python
- Practical - Analyze by adding or removing hidden layers and also change learning rates, regularization, and other learning settings.

Suggested Evaluation Methods:
- Evaluation of the practical implementation.
- Quizzes on different Supervised learning networks

UNIT IV  RADIAL BASIS FUNCTIONS


Suggested Activities:
- Flipped classroom on demonstrating the operations on the RBF network.

Suggested Evaluation Methods:
- Quizzes on operation of associate memory and recurrent neural networks.

UNIT V  UNSUPERVISED LEARNING

Unsupervised learning network paradigms – Structure of a self-organizing map(SOM) – Functionality, Training – Topology function – Decreasing Learning Rate – Variations of...

Suggested Activities:
- Flipped classroom on basics of SOM, and ART concepts.
- Practical – Implement an Unsupervised neural network using Python

Suggested Evaluation Methods:
- Quizzes on the basic operation of SOM and ART
- Demonstration for practical learning.

PRACTICAL EXERCISES

1. Implement a feed forward network with two input layers and one hidden layer on any standard dataset and
2. Analyze the performance of the model implemented in exercise 1 by varying activation functions and loss functions.
3. Implement a feed forward network with multiple hidden layers on any standard dataset. Experiment with logistic activation functions for the hidden nodes and linear activation for the output.
4. Implement a backpropagation network on any standard dataset to determine a set of suitable weights and analyze the performance of the model by varying activation functions and loss functions.
5. Implement the SOM algorithm and check its performance by varying the learning rate.
6. Implement the ART algorithm and check whether the input data fits into one of the already stored clusters or create a new cluster.
7. Visualizing a above implemented neural network model by choosing different activation function, learning rate and other hyper parameters.
8. Improve the performance of neural network by identifying the misclassifications being made by the above model.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
1. Know the purpose of Artificial Neural Networks.
2. Apply the concepts for training a neural network.
3. Work with a supervised learning network paradigm.
5. Work with an unsupervised learning network paradigm.
6. Learn procedures of various neural networks to generalize and associate data.

REFERENCES:
### OBJECTIVES:
- To define functions and use function calls in python
- To understand the problem-solving aspects using conditionals and loops
- To use python data structures such as list, tuples, and dictionaries
- To understand the operation of arrays using NumPy
- To explore data manipulation using pandas
- To visualize data with matplotlib and seaborn

### UNIT I PYTHON BASICS

**IDE** – Use of Functions - Collaborative version control system – git - Condition Statements - if then else - Nested conditionals - Loops - For -While - do while - List - Nested lists - slicing operation - Tuples - Dictionary - creation of python modules

**Suggested Activities:**
- Simple programs on print statements, arithmetic operations
- Simple programs on function calls
- Working with git commands on python programs

**Suggested Evaluation Methods:**
- Assignment on variables and arithmetic operators
- Conversion of programs to functions
- Auto grading using git and GitHub

### UNIT II FILE HANDLING AND WORKING WITH ARRAYS

Working with files - NumPy - Array Indexing - Array Slicing - Reshaping - Concatenation - Splitting - Aggregation - Broadcasting - Sorting - Vectorizing - Matrix operations

**Suggested Activities:**
- Importing, reading a file and writing/ appending to files
- Programming assignment on matrix operations and broadcast
- Program on vectorizing the data and analyzing the time of computation

**Suggested Evaluation Methods:**
- Programming assignment on above activities
- External learning with real dataset with NumPy
- Collaborative learning with git
UNIT III  WORKING WITH DATA
Pandas - Series object - Use of Data frames - importing and exporting data to csv/ other formats - Data indexing and selection - Handling missing data - Replacing data items - Combining datasets - Pivot Tables - working with time series

Suggested Activities:
- Installation of Pandas and creation of a data frame
- Conversion of dictionary to data frame and vice versa
- Explore real world dataset from UCI repository and perform operations on those datasets

Suggested Evaluation Methods:
- Programming assignment on the above activities
- Creation of a dataset
- External learning

UNIT IV  VISUALIZATION
Importing matplotlib and seaborn libraries - setting styles - simple line plots - Scatter plots - visualizing errors - density and contour plots - histograms - legend - colorbars - subplots - three-dimensional plotting

Suggested Activities:
- For the programs in Unit IV activities, draw relevant plots with matplotlib and seaborn libraries
- Customize the plot with legend, text and additional colors

Suggested Evaluation Methods:
- Programming assignment on the above activities
- Tutorials and quiz
- Number of commits in GitHub repository

UNIT V  STATISTICAL LEARNING
Scikit-learn – working with predefined datasets – classification with multiple algorithms – training -testing ratio - fitting with different parameters – normalization – cross validation

Suggested Activities:
- Installation of Scikit-learn
- For the programs for cross-validation.

Suggested Evaluation Methods:
- Programming assignment on the above activities
- Tutorials and quiz
- Number of commits in GitHub repository

PRACTICAL EXERCISES
1. Working with Git
2. Implementation of a calculator using python functions
3. Development of different python modules and integration
4. Different array and tensor operations using NumPy
5. Descriptive data analysis using Pandas
6. Visualization using different plots with matplotlib and seaborn
7. Development of python modules for normalization of data
8. Development of python modules for cross validation

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:

- Develop and execute programs with loops and other data structures
- Work with files and arrays using numpy
- Work with data using Pandas
- Write programs for visualization using matplotlib and seaborn
- Develop separate functions for statistical learning
- Develop computer applications for data science/machine learning projects

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IF5073  AUTONOMOUS GROUND VEHICLE SYSTEMS  L  T  P  C

OBJECTIVES:
- To learn the fundamentals of autonomous driving.
- To study the different ways of sensing internal states of Autonomous Ground Vehicles (AGVs).
- To learn the environment perception for autonomous driving.
- To explore the navigation techniques of AGVs.
- To learn the fundamentals of vehicle control systems and connected vehicles.

UNIT I  INTRODUCTION TO AUTONOMOUS DRIVING
Autonomous Driving Technologies Overview – Autonomous Driving Algorithms – Autonomous Driving Client System – Autonomous Driving Cloud Platform – Components of autonomy.
Difference between Unmanned and Autonomous Vehicles – Introduction to Unmanned Aerial Vehicles (UAVs).

Suggested Activities:
- Flipped classroom on autonomous driving system architecture.
- External learning – Building blocks of typical Unmanned Aerial Vehicles.
- Flipped classroom on robot operating system.
- External learning – Applications of autonomous vehicles (aerial, under water, ground vehicles).
- Assignment on the design requirement specifications of autonomous vehicles (aerial, under water, ground vehicles).

Suggested Evaluation Methods:
- Viva voce on assignment topics.
- Quizzes on Advanced Driver Assistance Systems (ADAS).
- Group Discussion on Google’s self-driving car.

UNIT II SENSORS FOR AUTONOMOUS GROUND VEHICLES


Suggested Activities:
- Flipped Classroom on sensor characteristics.
- External learning – Exploring Velodyne Lidar sensor dataset in Veloview software

Suggested Evaluation Methods:
- Practical Experiments on interfacing IMU sensor to Raspberry Pi board and recording the acceleration of a dummy vehicle.
- Practical Experiments on interfacing Lidar/RADAR sensor to Raspberry Pi board and recording the distances to the nearby objects.
- Practical Experiments on interfacing camera to Raspberry Pi board and capturing images/videos.

UNIT III ENVIRONMENT PERCEPTION AND MODELING

Road Recognition: Basic Mean Shift Algorithm, Mean Shift Clustering, Mean Shift Segmentation, Mean Shift Tracking, Road Recognition Algorithm – Vehicle Detection and Tracking: Generating ROIs, Multi Resolution Vehicle Hypothesis, Vehicle Validation using Gabor Features and SVM, Boosted Gabor Features – Multiple Sensor Based Multiple Object Tracking.

Suggested Activities:
- Flipped classroom on Basic Mean Shift Algorithm.
- External learning – Lane detection algorithm.
- Flipped classroom on vehicle tracking.

Suggested Evaluation Methods:
- Practical – Implementation of Mean Shift Clustering / Mean Shift Segmentation Algorithm.
- Practical – Experiments on stationary obstacle detection algorithm using Lidar sensor.
UNIT IV  NAVIGATION FUNDAMENTALS


Suggested Activities:
- Flipped classroom on GPS orbits/GPS Signals.
- External learning – Indian Regional Navigation Satellite System (IRNSS).
- Assignment on the working principles of Google Map.

Suggested Evaluation Methods:
- Quizzes on GNSS signal structure.
- Viva Voce on assignment topics.
- Practical – Simulation of Waypoint Navigation Algorithm.

UNIT V  VEHICLE CONTROL AND CONNECTED VEHICLE


Suggested Activities:
- Flipped classroom on cruise control.
- External learning – Study on proportional integral derivative (PID) control.
- Assignment – Communication protocols for connected vehicles.

Suggested Evaluation Methods:
- Viva Voce on assignment topic.
- Practical – Experiment on simple velocity control.
- Practical – Experiment on simple longitudinal motion control

PRACTICAL EXERCISES:

Implement the following exercise using python libraries on UCI Machine Learning Repository.

1. Write a python program to read Lidar sensor data and write it in a text file.
2. Write an Arduino sketch to operate DC motors through motor driver.
3. Write a python program on Raspberry Pi board to control the movement of pan-tilt platform with 5v dc motors.
4. Write a python program to read the IMU sensor values through I2C bus in Raspberry Pi board.
5. Develop an Arduino application to drive a simple rover with four wheels in a random path.
6. Write a python program to send the location of a rover with GPS to Firebase real-time database.
7. Develop a Lidar sensor assisted application to implement 2D collision cone-based obstacle avoidance for rovers.
8. Develop an application using python program to control the pan-tilt motion of a camera and to take pictures/videos in the field of view of the camera.
10. Develop a convolutional neural network model to detect road lanes in videos.
11. Mini Project

TOTAL: 75 PERIODS
OUTCOMES:
1. On completion of the course, the students will be able to:
2. Identify the requirements and design challenges of AGVs.
3. Select suitable sensors to sense the internal state and external world of AGVs.
4. Implement lane detection, road detection & vehicle detection algorithms.
5. Simulate/implement ground vehicle navigation algorithms.
6. Simulate/implement ground vehicle control systems.

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MM5072 MIXED REALITY

OBJECTIVES:
● To impart the fundamental aspects and principles of mixed reality technologies.
● To know the internals of the hardware and software components involved in the development of mixed reality enabled applications.
● To learn about the graphical processing units and their architectures.
● To gain knowledge about mixed reality application development.
● To know the technologies involved in the development of mixed reality-based applications

UNIT I INTRODUCTION
Suggested Activities:
- Flipped classroom on Uses of MR applications.
- Videos: Experience the virtual reality effect.
- Assignment on comparison of VR with traditional multimedia applications.

