1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Graduates will be able to:

I. Apply their computing skills to analyse, design and develop innovative software products to meet the industry needs and excel as software professionals.

II. Pursue lifelong learning and do research in the computing field based on solid technical foundations.

III. Communicate and function effectively in teams in multidisciplinary fields within the global, societal and environmental context.

IV. Exhibit professional integrity, ethics and an understanding of responsibility to contribute technical solutions for the sustainable development of society.

2. PROGRAM OUTCOMES (POs)

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. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

4. Able to select suitable data models, appropriate architecture, and platform to implement a system with good performance.

5. Able to design and integrate various system based components to provide user interactive solutions for various challenges.

6. Able to develop applications for real time environments using existing and upcoming technologies.

PEO/PO Mapping:

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(3-High, 2-Medium, 1-Low)
# MAPPING OF COURSE OUTCOMES AND PROGRAMME OUTCOMES

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# ANNA UNIVERSITY, CHENNAI
## NON-AUTONOMOUS AFFILIATED COLLEGES
### MASTER OF COMPUTER APPLICATIONS (2 YEARS)
#### REGULATIONS – 2021
##### CHOICE BASED CREDIT SYSTEM
###### I TO IV SEMESTERS CURRICULA AND SYLLABI

#### SEMESTER I

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*Audit course is optional

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### AUDIT COURSES (AC)

Registration for any of these courses is optional to students

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BRIDGE COURSES
(For the M.C.A students admitted under non-computer-science background category)

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Classes are to be conducted and completed before the start of the class of second semester,
Examinations will be conducted along with second semester

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Examinations will be conducted along with third semester

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### RESEARCH METHODOLOGY AND IPR COURSES (RMC)

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### SUMMARY

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COURSE OBJECTIVES:
- To encourage students to develop a working knowledge of the central ideas of Linear Algebra.
- To enable students to understand the concepts of Probability and Random Variables.
- To understand the basic probability concepts with respect to two dimensional random variables along with the relationship between the random variables and the significance of the central limit theorem.
- To apply the small / large sample tests through Tests of hypothesis.
- To enable the students to use the concepts of multivariate normal distribution and principal components analysis.

UNIT I LINEAR ALGEBRA

UNIT II PROBABILITY AND RANDOM VARIABLES

UNIT III TWO DIMENSIONAL RANDOM VARIABLES
Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression curve – Correlation.

UNIT IV TESTING OF HYPOTHESIS
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
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

COURSE OUTCOMES:
At the end of the course, students will be able to
- apply the concepts of Linear Algebra to solve practical problems.
- use the ideas of probability and random variables in solving engineering problems.
- be familiar with some of the commonly encountered two dimension random variables and be equipped for a possible extension to multivariate analysis.
- use statistical tests in testing hypothesis on data.
- develop critical thinking based on empirical evidence and the scientific approach to knowledge development.
REFERENCES:

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RM4151 RESEARCH METHODOLOGY AND IPR

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UNIT I RESEARCH DESIGN
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS
UNIT V PATENTS


TOTAL: 30 PERIODS

REFERENCES:

Course Outcomes:
At the end of this course, the students will have the ability to
1. Formulate and Design research problem
2. Understand and Comprehend the Data Collection Methods
3. Perform Data analysis and acquire Insights
4. Understand IPR and follow research ethics
5. Understand and Practice Drafting and filing a Patent in research and development

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MC4101 ADVANCED DATA STRUCTURES AND ALGORITHMS L T P C 3 0 0 3

COURSE 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 & COMPLEXITY ANALYSIS

Algorithms – Algorithms as a Technology , Time and Space complexity of algorithms - Asymptotic analysis-Average and worst-case analysis-Asymptotic notation-Importance of efficient algorithms- Program performance measurement - Recurrences: The Substitution Method – The Recursion-
Tree Method - Data structures and algorithms.

UNIT II HIERARCHICAL DATA STRUCTURES


UNIT III GRAPHS


UNIT IV ALGORITHM DESIGN TECHNIQUES


UNIT V NP COMPLETE AND NP HARD


TOTAL : 45 PERIODS

SUGGESTED ACTIVITIES:
1. Write an algorithm for Towers of Hanoi problem using recursion and analyze the complexity (No of disc-4)
2. Write any one real time application of hierarchical data structure
3. Write a program to implement Make_Set, Find_Set and Union functions for Disjoint Set Data Structure for a given undirected graph G(V,E) using the linked list representation with simple implementation of Union operation
4. Find the minimum cost to reach last cell of the matrix from its first cell
5. Discuss about any NP completeness problem

COURSE OUTCOMES:
CO1: Design data structures and algorithms to solve computing problems.
CO2: Choose and implement efficient data structures and apply them to solve problems.
CO3: Design algorithms using graph structure and various string-matching algorithms to solve real-life problems.
CO4: Design one’s own algorithm for an unknown problem.
CO5: Apply suitable design strategy for problem solving.

REFERENCES

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**MC4102 OBJECT ORIENTED SOFTWARE ENGINEERING**

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**COURSE OBJECTIVES:**
- To understand the phases in object oriented software development
- To gain fundamental concepts of requirements engineering and analysis.
- To know about the different approach for object oriented design and its methods
- To learn about how to perform object oriented testing and how to maintain software
- To provide various quality metrics and to ensure risk management.

**UNIT I SOFTWARE DEVELOPMENT AND PROCESS MODELS**


**UNIT II MODELING OO SYSTEMS**


**UNIT III DESIGN PATTERNS**

UNIT IV    SYSTEM TESTING

UNIT V    SOFTWARE QUALITY AND METRICS

SUGGESTED ACTIVITIES:
1. Discuss the different phases in any domain like Health Monitoring System using extreme programming
2. Describe Business Requirement Specification (BRS) and SRS (Software Requirement Specification) for any Project like Automatic Intelligent Plant Watering System .using any one of requirement analysis tool
3. Identify the classes , relationship between classes and draw standard UML diagrams using any one UML modeling tool (eg: ArgoUML that supports UML 1.4 and higher)
4. for a system (eg: Conference Management System, student management system)
5. Test the above UML for all the scenarios identified using Selenium /JUnit / Apache JMeter
6. Perform COCOMO estimation for Book Management System to find effort and development time considering all necessary cost estimation factors. (Use GanttPRO Software for estimation)

COURSE OUTCOMES:
On completion of the course the student would be able to :
CO1: Design object oriented software using appropriate process models.
CO2: Differentiate software processes under waterfall and agile methodology.
CO3: Design and Develop UML diagrams for software projects.
CO4: Apply Design Patterns for a software process.
CO5: Categorize testing methods and compare different testing tools for software processes.
CO6: Analyze object oriented metrics and quality for software engineering processes.

TOTAL: 45 PERIODS

REFERENCES:
4. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen,


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MC4103 PYTHON PROGRAMMING L T P C 3 0 0 3

COURSE OBJECTIVES:
- To develop Python programs with conditionals, loops and functions.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python.
- To use modules, packages and frameworks in python.
- To define a class with attributes and methods in python.

UNIT I BASIC OF PYTHON 9

UNIT II DATA TYPES IN PYTHON 9

UNIT III FILE HANDLING AND EXCEPTION HANDLING 8
Files: Introduction – File Path – Opening and Closing Files – Reading and Writing Files –File Position –Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions

UNIT IV MODULES, PACKAGES AND FRAMEWORKS 10
UNIT V  OBJECT ORIENTED PROGRAMMING IN PYTHON

Creating a Class, Class methods, Class Inheritance, Encapsulation, Polymorphism, class method vs. static methods, Python object persistence.

SUGGESTED ACTIVITIES:
1. Display a multiplication Table Both players are given the same string, S; Both players have to make substrings using the letters of the string S.
2. Player A has to make words starting with consonants. Player B has to make words starting with vowels. The game ends when both players have made all possible substrings. Do Scoring
3. Write a function definition for JTOI() in Python that would display the corrected version of entire content of the file .TXT (has wrongly alphabet J in place of alphabet I) with all the alphabets "J" to be displayed as an alphabet "I" on screen.
4. Consider a CSV file of profit of 10 items in monthly sales of a year. Read this file using Pandas or NumPy or using the in-built matplotlib function. Perform the following task.
5. Read Total profit of all months and show it using a line plot
   Read all product sales data and show it using a multi-line plot
   Read each item sales data of each month and show it using a scatter plot
   Read each item product sales data and show it using the bar chart
   Read sales data of bathing soap of all months and show it using a bar chart. Calculate total sale data an year for each product and show it using a Pie chart
6. Create a Python class called Bank Account which represents a bank account, having as attributes: account Number (numeric type), name (name of the account owner as string type), balance. Create a constructor with parameters: account Number, name, balance. Create a Deposit() method which manages the deposit actions. Create a Withdrawal() method which manages withdrawals actions

COURSE OUTCOMES:
On completion of the course the student would be able to:
CO1: Develop algorithmic solutions to simple computational problems
CO2: Represent compound data using Python lists, tuples and dictionaries.
CO3: Read and write data from/to files in Python Programs
CO4: Structure simple Python programs using libraries, modules etc.
CO5: Structure a program by bundling related properties and behaviors into individual objects.

TOTAL : 45 PERIODS

REFERENCES
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**MC4104**  
**FUNDAMENTALS OF ACCOUNTING**  
**L T P C**  
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**COURSE OBJECTIVES:**
- To understand the basic principles of Accounting
- To understand the Double entry system and the preparation of ledger.
- To understand the process and importance of the electronic accounting system.
- To Prepare the estimate for various business activities such as purchase, sale, production and cash budgets
- To ensure the decision making process of an organization.

**UNIT I  INTRODUCTION TO ACCOUNTING**

Introduction to Financial, Cost and Management Accounting - Objectives of Financial Accounting – Accounting Principles, Concepts and Conventions – Bookkeeping and Accounting  
Practical exercise session using Tally:  
1. Company Creation, Creating Groups  
2. Creation of Ledgers and Vouchers

**UNIT II  MANAGEMENT ACCOUNTING AND BOOKKEEPING**

Practical exercise session using Tally.:  
1. Creating Contra, Journals, Credit and Debit Notes  
2. Preparing Trial Balance and Final Accounts

**UNIT III  BUDGETS AND BUDGETARY CONTROL**

Budgets and Budgetary Control-Meaning-Types-Sales Budget-Production Budget-Cost of Production Budget-Flexible Budgeting-Cash Budget-Master Budget-Zero Base Budgeting-Computerized Accounting – with adjustments  
Practical sessions using Advanced tools in MS-Excel:  
1. Preparing Revenue Management and Portfolio Selection
UNIT IV     FINANCIAL MANAGEMENT
Practical exercise session using Tally.:  
1. Preparing Inventory Creation, Purchase order, Sales Order  
2. Preparing Sales Journal, Rejections, Delivery Note.

UNIT V     BANK RECONCILIATION STATEMENT AND REPORTING
Preparing Bank Reconciliation Statement (simple problems) – Insurance Claim – Average Clause - Export and Import of Data, Data Security,
Practical exercise session using Tally.:  
1. Preparing the Bank Reconciliation Statement  
2. Preparing the Trading, Profit And Loss Account and Trial Balance

TOTAL : 75 PERIODS

COURSE OUTCOMES:
On completion of the course the student would be able to :  
CO1. Able to understand the basic concepts of Accounting standards.  
CO2. Able to understand the process of maintaining Accounts in an organization  
CO3. Helps to understand and calculating the financial position of an organization  
CO4. Helps to understand Financial Management concepts and its components  
CO5. It helps to understand the importance of BRS and generation of various financial reports

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COURSE 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
- To understand the problems such as matrix chain multiplication, activity selection and Huffman coding
- To understand the necessary mathematical abstraction to solve problems.

LIST OF EXPERIMENTS:
1: Implementation of recursive function for tree traversal and Fibonacci
2: Implementation of iteration function for tree traversal and Fibonacci
3: Implementation of Merge Sort and Quick Sort
4: Implementation of a Binary Search Tree
5: Red-Black Tree Implementation
6: Heap Implementation
7: Fibonacci Heap Implementation
8: Graph Traversals
9: Spanning Tree Implementation
10: Shortest Path Algorithms (Dijkstra's algorithm, Bellman Ford Algorithm)
11: Implementation of Matrix Chain Multiplication
12: Activity Selection and Huffman Coding Implementation

HARDWARE/SOFTWARE REQUIREMENTS
1: 64-bit Open source Linux or its derivative
2: Open Source C++ Programming tool like G++/GCC

TOTAL : 60 PERIODS

COURSE OUTCOMES:
CO1: Design and implement basic and advanced data structures extensively
CO2: Design algorithms using graph structures
CO3: Design and develop efficient algorithms with minimum complexity using design techniques
CO4: Develop programs using various algorithms.
CO5: Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.

REFERENCES:
MC4112  PYTHON PROGRAMMING LABORATORY  L T P C  0 0 4 2

COURSE OBJECTIVES:
- Develop Python programs with conditionals, loops and functions
- Represent compound data using Python lists, tuples, dictionaries
- Read and write data from/to files in Python
- Implement NumPy, Pandas, Matplotlib libraries
- Implement object oriented concepts

LIST OF EXPERIMENTS:
Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines.
1. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
2. Scientific problems using Conditionals and Iterative loops.
3. Linear search and Binary search
4. Selection sort, Insertion sort
5. Merge sort, Quick Sort
6. Implementing applications using Lists, Tuples.
7. Implementing applications using Sets, Dictionaries.
8. Implementing programs using Functions.
9. Implementing programs using Strings.
10. Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, scipy)
11. Implementing real-time/technical applications using File handling.
12. Implementing real-time/technical applications using Exception handling.
13. Creating and Instantiating classes

HARDWARE/SOFTWARE REQUIREMENTS
1: Processors: Intel Atom® processor Intel®Core™i3 processor
2: Disk space: 1GB.
3: Operating systems: Windows 7, macOS and Linux
4: Python versions: 2.7, 3.6, 3.8
COURSE OUTCOMES:
On completion of the laboratory course, the student should be able to
CO1: Apply the Python language syntax including control statements, loops and functions to solve a
wide variety of problems in mathematics and science.
CO2: Use the core data structures like lists, dictionaries, tuples and sets in Python to store, process and
sort the data.
CO3: Create files and perform read and write operations.
CO4: Illustrate the application of python libraries.
CO5: Handle exceptions and create classes and objects for any real time applications.

