PROGRAM EDUCATIONAL OBJECTIVES (PEOs):
1. To enable graduates to excel professionally by adapting to the dynamic needs of the industry, academia and research in the field of Information Technology.
2. To enable graduates to practice and promote information technologies for societal needs.
3. To enable graduates to contribute to advancement of information technology by means of research and lifelong learning.

PROGRAM OUTCOMES (POs):
ENGINEERING GRADUATES WILL BE ABLE TO:
1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PROGRAM SPECIFIC OBJECTIVES (PSOs)
1. To analyse, design and develop applications relevant to the industrial needs.
2. To apply software engineering principles and practices for developing quality software for scientific and business applications.
3. To develop programs related to IT services based on open source technologies.

Provide mapping of 1) POs to PEOs and 2) PSOs to PEOs.
Use the following marking:

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MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table:

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OBJECTIVES:
This course is designed to provide the solid foundation on topics in applied probability and various statistical methods which form the basis for many other areas in the mathematical sciences including statistics, modern optimization methods and risk modeling. It is framed to address the issues and the principles of estimation theory, testing of hypothesis and multivariate analysis.

UNIT I PROBABILITY AND 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 – Small and large samples – 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
Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components - Population principal components – Principal components from standardized variables.

TOTAL: 60 PERIODS

OUTCOMES:
After completing this course, students should demonstrate competency in the following topics:

- Basic probability axioms and rules and the moments of discrete and continuous random variables.
- Consistency, efficiency and unbiasedness of estimators, method of maximum likelihood estimation and Central Limit Theorem.
- Use statistical tests in testing hypotheses on data.
- Perform exploratory analysis of multivariate data, such as multivariate normal density, calculating descriptive statistics, testing for multivariate normality.

The students should have the ability to use the appropriate and relevant, fundamental and applied mathematical and statistical knowledge, methodologies and modern computational tools.
REFERENCES:

CP5151 ADVANCED DATA STRUCTURES AND ALGORITHMS L T P C
4 0 0 4

OBJECTIVES:
- To understand the usage of algorithms in computing.
- To learn and use hierarchical data structures and its operations.
- To learn the usage of graphs and its applications.
- To select and design data structures and algorithms that is appropriate for problems.
- To study about NP Completeness of problems.

UNIT I ROLE OF ALGORITHMS IN COMPUTING 12

UNIT II HIERARCHICAL DATA STRUCTURES 12

UNIT III GRAPHS 12

UNIT IV ALGORITHM DESIGN TECHNIQUES 12

UNIT V NP COMPLETE AND NP HARD 12

TOTAL: 60 PERIODS
OUTCOMES:
Upon the completion of the course the student should be able to
- Design data structures and algorithms to solve computing problems.
- Design algorithms using graph structure and various string matching algorithms to solve real-life problems.
- Apply suitable design strategy for problem solving.

REFERENCES:

CP5152 ADVANCED COMPUTER ARCHITECTURE L T P C
3 0 0 3

OBJECTIVES:
- To introduce the students to the recent trends in the field of Computer Architecture and identify performance related parameters.
- To learn the different multiprocessor issues.
- To expose the different types of multicore architectures.
- To understand the design of the memory hierarchy.

UNIT I FUNDAMENTALS OF COMPUTER DESIGN AND ILP 9

UNIT II MEMORY HIERARCHY DESIGN 9

UNIT III MULTIPROCESSOR ISSUES 9
Introduction- Centralized, Symmetric and Distributed Shared Memory Architectures – Cache Coherence Issues – Performance Issues – Synchronization – Models of Memory Consistency – Case Study-Interconnection Networks – Buses, Crossbar and Multi-stage Interconnection Networks

UNIT IV MULTICORE ARCHITECTURES 9
UNIT V VECTOR, SIMD AND GPU ARCHITECTURES


OUTCOMES:
Upon completion of this course, the students should be able to:
- Identify the limitations of ILP.
- Discuss the issues related to multiprocessing and suggest solutions.
- Point out the salient features of different multicore architectures and how they exploit parallelism.
- Discuss the various techniques used for optimising the cache performance.
- Design hierarchical memory system.
- Point out how data level parallelism is exploited in architectures.

REFERENCES:

CP5153 OPERATING SYSTEM INTERNALS L T P C 3 0 0 3

OBJECTIVES:
- To be able to read and understand sample open source programs and header files.
- To learn how the processes are implemented in Linux.
- To understand the implementation of the Linux file system.
- To study Linux memory management data structures and algorithms.
- To acquire the knowledge in the implementation of interprocess communication.
- To understand how program execution happens in Linux.

UNIT I INTRODUCTION
UNIT II          PROCESSES  9
Processes, Lightweight Processes, and Threads - Process Descriptor - State - Identifying a Process -
Relationships among processes - Organization - Resource Limits - Creating Processes - - System
Calls - Kernel Threads - Destroying Processes -Termination - Removal.

UNIT III      FILE SYSTEM  9
The Virtual File System (VFS) - Role - File Model -System Calls - Data Structures - Super Block,
Inode, File, dentry Objects - dentry Cache - Files Associated with a Process - Filesystem Types -
Special Filesystems - Fileysystem Type Registration - Fileysystem Handling - Namespaces - Mounting -
Unmounting - Implementation of VFS System Calls.