Suggested Evaluation Methods:
- Tutorial - Applications of MR.
- Quizzes on the displayed video and the special effects.

UNIT II  MR COMPUTING ARCHITECTURE


Suggested Activities:
- Flipped classroom on basic graphics pipeline.
- External learning - Different types of Graphics architectures and workstations.
- Practical - GPU programming on simple modeling and rendering.

Suggested Evaluation Methods:
- Tutorial - Graphics pipelines.
- Brainstorming session on GPU architecture.
- Quizzes on graphical architectures.
- Demonstration of GPU related simple modeling and rendering programs.

UNIT III  MR MODELING


Suggested Activities:
- Flipped classroom on modeling three dimensional objects.
- External learning - Collision detection algorithms.
- Practical - Creating three dimensional models.

Suggested Evaluation Methods:
- Tutorial - Three-dimensional modeling techniques.
- Brainstorming session on collision detection algorithms.
- Demonstration of three-dimensional scene creation.

UNIT IV  PROGRAMMING AND APPLICATIONS


**Suggested Activities:**
- External learning - Different types of programming toolkits and learn different types of available VR applications.
- Practical - Create VR scenes using any toolkit and develop applications.

**Suggested Evaluation Methods:**
- Tutorial - VR tool comparison.
- Brainstorming session on tools and technologies used in VR.
- Evaluate the developed VR application.
- Demonstration of the created VR applications.

**UNIT V MIXED REALITY TECHNOLOGIES**


**Suggested Activities:**
- External learning - Different types of sensing and tracking devices for creating mixed reality environments.
- Practical - Create MR scenes using any toolkit and develop applications.

**Suggested Evaluation Methods:**
- Demonstration and evaluation of the developed MR application.
- Tutorial - Mobile interface design.
- Brainstorming on efficient usage of various MR technologies.

**PRACTICAL EXERCISES:**
1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection methods by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E-learning environment, Virtual walkthroughs, and visualization of historic places.
10. Develop simple MR enabled gaming applications.

**TOTAL: 75 PERIODS**
OUTCOMES:
On completion of the course, the students will be able to
● Familiarize with the basic concepts of mixed reality.
● Understand the tools and technologies related to Mixed Reality.
● Know the working principle of mixed reality related Sensor devices.
● Develop the Virtual Reality applications in different domains.
● Design of various models using modeling techniques.
● Expose the concept of Virtual Reality and Mixed reality Programming with toolkits.

REFERENCES:
1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create Compelling VR Experiences for Mobile”, Packt Publisher, 2018

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DS5011 DEEP LEARNING L T P C
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OBJECTIVES:
● To understand the basic ideas and principles of Neural Networks
● To understand the basic concepts of Big Data and Statistical Data Analysis
● To familiarize the student with The Image Processing facilities like Tensorflow and Keras
● To appreciate the use of Deep Learning Applications
● To understand and implement Deep Learning Architectures

UNIT I BASICS OF NEURAL NETWORKS 9
The basic concept of Neurons – Relationship between Artificial Intelligence, Deep Learning and Machine Learning - Activation Functions - Perceptron – McCulloh Pitts model - OR, AND Gate Implementation - Learning Rate - Introduction to feedforward and feedback networks.

Suggested Activities:
● Discuss the history of AI and Neural Networks.
● External learning – Turing Test.
● Practical – Installation of TensorFlow and Keras.

Suggested Evaluation Methods:
● Tutorial – Perceptron.
• Assignment problems on Hebbian and perceptron learning rule
• Quizzes on Neural Networks.

UNIT II INTRODUCTION TO DEEP LEARNING
Training Deep Neural Networks – Initialization, Activation functions – Optimizers - Gradient Descent – Momentum based optimization methods - Loss Functions – Types of Loss functions - Cross Entropy - Regularization Techniques - Dropout - Applications in Regression and Classification problems - Binary and multi-class classification

Suggested Activities:
• Discussion of the role of Gradient Descent in Deep Learning.
• External learning – Convolutional learning and feature learning.
• Survey of Deep Learning Development Frameworks.
• Discussion of Regularization methods.

Suggested Evaluation Methods:
• Tutorial – Optimizers in deep learning.
• Assignment problems in optimization.
• Quizzes on deep learning regularization and optimization.

UNIT III CONVOLUTIONAL NEURAL NETWORKS

Suggested Activities:
• Discussion of the role of Convolutional Networks in Machine Learning.
• External learning – Concept of convolution and need for Pooling.

Suggested Evaluation Methods:
• Tutorial – Image classification and recurrent nets.
• Assignment problems in image classification performances.
• Quizzes on Convolutional Neural Networks.

UNIT IV RECURRENT NEURAL NETWORK

Suggested Activities:
• Discussion of the role of Deep Learning architectures.
• External learning – Compression of features using Autoencoders.

Suggested Evaluation Methods:
• Tutorial – LSTM and Autoencoders.
• Assignment problems in deep generative models, Deep Belief Networks.
• Quizzes on deep learning architectures.
UNIT V GENERATIVE ADVERSARIAL NETWORKS

Generative Adversarial Networks - Discriminator model - Generator model - Training GAN - Minmax function - Evaluating GAN Models - Inception Score - Fréchet inception distance (FID) - Applications - Text-to-photo synthesis - Image to image translation

Suggested Activities:
- Discussion of the role of Deep Learning in Image and NLP applications.
- External learning – NLP concepts.

Suggested Evaluation Methods:
- Tutorial – Image segmentation.
- Assignment problems in parsing and sentiment analysis.
- Quizzes on deep learning architectures.

PRACTICAL EXERCISES:
1. Implement Simple Programs like vector addition in TensorFlow.
2. Implement a simple problem like a regression model in Keras.
4. Implement a Feed-Forward Network in TensorFlow/Keras.
5. Implement an Image Classifier using CNN in TensorFlow/Keras.
6. Implement a Transfer Learning concept in Image Classification.
8. Implement Opinion Mining in Recurrent Neural network.
9. Implement an Object Detection using CNN.
10. Mini Project

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
1. Understand the internal architecture of a neuron and the role of activation functions
2. Apply a feedforward neural network for classification problems with appropriate optimization techniques
3. Design and implement convolution neural networks for image classification
4. Understand the architecture of recurrent neural networks and their variants
5. Design the deep neural network with Generative Adversarial models
6. Apply relevant deep learning architectures for real-world applications

REFERENCES:
4. Eugene Charniaik, Introduction to Deep Learning, MIT Press, 2018
OBJECTIVES:

- To learn the fundamentals of the financial technologies, and investment analysis
- To study the different ways of raising money with fintech
- To learn how to harness data with artificial intelligence and machine learning
- To understand and describe the digital finance and alternative finance and the future of Fintech.
- Developing the capability in terms of the applications of tools and techniques in analyzing and solving problems related to investment

UNIT I  FINTECH  9
Reshaping the banking and payments industry - Analyze the source of banks’ vulnerability
FinTech Transformation, FinTech Evolution 1.0, 2.0, 3.0, 3.5, Collaboration between Financial
Institutions and Startups, FinTech Typology, Emerging Economics: Opportunities and
Challenges

Suggested Activities:

- Flipped classroom on basics of FinTech Typology.
- External learning - The Future of FinTech and the Technologies impacting it.

Suggested Evaluation Methods:

- Quizzes on FinTech.
- Assignment on Emerging Economics.

UNIT II  INNOVATIONS OF FINTECH  9
Banks’ disintermediation of credit, Individual Payments, Mobile Money, Regulation of Mobile
Money, RTGS Systems, ABCDs of Alternative Finance, Building a New stack
Cryptocurrencies, Legal and Regulatory Implications of Cryptocurrencies, Blockchain, The
Benefits from New Payment Stacks (Applications of Ripple)

Suggested Activities:

- Flipped classroom on basics of Mobile Money.
- External learning - Legal and Regulatory Implications of Cryptocurrencies

Suggested Evaluation Methods:

- Quizzes on ABCDs of Alternative Finance.
- Demonstration of the practical implementations of Blockchains.
UNIT III  FINTECH REGULATIONS AND DATA REGULATION

FinTech Regulations - Evolution of RegTech - RegTech Ecosystem: Financial Institutions, Startups, Challenges, Regulators, Regulatory Sandboxes, Smart Regulation. Data Regulation Data in Financial Services-European Big-Bang: PSD2 / GDPR / MIFID2 – Digital Identity- Regulation 1.0 to 2.0 (KYC to KYD)

Suggested Activities:
- Flipped classroom on basics of data regulations of various countries.
- External learning - Transforming Personal Finance with Fintech
- External learning - Application of AI in Smart Regulation (Mindbridge)
- Read: https://www.predictiveanalyticstoday.com/artificial-intelligence-platforms/

Suggested Evaluation Methods:
- Quizzes on FinTech Regulations.
- Assignments on automation in the investment management industry, Balancing Innovation and Regulation Challenges.
- Industry Showcase: Cybersecurity Industry, PSD2: Open Banking API for Startups (Gini), Application of Data Analytics in Finance.

UNIT IV  DIGITAL FINANCE AND ALTERNATIVE FINANCE


Suggested Activities:
- Flipped classroom on basics of Digitization of Financial Services.
- External learning - Ensuring Compliance from the Start

Suggested Evaluation Methods:
- Quizzes on Financial Innovation.
- Assignments on Method of AI used to Transform the Future of FinTech.

UNIT V  BUILDING & MANAGING A SUCCESSFUL FINTECH STARTUP

Understanding the impact of Macro & Micro factors on the Business Dynamics- Art & Science of Design Thinking Managing Growth, Fund Raising and Exits. Disruptive Technology Cases in FinTech

Suggested Activities:
- Flipped classroom on basics of TechFin.
- External learning – reconfiguring of FinTech financial services business models. Key disruption points. Success of FinTech
- External learning – Limits, risks, and broader policy and social implications of FinTech.
Suggested Evaluation Methods:

- Assignments on automation in the investment management industry.
- Case Studies - Revolut, Alibaba, Aadhaar, Credit Karma, Digibank

PRACTICAL EXERCISES:

1. Experiment on Retail Payments System
2. Experiment on risk predictions
3. Experiment on Financial time series modeling using deep nets
4. Install and Getting Started with the Bitcoin core client. Write a program to get a Bitcoin and create transaction.
5. Setup the Ethereum development environment. Generate addresses and create transaction.
6. Development of Smart contract
7. Experiment on Fraud prevention techniques
8. Experiment on digital signatures
9. Analysis of various cryptocurrencies
10. Toy application using Blockchain
11. Naive Blockchain construction
12. Memory Hard algorithm - Hashcash implementation
13. Mining puzzles
14. Mobile Money

TOTAL: 75 PERIODS

OUTCOMES:

On completion of the course, the students will be able to

1. Apply the concepts and computational basics in the real-world financial market scenario
2. Formulate trading strategies by identifying the patterns in trading and market price movements
3. Evaluate portfolios through systematic technical and fundamental analysis
4. Collaborate and compete with trading groups in a simulated environment and extend to the real investment scenarios
5. Demonstrate decision dynamics to attain the investment objectives in a stock market environment
6. Learn to assess the future of fintech and think strategically about challenges faced by financial companies

REFERENCES:

OBJECTIVES:

- To gain an understanding of the QAI’s fundamentals.
- To learn more about quantum computation and algorithm development.
- To understand how to use artificial intelligence, machine learning, and deep learning to extract value from large amounts of data.
- To better understand and be fluent on the concepts of advanced quantum computing.
- To learn how to use QAI to develop the Quantum Blockchain.