REFERENCES:
3. David M. Beazley “Python Essential Reference”. Addison-Wesley Professional; Fourth edition,
   2009.
4. David M. Baezly “Python Cookbook” O’Reilly Media; Third edition (June 1, 2013).

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MC4113 COMMUNICATION SKILLS ENHANCEMENT – I

COURSE OBJECTIVES:
- To provide opportunities to learners to practice English and thereby make them proficient users
  of the language.
- To enable learners to fine-tune their linguistic skills (LSRW) with the help of technology.
- To improve the performance of students’ listening, speaking, reading and writing skills and
  thereby enhance their career opportunities.

LIST OF ACTIVITIES:
1. Listening:
   - Listening and practicing neutral accents
2. Speaking:
   - Giving one minute talks
   - Participating in small Group Discussions
   - Making Presentations

3. Reading:
   - Reading Comprehension
   - Reading subject specific material
   - Technical Vocabulary

4. Writing:
   - Formal vs Informal Writing
   - Paragraph Writing
   - Essay Writing
   - Email Writing

REFERENCES / MANUALS / SOFTWARE: Open Sources / websites

TOTAL: 30 PERIODS

COURSE OUTCOMES:
On completion of the course, the students will be able to:
   - Listen and comprehend lectures in English
   - Articulate well and give presentations clearly
   - Participate in Group Discussions successfully
   - Communicate effectively in formal and informal writing
   - Write proficient essays and emails

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MC4201 FULL STACK WEB DEVELOPMENT

COURSE OBJECTIVES:
   - To understand the fundamentals of web programming and client side scripting.
   - To learn server side development using NodeJS.
• To understand API development with Express Framework.
• To understand and architect databases using NoSQL and SQL databases.
• To learn the advanced client side scripting and ReactJS framework

UNIT I  INTRODUCTION TO CSS and JAVASCRIPT

UNIT II  SERVER SIDE PROGRAMMING WITH NODE JS
Introduction to Web Servers – Javascript in the Desktop with NodeJS – NPM – Serving files with the http module – Introduction to the Express framework – Server-side rendering with Templating Engines – Static Files - async/await - Fetching JSON from Express

UNIT III  ADVANCED NODE JS AND DATABASE
Introduction to NoSQL databases – MongoDB system overview - Basic querying with MongoDB shell – Request body parsing in Express – NodeJS MongoDB connection – Adding and retrieving data to MongoDB from NodeJS – Handling SQL databases from NodeJS – Handling Cookies in NodeJS – Handling User Authentication with NodeJS

UNIT IV  ADVANCED CLIENT SIDE PROGRAMMING
React JS: ReactDOM - JSX - Components - Properties – Fetch API - State and Lifecycle - -JS Localstorage - Events - Lifting State Up - Composition and Inheritance

UNIT V  APP IMPLEMENTATION IN CLOUD
Cloud providers Overview – Virtual Private Cloud – Scaling (Horizontal and Vertical) – Virtual Machines, Ethernet and Switches – Docker Container – Kubernetes

TOTAL: 45 PERIODS

SUGGESTED ACTIVITIES:
1. Build an online MCQ quiz app. The questions and options should be fetched based on the chosen topic from a NodeJS server. The questions can be stored in a JSON file in the backend. Once the user has answered the questions, the frontend must send the chosen options to the backend and the backend must identify the right answers and send the score back to the front end. The frontend must display the score in a separate neatly designed page.
2. Build a blog website where you can add blog posts through a simple admin panel and the users can view the blog posts. The contents of the blog posts can be stored in either MongoDB or MySQL database. The home page should contain the titles of the blog post and the full post can be viewed by clicking the title. Frontend can be built either using React or through template engines served by the NodeJS server.
3. Take any ecommerce or social media website/app. Analyze what the API endpoints would have been used for and how the frontend interacts with the backend. The networks tab in the browser’s developer tools can be used if required.
4. Architect an entire database structure for an E-Commerce application for MongoDB. Discuss how the database would have been structured if you were using a SQL database.
5. Build a simple calculator app with React. The user should be able to add numbers and operations to the app by clicking on buttons, just like you would do in a mobile phone. The moment the operation and the two operations are defined, the answer should be displayed
COURSE OUTCOMES:
Upon completion of the course the students should be able to:
CO1: Write client side scripting HTML, CSS and JS.
CO2: Implement and architect the server side of the web application.
CO3: Implement Web Application using NodeJS.
CO4: Architect NoSQL databases with MongoDB.

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MC4202 ADVANCED DATABASE TECHNOLOGY

COURSE OBJECTIVES:
- To understand the working principles and query processing of distributed databases.
- To understand the basics of spatial, temporal and mobile databases and their applications.
- To distinguish the different types of NoSQL databases.
- To understand the basics of XML and create well-formed and valid XML documents.
- To gain knowledge about information retrieval and web search.

UNIT I DISTRIBUTED DATABASES
UNIT II SPATIAL AND TEMPORAL DATABASES 9

UNIT III NOSQL DATABASES 9
NoSQL – CAP Theorem – Sharding - Document based – MongoDB Operation: Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding–Cassandra: Data Model, Key Space, Table Operations, CRUD Operations, CQL Types – HIVE: Data types, Database Operations, Partitioning – HiveQL – OrientDB Graph database – OrientDB Features

UNIT IV XML DATABASES 9

UNIT V INFORMATION RETRIEVAL AND WEB SEARCH 9

TOTAL: 45 PERIODS

Suggested Activities:
1. Create a distributed database for any application (ex. book store) and access it using PHP and Python
2. Create spatial database of any place and perform query operations
3. Creating Databases and writing simple queries using MongoDB, DynamoDB, Voldemort Key-Value Distributed Data Store Hbase and Neo4j.
4. Creating XML Documents, Document Type Definition and XML Schema for any e-commerce website and perform XML Querying
5. Perform sentiment analysis for any web document using text preprocessing techniques

COURSE OUTCOMES:
On completion of the course, the student will be able to:
CO1: Design a distributed database system and execute distributed queries.
CO2: Manage Spatial and Temporal Database systems and implement it in corresponding applications.
CO3: Use NoSQL database systems and manipulate the data associated with it.
CO4: Design XML database systems and validate with XML schema.
CO5: Apply knowledge of information retrieval concepts on web databases.

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MC4203 CLOUD COMPUTING TECHNOLOGIES 9

COURSE OBJECTIVES:
- To understand the basic concepts of Distributed systems.
- To learn about the current trend and basics of Cloud computing.
- To be familiar with various Cloud concepts.
- To expose with the Server, Network and storage virtualization.
- To be aware of Microservices and DevOps.

UNIT I DISTRIBUTED SYSTEMS

UNIT II BASIC BASICS OF CLOUD COMPUTING

UNIT III CLOUD INFRASTRUCTURE
Cloud Architecture and Design – Architectural design challenges – Technologies for Network based system - NIST Cloud computing Reference Architecture – Public, Private and Hybrid

UNIT IV CLOUD ENABLING TECHNOLOGIES 9

UNIT V MICROSERVICES AND DEVOPS 9

SUGGESTED ACTIVITIES:
1. Write a client and server program to calculate the value of PI, in which server calls the remote procedure of the client side (C programming)
2. Create an word document of your class time table and store locally and also on cloud and share it (use www.zoho.com , docs.google.com)
3. Create your resume in a neat format using google and zoho cloud Programs on PaaS
4. Discuss processor virtualization, memory virtualization, I/O virtualization in VMWare
5. Set up Azure DevOps, Import Code and Create the Azure DevOps Build Pipeline

COURSE OUTCOMES:
Upon completion of the course, the students will be able to
CO1: Use Distributed systems in Cloud Environment.
CO2: Articulate the main concepts, key technologies, strengths and limitations of Cloud computing.
CO3: Identify the Architecture, Infrastructure and delivery models of Cloud computing.
CO4: Install, choose and use the appropriate current technology for the implementation of Cloud.
CO5: Adopt Microservices and DevOps in Cloud environments.

TOTAL:45 PERIODS

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MC4204 MOBILE APPLICATION DEVELOPMENT

COURSE 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 procedure for mobile applications.
- To develop mobile applications using various tools and platforms.

UNIT I INTRODUCTION
Mobile Application Model – Infrastructure and Managing Resources – Mobile Device Profiles – Frameworks and Tools
- Installation of necessary components and software

UNIT II USER INTERFACE
Generic UI Development – Multimodal and Multichannel UI – Gesture Based UI – Screen Elements and Layouts – Voice XML.

Lab Component:
- Implement mobile applications using UI toolkits and frameworks.
- Design an application that uses Layout Managers and event listeners.

UNIT III APPLICATION DESIGN

Lab Component:
- Design a mobile application that is aware of the resource constraints of mobile devices.
- Design an application that uses Dynamic Linking
UNIT IV MOBILE OS


Lab Component:

i. Develop an application that makes use of mobile database
ii. Implement an android application that writes data into the SD card.

UNIT V APPLICATION DEVELOPMENT

Communication via the Web – Notification and Alarms – Graphics and Multimedia: Layer Animation, Event handling and Graphics services – Telephony – Location based services

Lab Component:

i. Develop a web based mobile application that accesses internet and location data.
ii. Develop an android application using telephony to send SMS.

TOTAL:75 PERIODS

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

CO1: Understand the basics of mobile application development frameworks and tools.
CO2: Develop a UI for mobile applications.
CO3: Design mobile applications that manage memory dynamically.
CO4: Build applications based on mobile OS like Android, iOS.
CO5: Build location based services.

SOFTWARE REQUIREMENTS

1. JDK, ECLIPSE IDE / equivalent, ANDROID STUDIO

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**MC4205**

**CYBER SECURITY**

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**Course Objectives:**
- To learn the principles of cyber security and to identify threats and risks.
- To learn how to secure physical assets and develop system security controls.
- To understand how to apply security for Business applications and Network Communications.
- To learn the technical means to achieve security.
- To learn to monitor and audit security measures.

**Unit I: Planning for Cyber Security**


**Unit II: Security Controls**


**Unit III: Cyber Security for Business Applications and Networks**


**Unit IV: Technical Security**


**Unit V: Security Assessment**

SUGGESTED ACTIVITIES:
1. Discuss and debate information security policies that a privacy focused social media company should comply with.
2. Discuss data privacy policies implemented in various countries.
3. Demonstrate how ADB (Android debug bridge) is being used for malicious purposes.
4. Demonstrate how to troubleshoot networks and analyze packets using tools like WireShark.
5. Discuss the control challenges in virtual networks over cloud environments.

Discuss the common security flaws present in web applications and demonstrate how they can be identified using tools like ACUNETIX (or similar tools)
- OWASP ZAP: https://owasp.org/www-project-zap/
- ACUNETIX: https://www.acunetix.com/
- WireShark: https://www.wireshark.org/
- ADB: https://developer.android.com/studio/command-line/adb

COURSE OUTCOMES:
On completion of the course, the student will be able to
CO1: Develop a set of risk and security requirements to ensure that there are no gaps in an organization’s security practices.
CO2: Achieve management, operational and technical means for effective cyber security.
CO3: Audit and monitor the performance of cyber security controls.
CO4: Spot gaps in the system and devise improvements.
CO5: Identify and report vulnerabilities in the system

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MC4211  ADVANCED DATABASE TECHNOLOGY LABORATORY  L T P C  0 0 4 2

COURSE OBJECTIVES:
- To understand the process of distributing tables across multiple systems
- To understand the process of storing, retrieving spatial and temporal data
- To understand the process of storing, retrieving objects in a database
- To understand the process of storing and retrieving data from a XML Database
- To use the open source database for building a mobile application

LIST OF EXPERIMENTS:
1. NOSQL Exercises
   a. MongoDB – CRUD operations, Indexing, Sharding
   b. Cassandra: Table Operations, CRUD Operations, CQL Types
   c. HIVE: Data types, Database Operations, Partitioning – HiveQL
   d. OrientDB Graph database – OrientDB Features
2. MySQL Database Creation, Table Creation, Query
3. MySQL Replication – Distributed Databases
4. Spatial data storage and retrieval in MySQL
5. Temporal data storage and retrieval in MySQL
6. Object storage and retrieval in MySQL
7. XML Databases, XML table creation, XQuery FLWOR expression
8. Mobile Database Query Processing using open source DB (MongoDB/MySQL etc)

SOFTWARE REQUIREMENTS
1. Java / Python / R / Scala
2. Oracle, MySQL, MongoDB, Casandra, Hive

COURSE OUTCOMES:
On completion of the course, the student will be able to:
CO1: Design and implement advanced databases.
CO2: Use big data frameworks and tools.
CO3: Formulate complex queries using SQL.
CO4: Create an XML document and perform Xquery.
CO5: Query processing in Mobile databases using open source tools.

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TOTAL: 60 PERIODS
MC4212 \hspace{1cm} FULL STACK WEB DEVELOPMENT LABORATORY \hspace{1cm} L T P C
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COURSE OBJECTIVES:
- To implement the client side of the web application using javascript.
- To understand Javascript on the desktop using NodeJS.
- To develop a web application using NodeJS and Express.
- To implement a SPA using React.
- To develop a full stack single page application using React, NodeJS, and a Database (MongoDB or SQL).

LIST OF EXPERIMENTS:
1. Create a form and validate the contents of the form using JavaScript.
2. Get data using Fetch API from an open-source endpoint and display the contents in the form of a card.
3. Create a NodeJS server that serves static HTML and CSS files to the user without using Express.
4. Create a NodeJS server using Express that stores data from a form as a JSON file and displays it in another page. The redirect page should be prepared using Handlebars.
5. Create a NodeJS server using Express that creates, reads, updates and deletes students’ details and stores them in MongoDB database. The information about the user should be obtained from a HTML form.
6. Create a NodeJS server that creates, reads, updates and deletes event details and stores them in a MySQL database. The information about the user should be obtained from a HTML form.
7. Create a counter using ReactJS
8. Create a Todo application using ReactJS. Store the data to a JSON file using a simple NodeJS server and retrieve the information from the same during page reloads.
9. Create a simple Sign up and Login mechanism and authenticate the user using cookies. The user information can be stored in either MongoDB or MySQL and the server should be built using NodeJS and Express Framework.
10. Create and deploy a virtual machine using a virtual box that can be accessed from the host computer using SSH.
11. Create a docker container that will deploy a NodeJS ping server using the NodeJS image.