UNIT IV    MEMORY MANAGEMENT  9
Page frame management -page descriptors - non-uniform memory access - memory zones - reserved
page frames - zoned page frame allocator - kernel mappings - buddy system algorithm - page frame
cache - zone allocator.

UNIT V    PROCESS COMMUNICATION AND PROGRAM EXECUTION  9
Process Communication - Pipes -Usage - Data Structures - Creating and Destroying a Pipe - Reading
From and Writing into a Pipe.  Program Execution - Executable Files - Process Credentials -
Command-Line Arguments and Shell Environment - Libraries - Program Segments and Process
Memory Regions - Execution tracing - Executable Formats - Execution Domains - The exec Functions

OUTCOMES:
At the end of the course, the student should be able to:
• To explain the functionality of a large software system by reading its source.
• To revise any algorithm present in a system.
• To design a new algorithm to replace an existing one.
• To appropriately modify and use the data structures of the linux kernel for a different software
system.

REFERENCES:
4. Michael Beck, Harald Bohme, Mirko Dziadzka, Ulrich Kunitz, Robert Magnus, Dirk Verworner,
5. Harold Abelson, Gerald Jay Sussman and Julie Sussman,“Structure and Interpretation
OBJECTIVES:
The students should be made to:
- Acquire the knowledge of different programming paradigms.
- Be able to understand the methods of specifying the syntax formally.
- Learn the different data types available in programming languages and understand how the language translators handle the type checking process.
- Study the semantics of the various control structures.
- Understand the design issues for subprograms.
- Learn the different methods of specifying concurrency.
- Acquire knowledge on how the events and exceptions are handled.

UNIT I
INTRODUCTION
9

UNIT II
DATA TYPES, EXPRESSIONS AND CONTROL STRUCTURES
9

UNIT III
SUBPROGRAMS AND OBJECT-ORIENTED PROGRAMMING
9

UNIT IV
CONCURRENCY AND HANDLING OF EXCEPTIONS AND EVENTS
9

UNIT V
FUNCTIONAL AND LOGIC PROGRAMMING
9

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- To explain the concepts of programming languages.
- To compare the different programming paradigms.
- To identify appropriate programming paradigm for designing large software systems.
- To choose appropriately data types and control structures during the implementation of software systems.
REFERENCES:

IF5191 ADVANCED DATABASES

OBJECTIVES:
- To understand the design of databases.
- To acquire knowledge on parallel and distributed databases and its applications.
- To study the usage and applications of Object Oriented and Intelligent databases.
- To understand the emerging databases like Mobile, XML, Cloud and Big Data

UNIT I PARALLEL AND DISTRIBUTED DATABASES

UNIT II INTELLIGENT DATABASES

UNIT III XML DATABASES

UNIT IV MOBILE DATABASES

UNIT V MULTIMEDIA DATABASES

TOTAL :45 PERIODS

OUTCOMES:
Upon successful completion of this course, a student will be able to:
- To develop skills on databases to optimize their performance in practice.
- To analyze each type of databases and its necessity.
- To design faster algorithms in solving practical database problem.
REFERENCES:

CP5161 DATA STRUCTURES LABORATORY L T P C
0 0 4 2

OBJECTIVES:
• To acquire the knowledge of using advanced tree structures.
• To learn the usage of heap structures.
• To understand the usage of graph structures and spanning trees.

LIST OF EXPERIMENTS
Each student has to work individually on assigned lab exercises. Lab sessions could be scheduled as one contiguous four-hour session per week or two two-hour sessions per week. There will be about 15 exercises in a semester. It is recommended that all implementations are carried out in Java. If C or C++ has to be used, then the threads library will be required for concurrency. Exercises should be designed to cover the following topics:

EXPERIMENTS:
1. Implementation of Merge Sort and Quick Sort-Analysis
2. Implementation of a Binary Search Tree
3. Red-Black Tree Implementation
4. Heap Implementation
5. Fibonacci Heap Implementation
6. Graph Traversals
7. Spanning Tree Implementation
8. Shortest Path Algorithms (Dijkstra's algorithm, Bellmann Ford Algorithm)
9. Implementation of Matrix Chain Multiplication
10. Activity Selection and Huffman Coding Implementation.

TOTAL: 60 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
• Design and implement basic and advanced data structures extensively.
• Design algorithms using graph structures
• Design and develop efficient algorithms with minimum complexity using design techniques.
IF5161 DATABASES LABORATORY

OBJECTIVES:
The student should be able:
- To understand the concepts of DBMS.
- To familiarize with SQL queries.
- To write stored procedures in DBMS.
- To learn front end tools to integrate with databases.

EXPERIMENTS IN THE FOLLOWING TOPICS:
1. Data Definition, Manipulation of Tables and Views, Database Querying – Simple queries, Nested queries, Sub queries and Joins.
2. Triggers, Transaction Control.
3. Embedded SQL, Database Connectivity with Front End Tools High level language extensions - PL/SQL Basics, Procedures and Functions.
4. Active Databases, Deductive Databases.
5. Distributed and Parallel Transactions and Query Processing.
7. Object Oriented Database Design.
10. XML Databases and No SQL Database Storage and Retrieval.