UNIT I QUANTUM COMPUTING

Basic Concepts- Bit and Quantum Bits (Qubit), Working with Qubits (Computation with Qubits- Computation with one Qubit, Computation with m Qubit, Matrix Representation of Serial and Parallel Operations, Entanglement, Quantum Boolean Circuits, Deutsch Algorithm, Deutsch Jozsa Algorithm, Amplitude Distribution, Geometric Operations), Working with Multiple Qubits, Quantum States, Quantum Hardware Approaches, Quantum computer working.

Suggested Activities:

- Flipped classroom on Working with Qubits, Working with Multiple Qubits.
- External learning - Quantum Hardware Approaches.

Suggested Evaluation Methods:

- Quizzes on Quantum States.
- Assignments on Quantum computer working.

UNIT II QUANTUM COMPUTATION AND ALGORITHMS

Suggested Activities:
- Flipped classroom on basics of Quantum Information.
- External learning - Quantum Noise and Quantum Operations,
- External learning - Distance Measures for Quantum Information,
- External learning - Quantum Error Correction

Suggested Evaluation Methods:
- Quizzes on Data Compression.
- Demonstration of the practical implementations of Quantum Algorithms, Quantum Search, Reversible Algorithms.

UNIT III  ADVANCED QUANTUM COMPUTING: INTERFERENCE AND ENTANGLEMENT

Suggested Activities:
- Flipped classroom on Quantum Error Correction.
- External learning – Interference and Entanglement

Suggested Evaluation Methods:
- Quizzes on Quantum statistics
- Assignments on Practical Applications of Entanglement

UNIT IV  ARTIFICIAL INTELLIGENCE

Suggested Activities:
- Flipped classroom on Quantum Naïve Bayes.
- External learning - Quantum Cognition

Suggested Evaluation Methods:
- Quizzes on Information Geometry, and Geometric Deep Learning, Standardized Methods for Quantum Computing
- Assignments on Reinforcement Learning.

UNIT V  QUANTUM BLOCKCHAIN
Quantum Internet, Quantum Networks: A Deeper Dive, Quantum Cryptography and Quantum Key Distribution, Quantum Security: Blockchain Risk of Quantum Attack, Quantum-Resistant Cryptography for Blockchains.
Suggested Activities:
- Flipped classroom on basics of Quantum Internet, Quantum Networks.
- External learning – Quantum Cryptography and Quantum Key Distribution
- External learning – Limits, risks, and broader policy and social implications of Blockchain Risk of Quantum Attack, Quantum-Resistant Cryptography for Blockchains

Suggested Evaluation Methods:
- Assignments on Quantum Security and automation.
- Case Studies - Quantum Cryptography

PRACTICAL EXERCISES:
- Implementation of Quantum Algorithms
- Demonstrating the Quantum Complexity
- Experiment on Quantum Key Distribution
- Experiments on Optical Quantum Information Processing
- Experiments on Quantum Cryptography
- Case studies like Seismic Sensing Using Quantum Cryptography Network

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
1. Gain understanding of the QAI's fundamentals.
2. Learn more about quantum computation and algorithm development.
3. Understand how to use artificial intelligence, machine learning, and deep learning to extract value from large amounts of data.
4. Understand and be fluent on the concepts of advanced quantum computing.
5. Learn to assess the use QAI to develop the Quantum Blockchain
6. Learn Quantum statistics

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OBJECTIVES:
- To learn the graph theoretical basics of social networks and its applications
- To understand knowledge representation in social networks
- To know the basics of media and community mining in social networks
- To learn about techniques for understanding human behavior in social networks
- To understand the importance of security, privacy in social networks and visualization.

UNIT I  INTRODUCTION TO SOCIAL NETWORKS
Social Network Analysis: Definition and Features – The Development of Social Network Analysis – Representation of Social Networks: Graph and Matrix Representations – Graph Concepts in Network Analysis – Ties, Degree, Density, Path, Length, Geodesic, Eccentricity, Between – Ness, Centrality, Clique – Overview of Electronic Discussion Networks, Blogs and Online Communities

Suggested Activities:
- Given a social graph derive the various graph metrics.
- Group discussion on pros and cons of various online discussion forums.
- Convert a graph into equivalent matrix representation.

Suggested Evaluation Methods:
- Assignment on graph metrics.
- Report submission on features of online social forums.
- Quizzes on graph and matrix representations.

UNIT II  KNOWLEDGE REPRESENTATION IN SOCIAL NETWORKS

Suggested Activities:
- Group activity – Defining concepts and relations for sample scenarios using benchmark ontology.
- Practical – Developing ontology using tools.
- Assignment on inferring the entities involved from a sample RDF schema.

Suggested Evaluation Methods:
- Report submission on benchmark ontology.
- Quizzes and assignments on RDF/FOAF and other related vocabulary.

UNIT III  SOCIAL MEDIA MINING AND COMMUNITY MINING
Discovering Mobile Social Networks by Semantic Technologies – Online Identities and Social Networking – Concept Discovery and Categorization for Video Searching
Discovering Communities in Social Networks – Recommender Systems.

Suggested Activities:
- Group discussion on the pros and cons of communities in social networks.
- Charting the metrics for evaluating real time online communities.

Suggested Evaluation Methods:
- Group assignment on evaluating real time social network communities.
- Assignment on scenario based comparative analysis of community discovery.
- Open book quizzes on Recommender Systems for specific social networking scenarios.

UNIT IV UNDERSTANDING HUMAN BEHAVIOR IN SOCIAL NETWORKS
Understanding and Predicting Human Behavior for Social Communities – Decentralized Online Social Networks – Multi-Relational Characterization of Dynamic Social Network Communities-Inferential Methods in Social Network Analysis

Suggested Activities:
- User interaction data collection from real time social network applications.
- Comparison of behavior models in social networks using sample data.

Suggested Evaluation Methods:
- Tutorial – Scenarios to identify suitable web accessibility testing.
- Group projects – Use open-source data collection tools and predict user behavior.

UNIT V PRIVACY IN SOCIAL NETWORKS AND VISUALIZATION

Suggested Activities:
- Case studies on applications of social network analysis.
- In-class activities – Network visualization using benchmark data and network visualization tools.

Suggested Evaluation Methods:
- Assignments on chart work for modeling social networks using node-edge diagrams.
- Mini project on applications of social network analysis.

PRACTICAL EXERCISES:
1. Download and install open-source social network analysis tools like UCINET, Net Miner, Smart Network Analyzer, Pajek, Gephi and explore the visualization and analytical features of that tool using sample real world data.
2. Construct any graph representing a real-life social network scenario, feed the same as a matrix input to any tool and explore the graph theoretical metrics of the graph and note down your observations and inferences on those values.

3. Download any RDF schema on tourism and explore various tags in the schema. To analyzing, open them using a Word Editor. Highlight the subject, predicate, and object in each file. If necessary, use the RDF validator service by W3C to obtain the triplets.

4. Download and install any open-source RDF/Ontology editing tool like protégé, Onto Studio, etc. Try the following in that tool: (i) Load existing RDF schema and visualize and (ii) Add, modify, and delete RDF.

5. Do the following using W3C RDF Validator: (i) Enter a URI or paste an RDF/XML document and parse the RDF and (ii) Visualize the RDF/XML as Triples and/or Graph.

6. Download any benchmark FOAF ontology/RDF and study the various FOAF classes used in that RDF/Ontology.

7. Download and install Gephi tool and explore importing graph file formats from (i) Spreadsheet import wizard, (ii) Database import. Also use the statistics and metrics framework in Gephi to calculate the following: Betweenness Centrality, Closeness, Diameter, Clustering Coefficient, Page Rank.

8. Load different social network data into Gephi tool and perform community detection using the features available and also compute the shortest path.

9. Explore various forced layout and random forest algorithms in Gephi tool to create a network layout. Compare the outputs of various layouts algorithms.

10. Study of various bibliometric RDFs and visualization of citation networks.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
1. Convert a social network data into its equivalent graph data and derive social graph metrics.
2. Develop social blogs with necessary tags.
3. Design and develop ontology for various domains.
4. Predict human behavior in social web and related communities using community prediction and mining algorithms.
5. Design and develop trust models for social networks.
6. Visualize social network data and quantify its structural properties.

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DS5015 PREDICTIVE ANALYTICS L T P C
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OBJECTIVES:
- To introduce the concept of Analytics
- To learn data cleaning and processing
- To learn, how to develop models to predict categorical and continuous outcomes
- To apply cluster and principal components analysis to enhance supervised learning
- To apply time series forecasting on models

UNIT I INTRODUCTION TO ANALYTICS
Introduction to Analytics, Analytics in Decision Making, Predictive Analytics in the World – Exploring Structured and Unstructured Data - Complexities of data – Predictive analytics process

Suggested Activities:
- Flipped classroom on decision-making models.
- External learning – Data types and their relevance in predictive analytics

Suggested Evaluation Methods:
- Quiz and discussion on discussion models.
- Quiz on Data types

UNIT II WORKING WITH WORDS AND PIXELS

Suggested Activities:
- Flipped classroom on cleaning images.
• External learning – Unstructured data and its relevance in predictive analytics

Suggested Evaluation Methods:
• Quiz and discussion on textual features.
• Quiz on Image basics

UNIT III TIME SERIES DATA
Additive & Multiplicative models, Exponential smoothing techniques, Forecasting Accuracy, Auto-regressive and moving average models, Arima, Measures of Forecast Accuracy.

Suggested Activities:
• Survey of uses of Times series.
• External learning – Formulation of problems in Forecasting

Suggested Evaluation Methods:
• Quiz on the identification of time series problems.
• Seminar on problem formulation in time series

UNIT IV Development and Evaluation of Predictive model

Suggested Activities:
• Discussion of client/server architecture.
• External learning – Role of Tuning

Suggested Evaluation Methods:
• Quiz on ROC curve.
• Seminar on model performance.