SOFTWARE REQUIREMENTS
1. NodeJS/Express JS, ReactJS, Docker, any IDE like NOTEPAD++/visual studio code/sublime text etc.,
2. MySQL, MongoDB

TOTAL: 60 PERIODS
COURSE OUTCOMES:
**CO1:** To implement and deploy the client side of the web application.
**CO2:** To develop and deploy server side applications using NodeJS.
**CO3:** To use Express framework in web development.
**CO4:** To implement and architect database systems in both NoSQL and SQL environments.
**CO5:** To develop a full stack single page application using React, NodeJS, and a Database and deploy using containers.

### CO-PO Mapping

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**MC4213**  
**COMMUNICATION SKILLS ENHANCEMENT - II**  
**L T P C**  
**0 0 2 1**

COURSE OBJECTIVES:
- To provide opportunities to learners to practice their communication skills to make them become proficient users of English.
- To enable learners to fine-tune their linguistic skills (LSRW) with the help of Technology to communicate globally.
- To enhance the performance of learners at placement interviews and group discussions and other recruitment procedures

1. **SOFT SKILLS**
   - People skills
   - Interpersonal skills
   - Team building skills
   - Leadership skills
   - Problem solving skills

2. **PRESENTATION SKILLS**
   - Preparing slides with animation related to the topic
   - Introducing oneself to the audience
   - Introducing the topic
   - Presenting the visuals effectively – 5 minute presentation

3. **GROUP DISCUSSION SKILLS**
   - Participating in group discussions
   - Brainstorming the topic
   - Activities to improve GD skills.
4. **INTERVIEW SKILLS**
   - Interview etiquette – dress code – body language
   - Attending job interviews
   - Answering questions confidently
   - Technical interview – telephone/Skype interview
   - Emotional and cultural intelligence
   - Stress Interview

**TOTAL: 30 PERIODS**

**REFERENCES / MANUALS / SOFTWARE:** Open Sources / websites

**COURSE OUTCOMES:**

*Upon Completion of the course, the students will be able to:*

**CO1:** Students will be able to make presentations and participate in Group discussions with confidence.

**CO2:** Students will be able to perform well in the interviews.

**CO3:** Students will make effective presentations.

**CO-PO Mapping**

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**MC4301 **

**MACHINE LEARNING**

**COURSE OBJECTIVES:**

- To gain knowledge on foundations of machine learning and apply suitable dimensionality reduction techniques for an application
- To select the appropriate model and use feature engineering techniques
- To gain knowledge on Probability and Bayesian Learning to solve the given problem
- To design and implement the machine learning techniques for real world problems
- To analyze, learn and classify complex data without predefined models also

**UNIT I**

**INTRODUCTION**


**UNIT II**

**MODEL EVALUATION AND FEATURE ENGINEERING**

Model Selection - Training Model - Model Representation and Interpretability - Evaluating Performance of a Model - Improving Performance of a Model - Feature Engineering: Feature Transformation - Feature Subset Selection
UNIT III BAYESIAN LEARNING


UNIT VI PARAMETRIC MACHINE LEARNING

Logistic Regression: Classification and representation – Cost function – Gradient descent – Advanced optimization – Regularization - Solving the problems on overfitting. Perceptron – Neural Networks – Multi - class Classification - Backpropagation – Non-linearity with activation functions (Tanh, Sigmoid, Relu, PRelu) - Dropout as regularization

UNIT V NON PARAMETRIC MACHINE LEARNING


SUGGESTED ACTIVITIES:

1. Explore the significant steps involved in data preprocessing in Machine Learning
2. Choose a model and train a model in machine learning.
3. Explain the application of Bayes Theorem and how it’s useful to predict the future
4. Make the difference between supervised Learning and unsupervised Learning Techniques
5. Differentiate Perceptron, Neural Network, Convolutional Neural Network and Deep Learning

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Understand about Data Preprocessing, Dimensionality reduction
CO2: Apply proper model for the given problem and use feature engineering techniques
CO3: Make use of Probability Technique to solve the given problem.
CO4: Analyze the working model and features of Decision tree
CO5: Choose and apply appropriate algorithm to learn and classify the data

REFERENCES

MC4302  
COURSE OBJECTIVES:
- To understand the concepts of IoT and its working models
- To know the various IoT protocols
- To understand about various IoT Physical devices and Endpoints
- To know the security and privacy issues connected with IoT
- To apply the concept of Internet of Things in a real world scenario.

UNIT I  
FUNDAMENTALS OF IOT  

UNIT II  
IOT PROTOCOLS  

UNIT III  
IOT PHYSICAL DEVICES AND ENDPOINTS  
Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, and reading input from pins.

UNIT IV  
INTERNET OF THINGS PRIVACY, SECURITY AND GOVERNANCE  
UNIT V APPLICATIONS

IOT APPLICATIONS - IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms/middleware, IoT-A, Hydra etc.

SUGGESTED ACTIVITIES:
1: Study of 5 different types of sensors and actuators available in Market
2: Study of commercial IoT available in any one domain
3: Study the recent developments in IoT Protocol
4: Implement simple Python programs for IoT
5: Study on the latest government policies on IoT Security and Privacy
6: A study on how to use IoT to solve some problems in your neighborhood.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Able to

CO1: Define the infrastructure for supporting IoT deployments
CO2: Understand the usage of IoT protocols for communication between various IoT devices
CO3: Design portable IoT using Arduino/Raspberry Pi/equivalent boards.
CO4: Understand the basic concepts of security and governance as applied to IoT
CO5: Analyze and illustrate applications of IoT in real time scenarios

REFERENCES

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MC4311  MACHINE LEARNING LABORATORY  L T P C
0 0 4 2

COURSE OBJECTIVES:
- To understand about data cleaning and data preprocessing
- To familiarize with the Supervised Learning algorithms and implement them in practical situations.
- To familiarize with unsupervised Learning algorithms and carry on the implementation part.
- To involve the students to practice ML algorithms and techniques.
- Learn to use algorithms for real time data sets.

LIST OF EXPERIMENTS:
1. Demonstrate how do you structure data in Machine Learning
2. Implement data preprocessing techniques on real time dataset
3. Implement Feature subset selection techniques
4. Demonstrate how will you measure the performance of a machine learning model
5. Write a program to implement the naive Bayesian classifier for a sample training data set. Compute the accuracy of the classifier, considering few test data sets.
6. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using the standard Heart Disease Data Set.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file.
8. Write a program to implement k-Nearest Neighbor algorithm to classify the data set.
9. Apply the technique of pruning for a noisy data monk2 data, and derive the decision tree from this data. Analyze the results by comparing the structure of pruned and unpruned tree.
10. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets
11. Implement Support Vector Classification for linear kernels.
12. Implement Logistic Regression to classify problems such as spam detection. Diabetes predictions and so on.

TOTAL: 60 PERIODS

LAB REQUIREMENTS:
Python or any ML tools like R

COURSE OUTCOMES:
On completion of the laboratory course, the student should be able to
CO1: apply data preprocessing technique and explore the structure of data to prepare for predictive modeling
CO2: understand how to select and train a model and measure the performance.
CO3: apply feature selection techniques in Machine Learning
CO4: construct Bayesian Network for appropriate problem
CO5: learn about parametric and non-parametric machine Learning algorithms and implement to practical situations
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MC4312 INTERNET OF THINGS LABORATORY L T P C 0 0 4 2

COURSE OBJECTIVES:
- To design applications to interact with sensors
- To design and develop IoT application Arduino/Raspberry pi for real world scenario.
- To enable communication between IoT and cloud platforms
- To develop applications using Django Framework

EXPERIMENTS:
PART I:
1. To study various IoT protocols – 6LowPAN, IPv4/IPv6, Wifi, Bluetooth, MQTT.
2. IoT Application Development Using sensors and actuators (temperature sensor, light sensor, infrared sensor)
3. To study Raspberry Pi development board and to implement LED blinking applications.
4. To develop an application to send and receive data with Arduino using HTTP request
5. To develop an application that measures the room temperature and posts the temperature value on the cloud platform.
6. To develop an application that measures the moisture of soil and post the sensed data over Google Firebase cloud platform.
7. To develop an application for measuring the distance using ultrasonic sensor and post distance value on Google Cloud IoT platform
8. Develop a simple application based on sensors.
10. Develop a commercial IoT application.

TOTAL: 60 PERIODS

HARDWARE/SOFTWARE REQUIREMENTS:
1. The universal microcontroller development board
2. 8051 Daughter Board
3. Raspberry Pi 3B+ Original
4. Arduino Daughter Board
5. Humidity + IR Sensor Interface
6. Ultrasonic Sensors
7. Open source softwares Django Framework
8. Open cloud architectures like Bluemix, Development platforms like Firebase

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

- **CO1:** To understand the various IoT protocols
- **CO2:** Test and experiment different sensors for application development
- **CO3:** To develop applications using Arduino/Raspberry Pi/Equivalent boards.
- **CO4:** To develop applications that would read the sensor data and post it in Cloud
- **CO5:** Develop IOT applications with different platforms and frameworks.

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**MC4001 SOFTWARE PROJECT MANAGEMENT**

**COURSE OBJECTIVES:**
- To know how to do project planning for the software process.
- To learn the cost estimation techniques during the analysis of the project.
- To understand the quality concepts for ensuring the functionality of the software

**UNIT SOFTWARE PROJECT MANAGEMENT CONCEPTS**

**UNIT II SOFTWARE EVALUATION AND COSTING**

**UNIT III SOFTWARE ESTIMATION TECHNIQUES**
UNIT IV  RISK MANAGEMENT

UNIT V  GLOBALIZATION ISSUES IN PROJECT MANAGEMENT

SUGGESTED ACTIVITIES:
1. Reducing process variability using six-sigma model DMAIC on software company applications with respect to factors like quality aspects, production bugs classified and measured, the causes of the large number of production bugs leading to different improvement suggestions
2. Do cost benefit analysis using Ms-Excel for Selecting the project (from available data in the web like https://img.chandoo.org/a/24-cost-benefit-analysis.xlsx)
3. Frequencying and Scheduling the Project activities using open source Ms-Project
4. Risk analysis of any project with special reference to performance time cost trilogy
5. Set up a project and its tasks; Communicate with everyone on the project team from within dotProject software.

TOTAL:45 PERIODS

COURSE OUTCOMES:
CO1: Understand the activities during the project scheduling of any software application.
CO2: Learn the risk management activities and the resource allocation for the projects.
CO3: Apply the software estimation and recent quality standards for evaluation of the software projects
CO4: Acquire knowledge and skills needed for the construction of highly reliable software project
CO5: Create reliable, replicable cost estimation that links to the requirements of project planning and managing

REFERENCES
MC4002  PROFESSIONAL ETHICS IN IT  L  T  P  C  3  0  0  3

COURSE OBJECTIVES:
- To understand the concepts of computer ethics in the work environment.
- To understand the threats in computing environment
- To understand the intricacies of accessibility issues
- To ensure safe exits when designing the software projects

UNIT I  INTRODUCTION TO ETHICS  9
Definition of Ethics- Right, Good, Just- The Rational Basis of Ethics -Theories of Right: Intuitionist vs. End-Based vs. Duty-Based -Rights, Duties, Obligations -Theory of Value -Conflicting Principles and Priorities -The Importance of Integrity -The Difference Between Morals, Ethics, and Laws -Ethics in the Business World - Corporate Social Responsibility -Creating an Ethical Work Environment -Including Ethical Considerations in Decision Making

UNIT II  ETHICS IN INFORMATION TECHNOLOGY, INTERNET CRIME  9

UNIT III  FREEDOM OF EXPRESSION, PRIVACY  9
UNIT IV FREEDOM OF EXPRESSION, INTELLECTUAL PROPERTY RIGHTS


UNIT V SOCIAL NETWORKING ETHICS AND ETIQUETTES


SUGGESTED ACTIVITIES:
1. Prepare a report of CSR activities of any three organizations.
2. Study of the government rules and regulations for prosecuting Computer Attacks
3. Do case study of two incidents that lead to IT Security breach in any of the organizations
4. Recent cases (within last 5 years duration) of infringement of intellectual property rights
5. A study on Creative commons and its effect on Open Educational Resources
6. A study on the role of social networking advertising in the development of Business and Educational Sectors

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

CO1: Examine situations and to internalize the need for applying ethical principles, values to tackle various situations.

CO2: Develop a responsible attitude towards the use of computers as well as the technology.

CO3: Envision the societal impact on the products/projects they develop in their career

CO4: Understand the code of ethics and standards of computer professionals.

CO5: Analyze professional responsibility and empower access to information in the workplace.

REFERENCES
MC4003

E-LEARNING

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COURSE OBJECTIVES:
- To learn the various E-learning approaches and components.
- To explore Design Thinking.
- To understand the types of design models of E-learning.
- To learn about E-learning Authoring tools.
- To know about evaluation and management of E-learning solutions

UNIT I  INTRODUCTION

UNIT II  DESIGNING E-LEARNING COURSE CONTENT

UNIT III  CREATING INTERACTIVE CONTENT

UNIT V  LEARNING PLATFORMS
SUGGESTED ACTIVITIES:
1. Prepare the E-Learning Components and how will you measure the quality of the contents. Also, analyze synchronous and Asynchronous Modes of Learning, and discuss the advantages and disadvantages of both.
2. Explain how the course instructor design and create effective E-Learning content.
3. List the types of authoring tools and discuss which tool is best according to you.
4. Explain about different types of Learning Platforms.
5. Discuss about the Evaluation process of E-Learning courses in detail.

COURSE OUTCOMES:
On completion of course, the students will be able to:
CO1: Distinguish the phases of activities in models of E-learning.
CO2: Identify appropriate instructional methods and delivery strategies.
CO3: Choose appropriate E-learning Authoring tools.
CO4: Create interactive E-learning courseware.
CO5: Evaluate the E-learning courseware.

REFERENCES

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COURSE OBJECTIVES:

- To review the fundamentals of Operating Systems
- To gain knowledge on Distributed Operating System concepts that includes issues, Mutual exclusion algorithms, Deadlock detection algorithms
- To gain insight on the distributed resource management components viz. the algorithms for implementation of distributed shared memory, and distributed scheduling.
- To know the components and management aspects of Real time, Mobile operating systems
- To acquire knowledge on the basics of Linux and Mobile OS like iOS, Android

UNIT I FUNDAMENTALS OF OPERATING SYSTEMS 9

UNIT II DISTRIBUTED OPERATING SYSTEMS 9

UNIT III DISTRIBUTED RESOURCE MANAGEMENT 9

UNIT IV REAL TIME AND MOBILE OPERATING SYSTEMS 9

UNIT V CASE STUDIES 9

TOTAL: 45 PERIODS

SUGGESTED ACTIVITIES:

1. Consider the following preemption method to prevent deadlocks: All processes are assigned unique priorities that can be totally ordered. A requesting process is allowed to preempt another process that holds the needed resource only if the requesting process has higher priority, otherwise, it is blocked. Demonstrate that this method prevents deadlock.