TOTAL: 60 PERIODS

OUTCOMES:
Upon completion of this course, the student should be able to:
- Design and Implement databases.
- Formulate complex queries using SQL.
- Design and Implement applications that have GUI and access databases for backend connectivity.

IF5251 SOFTWARE INDUSTRIALIZATION

OBJECTIVES:
The student should be able:
- To point out the need for industrialization in software development
- To understand the non functional requirements in software engineering
- To carry out performance analyses
- To study the various types of scalability
- To acquire the art of capacity planning
- To Understand the techniques for infrastructure management

UNIT I  INDUSTRIALIZATION OF SOFTWARE DEVELOPMENT
The Fragile Hand Weaving – Features Vs Robustness – Components and Services Based Development – Agile and DevOps - Software Factory – Automation
UNIT II NON FUNCTIONAL REQUIREMENTS and ENGINEERING


UNIT III PERFORMANCE and SCALABILITY ENGINEERING


UNIT IV THE ART OF CAPACITY PLANNING


UNIT V PRODUCTION SYSTEMS MANAGEMENT


TOTAL: 45 PERIODS

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

- Understand SOA and DevOps
- Understand the non-functional requirements in software engineering
- Apply various performance analysis techniques
- Analyze software systems for scalability
- Apply capacity planning methods
- Apply infrastructure management techniques

REFERENCES:


IF5201 NETWORK ENGINEERING

OBJECTIVES:

- To provide an introduction to the principles and practices of Network Engineering.
- To understand the architecture of the network devices.
- To learn QoS related methodologies.
- To explore the emerging technologies in network engineering.
UNIT I  FOUNDATIONS OF NETWORKING

UNIT II  QUALITY OF SERVICE

UNIT III  HIGH PERFORMANCE NETWORKS

UNIT IV  NETWORK DEVICE ARCHITECTURE

UNIT V  SOFTWARE DEFINED NETWORKING

TOTAL: 45 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
- Explain the of the principles of network engineering.
- Knowledge of network engineering concepts and techniques.
- Recent development in network engineering

REFERENCES:
OBJECTIVES:
- To understand the fundamentals of Internet of Things.
- To learn about the basics of IOT protocols.
- To build a small low cost embedded system using Raspberry Pi.
- To apply the concept of Internet of Things in the real world scenario.

UNIT I INTRODUCTION TO IoT
Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology.

UNIT II IoT ARCHITECTURE
M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture.

UNIT III IoT PROTOCOLS

UNIT IV BUILDING IoT WITH RASPBERRY PI & ARDUINO

UNIT V CASE STUDIES AND REAL-WORLD APPLICATIONS
Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

OUTCOMES:
Upon completion of the course, the student should be able to:
- Analyze various protocols for IoT
- Develop web services to access/control IoT devices.
- Design a portable IoT using Raspberry Pi
- Deploy an IoT application and connect to the cloud.
- Analyze applications of IoT in real time scenario

REFERENCES:
OBJECTIVES:
- To understand the competitive advantages of big data analytics
- To understand the big data frameworks
- To learn data analysis methods
- To learn stream computing
- To gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

UNIT I   INTRODUCTION TO BIG DATA

UNIT II   HADOOP FRAMEWORK
Distributed File Systems - Large-Scale FileSystem Organization – HDFS concepts - MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN.

UNIT III   DATA ANALYSIS
Statistical Methods:Regression modelling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics – Data analysis using R.

UNIT IV   MINING DATA STREAMS

UNIT V   BIG DATA FRAMEWORKS

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
- Understand how to leverage the insights from big data analytics
- Analyze data by utilizing various statistical and data mining approaches
- Perform analytics on real-time streaming data
- Understand the various NoSql alternative database models
REFERENCES:
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.

CP5281 TERM PAPERWRITING AND SEMINAR

In this course, students will develop the scientific and technical reading and writing skills they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic
2. Stating an objective.
3. Collecting the relevant bibliography (atleast 15 journal papers)
4. Preparing a working outline.
5. Studying the papers and understanding the authors contributions and critically analysing each paper.
6. Preparing a working outline
7. Linking the papers and preparing a draft of the paper.
8. Preparing conclusions based on the reading of all the papers.
9. Writing the Final Paper and giving final Presentation