UNIT V Model Deployment
The architecture of a prediction service – Server/Client – Logistic regression service as a case study – Implementing a model with Dash - Iterating through A/B Testing – Deploying model as a web application

Suggested Activities:
• Discussion of web applications.
• External learning – Deploying models

Suggested Evaluation Methods:
• Quiz on web applications
• Quiz on model deployment

PRACTICAL EXERCISES:
1. Using Python programming to explore structured and unstructured data.
2. Write a Python program for share market prediction using time series
3. Write a Python program for text classification
4. Write a Python program for image noise-cleaning
5. Mini Project: Implementation of Logistic regression service

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
1. Understand the process of formulating data objectives, data selection/collection and preparation.
2. Apply the concepts of supervised and unsupervised in prediction.
3. Compare the underlying predictive modelling techniques.
4. To successfully design, build, evaluate and implement predictive models for a given application.
5. Know about the relevance of time series problems
6. Develop a classification application of predictive analytics in Python

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DS5016 CONVERSATIONAL SYSTEMS

OBJECTIVES:
- Enable attendees to acquire knowledge on chatbots and its terminologies
- Work with ML Concepts and different algorithms to build custom ML Model
- Better understand on Conversational experiences and provide better customer experiences
- Know about the relevance of Chatbots
- Know about the conversational systems and Metrics
UNIT I  FUNDAMENTALS OF CONVERSATIONAL SYSTEMS  
Introduction: Overview, Case studies, Explanation about different modes of engagement for a human being, History and impact of AI. Underlying technologies: Natural Language Processing, Artificial Intelligence and Machine Learning, NLG, Speech-To-Text, Text-To-Speech, Computer Vision etc. Introduction to Top players in Market – Google, MS, Amazon & Market trends. Messaging Platforms (Facebook, WhatsApp) and Smart speakers – Alexa, Google Home and other new channels. Ethical and Legal Considerations in AI Overview.

Suggested Activities:
- Understand the concepts of NLP.
- External learning – Understanding the types of roles of Chatbots.

Suggested Evaluation Methods:
- Group discussion on Chatbots.
- Quiz on NLP.

UNIT II  FOUNDATIONAL BLOCKS FOR PROGRAMMING AND NATURAL LANGUAGE PROCESSING

Suggested Activities:
- Understand the concepts of Chatbot using flipped classroom.
- External learning – Understanding the roles of Sentiment analysis.

Suggested Evaluation Methods:
- Group discussion on application of Chatbots.
- Quiz on Sentiment analysis.

UNIT III  BUILDING A CHAT BOT / CONVERSATIONAL AI SYSTEMS

Suggested Activities:
- Understand the concepts of Chatbot framework using flipped classroom.
- External learning – Understanding the testing frameworks.

Suggested Evaluation Methods:
- Group discussion on conversational design tools.
UNIT IV ROLE OF ML/AI IN CONVERSATIONAL TECHNOLOGIES AND CONTACT CENTERS

Brief Understanding on how Conversational Systems uses ML technologies in ASR, NLP, Advanced Dialog management, Language Translation, Emotion/Sentiment Analysis, Information extraction, Introduction to Contact centers – Impact & Terminologies. Case studies & Trends, How does a Virtual Agent/Assistant fit in here?

Suggested Activities:
- Understand the concepts of Chatbot dialog management using flipped classroom.
- External learning – Understanding the emotion/Sentiment analysis.

Suggested Evaluation Methods:
- Group discussion on Chatbot design.
- Quiz on Virtual agents/Assistants.

UNIT V CONVERSATIONAL ANALYTICS AND FUTURE

Conversation Analytics : The need of it - Introduction to Conversational Metrics - Summary, Robots and Sensory Applications overview - XR Technologies in Conversational Systems, XR-Commerce - Future technologies and market innovations overview.

Suggested Activities:
- Flipped classroom for conversational metrics.
- External learning – Understanding the technologies of Chatbots.

Suggested Evaluation Methods:
- Group discussion on Chatbot XR technologies.
- Quiz on conversational metrics

PRACTICAL EXERCISES:
1. A python program to identify morphological features of a word by analysing it.
2. A python program to generate word forms from root and suffix information.
3. A python program to do sentiment analysis for the given dataset and to classify sentences based on their categories.
4. A python program to know the importance of context and size of training corpus in learning Parts of Speech and understand the concept of chunking and get familiar with the basic chunk tag set.
5. A python program to build a Neural Network to recognize handwritten digits using MNIST dataset.
6. Project 1: Case Study to build a learning chatbot
7. Project 2: Case Study to build a ML Model using LSTM/any RNN and integrate with chatbot
8. Project 3: Building a user friendly Chatbot with many features.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
• Familiarize in the NLTK tool kit and the pre-processing techniques of natural language processing.
• Familiarize with the basic technologies required for building a conversational system.
• Build a Chabot for any application and deploy it
• Involve AI in building conversational system and build advanced systems that can be cognitively inclined towards human behaviour.
• Build a real time working conversational system for social domain that can intelligently process inputs and generate relevant replies.
• Implementation of a Chatbot

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DS5017 MOBILE APPS DESIGN DEVELOPMENT

OBJECTIVES:
• To understand the need and characteristics of mobile applications.
• To design the right user interface for mobile applications.
• To understand the design issues in the development of mobile applications.
• To understand the development procedures for mobile applications.
• To develop mobile applications using various tools and platforms.

UNIT I FUNDAMENTALS OF MOBILE APPLICATION DEVELOPMENT


Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
Suggested Activities:
- Flipped classroom on survey on mobile application models.
- External learning - mobile application design using frameworks and tools.

Suggested Evaluation Methods:
- Quiz - questionnaire related to mobile application models.
- Assignment - evaluate the right UI using designing strategies.

UNIT II BACKEND INTEGRATION


Suggested Activities:
- Flipped classroom on discussion on memory constraints for mobile application design.
- External learning - survey on services, native features, and plugins for simple mobile applications.

Suggested Evaluation Methods:
- Quizzes on various API and its usage
- Practical – Programming assignments on REST services.

UNIT III APPLICATION DEVELOPMENT USING REACT NATIVE


Suggested Activities:
- Simple customized form creation.
- Mobile application accessing the database to view the user data.

Suggested Evaluation Methods:
- Evaluation based on the demonstrated application functionality using emulators

UNIT IV APPLICATION DEVELOPMENT USING FLUTTER


Suggested Activities:
- Simple UI creation using Dart
- Mobile application accessing the database to view the user data.

Suggested Evaluation Methods:
- Evaluation based on the demonstrated application functionality using emulators
Communication via the Web – Notification and Alarms – Location Based Services- E-com application- Management application: LMS, text to speech conversion, OCR

Suggested Activities:
- Application accessing Internet for communication like web application.
- Android application accessing GPS for location-based service.

Suggested Evaluation Methods:
- Evaluation based on the demonstrated application functionality using emulators

PRACTICAL EXERCISE:
1. Develop an application that uses GUI components, Font and Colours.
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write a mobile application that creates an alarm clock.
5. Develop an application that makes use of databases.
6. Write an application that makes use of the internet for communication (mobile web app).
7. Develop a native application that uses GPS location information.
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message.
10. Develop a complete E-Commerce mobile application

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the need and characteristic of application development.
2. Choose the right UI that can match the application.
3. Solve the design issues at the time of server connection.
4. Understand the development procedure in various frameworks.
5. Understand and develop native mobile applications.
6. Understand the industrial need and develop mobile applications for various platforms.

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8. Building a mobile application using Flutter: https://youtu.be/x0uinJvhNxl
9. Flutter an overview: https://youtu.be/9XMt2hChbRo
10. A complete mobile application development using Flutter: https://github.com/Jahidul007/Flutter_Roadmap
OBJECTIVES:
- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

UNIT I  INTRODUCTION
Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures, classification, clustering, SVMs, dimensionality reduction - Overview of convex and linear optimization principles

Suggested Activities:
- Install python and explore the packages required for machine learning including NumPy, Pandas, scikit-learn, and matplotlib.
- Practical learning – Implement Data similarity measures.

Suggested Evaluation Methods:
- Quiz on Recommender systems.
- Quiz of python tools available for implementing Recommender systems

UNIT II  CONTENT-BASED RECOMMENDATION SYSTEMS
High-level architecture of content-based systems, Advantages and drawbacks of content-based filtering, Item profiles, discovering features of documents, obtaining item features from tags, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

Suggested Activities:
- Assignment on content-based recommendation systems
- Assignment of learning user profiles

Suggested Evaluation Methods:
- Quiz on similarity-based retrieval.
UNIT III  COLLABORATIVE FILTERING

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, and comparison, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection – Attacks on collaborative recommender systems.

Suggested Activities:
- Practical learning – Implement collaborative filtering concepts
- Assignment of security aspects of recommender systems

Suggested Evaluation Methods:
- Quiz on collaborative filtering
- Seminar on security measures of recommender systems

UNIT IV  ADVANCED TOPICS


Suggested Activities:
- Group Discussion on network aspects of recommender systems
- Study of impact of recommender systems in wireless networks

Suggested Evaluation Methods:
- Quiz on network aspects of recommender systems
- Seminar on selective case studies

UNIT V  APPLICATIONS OF RECOMMENDER SYSTEMS


Suggested Activities:
- Group Discussion on social network aspects of recommender systems
- Study of group recommendation systems

Suggested Evaluation Methods:
- Quiz on recommender systems applications
- Seminar on social recommendations

Quiz of content-based filtering
PRACTICAL EXERCISES

1. Implement Data similarity measures using Python
2. Implement SVM classifier for text documents
3. Implement dimension reduction techniques for recommender systems
4. Implement content-based recommendation systems
5. Implement collaborative filter techniques

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the basic concepts of recommender systems.
2. Implement machine-learning and data-mining algorithms in recommender systems data sets.
3. Implementation of Collaborative Filtering in Carry out performance evaluation of recommender systems based on various metrics.
4. Design and implement a simple recommender system.
5. Learn about advanced topics of recommender systems.
6. Learn about advanced topics of recommender systems applications

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IF5004 CRYPTOGRAPHY AND INFORMATION SECURITY

OBJECTIVES:
- To understand the mathematics behind Cryptography.
- To understand the standard algorithms used to provide confidentiality, Integrity, and authenticity.
- To understand Cryptographic theories and Systems.
- To get a working knowledge of layer wise security to build secure systems.
• To understand necessary approaches and techniques to build protection mechanisms to secure computer networks

UNIT I  INTRODUCTION TO SECURITY AND MATHEMATICAL FOUNDATIONS

Suggested Activities:
• External learning – Evolution of computer systems, identification of benchmarks.
• Demonstration on Cryptool.