2. Consider a distributed system where each node has its own clock. Assume that all the clocks in the system are perfectly synchronized. Also, assume that the communication network is reliable. Give an algorithm for recording the global state. Note that your algorithm should be simpler than the Chandy- Lamport algorithm.

3. Predict the performance of the receiver-initiated load sharing algorithm when the entire
system workload is generated at only a few nodes in the system instead of equally at all the nodes in the system. (Hint: performance depends on how successful receivers will be in locating senders)

4. Consider two processes, P1 and P2, where p1 = 50, t1 = 25, p2 = 75, and t2 = 30.
   a. Can these two processes be scheduled using Rate-Monotonic Scheduling? Illustrate your answer by displaying a Gantt chart
   b. Implement the scheduling of these two processes using Earliest Deadline-First (EDF) scheduling.

5. Developers David and Peter of R & D belong to group A. Administrative staff Jack and Mike belong to group B.
   a. Create a shared directory "/project_a". The files in this directory can only be read, added, deleted, modified, and executed by developers in the R & D department. Other users cannot perform any access operation in this directory.
   b. Create a directory "/project_b". The files in this directory can only be read, added, deleted, modified and executed by the staff of the Administration Department, other users cannot do anything to this directory Access operation.
   c. Create a directory "/project". The files in this directory can be read, added, deleted, modified, and executed by personnel in the R & D department and administrative department. Users in other departments can only use this directory and perform read-only access operations.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon Completion of the course, students should be able to:
CO1: Discuss various synchronization, scheduling and deadlock issues
CO2: Demonstrate mutual exclusion and deadlock detection of Distributed Operating system
CO3: Discuss various resource management techniques for distributed systems
CO4: Identify the different features of real time and mobile operating systems
CO5: Perform administrative tasks on Linux Servers, iOS and Android

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MC4005 INFORMATION RETRIEVAL TECHNIQUES

COURSE 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 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 AND RETRIEVAL

TOTAL: 45 PERIODS

SUGGESTED ACTIVITIES:
1. Compare the features of any three search engines
2. Compare and contrast the IR models
3. List out features of the various IR Query languages
4. List out the applications of classification and clustering in Machine Learning
5. A Study on web crawler used by any Search Engine for indexing the sites (For eg., Google, Mozilla, Internet Explorer,....)

COURSE OUTCOMES:
Upon completion of this course, the students should be able to:
CO1: Build an Information Retrieval system using the available tools.
CO2: Identify and design the various components of an Information Retrieval system.
CO3: Model an information retrieval system
CO4: Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.
CO5: Design an efficient search engine and analyze the Web content structure.

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MC4006 SOFT COMPUTING TECHNIQUES L T P C
3 0 0 3

COURSE OBJECTIVES:
- To gain knowledge of soft computing theories and its fundamentals.
- To design a soft computing system required to address a computational task.
To learn and apply artificial neural networks, fuzzy sets and fuzzy logic and genetic algorithms in problem solving and use of heuristics based on human experience.

To introduce the ideas of fuzzy sets, fuzzy logic and 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 while seeking global optimum in self – learning situations.

UNIT I Fuzzy Computing 9

UNIT II Fundamentals of Neural Networks 9

UNIT III Backpropagation Networks 9

UNIT IV Competitive Neural Networks 9
Kohonen’s Self Organizing Map – SOM Architecture, learning procedure – Application; Learning Vector Quantization – learning by LVQ; Adaptive Resonance Theory – Learning procedure – Applications.

UNIT V Genetic Algorithm 9

SUGGESTED ACTIVITIES:
- Prepare a weekly timetable for classes in a college for different groups of students so that there are no clashes between classes. The task is to search for the optimum using GA.
- Species identification of a plant using Back propagation Algorithm.
- Bandwidth allocation for wireless system using Neural network.
- Apply Fuzzy logic for washing machines to determine the correct amount of water and detergent, speed of agitation, and length of the wash cycles.
- Apply Fuzzy logic for breast cancer diagnosis.

COURSE OUTCOMES:
On completion of the course, the students will be able to:
CO1: Identify and describe soft computing techniques and their roles in building intelligent
machines.

CO2: Recognize the feasibility of applying a soft computing methodology for a particular problem.

CO3: Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.

CO4: Apply genetic algorithms to optimization problems.

CO5: Design neural networks to pattern classification and regression problems using a soft computing approach.

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MC4007 OPERATIONS RESEARCH

COURSE OBJECTIVES:

- To provide the concept and an understanding of basic concepts in Operations Research techniques for Analysis and Modeling in Applications.
- To understand, develop and solve mathematical model of linear programming problems.
- To understand, develop and solve mathematical model of Transport and assignment problems.
- To understand network modeling for planning and scheduling the project activities.

UNIT I LINEAR PROGRAMMING MODELS

Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables: big-M method, degeneracy and unbound solutions.
UNIT II TRANSPORTATION AND ASSIGNMENT MODELS

UNIT III SCHEDULING BY PERT AND CPM
Introduction - Rules to frame a Network - Fulkerson’s Rule to numbering of events - Activity, Times - Critical Path Computation - Slack and Float - PERT- Steps and computing variance, Merits and demerits of PERT, CPM- Time estimating & Limitations, Comparison between PERT & CPM.

UNIT VI QUEUEING MODELS
Characteristics of Queueing Models–Poisson Queues-(M /M/1);(FIFO/∞/∞), (M / M / 1) : (FIFO / N / ∞), (M / M / C) : (FIFO / ∞ / ∞), (M / M / C) : (FIFO / N / ∞)models.

UNIT V GAME THEORY
Competitive game, rectangular game, saddle point, minimax (maximin) method of optimal strategies- value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.

SUGGESTED ACTIVITIES:
1. Do some research on nutrients that are essential for a balanced diet. Select three or four nutrients and constraints on it. Explore the framework of LPP. Formulate an LPP with suitable objective function and constraints.
2. Identify some electricity distribution centers and areas which have requirements. Think of the objective and try to provide the solution framework.
3. Break down the stages of completing a construction of a house (like Start, Framing, Plumbing etc…) and find the minimum days to complete the construction.
4. Try to observe the customer arrival rate in a departmental store near your residence for a week. Also the service rate rendered. Make your inference on appointing an extra salesgirl.
5. Decision making is very crucial. Consider the situation where two companies share a market, in which they currently make Rs 50, 00,000 each. Both need to determine whether they should advertise. For each company advertising costs Rs 20, 00,000 and captures Rs 30, 00, 000 from the competitor provided the competitor doesn’t advertise. What should the companies do?

COURSE OUTCOMES:
CO1: Understand and apply linear programming to solve operational problem with constraints
CO2: Apply transportation and assignment models to find optimal solution
CO3: Prepare project scheduling using PERT and CPM
CO4: Identify and analyze appropriate queuing models to reduce the waiting time in queue.
CO5: Choose the best strategy using decision making methods under game theory.

TOTAL: 45 PERIODS

REFERENCES
S. Chand& Sons Education Publications, New Delhi, 2017


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### COURSE 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


### UNIT II

#### ESSENTIALS OF BUSINESS ANALYTICS


### UNIT III

#### MODELING UNCERTAINTY AND STATISTICAL INFERENCE

UNIT IV   ANALYTICS USING HADOOP AND MAPREDUCE
FRAMEWORK

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

SUGGESTED ACTIVITIES:
1. Study on some application of Business analytics in organizations of any domain
2. Study the statistics and data visualization charts of sales data like Amazon using R
3. Study on new strategies derived using data analytic tools on some business data set available and its impact on company progress
4. Prepare a report on the use of Hadoop framework in any two companies
5. Compare and contrast the various Data Analytical Frameworks

COURSE OUTCOMES:
On completion of the course, the student will be able to:
CO1: Identify the real world business problems and model with analytical solutions.
CO2: Solve analytical problems with relevant mathematics background knowledge.
CO3: Convert any real world decision making problem to hypothesis and apply suitable statistical testing.
CO4: Write and Demonstrate simple applications involving analytics using Hadoop and MapReduce
CO5: Use open source frameworks for modeling and storing data

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TOTAL: 45 PERIODS

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MC4009  
DEVOPS AND MICROSERVICES  
L T P C  
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COURSE OBJECTIVES:
- To introduce Microservices and Containers.
- To understand the key concepts and principles of DevOps.
- To be familiar with most common DevOps tools.
- To explain the business benefits of DevOps and continuous delivery.
- To recall specific DevOps methodologies and frameworks.

UNIT I  INTRODUCTION TO MICROSERVICES  9
Definition of Microservices – Characteristics - Microservices and Containers – Interacting with Other Services – Monitoring and Securing the Services – Containerized Services – Deploying on Cloud

UNIT II  MICROSERVICES ARCHITECTURE  9
Monolithic architecture- Microservices architectural style- Benefits - Drawbacks of Microservices architectural style - decomposing monolithic applications into Microservices

UNIT III  DevOps Tools  9

UNIT IV  MICROSERVICES IN DEVOPS ENVIRONMENT  9
Evolution of Microservices and DevOps – Benefits of combining DevOps and Microservices- working of DevOps and Microservices in Cloud environment - DevOps Pipeline representation for a NodeJS based Microservices

UNIT V  VELOCITY AND CONTINUOUS DELIVERY  9
Velocity - Delivery Pipeline- test stack - Small/Unit Test – medium /integration testing – system testing- Job of Development and DevOps - Job of Test and DevOps – Job of Op and Devops- Infrastructure and the job of Ops

TOTAL:45 PERIODS

SUGGESTED ACTIVITIES:
- Write your understanding about Microservices and how it works. How you deploy Microservices on cloud.
- Discuss about Microservices Architecture.
- Write a report on about DevOps tools.
Explaining the benefits of combining DevOps and Microservices with case study
Describe continuous integration and continuous delivery by taking a case study

COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Select the Microservices design and apply the principles..
CO2: Apply Microservices in DevOps
CO3: Understand about DevOps and the common tools used in DevOps.
CO4: Develop and integrate projects using DevOps
CO5: Deploy and monitor projects using DevOps

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MC4010 ADVANCES IN NETWORKING

COURSE OBJECTIVES:
- To understand the theme underlying IPv6 Structure and addressing methods
- To understand and analyze the protocols for IPv6 Implementation
- To identify and provide solutions for QoS and Security Issues with IPv6
- To learn about Software Defined concepts, architectures, protocols and applications
- To explore the significance of Network Function Virtualization

UNIT I IPv6 STRUCTURE AND ADDRESSING
IPv4 Address Depletion- IPv6 Transition Issues-IPv6 Structure: IPv6 Header, Extension Headers:
Hop-by-Hop Options Header, Destination Options Header, Routing Header, Fragment Header, AH, ESP - IPv6 Addresses: Unicast, Anycast, Multicast – Address Autoconfiguration

UNIT II IPv6 NETWORKING

UNIT III QoS, PROVISIONING AND SECURITY WITH IPv6

UNIT IV SOFTWARE DEFINED NETWORKING
Specification

UNIT V NETWORK FUNCTION VIRTUALIZATION

SUGGESTED ACTIVITIES:
1. IPv6 Packet Analysis Using Wireshark
2. Verifying the Router's Link-Local Address on Ethernet and Serial Interfaces using Cisco Packet Tracer
3. Configuring a Windows Host to Use EUI-64 using Cisco Packet Tracer
4. Analysis of Router Advertisement Using Wireshark
5. Simulating the basic network topology with SDN based Open Flow Switch using NS3

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Describe how IPv6 interacts with data link layer with IPv6 Structure and addressing methods
CO2: To develop the strategies for deploying IPv6 in the place of IPv4
CO3: Analyze the security issues for IPv6 in emerging applications
CO4: Analyze the need for separation of data and control plane in Networking
CO5: To use SDN to enable and enhance NFV

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MC4011 DIGITAL IMAGE PROCESSING L T P C

COURSE OBJECTIVES:
- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Learn to represent image enhancement in the spatial and frequency domain.
- Be familiar with image segmentation and compression techniques

UNIT I DIGITAL IMAGE FUNDAMENTALS
Elements of visual perception, Image Acquisition Systems, Sampling and Quantization, Image Formation, Image Geometry, Different types of digital images. Relationship between pixels, Basic concepts of distance transform, Color Image fundamentals- RGB-HIS Models, Different color models-conversion.

UNIT II IMAGE TRANSFORMS
1D Discrete Fourier Transform (DFT), 2D transforms – DFT, Discrete Cosine Transform, Walsh and PCA

UNIT III IMAGE ENHANCEMENT

UNIT IV IMAGE SEGMENTATION AND FEATURE EXTRACTION
Segmentation: Point detection, line detection, edge detection, Region based segmentation, Region Splitting and Merging Technique. Thresholding Techniques: multilevel thresholding, optimal thresholding using Bayesian classification. Feature Extraction: GLCM, Hough Transform,
Morphological operation

UNIT V IMAGE COMPRESSION
Lossy and lossless compression schemes, prediction based compression schemes, sub-band encoding schemes, JPEG compression standard, Fractal compression scheme, Wavelet compression scheme

TOTAL: 45 PERIODS

SUGGESTED ACTIVITIES:
1. Compute the GLCM Gray Level Co-occurrence Matrix at \((d=1, \theta=0^\circ)\) for the image of size \(n \times n\) and derive the possible features from the GLCM matrix.
2. For the given \(3 \times 3\) input matrix, perform histogram equalization (Assume the image is 5 bit).
3. Classify an image \(8 \times 8\) into 3 classes using K-means clustering.
4. Tools – OpenCV/ Python / Matlab Trial Version
5. To read, view any image and convert a colour image (peppers.png) into greyscale image, binary Image.
6. To obtain Discrete Cosine transform of any grey scale image (eg: cameraman.tif).
7. Apply Principal Component Analysis (PCA) transform of any colour image (eg: peppers.png) and prove that it reduces the dimensionality of the data.
8. By using (GLCM), extract the different features of any image (cameraman.tif) like energy feature.
9. Segment any image (peppers.png) by using thresholding, and compute Euclidean distance for classifying using k-NN classifier.