Activities to be carried Out

<table>
<thead>
<tr>
<th>Activity</th>
<th>Instructions</th>
<th>Submission week</th>
<th>Evaluation</th>
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<tbody>
<tr>
<td>Selection of area of interest and Topic</td>
<td>You are requested to select an area of interest, topic and state an objective</td>
<td>2nd week</td>
<td>3 % Based on clarity of thought, current relevance and clarity in writing</td>
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<tr>
<td>Stating an Objective</td>
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<tr>
<td>Collecting Information about your area &amp; topic</td>
<td>1. List 1 Special Interest Groups or professional society</td>
<td>3rd week</td>
<td>3% (the selected information must be area specific and of international and national standard)</td>
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<tr>
<td></td>
<td>2. List 2 journals</td>
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<td>3. List 2 conferences, symposia or workshops</td>
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<tr>
<td></td>
<td>4. List 1 thesis title</td>
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<td></td>
<td>5. List 3 web presences (mailing lists,</td>
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</table>
| Collection of Journal papers in the topic in the context of the objective – collect 20 & then filter | • You have to provide a complete list of references you will be using. Based on your objective - Search various digital libraries and Google Scholar  
• When picking papers to read - try to:  
  • Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them,  
  • Favour papers from well-known journals and conferences,  
  • Favour “first” or “foundational” papers in the field (as indicated in other people’s survey paper),  
  • Favour more recent papers,  
  • Pick a recent survey of the field so you can quickly gain an overview,  
  • Find relationships with respect to each other and to your topic area (classification scheme/categorization)  
• Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered | 4th week | 6%  
( the list of standard papers and reason for selection) |
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</table>
| Reading and notes for first 5 papers | Reading Paper Process  
• For each paper form a Table answering the following questions:  
• What is the main topic of the article?  
• What was/were the main issue(s) the author said they want to discuss?  
• Why did the author claim it was important?  
• How does the work build on other’s work, in the author's opinion?  
• What simplifying assumptions does the author claim to be making?  
• What did the author do?  
• How did the author claim they were going to evaluate their work and compare it to others?  
• What did the author say were the limitations of their research?  
• What did the author say were the important directions for future research? | 5th week | 8%  
( the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper) |
<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
<th>Week</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading and notes for next 5 papers</td>
<td>Repeat Reading Paper Process</td>
<td>6th</td>
<td>8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)</td>
</tr>
<tr>
<td>Reading and notes for final 5 papers</td>
<td>Repeat Reading Paper Process</td>
<td>7th</td>
<td>8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)</td>
</tr>
<tr>
<td>Draft outline 1 and Linking papers</td>
<td>Prepare a draft Outline, your survey goals, along with a classification / categorization diagram</td>
<td>8th</td>
<td>8% (this component will be evaluated based on the linking and classification among the papers)</td>
</tr>
<tr>
<td>Abstract</td>
<td>Prepare a draft abstract and give a presentation</td>
<td>9th</td>
<td>6% (Clarity, purpose and conclusion)</td>
</tr>
<tr>
<td>Introduction Background</td>
<td>Write an introduction and background sections</td>
<td>10th</td>
<td>5% (clarity)</td>
</tr>
<tr>
<td>Sections of the paper</td>
<td>Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey</td>
<td>11th</td>
<td>10% (this component will be evaluated based on the linking and classification among the papers)</td>
</tr>
<tr>
<td>Your conclusions</td>
<td>Write your conclusions and future work</td>
<td>12th</td>
<td>5% (conclusions – clarity and your ideas)</td>
</tr>
<tr>
<td>Final Draft</td>
<td>Complete the final draft of your paper</td>
<td>13th</td>
<td>10% (formatting, English, Clarity and linking)</td>
</tr>
<tr>
<td>Seminar</td>
<td>A brief 15 slides on your paper</td>
<td>14th &amp; 15th week</td>
<td>10% (based on presentation and Viva-voce)</td>
</tr>
</tbody>
</table>

**TOTAL: 30 PERIODS**
OBJECTIVES:
- To implement MapReduce programs for processing big data
- To realize storage of big data using Hbase, MongoDB
- To analyse big data using linear models
- To analyse big data using machine learning techniques such as SVM / Decision tree classification and clustering

LIST OF EXPERIMENTS:
Hadoop
1. Install, configure and run Hadoop and HDFS
2. Implement word count / frequency programs using MapReduce
3. Implement an MR program that processes a weather dataset
R
4. Implement Linear and logistic Regression
5. Implement SVM / Decision tree classification techniques
6. Implement clustering techniques
7. Visualize data using any plotting framework
8. Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R.

TOTAL: 60 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
- Process big data using Hadoop framework.
- Build and apply linear and logistic regression models.
- Perform data analysis with machine learning methods.
- Perform graphical data analysis.

LIST OF SOFTWARE FOR A BATCH OF 30 STUDENTS:
Hadoop
YARN
R Package
Hbase
MongoDB

REFERENCES:
2. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer Publications, 2015(Corrected 6th Printing)
OBJECTIVES:
- To understand the concepts of virtualization and virtual machines
- To gain expertise in server, network and storage virtualization.
- To understand and deploy practical virtualization solutions and enterprise solutions
- To gain knowledge on the concept of virtualization that is fundamental to cloud computing
- To understand the various issues in cloud computing
- To be able to set up a private cloud
- To understand the security issues in the grid and the cloud environment.