Suggested Evaluation Methods:
• Assignment problems on first three activities.
• Quiz on external learning.
• Group discussion on tool demonstration

UNIT II  SYMMETRIC CRYPTOGRAPHY

Suggested Activities:
• External learning – Attacks on DES and AES and Cryptanalysis.
• Practical – Study of various attacks related to symmetric key encryption.

Suggested Evaluation Methods:
• Assignment on problems on cryptographic algorithms.
• Quiz on DES and AES attacks.

UNIT III  ASYMMETRIC KEY CRYPTOGRAPHY

Suggested Activities:
• External learning – Familiarizing with public and private keys in asymmetric cryptography.
• Practical – Verify the message integrity using hashing techniques.

Suggested Evaluation Methods:
• Tutorial – ECC.
• Quiz on various hashing and authentication techniques

UNIT IV  NETWORK SECURITY
Suggested Activities:
- Understand the components of x.509 certificate.
- Demonstration of email security.
- Practical – Experiment with SSL in web server.
- External learning – Understanding how the existing firewalls work and their usages.

Suggested Evaluation Methods:
- Group discussion on demonstration.
- Quiz on layer-wise security protocols

UNIT V  SYSTEM SECURITY


Suggested Activities:
- External learning – Designing trusted OS.
- Case study – Applications that use Blockchain technology.

Suggested Evaluation Methods:
- Group Discussion – various applications that use Block chain technology.
- Group discussion – The need for Ethical Hacking.

PRACTICAL EXERCISES:

1. Write a program to perform encryption and decryption using the following algorithms.
   2. Hill Cipher, Playfair Cipher.
   3. Transposition Cipher.

2. Perform Cryptographic attack on the ciphertext generated using any of the algorithm implemented in exercise 1.

3. Implementation of symmetric cryptographic algorithms such as DES, AES, etc.

4. Implementation of RSA algorithm and demonstration of the key generation and encryption process.

5. Generation of Keys between two end parties using Diffie Hellman Key Exchange.

6. Write a program to generate message digest for the given message using the SHA/MD5 algorithm and verify the integrity of message.

7. Write a program to sign and verify a document using DSA algorithm.

8. Perform Penetration testing on a web application to gather information about the system, then initiate XSS and SQL injection attacks using tools in kali Linux.

9. Hands–on with Software and Hardware firewall configuration and intrusion detection using SNORT

10. Configuring and utilizing network protection components like VPNs, anti–virus software, anti–spyware, etc.
OUTCOMES:
On completion of the course, the students will be able to

- Understand the mathematical background required for Information Security and the Security Models.
- Know about the Symmetric Cryptographic protocols and to analyze them.
- Know about the Public Key Cryptographic protocols, and Key Sharing.
- Apply the various Authentication schemes and to simulate different network security applications.
- Understand various Security practices, System security standards, and state of art technologies like Ethical Hacking, Block chain.
- Design and develop a secure environment for any computing application

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IF5006          SOFT COMPUTING AND ITS APPLICATIONS          L   T   P   C
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OBJECTIVES:

- To learn fuzzy logic, fuzzification and defuzzification.
- To design a soft computing system required to address a computational task.
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.
- To understand the hybrid system to revise the principles of soft computing in various applications
UNIT I  FUZZY COMPUTING

Suggested Activities:
- Practical – Install MATLAB Fuzzy Logic toolbox and ANN toolbox to design and simulate systems.

Suggested Evaluation Methods:
- Quiz on basic concepts of fuzzy logic and operations

UNIT II  FUNDAMENTALS OF NEURAL NETWORKS

Suggested Activities:
- Practical – Develop a supervised model to train neural net that uses the AND/OR/XOR two input binary/bipolar input and output data and learn linear models to understand the importance of initialization parameters

Suggested Evaluation Methods:
- Evaluation of the practical implementation with appropriate input set.

UNIT III  COMPETITIVE NEURAL NETWORKS
Kohenen’s Self Organizing Map–SOM Architecture – Learning procedure – Application – Learning Vector Quantization – Learning by LVQ – Adaptive Resonance Theory – Learning procedure – Applications

Suggested Activities:
- Practical – Develop an unsupervised model to train neural net that uses any dataset and plot the cluster of patterns.

Suggested Evaluation Methods:
- Evaluation of the practical implementation with appropriate input set.

UNIT IV  GENETIC ALGORITHM
Suggested Activities:
- Practical – Implement GA for the Travelling Salesman problem to find the shortest path that visits all cities in a set exactly once.

Suggested Evaluation Methods:
- Implementation evaluation by testing the code on different route maps and checking the optimal solution.

UNIT V HYBRID SYSTEMS

Suggested Activities:
- Practical – Develop adaptive neuro-fuzzy hybrid technique to train NAND gate with two binary and targets and observe the training performance.

Suggested Evaluation Methods:
- Group discussion on developing a hybrid system for solving a problem.
- Evaluation of the practical implementation

PRACTICAL EXERCISES: 30
1. Develop an application that fraud detection systems from data using fuzzy logic.
2. Develop a system to implement Neural Networks techniques to define predictive models for fraud detection.
3. Develop a system that can optimize the solution of the fraud detection system developed by fuzzy logic.
4. Implement Pareto-based approaches to solve MOOPs.
5. Develop a hybrid system by integrating neural networks, fuzzy logic and genetic algorithms for any real time application.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
- Identify and describe soft computing techniques and their roles in building intelligent machines.
- Recognize the feasibility of applying a soft computing methodology for a particular problem.
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- Apply genetic algorithms to optimization problems.
- Design neural networks to pattern classification and regression problems using soft computing approach.
- Describe the importance of tolerance of imprecision and uncertainty to a design of robust and low-cost intelligent machines.
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IF5008 TEXT MINING L T P C
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OBJECTIVES:
- To understand the basic issues and needs of text mining.
- To appreciate the different aspects of text categorization and clustering.
- To understand the role played by text mining in Information retrieval and extraction.
- To appreciate the use of probabilistic models and its principles applicable in text mining.
- To appreciate the current trends in text mining on various systems.

UNIT I INTRODUCTION
Suggested Activities:
- Develop a web application for search engine.
- Tokenize the given text information using any parser.
- Practical – Implement all the preprocessing steps needed for text mining.

Suggested Evaluation Methods:
- Practical assessment may be conducted in laboratory environment to implement any preprocessing steps.

UNIT II TEXT CATEGORIZATION AND CLUSTERING

Suggested Activities:
- Role playing to be carried out for groups of students for the understanding of the working principles of clustering and classification.

Suggested Evaluation Methods:
- Assignment on analyzing the performance of different clustering and classification algorithms and showing the best performance of each algorithm for any specific application.

UNIT III TEXT MINING FOR INFORMATION RETRIEVAL AND INFORMATION EXTRACTION

Suggested Activities:
- In class activity – Name entity and relation extraction using role play game.
- In class activity – Show the working principle of searching technique.

Suggested Evaluation Methods:
- Assignment on developing Flash or animated presentation for explaining the working principles of any one algorithm for information retrieval and extraction.

UNIT IV PROBABILISTIC MODELS
Random Fields.

**Suggested Activities:**
- In-class activity – Document clustering and Information Extraction.
- External learning – Markov models and entropy models.

**Suggested Evaluation Methods:**
- Tutorials – Topic modeling to show its behavior on different data types

**UNIT V  RECENT TRENDS**
9

**Suggested Activities:**
- In-class activity – Visualization Approaches.
- External learning – Understanding text mining applications and case studies.

**Suggested Evaluation Methods:**
- Assignment on extracting the sentiment expressed in the given sentence using opinion word.
- Tutorials – Methodologies available to detect the spam in opinion mining.

**PRACTICAL EXERCISES:**
1. Study Natural Language toolkit (NLTK) and explore the features within that.
2. Study experiment for implement simple text processing operations like character count, word count, stop word removal, etc.,
3. Write a Java program for parsing and tokenizing the given text using NLTK.
4. Write a Java program to implement the named entity recognition and part of speech tagging.
5. Write a Java program to extract the specific pattern for gene – gene and protein – protein interaction information
6. Install RapidMiner and Vega tools and explore the features.
7. Classify any given data set using two classification algorithms using RapidMiner.
8. Clustering the given data set using two clustering algorithms using RapidMiner.
10. Clustering the given data set using two clustering algorithms using Vega Tool

**TOTAL: 75 PERIODS**

**OUTCOMES:**
On completion of the course, the students will be able to
- Identify the different features that can be mined from text and web documents.
- Use available open-source classification and clustering tools on some standard text data sets.
- Modify existing classification/clustering algorithms in terms of functionality or features used.
• Design a system that uses text mining to improve the functions of an existing open-source search engine.
• Implement a text mining system that can be used for an application of your choice.
• Use the opinion mining concepts to extract the sentiment from the large database.

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IF5015 BLOCKCHAIN TECHNOLOGIES

OBJECTIVES:
• To decompose a blockchain system’s fundamental components, how they fit together and examine a decentralization using blockchain.
• To explain how Cryptocurrency works, from when a transaction is created to when it is considered part of the blockchain.
• To explain the components of Ethereum and Programming Languages for Ethereum.
• To study the basics Hyperledger and Web3.
• To provide a detail of alternative blockchain and blockchain projects in different perspective.

UNIT I INTRODUCTION TO BLOCKCHAIN


Suggested Activities:
• External learning - programming to create your own blockchain.
• Flipped classroom on studying blockchain security issues.
Suggested Evaluation Methods:

- Practical assessment to be conducted to evaluate the program for creating blockchain.

UNIT II INTRODUCTION TO CRYPTOCURRENCY


Suggested Activities:

- External learning - creating the Wallets.
- Flipped classroom on showing the tracking process of transaction in Cryptocurrency.

Suggested Evaluation Methods:

- Assignment to be given on Cryptocurrency failures.

UNIT III ETHEREUM


Suggested Activities:

- External learning - For exploring Ethereum tools like Ganache and GO.
- Implement Ethereum development environment.

Suggested Evaluation Methods:

- Practical assessment on developing smart contract on private Blockchain.

UNIT IV WEB3 AND HYPERLEDGER


Suggested Activities:

- Creating and deploying a business network on Hyperledger Composer Playground.
- Implementing Business Network in Blockchain using HyperLedger Fabric.

Suggested Evaluation Methods:

- Practical assessment on developing business network on Hyperledger Fabric.

UNIT V ALTERNATIVE BLOCKCHAINS AND NEXT EMERGING TRENDS

Suggested Activities:
- External learning - blockchain using Multichain.
- Study about blockchain frameworks and business applications

Suggested Evaluation Methods:
- Practical assessment on developing blockchain using Multichain for banking system.