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

CO1: digitize the input image using appropriate sampling and quantizing techniques

CO2: Transform the input images to various domains and classify the images

CO3: Enhance the images using spatial domain and frequency domain for better visual representation

CO4: To extract the features of a image by applying Morphological Image Processing techniques.

CO5: Analyze the different image compression techniques and its significance

REFERENCES
### MC4012 SOCIAL NETWORK ANALYTICS

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<td>- To study about the knowledge representation technologies for social network analysis.</td>
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<td>- To analyze the data left behind in social networks.</td>
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<td>- To gain knowledge about the community-maintained social media resources.</td>
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<td>- To learn about the visualization of social networks.</td>
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#### UNIT I INTRODUCTION TO SEMANTIC WEB

The development of Semantic Web – Emergence of the Social Web – The Development of Social Network Analysis – Basic Graph Theoretical Concepts of Social Network Analysis – Electronic Sources for Network Analysis – Electronic Discussion Networks, Blogs and Online Communities

#### UNIT II KNOWLEDGE REPRESENTATION ON THE SEMANTIC WEB

Ontology-based knowledge Representation – Ontology languages for the Semantic Web: RDF and OWL

#### UNIT III SOCIAL NETWORK MINING

Detecting Communities in Social Network – Evaluating Communities – Methods for Community Detection – Applications of Community Mining Algorithms – Tools for detecting communities – Application: Mining Facebook

#### UNIT IV COMMUNITY MAINTAINED SOCIAL MEDIA RESOURCES

Community Maintained Resources – Supporting technologies for community maintained resources – User motivations – Location based social interaction – location technology – mobile location sharing – Automated recommender system

#### UNIT V VISUALIZATION OF SOCIAL NETWORKS


**TOTAL: 45 PERIODS**
SUGGESTED ACTIVITIES:
1. Create complex topologies for a social network (Eg: Society of Friends (Quakers) https://programminghistorian.org/assets/exploring-and-analyzing-network-data-with-python/quakers_nodelist.csv) using an open source library (NetworkX) and analyse multiple metrics (Node degree, Node strength, Average path length, Clustering coefficient, Node centralities and Ego-betweenness centrality).
2. Describe the steps in Ontology development using Uniform Modeling Language. Also discuss how to interact with the ontology by extending UML.
3. Collect different types of data from Twitter by using an open source library (Tweepy) and build your own Twitter data crawler.
4. Discuss about community welfare application in social network analysis using an open source tool (Gephi).

COURSE OUTCOMES:
Up on completion of the course, the students will be able to:
CO1: create entities and relationships of data as network and do analysis
CO2: Model and represent knowledge for social semantic Web.
CO3: Use extraction and mining tools for analyzing Social networks.
CO4: Collect data from various social media resources and analyse.
CO5: Develop personalized visualization for Social networks.

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MC4013 CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES

COURSE OBJECTIVES:
To understand the basics of Blockchain
- To understand the basics of Cryptocurrency
- To understand the working of digital tokens and wallets
- To understand the working of contracts
- To understand the working of block chain platforms

UNIT I OVERVIEW OF BLOCKCHAIN:
Why Blockchain - The Structure of Blockchain - Data Structure of Blockchain - Data Distribution in Blockchain - Block Validation. **Block Validators**: Consensus - Proof of Work – Proof of Stake - Proof of Activity - Proof of Elapsed Time - Proof of Burn

UNIT II CRYPTOCURRENCY

UNIT III DEVELOPMENT FRAMEWORKS

UNIT V HYPERLEDGER

UNIT V BLOCKCHAIN PLATFORMS
**Multichain** - HydraChain. **Future Blockchain**: IOTA – Corda - Chain Core. **Blockchain Framework**: CoCo Framework – Tierion – BigchainDB.

SUGGESTED ACTIVITIES:
- Discuss that Blockchain is itself a data structure. Mention the type of data structure in Blockchain. How data distribution happens in Blockchain?
- Write your understanding about Bitcoin and how to create our own Cryptocurrency.
- Compare OmiseGO, EOS and Tether.
- Write the features and applications of Hyperledger Fabric in Blockchain Technology.
- Explore Blockchain platforms.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to
**CO1**: Identify Block Chain as Data structure and Distribution Data
**CO2**: Implement the transactions of Crypto currency
**CO3**: Identify the different ways to achieve Block chain Technology
CO4: Design and build smart contracts
CO5: Use smart contract for real world application in a Blockchain Platform

REFERENCES
4. Antony Lewis, The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them, Mango Publishing group, 2018

MC4014 BIO INSPIRED COMPUTING L T P C 3 0 0 3

COURSE 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 various fields

UNIT I INTRODUCTION 9

UNIT II RANDOM WALK AND ANNEALING 9
Random variables - Isotropic random walks - Levy distribution and flights - Markov chains - step sizes and search efficiency - Modality and intermittent search strategy - importance of
randomization- Eagle strategy-Annealing and Boltzmann Distribution - parameters -SA algorithm - Stochastic Tunneling

UNIT III GENETIC ALGORITHMS AND DIFFERENTIAL EVOLUTION 9

UNIT IV SWARM OPTIMIZATION AND FIREFLY ALGORITHM 9
Swarm intelligence - PSO algorithm - accelerated PSO - implementation - convergence analysis - binary PSO - The Firefly algorithm - algorithm analysis - implementation - variants- Ant colony optimization toward feature selection

UNIT V APPLICATIONS OF BIO INSPIRED COMPUTING 9

TOTAL: 45 PERIODS

SUGGESTED ACTIVITIES:
1. Identify problems with domains where Bio inspired computing will be most suitable to find a solution
2. Identify the applications of Random walk
3. List out the applications of Genetic algorithms in AI and machine learning
4. Apply swarm intelligence and Firefly algorithm to find an optimal solution for a problem Compare their efficiency and accuracy
5. Try to implement a Bio inspired computing in Networks/Biomedical/Cloud computing applications to obtain an optimal solution

COURSE OUTCOMES:
Upon completion of the course, the students should be able to
CO1: Implement and apply bio-inspired algorithms
CO2: Explain random walk and simulated annealing
CO3: Implement and apply genetic algorithms
CO4: Explain swarm intelligence and ant colony for feature selection
CO5: Apply bio-inspired techniques in various fields

REFERENCES
MC4015 DIGITAL MARKETING L T P C 3 0 0 3

COURSE OBJECTIVES:
- To understand the difference between Traditional Marketing and digital Marketing
- To understand and analyze the search engine functions
- To develop a deep knowledge about the Digital marketing platforms and the theoretical aspects of creating a website
- To analyze inbuilt tools for digital Marketing

UNIT I INTRODUCTION TO DIGITAL MARKETING
What is Digital Marketing- Need of Digital Marketing-Digital Marketing Platforms – Understanding digital marketing process- Difference between Traditional Marketing and digital Marketing- tools of Digital marketing - Advantage of Digital Marketing-Digital Marketing Manager Role and functions - How we use both Digital & Traditional Marketing

UNIT II WEBSITE & SEARCH ENGINE
Website –Hosting and Domain– Different platforms for website creation- Introduction to SERP- What are search engines- How search engines work- Major functions of a search engine- What are keywords -Different types of keywords- Google keyword planner tool.

UNIT III MISC TOOLS- GOOGLE WEBMASTER TOOLS
Site Map Creators- Browser-based analysis tools-Page Rank tools-pinging & indexing tools- Dead links identification tools- Open site explorer Domain information/ whois tools- Quick sprout

UNIT IV LEAD MANAGEMENT & DIGITAL MARKETING
Web to lead forms- Web to case forms- Lead generation techniques- Leads are everywhere- Social media and lead gen Inbuilt tools for Digital Marketing-Ip Tracker- CPC reduction (in case of paid ads) Group posting on Social Media platforms

UNIT V TRENDING DIGITAL MARKETING SKILLS
Search Engine Optimization(SEO)-Search Engine Marketing(SEM)-Social Media Marketing/Optimization- Email Marketing. Website :Product Marketing- Content Writing. Marketing
the created content online Copywriting- Blogging- Local Marketing. Google Ad Words - Campaign Management- PPC Advertising- Affiliate Marketing. Mobile and SMS Marketing- Marketing Automation-Web Analytics- Growth Hacking

SUGGESTED ACTIVITIES:
1. Subscribe to a weekly/quarterly newsletter and analyze how it’s content and structure aid with the branding of the company and how it aids its potential customer segments.
2. Perform keyword search for a skincare hospital website based on search volume and competition using Google keyword planner tool.
3. Demonstrate how to use the Google WebMasters Indexing API
4. Discuss an interesting case study regarding how an insurance company manages leads.
5. Discuss negative and positive impacts and ethical implications of using social media for political advertising.
6. Discuss how Predictive analytics is impacting marketing automation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: To gain insight on the concept of digital marketing and the role of a digital manager.
CO2: To understand and administer the website and the search engines.
CO3: To understand how to use MISC and Google Webmaster tools.
CO4: To understand the concepts of lead management and digital marketing.
CO5: To gain knowledge on the latest digital marketing trends

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MC4016 SOFTWARE ARCHITECTURE

COURSE OBJECTIVES:

- Understand software architectural requirements and drivers
- Be exposed to architectural styles and views
- Be familiar with architectures for emerging technologies

UNIT I INTRODUCTION AND ARCHITECTURAL DRIVERS


UNIT II QUALITY ATTRIBUTE WORKSHOP

Quality Attribute Workshop – Documenting Quality Attributes – Six part scenarios – Case studies.

UNIT III ARCHITECTURAL VIEWS


UNIT IV ARCHITECTURAL STYLES

Introduction – Data flow styles – Call-return styles – Shared Information styles – Event styles – Case studies for each style

UNIT V DOCUMENTING THE ARCHITECTURE

Good practices – Documenting the Views using UML – Merits and Demerits of using visual languages – Need for formal languages – Architectural Description Languages – ACME – Case studies. Special topics: SOA and Web services – Cloud Computing – Adaptive structures

SUGGESTED ACTIVITIES:

1. List the stakeholders for a software architecture. How do project managers, chief technical officers, chief information officers, analysts, customers, and users fit into your list?
2. Which quality attributes tend to be the most important to systems in your organization? How are those attributes specified? How does the architect know what they are, what they mean, and what precise levels of each are required?
3. Software architecture is often compared to building architecture. What are the strong points of this comparison? What is the correspondence in buildings to software architecture structures and views? To patterns? What are the weaknesses of the comparison? When does it break down?
4. How does a UML class diagram relate to the styles discussed? Does that diagram show decomposition, uses, generalization, or another combination?
5. You are a new hire to a project. Lay out a sequence of documentation you would like to have to acquaint you with your new position

TOTAL: 45 PERIODS
COURSE OUTCOMES:
Upon Completion of the course, the students will be able to
CO1: Explain influence of software architecture on business and technical activities
CO2: Summarize quality attribute workshop
CO3: Identify key architectural structures
CO4: Use styles and views to specify architecture
CO5: Design document for a given architecture

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MC4017 DIGITAL FORENSICS

COURSE OBJECTIVES:
- To learn the security issues network layer and transport layer.
- To be exposed to security issues of the application layer.
- To be familiar with forensics tools.
- To analyze and validate forensics data.
- To perform digital forensic analysis based on the investigator's position.

UNIT I INTRODUCTION
Method – Role of Forensic examiner in Judicial System – Key technical concepts – Bits, bytes and numbering schemes- File extension and file signatures – Storage and memory- computing environment - Legal, Professional and Ethical aspects of Cyber Forensics

UNIT II ANTI-FORENSICS & LEGAL

UNIT III EVIDENCE COLLECTION

UNIT IV COMPUTER FORENSICS

UNIT V NETWORK FORENSICS & MOBILE DEVICE FORENSICS

COURSE OUTCOMES
Upon Completion of the course, the students will be able to
CO1:Understand the digital forensic process and to play the role of forensic examiner.
CO2:Include the Legal amendments in the analysis of the digital forensic process
CO3:Demonstrate evidence collection related to digital forensic process
CO4:Explore the computer forensics, network forensics and mobile device forensics.
CO5:Use the forensics tools for real world problem

SUGGESTED ACTIVITIES
1. Illustrate with an example about file signature. Why file signature is important in digital forensics.
2. Explore the legal Fourth amendment related to criminal laws in digital forensics. Write about searching and seizing computers, laptops, and other electronic gadgets as an evidence in Criminal Investigations
3. Describe legal aspects of collecting and preserving computer forensic evidence.
4. Explain the steps involved in incident response methodology.
5. Give the guidelines for mobile device forensics. Why mobile forensic is important?

TOTAL: 45 PERIODS
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MC4018 WIRELESS NETWORKING

COURSE OBJECTIVES:
The student should be made:

- To understand the concept about Wireless networks, protocol stack and standards
- To understand and analyse the network layer solutions for Wireless networks
- To study about fundamentals of 3G Services, its protocols and applications
- To learn about evolution of 4G Networks, its architecture and applications
- To explore the architecture of 5G, 5G Modulation Schemes and to analyse the concept of MIMO and other research areas in 5G

UNIT I WIRELESS LAN


UNIT II MOBILE NETWORK LAYER

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6- Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network:
Routing: Destination-Sequenced Distance-Vector (DSDV), Dynamic source routing, IoT: CoAP. TCP enhancements for wireless protocols

UNIT III 3G OVERVIEW

UNIT IV 4G NETWORKS

UNIT V 5G NETWORKS

SUGGESTED ACTIVITIES:
1. Build a simple WLAN Topology using ns-3 scripting or CORE GUI
2. Performance Analysis of MANET Routing Protocols using ns3 or INET Framework
3. 5G NR Network Simulation using Simu 5G or 5G-LENA
4. Describe some problems with Wi-Fi access for an apartment building and explain how it can be rectified.
5. Study error and throughput varies in a wireless LAN network changes as the distance between the Access Point and the wireless nodes is varied with NetSim or any Simulation tool
6. Study how call blocking probability varies as the load on GSM network increases continuously

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student should be able to:
CO1: Select a wireless network environment for an application based on factors like distance etc
CO2: Implement Packet Delivery from source to destination in a mobile network
CO3: Select 3G wireless technology and protocol based on the requirement
CO4: Understand various 4G networking technologies and their unique functionalities
CO5: Get an overview of the implementation latest network Architecture, its principles and evolution

REFERENCES
3. Afif Osseiran, Jose F. Monserrat and Patrick Marsch, "5G Mobile and Wireless

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MC4019 DATA VISUALIZATION TECHNIQUES

COURSE OBJECTIVES:
- To understand the categories of data quality principles.
- To describe data through visual representation.
- To provide basic knowledge about how large datasets are represented into visual graphics and easily understand the complex relationships within the data.
- To design effective visualization techniques for any different problems

UNIT I INTRODUCTION
Visualization – visualization process – role of cognition – Pseudocode conventions – Scatter plot - Data foundation : Types of data - Structure within and between records - Data preprocessing – Human perceptions and information processing

UNIT II VISUALIZATION FOUNDATIONS

UNIT III DESIGNING EFFECTIVE VISUALIZATION
Steps in Designing Visualization – problems in Designing Effective Visualization – Comparing and evaluating visualization techniques – Visualization Systems
UNIT IV INFORMATION DASHBOARD DESIGN


UNIT V VISUALIZATION SYSTEMS


Suggested Activities
1. Brief about Data Visualization with tools and techniques involved. Write its application in Data Analytics.
2. Discuss about visualization technique for two-dimensional data
3. Explore the steps involved in designing effective visualization.
4. Create a dashboard using visualization techniques for road accidents in TamilNadu
5. Summarize Visualization Toolkit and discuss by taking a case study.