UNIT I VIRTUALIZATION

UNIT II VIRTUALIZATION INFRASTRUCTURE

UNIT III CLOUD PLATFORM ARCHITECTURE

UNIT IV PROGRAMMING MODEL
Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Developing Map Reduce Applications - Design of Hadoop file system – Setting up Hadoop Cluster - Cloud Software Environments - Eucalyptus, Open Nebula, Open Stack, Nimbus

UNIT V CLOUD SECURITY
Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud – Cloud Security and Trust Management

TOTAL :45 PERIODS

OUTCOMES:
Upon Completion of the course, the students should be able to
- Employ the concepts of storage virtualization, network virtualization and its management
- Apply the concept of virtualization in the cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Develop services using Cloud computing
- Apply the security models in the cloud environment
REFERENCES:

CP5191  MACHINE LEARNING TECHNIQUES  L  T  P  C
3  0  0  3

OBJECTIVES:
- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques.
- To study the various probability based learning techniques.
- To understand graphical models of machine learning algorithms.

UNIT I  INTRODUCTION

UNIT II  LINEAR MODELS

UNIT III  TREE AND PROBABILISTIC MODELS

UNIT IV  DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS
UNIT V   GRAPHICAL MODELS

TOTAL: 45 PERIODS

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

- Distinguish between, supervised, unsupervised and semi-supervised learning.
- Apply the apt machine learning strategy for any given problem.
- Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem.
- Design systems that uses the appropriate graph models of machine learning.
- Modify existing machine learning algorithms to improve classification efficiency.

REFERENCES:
OBJECTIVES:
- To understand the fundamentals of Energy Efficient Computing
- To understand the concept of Energy Efficient Storage Systems
- To introduce the various types of scheduling algorithms in energy efficient computing
- To introduce the concept of Green Networking
- To study Energy Aware Computing Applications

UNIT I  INTRODUCTION

UNIT II  ENERGY EFFICIENT STORAGE

UNIT III  ENERGY EFFICIENT SCHEDULING ALGORITHMS

UNIT IV  INTRODUCTION TO GREEN NETWORKING
Power-Aware Middleware for Mobile Applications -Energy Efficiency of Voice-over-IP Systems -Intelligent Energy-Aware Networks - Green TCAM-Based Internet Routers

UNIT V  ENERGY AWARE COMPUTING APPLICATIONS

OUTCOMES:
Upon Completion of the course, the students will be able to
- Design Power efficient architecture Hardware and Software
- Analyze the different types of Energy Efficient Storage systems.
- Design the algorithms for Energy Efficient Systems
- Identify the different types of Green Networking schemes in the energy efficient computing
- Explore the applications of Energy Aware Computing

REFERENCES:
OBJECTIVES:
- To Learn bio-inspired theorem and algorithms
- To Understand random walk and simulated annealing
- To Learn genetic algorithm and differential evolution
- To Learn swarm optimization and ant colony for feature selection
- To understand bio-inspired application in image processing

UNIT I  INTRODUCTION

UNIT II  RANDOM WALK AND ANEALING

UNIT III  GENETIC ALGORITHMS AND DIFFERENTIAL EVOLUTION

UNIT IV  SWARM OPTIMIZATION AND FIREFLY ALGORITHM

UNIT V  APPLICATION IN IMAGE PROCESSING

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- Implement and apply bio-inspired algorithms
- Explain random walk and simulated annealing
- Implement and apply genetic algorithms
- Explain swarm intelligence and ant colony for feature selection
- Apply bio-inspired techniques in image processing.

REFERENCES:
4. Xin-She Yang, "Nature Ispired Optimization Algorithm, Elsevier First Edition 2014
OBJECTIVES:
- To understand the basic concepts and algorithms of digital processing.
- To familiarize the student with the image processing environments like Matlab and its equivalent open source Image processing environments.
- To expose the students to a broad range of image processing techniques and issues and their applications, and to provide the student with practical experiences using them.
- To appreciate the use of image processing in current technologies and to expose the students to real-world applications of the image processing.

UNIT I  FUNDAMENTALS OF IMAGE PROCESSING

UNIT II  IMAGE ENHANCEMENT AND RESTORATION

UNIT III  IMAGE SEGMENTATION AND MORPHOLOGY

UNIT IV  INTRODUCTION TO PATTERN RECOGNITION

UNIT V  IMAGE PATTERN RECOGNITION CASE STUDIES

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course
- The students should be able to implement basic image processing algorithms using MATLAB tools
- Design an application that incorporates different concepts of Image processing
- Apply and explore new techniques in the areas of image enhancement, restoration, segmentation, compression, wavelet processing and image morphology
- critically analyze different approaches to implements mini projects
- Explore the possibility of Applying image processing concepts in various domains
REFERENCES:

CP5095 COMPUTER VISION L T P C
3 0 0 3

OBJECTIVES:
- To review image processing techniques for computer vision
- To understand shape and region analysis
- To understand Hough Transform and its applications to detect lines, circles, ellipses
- To understand three-dimensional image analysis techniques
- To understand motion analysis
- To study some applications of computer vision algorithms

UNIT I IMAGE PROCESSING FOUNDATIONS 9
Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture

UNIT II SHAPES AND REGIONS 9

UNIT III HOUGH TRANSFORM 9

UNIT IV 3D VISION AND MOTION 9
UNIT V    APPLICATIONS

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
- Implement fundamental image processing techniques required for computer vision
- Perform shape analysis
- Implement boundary tracking techniques
- Apply chain codes and other region descriptors
- Apply Hough Transform for line, circle, and ellipse detections
- Apply 3D vision techniques
- Implement motion related techniques
- Develop applications using computer vision techniques