PRACTICAL EXERCISES:
1. Construct the simple blockchain based application to store and retrieve the cryptocurrencies.
2. Create the wallet to send the digital currencies from one account to another account.
4. Develop the environment for Ethereum by using Ganache.
5. Create the nodes on Ethereum blockchain and mine the blockchain.
6. Learn Solidity programming language and develop simple Ethereum based applications.
7. Build the decentralized app and deploy it to provide Ethereum environment.
8. Build a simple application using hyperledger in blockchain environment.
9. Design a smart contract and test it in a Ethereum environment.
10. Develop a blockchain-based applications which is suitable for your online shopping services.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
- Understand the technology components of Blockchain and how it works behind-the-scenes.
- Aware of different approaches to developing decentralized applications.
- Understand the Bitcoin and its limitations by comparing with other alternative coins.
- Establish deep understanding of the Ethereum model, its consensus model, code execution.
- Understand the architectural components of a Hyperledger and its development framework.
- Come to know the Alternative blockchains and emerging trends in blockchain.

REFERENCES:
OBJECTIVES:

- To study the working principles of distributed databases.
- To have an introductory knowledge about the query processing in Object-based databases and its usage.
- To understand the basics of Spatial, temporal and Mobile Databases and their applications.
- To learn emerging databases such as XML, Data warehouse and NoSQL.

UNIT I DISTRIBUTED DATABASES


Suggested Activities:

- Practical - Design of distributed database with fragmentation using any DBMS.
- Flipped classroom on distributed transaction protocols.
- Practical - Writing distributed queries and optimizing the queries.

Suggested Evaluation Methods:

- Evaluation of practical implementation.
- Quizzes on distributed transaction protocols.
- Tutorial - Distributed queries and optimization.

UNIT II NOSQL DATABASES

Suggested Activities:
- Practical - Exploring MongoDB using JAVA/Python/Ruby/PHP.
- Practical - Perform database operations using MongoDB/Cassandra/HYPE.
- Practical - Scenario based query development for database applications

Suggested Evaluation Methods:
- Evaluation of the database operations.
- Tutorial - Scenarios to analyze the need for DB in various applications.
- Quizzes on MongoDB basics.

UNIT III ADVANCED DATABASE SYSTEMS

Suggested Activities:
- Individual/group activities for application specific data handling.
- Discussion about advantages and drawbacks of transaction models for different applications involving spatial-temporal data.

Suggested Evaluation Methods:
- Assignment on application specific data handling.
- Quizzes on different transaction models

UNIT IV XML AND DATAWAREHOUSE

Suggested Activities:
- Flipped classroom on demonstrate the operations on XML data and data warehouse.
- Practical - Use tools to solve data access scenarios

Suggested Evaluation Methods:
- Quizzes on XML data and basics of data warehouse.
- Project demonstration on practical implementation

UNIT V INFORMATION RETRIEVAL AND WEB SEARCH

Suggested Activities:
- Flipped classroom on basics of IR concepts.
- Practical - Evaluation measures of IR.
Suggested Evaluation Methods:
- Quizzes on basic IR concepts.
- Demonstration for practical learning.

PRACTICAL EXERCISES:

1. Create a distributed database using horizontal and vertical fragmentation in any DBMS.
2. Creation of distributed queries using the fragmented data created.
3. Create a document-based database using mongodb and manipulate the data.
4. Create a data warehouse and perform OLAP operations in an unstructured data environment.
5. Create a database to store multimedia elements and perform data retrieval operations.
6. Create a temporal database and explore the usage of temporal queries in it.
8. Given an XML document, traverse the document using DOM and SAX parser.
9. Design a web crawler to extract the information from the websites containing product reviews and classify the reviews as either positive or negative.
10. Create an information retrieval system which processes the corpus of documents and create TF/IDF for the keywords extracted from the documents. Create an inverted index to enable an efficient retrieval process.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
- Design a distributed database system and execute distributed queries.
- Use NoSQL database systems and manipulate the data associated with it.
- Have knowledge on advanced database system concepts.
- Design a data warehouse system and apply OLAP operations.
- Design XML database systems and validating with XML schema.
- Have knowledge on information retrieval concepts and apply it in web databases

REFERENCES:
OBJECTIVES:
- To understand the fundamentals of Internet of Things.
- To build a small low-cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To learn communication protocols that is frequently used in IoT ecosystems.
- To explore the ways of processing enormous amount of data generated in IoT based systems.
- To understand the role of cloud computing in IoT and to become familiar with various cloud offerings.

UNIT I  ENABLING TECHNOLOGIES AND REFERENCE MODELS


Suggested Activities:
- Flipped classroom on enabling technologies.
- External learning – Exploring proprietary protocols used in IoT and M2M.
- Analyzing the required level of design for different IoT based ecosystems.

Suggested Evaluation Methods:
- Quiz and discussion on enabling technologies (WSN, Cloud and Big Data).
- Assignments on proprietary protocols used in IoT and M2M.
- Deciding the level and designing the IoT framework for case studies.

UNIT II  DESIGN OF END DEVICES

Suggested Activities:
- Flipped classroom on open-source movement in hardware and SDLC for embedded systems.
- Explore the variants of Arduino Boards, Atmel Microcontrollers, Cypress Pioneer and NXP Freedom.
- Learning to write Arduino Sketches and Python Programs.

Suggested Evaluation Methods:
- Quiz and discussion on open-source movement in hardware and SDLC for embedded systems.
- Assignments on Arduino boards, Atmel Microcontrollers, Cypress Pioneer and NXP Freedom.
- Practical – Developing Arduino Scripts and Python Programs.

UNIT III IoT PROTOCOLS

MAC Layer Protocols – IEEE 802.15.4 – G And E Variants of IEEE 802.15.4 – IEEE 802.11ah – IEEE 1901.2a – LoRaWAN – 6LoWPAN – From 6LoWPAN to 6Lo – NB IoT – REST Based Protocols – SCADA, CoAP and MQTT

Suggested Activities:
- External learning – Explore various software tools that support Coap and MQTT.
- Flipped classroom on role of Ipv6 in designing IoT based systems.
- Analyze Cisco Reference Model and IBM Reference Models

Suggested Evaluation Methods:
- Assignments on software tools that support Coap and MQTT.
- Quiz and discussion on role of Ipv6 in IoT based systems.
- Assignments on the IoT policy of Meity (Government of India).

UNIT IV DATA ANALYTICS


Suggested Activities:
- External learning – Exploring popular machine learning algorithms (both supervised and unsupervised).
- Flipped classroom on MapReduce programming.
- Learning dataflow programming using open-source software library.

Suggested Evaluation Methods:
- Assignments on supervised, unsupervised and reinforcement algorithms.
- Quiz and discussion on MapReduce programming.
- Group discussion on IoT based Tools libraries and software.
UNIT V CLOUD OFFERINGS


Suggested Activities:
- Flipped classroom on cloud models and type of clouds.
- External learning – Django framework

Suggested Evaluation Methods:
- Quiz and discussion on cloud models and types of clouds.
- Developing web apps for IoT ecosystems using Django framework

PRACTICAL EXERCISES:
1. Develop a BLINK sketch in Arduino.
2. Develop an Arduino sketch that repeats an LED to glow brightly, decrease the brightness, switches off the LED, increases the brightness and LED glows with maximum intensity (a sketch for fading).
3. Develop an Arduino sketch that takes sensor readings for five seconds during the startup and tracks the highest and lowest values it gets. These sensor readings during the first five seconds of the sketch execution define the minimum and maximum of expected values for the readings taken during the loop (a sketch for calibrating a sensor).
4. Develop an Arduino sketch that reads the value of a variable resistor as an analog input and changes blink rate of the LED.
5. Develop an Arduino sketch to use a piezo element to detect the vibration.
6. Develop a Python program to control an LED using Raspberry Pi.
7. Develop a Python program to interface an LED with a switch using Raspberry Pi.
8. Implement a map reduce program that produces a weather data set.
9. Implement an application that stores big data in Hbase/Mongo DB using Hadoop/R.
10. Use Google Collaboration Tools: Create Google Docs, Sheets, and Slides and share it with others.
11. Miniproject.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
- Understand the enabling technologies and reference models of IoT.
- Design portable IoT devices using Arduino IDE/ Raspberry Pi with Python.
- Apply appropriate protocols in various parts of IoT based systems.
- Understand Big Data tools and technologies and apply them in IoT based systems.
- Design and deploy IoT based systems and connect them to cloud offerings.
- Design IoT systems for various real time applications.

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IF5078 DISTRIBUTED AND CLOUD COMPUTING L T P C 3 0 2 4

OBJECTIVES:
- To learn distributed Systems and communication.
- To understand distributed resource management.
- To study the basics of cloud computing.
- To study about virtualization and cloud resource management.

UNIT I INTRODUCTION TO DISTRIBUTED SYSTEM AND COMMUNICATION

Suggested Activities:
- Practical – Implement clock synchronization in distributed system using Lamport’s algorithm.
- Practical – Create and distribute a Torrent file to share a file in LAN environment.

Suggested Evaluation Methods:
- Demonstration and assessment of the working of the implemented algorithm.

UNIT II DISTRIBUTED RESOURCE MANAGEMENT

Attested
Suggested Activities:
- Practical – Implement Election Algorithm.
- Practical – Implement any one deadlock detection Algorithm.

Suggested Evaluation Methods:
- Demonstration and assessment of the working of the implemented algorithm.

UNIT III CLOUD COMPUTING, ARCHITECTURE MODELS AND SERVICES


Suggested Activities:
- Practical – Use Google Collaboration Tools: Create Google Docs, Sheets, and Slides and share it with others.
- Practical – Explore public cloud services including Amazon, Google, Sales force, and Digital Ocean etc.

Suggested Evaluation Methods:
- Quizzes on different service models and deployment models.
- Report submission – Comparison of various services provided by different Cloud Service Provider (Configuration of VM, Cost, Network Bandwidth etc).

UNIT IV CLOUD ENABLING TECHNOLOGIES


Suggested Activities:
- Create a simple web service using Python Flask /Java /any language [Web Service: Client-server model should be implemented using socket/http].
- Install Oracle Virtual Box/Vmware Workstation and Create a blackboard application [Hint: One VM should act as a master and other VMs acts as a listeners, when any content is written by the master VM, the content should be displayed in all the Listener VMs].

Suggested Evaluation Methods:
- Review of the Web Service Implementation: Proper Connection should be established between the client and server to make use of the service offered by the Server.
- Assessment of the workings of installed Virtualization Tools.
• Review the workings of application in virtual environment [Implemented using basic echo and chat concepts].