TOTAL: 45 PERIODS

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

CO1: Describe principles of visual perception
CO2: Apply visualization techniques for various data analysis tasks – numerical data
CO3: Apply visualization techniques for various data analysis tasks – Non numerical data
CO4: Design effective visualization techniques for different problems
CO5: Design information dashboard

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MC4020 DATA MINING AND DATA WAREHOUSING TECHNIQUES  

COURSE OBJECTIVES:
- To characterize the kinds of patterns that can be discovered by association rule mining.
- To implement classification techniques on large datasets.
- To analyse various clustering techniques in real world applications.
- To get exposed to the concepts of data warehousing architecture and implementation

UNIT I DATA MINING & DATA PREPROCESSING

UNIT II ASSOCIATION RULE MINING AND CLASSIFICATION
Introduction to Association rules – Association Rule Mining – Mining Frequent Itemsets with and without Candidate Generation – Classification versus Prediction – Data Preparation for Classification and Prediction

UNIT III CLASSIFICATION AND PREDICTION TECHNIQUES
Classification by Decision Tree – Bayesian Classification – Rule Based Classification – Bayesian Belief Networks – Classification by Backpropagation – Support Vector Machines – K-Nearest Neighbor Algorithm – Linear Regression, Nonlinear Regression

UNIT IV CLUSTERING TECHNIQUES
Cluster Analysis – Partitioning Methods: k-Means and k-Medoids – Hierarchical Methods: Agglomerative and Divisive – Model Based Clustering Methods: Fuzzy clusters and Expectation-Maximization Algorithm

UNIT V DATA WAREHOUSE

SUGGESTED ACTIVITIES:
2. Identify the association rules in the above dataset using Apriori algorithm.
4. Demonstrate the K-means clustering process in the above dataset.
5. Describe the steps in building Data warehouse using open source tools (Eg: Pentaho Data
COURSE OUTCOMES:
On completion of the course, the students will be able to:

CO1: Identify data mining techniques in building intelligent model.
CO2: Illustrate association mining techniques on transactional databases.
CO3: Apply classification and clustering techniques in real world applications.
CO4: Evaluate various mining techniques on complex data objects.
CO5: Design, create and maintain data warehouses

REFERENCES
3. Data Warehousing, Data Mining, & OLAP – Alex Berson, Stephen Smith, TMHill,2008.

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MC4021  AGILE METHODOLOGIES  L T P C  3 0 0 3

COURSE OBJECTIVES:
- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of Agile development and testing techniques.
- To understand the benefits and pitfalls of working in an Agile team.
- To understand Agile development and testing
UNIT I AGILE FUNDAMENTAL 9
Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model
- Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

UNIT II AGILE PROCESSES 9

UNIT III AGILITY AND KNOWLEDGE MANAGEMENT 9

UNIT IV AGILITY AND REQUIREMENTS ENGINEERING 9

UNIT V AGILITY AND QUALITY ASSURANCE 9

SUGGESTED ACTIVITIES:
1. Describe all the phases of Agile software development methodologies for student enrollment system
2. Discuss the five values of Extreme programming practices and explain the use cases involved in airline reservation system
3. Describe about agile knowledge sharing and the role of Story-Card Maturity Model for airline reservation system
4. Describe the requirement engineering challenges for agile software development of any one the system (Use Jira Software for project planning)
5. Discuss the role and responsibility of quality assurance in an agile methodology for airline reservation system

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1:Realize the importance of interacting with business stakeholders in determining the requirements for a software system
CO2:Perform iterative software development processes: how to plan them, how to execute them.
CO3:Point out the impact of social aspects on software development success.
CO4:Develop techniques and tools for improving team collaboration and software quality.
CO5:Show how agile approaches can be scaled up to the enterprise level
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MC4022 ORGANIZATIONAL BEHAVIOR

COURSE OBJECTIVES:
- To enable the students to understand the Organizational Behavior
- To analyse various factors affecting Personality Organizational Change
- dynamic of groups
- To Understand various type of Group Behavior

UNIT I ORGANIZATIONAL BEHAVIOR INTRODUCTION
Organization Behaviour – Definition – Scope and Application in Management – Contributions of Other Disciplines to OB. Emerging Issues in Organizational Behaviour- Organizational behaviour models

UNIT II INDIVIDUAL PROCESSES

UNIT III LEADERSHIP AND POWER 9

UNIT IV GROUP DYNAMICS 9

UNIT V ORGANIZATIONAL CHANGE AND DEVELOPMENT 9

SUGGESTED ACTIVITIES:
1. To analyze and understand the impact of various functional modules on the behaviour of individuals with real time examples like buying behavior of consumers in supermarkets.
2. To Analyze and understand the Perception of individuals and performance based on situations like an individual's effectiveness in the workplace( often depends on their personality, attitudes and values along with their motivation) to succeed.
3. Conduct a group discussion among 10 members on some topic and write a report on analysis of behaviour of team members in group decision making
4. Justify the selection of team members for executing a project with the analysis of various factors like domain expertise ,communication skill of members etc
5. To study the Performance of employees on organizational change with respect to environment

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course should be able to:
CO1: Students will have a better understanding of human behavior in organization.
CO2: They will know the framework for managing individual and group performance.
CO3: Characteristics of attitudes and components of attitudes — A brief discussion
CO4: List the determinants of personality
CO5: List the characteristics of various leadership styles.

REFERENCES
MC4023 WEB DESIGN  L T P C  3 0 2 4

COURSE OBJECTIVES:  
- To understand the concepts and architecture of the World Wide Web.  
- To understand and practice markup languages  
- To understand and practice embedded dynamic scripting on client-side Internet  
- Programming  
- To understand and practice web development techniques on client-side  

UNIT I INTRODUCTION TO WWW  9+6  

UNIT II UI DESIGN  9+6  
SVG- Iframes - HTML5 Video and Audio tags - CSS Specificity - Box model - Margins, padding and border – Inline and block elements - Structuring pages using Semantic Tags - Positioning with CSS: Positions, Floats, z-index – CSS with CSS Preprocessors: SASS

UNIT III ADVANCED UI WITH CSS3  9+6  
Layouts with CSS Grids Flexbox- Responsive web design with media queries - Advanced CSS Effects – Gradients, opacity, box-shadow - CSS3 Animations: Transforms and Transitions - CSS Frameworks: Bootstrap

UNIT IV JAVA SCRIPT  9+6  

UNIT V SERVER-SIDE PROGRAMMING WITH PHP  9+6  
PHP basic syntax-PHP Variables and basic data structures-Using PHP to manage form
submissions-File Handling -Cookies and Sessions with PHP-Working with WAMP and PHPMYADMIN-Establishing connectivity with MySQL using PHP

Lab Components
1. Design a landing page for a website using Adobe XD (Unit 1)
2. Design an Admin Dashboard for an E-commerce website using Adobe XD (Unit 1)
3. Design and develop an event registration form. (Unit 2)
4. Design and develop a sticky navubar using floats and SASS. (Unit 2)
5. Design and develop a developer portfolio page. Develop the layout using flexbox and ensure the page is responsive. (Unit 3)
6. Design and develop pricing card list which are responsive using plain CSS and Flexbox (Unit 3)
7. Develop a register form and validate it using JavaScript. Design the forms using CSS3 and display Error Messages in the HTML page. (Unit 4)
8. Develop a website that uses the ‘jsonplaceholder’ Api to get posts data and display them in the form of a card. Use Flexbox to style the cards (Unit 4)
9. Develop a php server that Creates, Reads, Updates and Deletes Todo and save them in MySQL database. (Unit 5)
10. Develop a php server that registers and authenticates user session and stores user data in MySQL database. (Unit 5)

COURSE OUTCOMES:
CO1: Create a basic website using HTML and Cascading Style Sheets.
CO2: Create websites with complex layouts
CO3: Add interactivity to websites using simple scripts
CO4: Design rich client presentation using AJAX.
CO5: Add business logic to websites using PHP and databases

TOTAL: 75 PERIODS

REFERENCES
5. Keith J Grant; “CSS in Depth”, Manning Publications. 1st edition, 2018

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MC4024 C# AND .NET

COURSE OBJECTIVES:
- To learn the technologies of the .NET framework.
- To cover all segments of programming in C# starting from the language basis, followed by the object oriented programming concepts.
- To update and enhance skills in writing Windows applications, ADO.NET and ASP.NET.
- To introduce advanced topics namely data connectivity, WPF, WCF and WPF with C# and .NET 4.5.
- To implement mobile applications using .Net Compact Framework.

UNIT I .NET FRAMEWORK INTRODUCTION

UNIT II C# ADVANCED FEATURES

UNIT III BASE CLASS LIBRARIES AND DATA MANIPULATION
Diagnostics Tasks – Threads and Synchronization – Manipulating XML – SAX and DOM – Manipulating files and the Registry – Transactions – Data access with ADO.NET: Introduction, LINQ to Entities and the ADO.NET Entity Framework, Querying a Database with LINQ – Creating the ADO.NET Entity Data Model Class Library, Creating a Windows Forms Project – Data Bindings between Controls

UNIT VI WINDOW AND WEB BASED APPLICATIONS
Window Based Applications – Core ASP.NET – ASP.NET Web Forms – Server Controls, Data Binding – ASP.NET State Management, Tracing, Caching, Error Handling, Security, Deployment, User and Custom Controls – Windows Communication Foundation (WCF)

UNIT V NET COMPACT FRAMEWORK
List of Experiments
1. Write a program in C# to check whether a number is palindrome or not
2. Design a simple calculator using switch statement in C#
3. Write a program in C# to find the roots of quadratic equation.
4. Using try, catch and finally blocks write a program in C# to demonstrate error handling
5. Write a program in C# to build a class which implements an interface which already exists.
6. Implement linked lists in C# using the existing collections name space
7. Write a C# program to create a dataset for student details, use grid view to display information.
8. Write a C# program to add new rows and new columns in the above program (student details) and create methods to access the dataset
9. Write an ASP.Net program to display a welcome message in the form when the button is clicked.
10. Write an ASP.Net program containing a listbox, button, an image and label controls. When the user clicks on an item in the listbox, its image should be displayed in the image control. When the user clicks the button, the cost of the selected item should be displayed in the control.

COURSE OUTCOMES:
Up on completion of the course the students will be able to
CO1: Understand the difference between .NET and Java framework.
CO2: Work with the basic and advanced features of C# language.
CO3: Create applications using various data providers.
CO4: Create a web application using ASP.NET.
CO5: Create mobile applications using .NET compact framework.

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TOTAL: 75 PERIODS
MC4025  BIG DATA ANALYTICS  L T P C
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COURSE OBJECTIVES:
- To understand fundamentals of BigData and Hadoop
- To learn about file system configuration in HADOOP
- To learn Map Reduce concept of Hadoop in executing Task
- To learn the Queue Processing and stream processing of Data
- To learn about Hadoop Frameworks

UNIT I  INTRODUCTION TO BIG DATA AND HADOOP  9+6
Types of Digital Data - Introduction to Big Data - Challenges of conventional systems - Web data –
Evolution of Analytic scalability - Analytic Processes and Tools - Analysis vs Reporting -History of
Hadoop - Apache Hadoop - Analyzing Data with Hadoop - Hadoop Streaming

Lab Components:
Perform setting up and Installing Hadoop

UNIT II  HDFS & HADOOP I/O  9+6
Hadoop Distributed File System :The Design of HDFS- HDFS Concepts- The Command-Line
Interface- Hadoop File Systems- Data Flow- Parallel Copying with distcp- Hadoop Archives-
Hadoop I/O: Data Integrity- Compression- Serialization

Lab Components:
- Implement HDFS Command Reference:
- Listing contents of directory, Displaying and printing disk usage, Moving files &
directories, Copying files and directories
- Implement the following file management tasks in Hadoop: Writing a file into HDFS
- Reading data from HDFS, Retrieving files, Deleting files

UNIT III  MAPREDUCE  9+6
Analyzing the Data with Hadoop- Hadoop Pipes- MapReduce Types - Input Formats- Output
Formats- MapReduce Features - MapReduce Works - Anatomy of a MapReduce Job Run –
Failures - Job Scheduling - Shuffle and Sort - Task Execution

Lab Components:
- Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
- Implement Matrix vector multiplication map reduce program

UNIT IV  QUEUEING AND STREAM PROCESSING SYSTEMS  9+6
Queueing: Queueing systems, Introduction to kafka, producer consumer, brokers, types of queues
- single consumer, multi consumer queue servers.
- Streaming systems: Stream processing – queues and workers - micro batch streaming processing
- introduction to kafka streaming processing API

Lab Components:
Implement Single consumer queue in Kafka
Implement video streaming with producer consumer in Kafka
UNIT V  HADOOP FRAMEWORKS

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

Lab Components:
- Install and Run Pig then write Pig Latin scripts to sort, group, join your data.
- Write a Pig Latin scripts for finding TF-IDF value for book dataset (A corpus of eBooks available at: Project Gutenberg)
- Install and Run Hive then use Hive to create, alter, and drop databases, tables

COURSE OUTCOMES:
CO1: Able to apply Hadoop for analyzing Big Volume of Data
CO2: Able to access, store, do operations on data as Files and directories
CO3: Able to implement MapReduce Concept in analyzing BigData
CO4: Able to implement event streaming using Kafka API
CO5: Able to access volume of data with Hadoop Framework