REFERENCES:

MP5091    HUMAN COMPUTER INTERACTION

OBJECTIVES:
- To know how to analyze and consider user’s need in the interaction system
- To understand various interaction design techniques and models
- To understand the theory and framework of HCI
- Understand and analyze the cognitive aspects of human – machine interaction

UNIT I    INTRODUCTION

UNIT II    DESIGN PROCESS
UNIT III IMPLEMENTATION AND EVALUATION PROCESS

UNIT IV MODELS

UNIT V APPLICATIONS
Socio – organization issues and stakeholder requirements - Ubiquitous Computing - Context – aware User Interfaces - Hypertext, multimedia and the World Wide Web

TOTAL : 45 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
- To develop good design for human machine interaction system
- Analyze the user’s need in interaction system
- To design new interaction model to satisfy all types of customers
- Evaluate the usability and effectiveness of various products
- To know how to apply interaction techniques for systems

REFERENCES:

CP5094 INFORMATION RETRIEVAL TECHNIQUES

OBJECTIVES:
- To understand the basics of information retrieval with pertinence to modeling, 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, web search
- To understand the concepts of digital libraries

UNIT I INTRODUCTION: MOTIVATION

UNIT II MODELING
UNIT III  INDEXING  
Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations - Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency

UNIT IV  CLASSIFICATION AND CLUSTERING  
Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering – Matrix decompositions and latent semantic indexing – Fusion and Meta learning

UNIT V  SEARCHING THE WEB  

OUTCOMES:  
Upon completion of this course, the student should be able to
- Build an Information Retrieval system using the available tools
- Identify and design the various components of an Information Retrieval system
- Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval
- Design an efficient search engine and analyze the Web content structure

REFERENCES:  

CP5074  
SOCIAL NETWORK ANALYSIS  
L  T  P  C  
3  0  0  3  
OBJECTIVES:  
- To understand the components of the social Network  
- To model and visualize the social network  
- To mine the users in the w4  
- To understand the evolution of the social Network  
- To know the applications in Real Time Systems

UNIT I  INTRODUCTION  
UNIT II MODELING AND VISUALIZATION

UNIT III MINING COMMUNITIES
Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.

UNIT IV EVOLUTION

UNIT V APPLICATIONS
A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection

OUTCOMES:
Upon Completion of the course, the students will be able to
• Work on the internals components of the social network
• Model and visualize the social network
• Mine the behaviour of the users in the social network
• Predict the possible next outcome of the social network
• Apply social network in real time application.

REFERENCES:
OBJECTIVES:

- Understand system requirements for mobile applications
- Generate suitable design using specific mobile development frameworks
- Generate mobile application design
- Implement the design using specific mobile development frameworks
- Deploy the mobile applications in marketplace for distribution.

UNIT I INTRODUCTION

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications.

UNIT II BASIC DESIGN

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT III ADVANCED DESIGN

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV ANDROID


UNIT V IOS

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

OUTCOMES:

- Describe the requirements for mobile applications
- Explain the challenges in mobile application design and development
- Develop design for mobile applications for specific requirements
- Implement the design using Android SDK
- Implement the design using Objective C and iOS
- Deploy mobile applications in Android and iPhone marketplace for distribution
REFERENCES:

IF5092 VIDEO ANALYTICS

OBJECTIVES:
- To know the fundamental concepts of big data and analytics
- To learn various techniques for mining data streams
- To acquire the knowledge of extracting information from surveillance videos.
- To learn Event Modelling for different applications.
- To understand the models used for recognition of objects in videos.

UNIT I INTRODUCTION TO BIG DATA & DATA ANALYSIS

UNIT II MINING DATA STREAMS

UNIT III VIDEO ANALYTICS

UNIT IV BEHAVIOURAL ANALYSIS & ACTIVITY RECOGNITION

UNIT V HUMAN FACE RECOGNITION & GAIT ANALYSIS

TOTAL: 45 PERIODS
OUTCOMES:
On successful completion of this course, students will be able to:

- Work with big data platform and its analysis techniques.
- Design efficient algorithms for mining the data from large volumes.
- Work with surveillance videos for analytics.
- Design of optimization algorithms for better analysis and recognition of objects in a scene.
- Model a framework for Human Activity Recognition

REFERENCES:

IF5002 DEEP LEARNING L T P C
3 0 0 3

OBJECTIVES:
This course covers the basics of machine learning, neural networks and deep learning. Model for deep learning technique and the various optimization and generalization mechanisms are included. Major topics in deep learning and dimensionality reduction techniques are covered. The objective of this course is:

- To present the mathematical, statistical and computational challenges of building neural networks
- To study the concepts of deep learning
- To introduce dimensionality reduction techniques
- To enable the students to know deep learning techniques to support real-time applications
- To examine the case studies of deep learning techniques

UNIT I INTRODUCTION 9
Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT II DEEP NETWORKS 9

UNIT III DIMENTIONALITY REDUCTION 9
Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization
UNIT IV  OPTIMIZATION AND GENERALIZATION  9