UNIT V CLOUD MANAGEMENT, SECURITY AND COMPUTING PLATFORMS


Suggested Activities:
• Practical – Use security tools like ACUNETIF, ETTERCAP to scan web applications on the cloud, cloud networks for finding vulnerabilities, verifying leakage of information to an unauthorized third party.
• Practical – Install and configure OpenStack all-in-one using Devstack/Packstack and Launch VMs in OpenStack through dashboard:

Suggested Evaluation Methods:
• Report Submission – A detailed report describing vulnerabilities along with the suitable action that can be taken to remedy the loopholes.
• Evaluation of the practical: OpenStack Dashboard should be accessed through web browser and the working of the instances must be verified by logging in to it/pinging the instance.

PRACTICAL EXERCISES:
1. Connect a minimum of 3 nodes and implement a group chat amongst them.
2. Implement any one of the message ordering algorithms on the previously implemented system.
3. Implement an election algorithm to elect a co-ordinator for the system.
4. Perform clock synchronization on the system, with the co-ordinator node’s time as reference. Create a VM image which has a C compiler along with an operating system and do the following experiments
5. Install Virtualbox with different flavours of linux or windows OS on top of windows 7 or 8.
6. Install Google App Engine/Heroku and run a simple webapp using python/java.
7. Install and run Openstack using Packstack/Devstack
8. Create two VMs in Openstack and exchange data.
9. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim.
10. Install hadoop and manipulate a large dataset and run on Hadoop

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
● Understand the Distributed Computing concepts and appreciate distributed communication
● Describe and implement various distributed resource management techniques and algorithms.
● Articulate the main concepts, key technologies, strengths, and limitations of cloud computing.
● Learn the key and enabling technologies that help in the development of the cloud.
● Explain the core issues of cloud computing such as resource management and security.
● Choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

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IF5085 VIDEO PROCESSING AND ANALYTICS L T P C
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OBJECTIVES:
● To have a better knowledge about video representation and its formats.
● To know the fundamental concepts of data science and analytics.
● To enrich students familiar with video processing tools for analytics.
● To understand the data analytics for processing video content.
● To expose the student to emerging trends in video analytics.
UNIT I VIDEO FUNDAMENTALS

Suggested Activities:
- In-class activity - Numerical problems on sampling and standard conversions.
- Flipped classroom on description about video features.

Suggested Evaluation Methods:
- Assignments on sampling and standard conversions.
- Quiz on video features.

UNIT II MOTION ESTIMATION AND VIDEO SEGMENTATION
Fundamentals of Motion Estimation – Optical flow – 2D and 3D Motion Estimation – Block based point correspondences – Gradient Based Intensity Matching – Feature Matching – Frequency Domain Motion Estimation – Video Segmentation.

Suggested Activities:
- In-class activity - Numerical problems on motion estimation.
- External learning - Survey on optical flow techniques.

Suggested Evaluation Methods:
- Online quiz on optical flow techniques.
- Assignments on numerical problems in motion estimation.

UNIT III FUNDAMENTAL DATA ANALYSIS

Suggested Activities:
- In-class activity - Graphical presentation of data for visualization.
- Flipped classroom on description about analytic processes and tools.

Suggested Evaluation Methods:
- Assignments on data visualization.
- Quiz on questionnaires on analytic tools.

UNIT IV MINING DATA STREAMS AND VIDEO ANALYTICS
Suggested Activities:
- Flipped classroom on discussion on streaming data.
- External learning - Survey on video-based content retrieval.

Suggested Evaluation Methods:
- Quiz on questionnaires on data streams.
- Assignments on video-based content retrieval.

UNIT V  EMERGING TRENDS

Suggested Activities:
- External learning - Survey on Affective Video Content Analysis.
- Flipped classroom on discussion on forensic video analysis

Suggested Evaluation Methods:
- Assignments on affective video content analysis.
- Quiz on questionnaires on forensic video analysis.

PRACTICAL EXERCISES:
1. Choose appropriate features for video segmentation for given sample video.
2. Compute two-dimension motion estimation using block-based match technique.
3. Calculate the motion estimation based on Frequency domain.
4. Compare the video features extracted from a given video dataset using graphical representation.
5. Compute the number of distinct elements found in the given sample data stream.
6. Detect shot boundary for given sample video.
7. Parse the given sample video for indexing and faster retrieval.
8. Generate an automatic video trailer for given sample video.
9. Design simple application using video inpainting technique.
10. Mini project for video categorization based on content analysis.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
- Apply mathematics and basic science knowledge to compute basic video processing functions.
- Compute optical flow and motion estimation
- Implement algorithms and techniques to segment video based on its features.
- Analyze video data to visualize graphically for presentation.
- Solve engineering problems to index and retrieve videos for faster access.
- Develop and design applications for video analytics using current trend.
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IF5087 VISUALIZATION TECHNIQUES

OBJECTIVES:
- To understand the fundamentals of data visualization.
- To know the working principles of various information visualization tools.
- To acquire knowledge about the issues in data representation.
- To visualize the complex engineering design.
- To gain skill in designing real time interactive information visualization system.

UNIT I INTRODUCTION


Suggested Activities:
- Blended Learning - Displaying Different types / visualization images.
- Flipped classroom on task of representing information.
- External learning - Problems related to acquiring data

Suggested Evaluation Methods:
- Tutorial - Different data visualizing images.
- Assignment on different data acquiring methods.
- Quizzes on issues and solutions in different visualization applications.
UNIT II DATA REPRESENTATION


Suggested Activities:
- Blended learning - Human visual and auditory system.
- Flipped classroom on color formats.
- External learning - Survey on different human computer interaction and types of user interface.

Suggested Evaluation Methods:
- Assignment on human visual and auditory system.
- Quizzes on various color format.
- Assignment on human computer interaction user interface.

UNIT III DATA PRESENTATION


Suggested Activities:
- Blended learning - Drawing charts for display.
- Flipped classroom on various presentation techniques.
- External learning-Different font and font styles, symbols and Gesture representation.

Suggested Evaluation Methods:
- Assignment on chart preparation.
- Quizzes on Various presentation techniques.
- Assignment on gesture presentation.

UNIT IV INTERACTION AND DESIGN


Suggested Activities:
- Flipped classroom on various interacting techniques.
- External learning - Interaction facilities and high-level support for animation design.

Suggested Evaluation Methods:
- Tutorial - Interaction models.
- Assignment on animation design.
UNIT V 
CURRENT TRENDS


Suggested Activities:
• External learning - Mini project for designing and implementing a innovative interfaces.
• Flipped classroom on implementation of virtual reality environment.

Suggested Evaluation Methods:
• Demonstration of the mini project.
• Tutorial - Virtual reality application.

PRACTICAL EXERCISES:
1. Creating Interoperable Web Visualization Components using Candela tool.
2. Implementing Line and Stacked charts with Labels and Notes using Datawrapper tool.
4. Use Myheatmap tool to View Geographic Data Interactively.
5. Visualizing TSV, CSV, DSV data using Rawgraph.
8. Visualizing Complex Historical Data using Palladio tool.
10. Implementing a Real Time Application using VTK tool as a mini project.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
• Apply mathematics and basic science knowledge for Computational Support designing.
• Collect data ethically and solve engineering problems in information visualization and representation.
• Conduct experiments by applying various modern visualization tools and solve the space layout problem for presentation.
• Implement algorithms and techniques for interactive information visualization.
• Analyze and design systems to and visualize multidisciplinary multivariate Data individually or in teams.
• Develop a cost effective and a scalable information visualization system.

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**OPEN ELECTIVE COURSES (OEC)**

**OE5091 BUSINESS DATA ANALYTICS**

**OBJECTIVES:**
- To understand the basics of business analytics and its life cycle.
- To gain knowledge about fundamental business analytics.
- To learn modeling for uncertainty and statistical inference.
- To understand analytics using Hadoop and Map Reduce frameworks.
- To acquire insight on other analytical frameworks.

**UNIT I OVERVIEW OF BUSINESS ANALYTICS**

9

**Suggested Activities:**
- Case studies on applications involving business analytics.
- Converting real-time decision-making problems into hypothesis.
- Group discussion on entrepreneurial opportunities in Business Analytics.

**Suggested Evaluation Methods:**
- Assignment on business scenario and business analytical life cycle process.
- Group presentation on big data applications with societal need.
- Quiz on case studies.

**UNIT II ESSENTIALS OF BUSINESS ANALYTICS**

9
Frequency, Mean, Median, Mode, Range, Variance, Standard Deviation, Percentile, Quartile, z-Score, Covariance, Correlation – Data Visualization: Tables, Charts, Line Charts, Bar and Column Chart, Bubble Chart, Heat Map – Data Dashboards.

**Suggested Activities:**
- Solve numerical problems on basic statistics.
- Explore chart wizard in MS Excel Case using sample real time data for data visualization.
- Use R tool for data visualization.

**Suggested Evaluation Methods:**
- Assignment on descriptive analytics using benchmark data.
- Quiz on data visualization for univariate, bivariate data.

**UNIT III MODELING UNCERTAINTY AND STATISTICAL INFERENCE**

**Suggested Activities:**
- Solving numerical problems in sampling, probability, probability distributions and hypothesis testing.
- Converting real-time decision-making problems into hypothesis.

**Suggested Evaluation Methods:**
- Assignments on hypothesis testing.
- Group presentation on real time applications involving data sampling and hypothesis testing.
- Quizzes on topics like sampling and probability.

**UNIT IV ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK**

**Suggested Activities:**
- Practical – Install and configure Hadoop.
- Practical – Use web-based tools to monitor Hadoop setup.
- Practical – Design and develop MapReduce tasks for word count, searching involving text corpus etc.

**Suggested Evaluation Methods:**
- Evaluation of the practical implementations.
- Quizzes on topics like HDFS and extensions to MapReduce.

**UNIT V OTHER DATA ANALYTICAL FRAMEWORKS**
Overview of Application development Languages for Hadoop – PigLatin – Hive – Hive Query
Language (HQL) – Introduction to Pentaho, JAQL – Introduction to Apache: Sqoop, Drill and Spark, Cloudera Impala – Introduction to NoSQL Databases – HBase and MongoDB.

Suggested Activities:
- Practical – Installation of NoSQL database like MongoDB.
- Practical – Demonstration on Sharding in MongoDB.
- Practical – Install and run Pig
- Practical – Write PigLatin scripts to sort, group, join, project, and filter data.
- Design and develop algorithms to be executed in MapReduce involving numerical methods for analytics.

Suggested Evaluation Methods:
- Mini Project (Group) – Real time data collection, saving in NoSQL, implement analytical techniques using Map-Reduce Tasks and Result Projection.