TOTAL: 75 PERIODS

REFERENCES
5. Kafka: The Definitive Guide- Real-Time Data and Stream Processing at Scale, by Gwen Shapira, Neha Narkhede, Todd Palino

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COURSE OBJECTIVES:

- To know the behavior of the testing techniques and to design test cases to detect the errors in the software
- To get insight into software testing methodologies
- To understand standard emerging areas in testing
- To learn about the software quality models.
- To understand the models and metrics of software quality and reliability

UNIT I  INTRODUCTION  9+6

UNIT II  SOFTWARE TESTING METHODOLOGY  9+6

UNIT III  EMERGING SPECIALIZED AREAS IN TESTING  9+6

UNIT VI  SOFTWARE QUALITY MODELS  9+6

UNIT V  QUALITY THROUGH CONTINUOUS IMPROVEMENT PROCESS  9+6
Role of Statistical Methods in Software Quality – Transforming Requirements into Test Cases – Deming’s Quality Principles – Continuous Improvement through Plan Do Check Act (PDCA)

List of Experiments

1. Perform data flow testing for any C program to verify the def-use variables (Ex: largest of two numbers)
2. Using Selenium IDE, Write a test suite containing minimum 4 test cases for any simple C program (Ex: To check Adam Number)
3. Write and test a program to update 10 student records into tables into Excel file. (Selenium)
4. Write and test a program to select the number of students who have scored more than 60 in any one subject (or all subjects). (Selenium)
5. Write and test a program to login to a specific web page. (Selenium)
6. Write and test a program to provide a total number of objects present / available on the page. (Selenium)
7. Write and test a program to get the number of list items in a list / combo box. (Selenium)
8. Identify system specification and design test cases to test any application using any one of a testing tool (Selenium/Bugzilla/Test Director)
9. Automate the test cases of the above system using any test automation tool (Bugzilla /QA Complete)
10. Design test cases for web pages to test any web sites (Web Performance Analyzer/Open STA)

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

CO1: choose the software testing techniques to cater to the need of the project
CO2: identify the components of software quality assurance systems
CO3: apply various software testing strategies
CO4: design and develop software quality models
CO5: make use of statistical methods in software quality.

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**MC4027 ADVANCED JAVA PROGRAMMING**

**COURSE OBJECTIVES:**
- To understand the fundamentals of web programming and client side scripting.
- To learn server side development using servlets, web sockets.
- To learn the Spring framework and build applications using Spring.
- To learn and implement the concept of Java Persistence API.
- To learn the advanced client side scripting and framework.
UNIT I  INTRODUCTION TO WEB & JAVASCRIPT  9 +6
Introduction to Web: Server - Client - Communication Protocol (HTTP), Javascript Prototypes - Classes - Modules – Fetch API – JS Canvas - Storage: LocalStorage, Cookies, IndexedDB, JSON
Lab Components
1. Create an event registration application using javascript. It should implement different widgets for registration form and registered records view using tabs. It should perform the form validation. (Unit I)
2. Create a javascript application in an Object Oriented way using Classes and Modules. It should also use browser storage for persistence. (Unit I)

UNIT II  SERVER SIDE PROGRAMMING  9 +6
Lab Components
1. Build a web application using Gradle. The server side of the application should implement RESTful APIs using Servlet and do necessary logging. The client side of the application should be a single page application which consumes the RESTful APIs through AJAX. (Unit II)
2. Build a chat application using WebSocket. (Unit II)

UNIT III  SPRING  9 +6
Spring Configuration and Spring Boot, Spring MVC, Spring Bean Lifecycle - DispatcherServlet and Configuration - Interceptors – Annotations, Controllers - Views - Input Validation -File Upload-Container,Dependency and IOC.
Lab Components
1. Create a Spring MVC application. The application should handle form validation, file upload, session tracking.
2. Implement a RESTful Spring Boot application using Spring REST, Spring Security and Spring Cache.

UNIT IV  AOP, JAVA PERSISTENCE API AND HIBERNATE  9 +6
Lab Components
1. Design a system using JPA and Hibernate. The system should have multiple entities and relationships between the entities. The database schema should be generated through Hibernate. Provide RESTful endpoints for CRUD operations for the defined entities. Also, support pagination and searching using JPA’s JPQL and Criteria API. (Unit IV)
2. Create a Spring RESTful Application with Spring Data JPA. Support pagination and searching using Specifications. (Unit IV)

UNIT V  ADVANCED SPRING PROGRAMMING  9 +6
Spring Boot JDBC - Spring Boot Actuator - Spring Cloud -Spring Boot Testing - Spring Security Architecture, Spring Cache - Building RESTful Web Services
Lab Components
1. Create a React application with different components and interactions between the components.
2. Develop a full-stack application using React and Spring. Make use of Spring REST, Spring
Security, Spring Data JPA, Hibernate, Spring Boot, Gradle and ReactJS state and component mechanism.

COURSE OUTCOMES:
Upon completion of the course the students should be able to:
CO1: To write client side scripting.
CO2: To implement the server side of the web application.
CO3: To implement Web Application using Spring.
CO4: To implement a Java application using Java Persistence API.
CO5: To implement a full-stack Single Page Application using React, Spring and JPA.

TOTAL: 75 PERIODS

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MC4028  NETWORK PROGRAMMING AND SECURITY  L T P C  3 0 2 4

COURSE OBJECTIVES:
- To understand the basics of Network Programming
- To be familiar with building network applications
- To design and implement client server Applications using TCP and UDP Sockets
- To expose with various socket options
- To get aware of Network security for Network Programming
UNIT I  INTRODUCTION
TCP/IP Layer Model – Multicast, broadcast and Anycast - Socket address Structures – Byte ordering functions – address conversion functions – Elementary TCP Sockets – socket, connect, bind, listen, accept, read, write, close functions – Iterative Server – Concurrent Server
Lab Components
1. Socket Creation
2. Implementation of Client-Server Communication Using TCP

UNIT II  UNIT TITLE
TCP Echo Server – TCP Echo Client – Posix Signal handling – Server with multiple clients – boundary conditions: Server process Crashes, Server host Crashes, Server Crashes and reboots, Server Shutdown
Lab Components
1. Implementation of TCP Echo Client Server
2. Design a multiuser TCP client - server chat application

UNIT III  SOCKET OPTIONS AND MULTIPLEXING
Lab Components
1. TCP echo server with multiplexing to estimate round trip time from client to server.
2. Design a server for multi-player tic tac toe game

UNIT IV  ELEMENTARY UDP SOCKETS
UDP echo Server – UDP echo Client – Multiplexing TCP and UDP sockets – Domain name system – gethostbyname function – Ipv6 support in DNS – gethostbyadr function – getservbyname and getservbyport functions
Lab Components
1. Design a UDP client/server Chat application
2. Design a UDP Domain Name Server (DNS)

UNIT V  NETWORK SECURITY
Lab Components

COURSE OUTCOMES:
Upon completion of the course, the student will be able to
CO1: Design and implement the client/server programs using variety of protocols
CO2: Understand the key protocols which support Internet
CO3: Demonstrate advanced knowledge of programming interfaces for network communication
CO4: Use the basic tools for design and testing of network programs in Unix environment.
CO5: Identify some of the factors driving the need for network security

TOTAL: 75 PERIODS
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AUDIT COURSES

AX4091 ENGLISH FOR RESEARCH PAPER WRITING L T P C
2 0 0 0

COURSE 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 the first-time submission

TOTAL: 30 PERIODS

COURSE OUTCOMES:
CO1 – Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

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AX4092                                       DISASTER MANAGEMENT  L  T  P  C  2 0 0 0

COURSE OBJECTIVES:
• Summarize basics of disaster
• Explain a critical understanding of key concepts in disaster risk reduction and humanitarian
• Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
• 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

COURSE OUTCOMES:
CO1: Ability to summarize basics of disaster
CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO5: Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCES

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### AX4093 CONSTITUTION OF INDIA

**L T P C**

2 0 0 0

**COURSE OBJECTIVES:**

Students will be able to:

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

### 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

District’s Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila

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

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

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

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AX4094 நான்மை தமிழியம்
L T P C 2 0 0 0

UNIT I சங்கிலிதம்
1. தமிழின் துவக்கநூல் ததொல்கொப்பியம் - எழுத்து, எழுத்து
2. அகநொனூறு (82)
   - பொரிமுனை அரங்கம்
3. இயற்ககிலே மார்க்கண்டாலி
4. பொர்கப்பகொட்டம் (95,195)
   - பாணார் வியாழிய விளக்கம்

UNIT II  அறநநறி குறிப்
1. அறநநறி அரச விளக்கம்
   - அரச விளக்கம், அமர்ப்பொருள், குறிப்பிட்டு, பதி
2. பிரார்த்தனை - இராசிய விளக்கம்
   - வியாழிய, திருச்சந்துபெண், குறிப்பிட்டு, அமர்ப்பொருள் (இம்மாற்றம்
      முதல்வாழிய விளக்கம்)

UNIT III  குறிப் குறிபாட்டைக்
1. குறிப்பிட்டுப் புரட்சி
   - வியாழிய வி க்கம் கடகம்
2. துவக்கப் பெண்கொட்டம் விளக்கம்
   - வியாழிய விளக்கம் அமர்ப்பொருளமிக்

UNIT IV  அறநநறி குறிப்
1. சிறுப்பொணைப் பகடல்
   - பகடய விளக்கம் பதிவு, மூலப்பிள்ளை
     விளக்கம் பதிவுக், அமர்ப்பொருள் முதல்வாழிய விளக்கம், அன்புப்பு
     பர்வபள்ள
2. பொர்குறிப்
   - அண்டோர்ககயம் புரட்சி திசை
3. திசைகாரர் (617, 618)
   - பியாலம் சிதிலை விளக்கம்
4. துவக்க விளக்கம் விலைமை விளக்கம்
5. புரட்சிகம்
   - சிறுப்பொணைப் பகடல்
6. அகநொனூறு (4) - புரட்சி
   - சிறுப்பொணைப் (11) - விலைமை
   - குறிப்பிட்டுப் பகடல் (11) - பர்வபள்ள, புரட்சி
   - குறிப்பிட்டு (50) (27) - பர்வ
   - முதல்வாழிய பொருள் விளக்கம்

UNIT V  துவக்க குறிப் பகடல்
1. ஆகநொனூற் குறிப்
   - பொரிமுனை பரிமாம்.
   - பொரிமுனை விழா விளக்கம்.
   - விழா விளக்கம்.
- பல்லுய திறந்தியம்.
- திட்டமுன்.
2. பல்லுய திறந்தியம் பொருளாக்கைய தமிழ் திறந்தியம்.
3. தமிழ் திறந்தியம் தமிழ் திறந்தியம்.
4. பல்லுய திறந்தியம் தமிழ் திறந்தியம் தமிழ் திறந்தியம்.
5. அறிவியல் திறந்தியம்.
6. தமிழ் திறந்தியம்.
7. கல்விக் கல்விக்காயம் தமிழ் திறந்தியம்.

TOTAL: 30 PERIODS

தமிழ் திறந்தியம் வரிசைப்படித்து / பகுதிகள்
1. தமிழ் வித்யாப் கல்வி முன்னையகம் (Tamil Virtual University)
   - www.tamilvu.org
2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)
   - https://ta.wikipedia.org
3. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)
4. விக்கிப்பீடியா தமிழகம்
   - தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)
5. தமிழ் தமிழகம் தமிழகம்
   - தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)
6. தமிழ் தமிழகம்
   - தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)

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BUS001 - DATA STRUCTURES AND ALGORITHMS

OBJECTIVES:
- Be familiar with basic techniques of algorithm analysis.
- Be exposed to the concept of ADTs.
- Learn linear data structures-List, Stack and Queue.
- Learn nonlinear data structures-Tree and Graphs.
- Be exposed to sorting, searching and hashing algorithms.

UNIT I  INTRODUCTION

Lab Experiments:
1. Develop a program to perform various array operations
2. Write a program to find running time complexity by considering each statement in the program for a given set of numbers.

UNIT II  LINEAR DATA STRUCTURES - STACK, QUEUE

Lab Experiments:
1. Write a program to convert infix to postfix using stack data structure
2. Develop a program to perform circular queue operations

UNIT III  LINEAR DATA STRUCTURES – LIST

Lab Experiments:
1. Perform Polynomial Manipulation using Single Linked List.
2. Implement the various operations in double linked list.

UNIT IV  SEARCHING, SORTING AND HASH TECHNIQUES

Lab Experiments:
1. Write a program to perform binary search
2. Write a program to sort a given set of numbers and compare among Bubble Sort, Selection Sort and Insertion Sort with respect to computational complexity.

UNIT V  NON LINEAR DATA STRUCTURES - TREES AND GRAPHS
Trees and its representation – left child right sibling data structures for general trees- Binary Tree – Binary

Lab Experiments:
1. Write a program to delete a node from a given Binary search tree
2. Write a program to perform Graph Traversals

TOTAL : 75 PERIODS

COURSE OUTCOMES:
Upon Completion of the course, the students will be able to
- analyze algorithms and determines their time complexity.
- understand the concepts of data types, data structures and linear structures
- apply data structures to solve various problems
- apply different Sorting, Searching and Hashing algorithms.
- understand non-linear data structures

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BX4002 PROBLEM SOLVING AND PROGRAMMING IN C L T P C 3 0 2 4

COURSE OBJECTIVES:
- To understand the basic concepts of problem solving approaches and to develop the algorithms
• Apply the techniques of structured (functional) decomposition to break a program into smaller pieces and describe the mechanics of parameter passing.
• To design, implements, test, and apply the basic C programming concepts

UNIT I  INTRODUCTION TO COMPUTER PROBLEM SOLVING  9

UNIT II  PROGRAMMING AND ALGORITHMS  9
Programs and Programming – building blocks for simple programs -pseudo code representation – flow charts - Programming Languages - compiler –Interpreter, Loader and Linker - Program execution – Classification of Programming Language - Structured Programming Concept – Illustrated Problems: Algorithm to check whether a given number is Armstrong number or not- Find factorial of a number

UNIT III  BASICS OF ‘C’, INPUT / OUTPUT & CONTROL STATEMENTS  9 +10

Lab Experiments:
1. Write programs to get some input, perform some operation and display the output using I/O statements
2. Write a program to execute some specific statements based on the test condition
3. Write programs to implement nested loop

UNIT IV  ARRAYS, STRINGS, FUNCTIONS AND POINTERS  9 +10

Lab Experiments
1. Write a program in C to get the largest element of an array using the function.
2. Display all prime numbers between two intervals using functions.
3. Reverse a sentence using recursion.
4. Write a C program to concatenate two strings

UNIT V  USER-DEFINED DATATYPES & FILES  9 +10

Lab Experiments:
1. Write a C program to Store Student Information in Structure and Display it.
2. The annual examination is conducted for 10 students for five subjects.
3. Write a program to read the data from a file and determine the following:
   Total marks obtained by each student; Topper of the class

COURSE OUTCOMES:
- Able to design a computational solution for a given problem.
- Able to break a problem into logical modules that can be solved (programmed).
- Able to transform a problem solution into programs involving programming constructs.
- To write programs using structures, strings, arrays, pointers and files for solving complex computational problems.
- Able to introduce modularity using functions and pointers which permit ad hoc runtime polymorphism.