UNIT V  CASE STUDY AND APPLICATIONS  9
Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection-BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- Understand basics of deep learning
- Implement various deep learning models
- Realign high dimensional data using reduction techniques
- Analyze optimization and generalization in deep learning
- Explore the deep learning applications

REFERENCES:

IF5003 AUTOMATA THEORY AND FORMAL LANGUAGES  L T P C  3 0 0 3

OBJECTIVES:
- To know the formal relationships between machines, languages and grammar.
- To construct automata for any given word pattern and find its equivalent regular expressions
- To design grammars for recognizing the syntax of any given language
- To understand the need for designing Turing machines and their capability
- To have the capability to solve un-decidable problems and NP problems

UNIT I  REGULAR EXPRESSIONS AND LANGUAGES  9
Introduction to Formal Proof – Additional Forms of proof – Inductive proofs – Proof by Contradiction - Regular Expressions – Regular and Non Regular Languages - Closure Properties of Regular Languages - Proving Languages Not to Be Regular - Decision Properties of Regular Languages.

UNIT II  AUTOMATA  9

UNIT III  CONTEXT-FREE GRAMMARS AND LANGUAGES  9
UNIT IV  PUSHDOWN AUTOMATA AND TURING MACHINES  9

UNIT V  UNDECIDABILITY  9
Not Recursively Enumerable Language – Recursively Enumerable Undecidable problem– Undecidable Problems about Turing Machines – Post’s Correspondence Problem - The classes P and NP - NP-complete problems.

OUTCOMES:
Upon completion of the course, the students will be able to:
- Construct automata for a language and regular expression for any pattern.
- Write Context free grammar for any construct and perform syntax analysis.
- Design Push down automata for any language and solve problems
- Propose computation solutions using Turing machines.
- Derive whether a problem is decidable or not.

REFERENCE S:

IF5071  GPU ARCHITECTURE AND PROGRAMMING  L T P C
3 0 0 3

OBJECTIVES:
- To understand the architecture of GPUs in order to program them effectively.
- To program using GPU programming frameworks.
- To optimize multimedia applications to run on GPUs.

UNIT I  GPU ARCHITECTURES  9

UNIT II  GPU COMPUTING AND CUDA  9
Introduction – Parallel Programming Languages and models – Evolution of Graphic pipelines – GPGPUs - CUDA Program Structure – Device memories – Data Transfer – Kernel Functions

UNIT III  CUDA DETAILS  9
CUDA Threads – Thread Organization – Synchronization & Scalability – CUDA memories – Performance – Imaging Case study
UNIT IV OPENCL BASICS

UNIT V OPENCL CONCURRENCY & EXECUTION MODEL
OpenCL Synchronization – Kernels – Fences – Barriers – Queueing – Global Synchronization – Memory Consistency – Events – Host side memory model – Device Side memory Model – Case study

OUTCOMES:
At the end of the course, the student will be able to
- Design multimedia applications using GPUs.
- Write Programs for GPUs using CUDA / OpenCL.
- Optimize programs to run on massively parallel architectures.

REFERENCES:

IF5004 CYBER FORENSICS

OBJECTIVES:
- To study the fundamentals of computer forensics.
- To have an overview of techniques for Data Recovery and Evidence Collection.
- To study various threats associated with security and information warfare.
- To study the tools and tactics associated with cyber forensics.

UNIT I INTRODUCTION

UNIT II COMPUTER FORENSICS EVIDENCE AND CAPTURE

UNIT III COMPUTER FORENSIC ANALYSIS
UNIT IV INFORMATION WARFARE
Arsenal – Surveillance Tools- Hackers and Theft of Components- Contemporary computer Crime
Identity Theft and Identity Fraud-Organized Crime & Terrorism Avenues Prosecution and Government
Efforts- Applying the First Amendment to Computer Related Crime-The Fourth Amendment and Other
Legal Issues.

UNIT V COMPUTER FORENSIC CASES
Developing Forensic Capabilities- Searching and Seizing Computer Related Evidence-Processing

OUTCOMES:
Upon Completion of the course, the students should be able to
- To apply the concepts of computer forensics.
- To handle threats associated with security and information warfare.
- To design tools and tactics associated with cyber forensics.

REFERENCES:
Learning, 2005.
2013

IF5005 TRUST NETWORKS

OBJECTIVES:
- To understand trust networks
- To learn how decentralization of trust is achieved
- To study the technologies behind cryptocurrencies
- To impart knowledge in block chain network mining
- To acquire knowledge in emerging concepts using block chain

UNIT I TRUST NETWORKS
Technical and Business Imperatives – Trust Networks to enable the machine economy –
Decentralization of Trust – Technologies Blockchain and Crypto currency

UNIT II DECENTRALIZATION OF NETWORK
Centralization Vs Decentralization – Building Consensus – Distributed Consensus – Consensus
Algorithm – Consensus without Identity- Incentives and Proof of Work –Forming the Decentralized
Network

UNIT II BLOCKCHAIN
Blockchain the protocol – Types of Blockchain Networks – Design principles of the Blockchain
economy – Networked Integrity – Distributed power – Value as Incentive – Security and Privacy –
Rights and Inclusion – Distributed Ledger – Non Repudiation
UNIT III  CRYPTOCURRENCIES  9