OUTCOMES:
On completion of the course, the student will be able to:
- Identify the real-world business problems and model with analytical solutions.
- Solve analytical problem with relevant mathematics background knowledge.
- Convert any real-world decision-making problem to hypothesis and apply suitable statistical testing.
- Write and demonstrate simple applications involving analytics using Hadoop and MapReduce
- Use open-source frameworks for modeling and storing data.
- Apply suitable visualization technique using R for visualizing voluminous data.

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OBJECTIVES:

- Summarize basics of industrial safety
- Describe fundamentals of maintenance engineering
- Explain wear and corrosion
- Illustrate fault tracing
- Identify preventive and periodic maintenance

UNIT I  INTRODUCTION  9
Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment, and methods.

UNIT II  FUNDAMENTALS OF MAINTENANCE ENGINEERING  9
Definition and aim of maintenance engineering. Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relationship with replacement economy, Service life of equipment.

UNIT III  WEAR AND CORROSION AND THEIR PREVENTION  9

UNIT IV  FAULT TRACING  9
Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal, and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V  PERIODIC AND PREVENTIVE MAINTENANCE  9
Periodic inspection-concept and need, degreasing, cleaning, and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:
1. Ability to summarize basics of industrial safety
2. Ability to describe fundamentals of maintenance engineering
3. Ability to explain wear and corrosion
4. Ability to illustrate fault tracing
5. Ability to identify preventive and periodic maintenance

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OE5093 OPERATIONS RESEARCH

OBJECTIVES:
- Solve linear programming problem and solve using graphical method.
- Solve LPP using simplex method
- Solve transportation, assignment problems
- Solve project management problems
- Solve scheduling problems

UNIT I LINEAR PROGRAMMING
Introduction to Operations Research – assumptions of linear programming problems - Formulations of linear programming problem – Graphical method
UNIT II ADVANCES IN LINEAR PROGRAMMING
Solutions to LPP using simplex algorithm - Revised simplex method - primal dual relationships – Dual simplex algorithm - Sensitivity analysis

UNIT III NETWORK ANALYSIS – I
Transportation problems - Northwest corner rule, least cost method, Voges’s approximation method - Assignment problem - Hungarian algorithm

UNIT IV NETWORK ANALYSIS – II
Shortest path problem: Dijkstra’s algorithms, Floyds algorithm, systematic method - CPM/PERT

UNIT V NETWORK ANALYSIS – III
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:
1. To formulate linear programming problem and solve using graphical method.
2. To solve LPP using simplex method
3. To formulate and solve transportation, assignment problems
4. To solve project management problems
5. To solve scheduling problems

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OBJECTIVES:
- Summarize the costing concepts and their role in decision making
- Infer the project management concepts and their various aspects in selection
- Interpret costing concepts with project execution
- Develop knowledge of costing techniques in service sector and various budgetary control techniques
- Illustrate with quantitative techniques in cost management

UNIT I INTRODUCTION TO COSTING CONCEPTS 9
Objectives of a Costing System; Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost; Creation of a Database for operational control.

UNIT II INTRODUCTION TO PROJECT MANAGEMENT 9
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities, Detailed Engineering activities, Pre project execution main clearances and documents, Project team: Role of each member, Importance Project site: Data required with significance, Project contracts.

UNIT III PROJECT EXECUTION AND COSTING CONCEPTS 9
Project execution Project cost control, Bar charts and Network diagram, Project commissioning: mechanical and process, Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems, Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing.

UNIT IV COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL 9
Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis, Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets.

UNIT V QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT 9
Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:
1. Understand the costing concepts and their role in decision making
2. Understand the project management concepts and their various aspects in selection
3. Interpret costing concepts with project execution
4. Gain knowledge of costing techniques in service sector and various budgetary control techniques
5. Become familiar with quantitative techniques in cost management
REFERENCES:
2. Charles T. Horngren and George Foster, Advanced Management Accounting, 1988

OE5095 COMPOSITE MATERIALS

OBJECTIVES:
1. Summarize the characteristics of composite materials and effect of reinforcement in composite materials.
2. Identify the various reinforcements used in composite materials.
3. Compare the manufacturing process of metal matrix composites.
4. Understand the manufacturing processes of polymer matrix composites.
5. Analyze the strength of composite materials.

UNIT I INTRODUCTION
Definition – Classification and characteristics of Composite materials - Advantages and application of composites - Functional requirements of reinforcement and matrix - Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II REINFORCEMENTS
Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers - Properties and applications of whiskers, particle reinforcements - Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures - Isostrain and Isostress conditions.

UNIT III MANUFACTURING OF METAL MATRIX COMPOSITES

UNIT IV MANUFACTURING OF POLYMER MATRIX COMPOSITES

UNIT V STRENGTH
Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.
OUTCOMES:
Students will be able to:
1. Know the characteristics of composite materials and effect of reinforcement in composite materials.
2. Know the various reinforcements used in composite materials.
3. Understand the manufacturing processes of metal matrix composites.
4. Understand the manufacturing processes of polymer matrix composites.
5. Analyze the strength of composite materials.

REFERENCES:

OBJECTIVES:
1. Interpret the various types of wastes from which energy can be generated
2. Develop knowledge on biomass pyrolysis process and its applications
3. Develop knowledge on various types of biomass gasifiers and their operations
4. Invent knowledge on biomass combustors and its applications on generating energy
5. Summarize the principles of bio-energy systems and their features

UNIT I     INTRODUCTION TO EXTRACTION OF ENERGY FROM WASTE     9
Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT II     BIOMASS PYROLYSIS   9
Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT III     BIOMASS GASIFICATION   9

UNIT IV     BIOMASS COMBUSTION   9
Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.
UNIT V  BIO ENERGY
Properties of biogas (Calorific value and composition), Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production -Urban waste to energy conversion - Biomass energy programme in India.

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:
1. Understand the various types of wastes from which energy can be generated
2. Gain knowledge on biomass pyrolysis process and its applications
3. Develop knowledge on various types of biomass gasifiers and their operations
4. Gain knowledge on biomass combustors and its applications on generating energy
5. Understand the principles of bio-energy systems and their features

REFERENCES:

AUDIT COURSES (AC)
AX5091  ENGLISH FOR RESEARCH PAPERWRITING  2 0 0 0

OBJECTIVES
- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I  INTRODUCTION TO RESEARCH PAPER WRITING  6
Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II  PRESENTATION SKILLS  6
UNIT III  TITLE WRITING SKILLS  6
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, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV  RESULT WRITING SKILLS  6
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

UNIT V  VERIFICATION SKILLS  6
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be

TOTAL: 30 PERIODS

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

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AX5092  DISASTER MANAGEMENT  L T P C
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OBJECTIVES
- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
• Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
• Develop the strengths and weaknesses of disaster management approaches

UNIT I  INTRODUCTION  6
Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II  REPERCUSSIONS OF DISASTERS AND HAZARDS  6

UNIT III  DISASTER PRONE AREAS IN INDIA  6
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 IV  DISASTER PREPAREDNESS AND MANAGEMENT  6
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 V  RISK ASSESSMENT  6
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

TOTAL: 30 PERIODS

OUTCOMES
1. Ability to summarize basics of disaster
2. Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
3. Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
4. Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
5. Ability to develop the strengths and weaknesses of disaster management approaches

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AX5093  SANSKRIT FOR TECHNICAL KNOWLEDGE

OBJECTIVES
1. Illustrate the basic sanskrit language.
2. Recognize sanskrit, the scientific language in the world.
3. Appraise learning of sanskrit to improve brain functioning.
4. Relate sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
5. Extract huge knowledge from ancient literature.

UNIT I  ALPHABETS
Alphabets in Sanskrit

UNIT II  TENSES AND SENTENCES
Past/Present/Future Tense - Simple Sentences

UNIT III  ORDER AND ROOTS
Order - Introduction of roots

UNIT IV  SANSKRIT LITERATURE
Technical information about Sanskrit Literature

UNIT V  TECHNICAL CONCEPTS OF ENGINEERING
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TOTAL: 30 PERIODS

OUTCOMES
1. Understanding basic Sanskrit language.
2. Write sentences.
3. Know the order and roots of Sanskrit.
4. Know about technical information about Sanskrit literature.
5. Understand the technical concepts of Engineering.
REFERENCES
1. “Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-VempatiKutumbashastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

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AX5094
VALUE EDUCATION

OBJECTIVES
1. Understand value of education and self-development
2. Imbibe good values in students
3. Let they should know about the importance of character

UNIT I

UNIT II

UNIT III

UNIT IV

TOTAL: 30 PERIODS
OUTCOMES
Students will be able to
2. Learn the importance of Human values.
3. Developing the overall personality.

Suggested reading

AX5095 CONSTITUTION OF INDIA
L T P C
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OBJECTIVES
1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. 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 nationalism in the early years of Indian nationalism.
3. 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.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION:
History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION:
Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES:

UNIT IV ORGANS OF GOVERNANCE:
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION:

UNIT VI ELECTION COMMISSION:
Election Commission: Role and Functioning, Chief Election Commissioner and Election
Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

OUTCOMES
Students will be able to:
1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. 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.

SUGGESTED READING
1. The Constitution of India,1950(Bare Act),Government Publication.

AX5096

PEDAGOGY STUDIES

OBJECTIVES
1. Review existing evidence on their view topic to inform programme design and policy
2. Making undertaken by the DFLD, other agencies and researchers.
3. Identify critical evidence gaps to guide the development.

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 in-depth 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
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.

TOTAL: 30 PERIODS

OUTCOMES
Students will be able to understand:
1. What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

SUGGESTED READING

AX5097  STRESS MANAGEMENT BY YOGA

OBJECTIVES
1. To achieve overall health of body and mind
2. To overcome stress

UNIT I
Definitions of Eight parts of yoga (Ashtanga)

UNIT II
Yam and Niyam - Do’s and Don’ts in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, bramhacharya and aparigraha.
UNIT III
Asan and Pranayam - Various yog poses and their benefits for mind & body - Regularization of breathing techniques and its effects - Types of pranayam

TOTAL: 30 PERIODS

OUTCOMES
Students will be able to:
- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

SUGGESTED READING
1. ‘Yogic Asanas for Group Training-Part-I”: Janardan Swami Yoga bhyasi Mandal, Nagpur
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

AX5098 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

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

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

UNIT II
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 III
Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter 2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16, 17, 18 - Personality of role model - shrimadbhagwadgeeta - Chapter 2-Verses 17, Chapter 3-Verses 36, 37, 42 - Chapter 4-Verses 18, 38, 39 Chapter 18 – Verses 37, 38, 63

TOTAL: 30 PERIODS

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
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neet is hatakam will help in developing versatile personality of students.

SUGGESTED READING