UNIT IV  BLOCKCHAIN NETWORK MINING  9
Bitcoin Mining – Mining Hardware – Energy Consumption – Mining Pools – Mining Incentives and Strategies

UNIT V  EMERGING CONCEPTS AND FRAMEWORKS  9
Smart Contracts – Ethereum, Hyperledger, Multichain Frameworks – Solidity Programming Language – Blockchain with IOT and Cloud

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course the students will be able to:

- Realize the importance of trust networks
- Comprehend the challenges and design issues in bitcoin technology
- Analyze the algorithms developed for bitcoin mining
- Use appropriate techniques for designing trust-based business networks

REFERENCES:

CU5097  WIRELESS ADHOC AND SENSOR NETWORKS  L T P C  3 0 0 3

OBJECTIVES:
- To understand the basics of Ad-hoc & Sensor Networks.
- To learn various fundamental and emerging protocols of all layers.
- To study about the issues pertaining to major obstacles in establishment and efficient management of Ad-hoc and sensor networks.
- To understand the nature and applications of Ad-hoc and sensor networks.
- To understand various security practices and protocols of Ad-hoc and Sensor Networks.

UNIT I  MAC & TCP IN AD HOC NETWORKS  9

UNIT II  ROUTING IN AD HOC NETWORKS  9
UNIT III  MAC, ROUTING & QOS IN WIRELESS SENSOR NETWORKS


UNIT IV  SENSOR MANAGEMENT


UNIT V  SECURITY IN AD HOC AND SENSOR NETWORKS


TOTAL : 45 PERIODS

OUTCOMES:
 Upon Completion of the course, the students should be able to:

- Identify different issues in wireless ad hoc and sensor networks.
- To analyze protocols developed for ad hoc and sensor networks.
- To identify and address the security threats in ad hoc and sensor networks.
- Establish a Sensor network environment for different type of applications.

REFERENCES:

OBJECTIVES:
The student should be able to
- To understand the mathematics behind Cryptography.
- To understand the standard algorithms used to provide confidentiality, integrity and authenticity.
- To get the knowledge of various security practices applied in the field of information technology

UNIT I  FUNDAMENTALS AND MATHEMATICS OF CRYPTOGRAPHY

UNIT II  ENCRYPTION TECHNIQUES

UNIT III  HASH FUNCTIONS AND SIGNATURES

UNIT IV  NETWORK SECURITY

UNIT V  SYSTEM SECURITY

OUTCOMES :
Upon completion of this course, the student will:
- Analyze the basic security algorithms required by any computing system.
- Predict the vulnerabilities across any computing system.
- Design a security solution for any computing system.

REFERENCES :
OBJECTIVES:
- To introduce the idea of design thinking in product development
- To understand the practice of design thinking
- To leverage use of tools for the design process
- To learn the application of design thinking for the IT industry
- To design using the methodology

UNIT I  INTRODUCTION  9
Understanding Design thinking – Shared model in team based design – Theory and practice in Design thinking – Exploring work of Designers across globe – MVP or Prototyping

UNIT II  9
Tools for Design Thinking – Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design

UNIT III  Design Thinking in IT  9
Design Thinking to Business Process modeling – Agile in Virtual collaboration environment – Scenario based Prototyping

UNIT IV  9

UNIT V  9
Design Thinking Work shop Empathize, Design, Ideate, Prototype and Test.
http://dschool.stanford.edu/dgift/
Follow the above link to conduct workshop

OUTCOMES:
Upon completion of the course the students will be able to:
- Apply design thinking for product development
- Use design thinking tools
- Identify need for products and disruption
- Design innovative products
- Apply design thinking to improve on existing products in IT
- Facilitate design thinking workshop

TOTAL : 45 PERIODS

REFERENCES:
IF5007 FORECASTING AND OPTIMIZATION

OBJECTIVES:
- To provide a comprehensive introduction of the forecasting methods
- To study the various regression models and perform forecasting
- To understand the autoregressive models and its variants for forecasting
- To get an overview of various numerical methods of optimization
- To get an insight into advanced optimization techniques.

UNIT I INTRODUCTION TO FORECASTING


UNIT II REGRESSION ANALYSIS AND FORECASTING


UNIT III AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) AND OTHER MODELS


1. http://www.creativityatwork.com/design-thinking-strategy-for-innovation/
2. https://www.nngroup.com/articles/design-thinking/
3. https://designthinkingforeducators.com/design-thinking/
UNIT IV  NUMERICAL METHODS OF OPTIMIZATION

UNIT V  ADVANCED OPTIMIZATION TECHNIQUES AND ASPECTS OF OPTIMIZATION

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the student will:
- Identify the types of forecasting techniques
- Perform time series modeling and forecasting
- Evaluate the performance of forecasting models
- Perform regression analysis using different regression models
- Distinguish and identify a suitable numerical method of optimization
- Discuss the concept of advanced optimization techniques using soft computing techniques and apply them to various problems.

REFERENCES:
2. George Athanasopoulos and Rob J. Hyndman, “Forecasting: Principles and Practice”. O texts, WWW. otexts.org