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BX4003
INTRODUCTION TO COMPUTER ORGANIZATION AND OPERATING SYSTEMS

COURSE OBJECTIVES:
- To learn the basic structure and operations of a computer.
- To learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit.
- To understand the memory hierarchies, cache memories and virtual memories and to learn the different ways of communication with I/O devices.
- To understand the basic concepts and functions of Operating Systems
To understand Process and various Scheduling Algorithms of OS

UNIT I  BASIC STRUCTURE AND ARITHMETIC OPERATIONS  9

UNIT II  PROCESSOR AND CONTROL UNIT  9
- A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining – Pipelined datapath and control – Handling Data Hazards & Control Hazards – Exceptions.

UNIT III  MEMORY & I/O SYSTEMS  9

UNIT IV  OPERATING SYSTEMS OVERVIEW  9

UNIT V  PROCESS MANAGEMENT  9
- CPU Scheduling – Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Threads Overview– The critical-section problem, Semaphores, Classical problems of synchronization, Critical regions

TOTAL : 45 PERIODS

COURSE OUTCOMES:
On Completion of the course, the students should be able to:
- Understand the basics structure of computers, operations and instructions.
- Design arithmetic and logic unit, control unit.
- Understand the various memory systems and I/O communication.
- Understand operating system functions, types, system calls
- Analyze Process and various scheduling algorithms

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### CO-PO Mapping

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### OBJECTIVES:
- To understand the fundamentals of data models and conceptualize and depict a database system using ER diagram.
- To make a study of SQL and relational database design.
- To know about data storage techniques and query processing.
- To impart knowledge in transaction processing, concurrency control techniques and recovery procedures.

### UNIT I  INTRODUCTION

### UNIT II  RELATIONAL MODEL AND QUERY EVALUATION
Relational Model Concepts – Relational Algebra – SQL – Basic Queries – Complex SQL Queries – Views – Constraints

### UNIT III  DATABASE DESIGN & APPLICATION DEVELOPMENT

### UNIT IV  TRANSACTION PROCESSING

### UNIT V  FILES AND INDEXING
File operations – Hashing Techniques – Indexing – Single level and Multi-level Indexes – B+ tree – Static Hashing
LIST OF EXPERIMENTS:

Data Definition Commands to create, describe, alter, rename, drop and truncate the tables

1. Data Manipulation Commands for inserting, deleting, updating and retrieving in Tables
2. Transaction Control Language Commands like Commit, Rollback and Save Point
3. Illustrate the statements to create index and drop index
4. Perform database querying using simple query, nested query, subquery and join operations
5. Create a PL/SQL block to implement implicit and explicit cursors
6. Create a PL/SQL block to implement procedures and functions
7. Create a PL/SQL block to execute triggers
8. Execute a procedure which handles exception using PL/SQL
9. Create a embedded PL/SQL block to connect with any host language like ‘C’

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

- Understand the basic concepts of the database and data models.
- Design a database using ER diagrams and map ER into Relations and normalize the relations
- Acquire the knowledge of query evaluation to monitor the performance of the DBMS.
- Develop a simple database applications using normalization.
- Acquire the knowledge about different special purpose databases and to critique how they differ from traditional database systems.

TOTAL : 75 PERIODS

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COURSE OBJECTIVES:

- To introduce Mathematical Logic and their rules for validating arguments and programmes.
- To introduce counting principles for solving combinatorial problems.
- To give exposure to Graph models and their utility in connectivity problems.
- To introduce abstract notion of Algebraic structures for studying cryptographic and its related areas.
- To introduce Boolean algebra as a special algebraic structure for understanding logical circuit problems.

UNIT I  LOGIC AND PROOFS  9

UNIT II  COMBINATORICS  9

UNIT III  GRAPHS  9
Graphs and Graph Models – Graph Terminology and Special Types of Graphs – Matrix Representation of Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton Paths.

UNIT VI  ALGEBRAIC STRUCTURES  9

UNIT V  LATTICES AND BOOLEAN ALGEBRA  9

TOTAL : 45 PERIODS

COURSE OUTCOMES:
CO1: Apply Mathematical Logic to validate logical arguments and programmes.
CO2: Apply combinatorial counting principles to solve application problems.
CO3: Apply graph model and graph techniques for solving network other connectivity related problems.
CO4: Apply algebraic ideas in developing cryptograph techniques for solving network security problems.
CO5: Apply Boolean laws in developing and simplifying logical circuits.

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BX4006  BASICS OF COMPUTER NETWORKS  L T P C  3 0 0 3

COURSE OBJECTIVES:
- To understand networking concepts and basic communication model
- To understand network architectures and components required for data communication.
- To analyze the function and design strategy of physical, data link, network layer and transport layer
- To acquire basic knowledge of various application protocol for internet security issues and services

UNIT I  NETWORK FUNDAMENTALS

UNIT II  DATA LINK LAYER

UNIT III  NETWORK LAYER

UNIT IV  TRANSPORT LAYER
Transport layer – service – Connection establishment – Flow control – Transmission control protocol –
UNIT V  APPLICATIONS AND SECURITY

Applications - DNS- SMTP – WWW –SNMP- Security –threats and services - DES- RSA.

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

- Able to trace the flow of information from one node to another node in the network
- Able to identify the components required to build different types of networks
- Able to understand the functionalities needed for data communication into layers
- Able to choose the required functionality at each layer for given application
- Able to understand the working principles of various application protocols and fundamentals of security issues and services available

TOTAL : 45 PERIODS

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OBJECTIVE
• Students will be introduced to the concepts and principles of IWRM, which is inclusive of the economics, public-private partnership, water & health, water & food security and legal & regulatory settings.

UNIT I CONTINUOUS FOR IWRM
Water as a global issue: key challenges – Definition of IWRM within the broader context of development – Key elements of IWRM - Principles – Paradigm shift in water management - Complexity of the IWRM process – UN World Water Assessment - SDGs.

UNIT II WATER ECONOMICS
Economic view of water issues: economic characteristics of water good and services – Non-market monetary valuation methods – Water economic instruments – Private sector involvement in water resources management: PPP objectives, PPP models, PPP processes, PPP experiences through case studies.

UNIT III LEGAL AND REGULATORY SETTINGS
Basic notion of law and governance: principles of international and national law in the area of water management - Understanding UN law on non-navigable uses of international water courses – International law for groundwater management – World Water Forums – Global Water Partnerships - Development of IWRM in line with legal and regulatory framework.

UNIT IV WATER AND HEALTH WITHIN THE IWRM CONTEXT
Links between water and health: options to include water management interventions for health – Health protection and promotion in the context of IWRM – Global burden of Diseases - Health impact assessment of water resources development projects – Case studies.

UNIT V AGRICULTURE IN THE CONCEPT OF IWRM
Water for food production: ‘blue’ versus ‘green’ water debate – Water foot print - Virtual water trade for achieving global water and food security — Irrigation efficiencies, irrigation methods - current water pricing policy— scope to relook pricing.

TOTAL: 45 PERIODS

OUTCOMES
• On completion of the course, the student is expected to be able to

CO1 Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.

CO2 Select the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.

CO3 Apply law and governance in the context of IWRM.

CO4 Discuss the linkages between water-health; develop a HIA framework.

CO5 Analyse how the virtual water concept pave way to alternate policy options.
REFERENCES:

OCE432 WATER, SANITATION AND HEALTH L T P C 3 0 0 3

OBJECTIVES:
• Understand the accelerating health impacts due to the present managerial aspects and initiatives in water and sanitation and health sectors in the developing scenario

UNIT I FUNDAMENTALS WASH 9
Meanings and Definition: Safe Water- Health, Nexus: Water- Sanitation - Health and Hygiene – Equity issues-Water security - Food Security. Sanitation And Hygiene (WASH) and Integrated Water Resources Management (IWRM) - Need and Importance of WASH

UNIT II MANAGERIAL IMPLICATIONS AND IMPACT 9

UNIT III CHALLENGES IN MANAGEMENT AND DEVELOPMENT 9

UNIT IV GOVERNANCE 9
Public health -Community Health Assessment and Improvement Planning (CHA/CHIP)- Infrastructure and Investments on Water, (WASH) - Cost Benefit Analysis – Institutional Intervention-Public Private Partnership - Policy Directives - Social Insurance -Political Will vs Participatory Governance -

UNIT V INITIATIVES 9
Management vs Development -Accelerating Development- Development Indicators -Inclusive Development-Global and Local- Millennium Development Goal (MDG) and Targets - Five Year Plans - Implementation - Capacity Building - Case studies on WASH.
OUTCOMES:

CO1 Capture to fundamental concepts and terms which are to be applied and understood all through the study.

CO2 Comprehend the various factors affecting water sanitation and health through the lens of third world scenario.

CO3 Critically analyse and articulate the underlying common challenges in water, sanitation and health.

CO4 Acquire knowledge on the attributes of governance and its say on water sanitation and health.

CO5 Gain an overarching insight into the aspects of sustainable resource management in the absence of a clear level playing field in the developmental aspects.

REFERENCES


OBJECTIVES:

- To impart knowledge on environmental, social and economic dimensions of sustainability and the principles evolved through landmark events so as to develop an action mindset for sustainable development.

UNIT I SUSTAINABILITY AND DEVELOPMENT CHALLENGES


UNIT II PRINCIPLES AND FRAME WORK
of civil society, business and government – United Nations’ 2030 Agenda for sustainable development – 17 sustainable development goals and targets, indicators and intervention areas

UNIT III SUSTAINABLE DEVELOPMENT AND WELLBEING 9

UNIT IV SUSTAINABLE SOCIO-ECONOMIC SYSTEMS 10

UNIT V ASSESSING PROGRESS AND WAY FORWARD 8

TOTAL: 45 PERIODS

OUTCOMES:
- On completion of the course, the student is expected to be able to
  CO1 Explain and evaluate current challenges to sustainability, including modern world social, environmental, and economic structures and crises.
  CO2 Identify and critically analyze the social environmental, and economic dimensions of sustainability in terms of UN Sustainable development goals
  CO3 Develop a fair understanding of the social, economic and ecological linkage of Human well being, production and consumption
  CO4 Evaluate sustainability issues and solutions using a holistic approach that focuses on connections between complex human and natural systems.
  CO5 Integrate knowledge from multiple sources and perspectives to understand environmental limits governing human societies and economies and social justice dimensions of sustainability.

REFERENCES:

OCE434 ENVIRONMENTAL IMPACT ASSESSMENT L T P C 3 0 0 3

OBJECTIVES:
• To make the students to understand environmental clearance, its legal requirements and to provide knowledge on overall methodology of EIA, prediction tools and models, environmental management plan and case studies.

UNIT I INTRODUCTION 9

UNIT II IMPACT IDENTIFICATION AND PREDICTION 10

UNIT III SOCIO-ECONOMIC IMPACT ASSESSMENT 8
Socio-economic impact assessment - relationship between social impacts and change in community and institutional arrangements. factors and methodologies- individual and family level impacts. communities in transition-rehabilitation

UNIT IV EIA DOCUMENTATION AND ENVIRONMENTAL MANAGEMENT PLAN 9
Environmental management plan - preparation, implementation and review – mitigation and rehabilitation plans – policy and guidelines for planning and monitoring programmes – post project audit – documentation of EIA findings – ethical and quality aspects of environmental impact assessment

UNIT V CASE STUDIES 9
Mining, power plants, cement plants, highways, petroleum refining industry, storage & handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects

TOTAL: 45 PERIODS

OUTCOMES:
• On completion of the course, the student is expected to be able to
  CO1 Understand need for environmental clearance, its legal procedure, need of EIA, its types, stakeholders and their roles
  CO2 Understand various impact identification methodologies, prediction techniques and model of impacts on various environments
CO3 Understand relationship between social impacts and change in community due to development activities and rehabilitation methods

CO4 Document the EIA findings and prepare environmental management and monitoring plan

CO5 Identify, predict and assess impacts of similar projects based on case studies

REFERENCES:
1. EIA Notification 2006 including recent amendments, by Ministry of Environment, Forest and Climate Change, Government of India
2. Sectoral Guidelines under EIA Notification by Ministry of Environment, Forest and Climate Change, Government of India

OME431 VIBRATION AND NOISE CONTROL STRATEGIES

OBJECTIVES
- To appreciate the basic concepts of vibration in damped and undamped systems
- To appreciate the basic concepts of noise, its effect on hearing and related terminology
- To use the instruments for measuring and analyzing the vibration levels in a body
- To use the instruments for measuring and analyzing the noise levels in a system
- To learn the standards of vibration and noise levels and their control techniques

UNIT- I BASICS OF VIBRATION

UNIT- II BASICS OF NOISE
Introduction - Anatomy of human ear - Mechanism of hearing - Amplitude, frequency, wavelength and sound pressure level - Relationship between sound power, sound intensity and sound pressure level - Addition, subtraction and averaging decibel levels - sound spectra - Types of sound fields - Octave band analysis - Loudness.

UNIT- III INSTRUMENTATION FOR VIBRATION MEASUREMENT
and Electrodynamics – Frequency Measuring Instruments -. System Identification from Frequency Response - Testing for resonance and mode shapes

UNIT- IV INSTRUMENTATION FOR NOISE MEASUREMENT AND ANALYSIS 9
Microphones - Weighting networks - Sound Level meters, its classes and calibration - Noise measurements using sound level meters - Data Loggers - Sound exposure meters - Recording of noise - Spectrum analyser - Intensity meters - Energy density sensors - Sound source localization.

UNIT- V METHODS OF VIBRATION CONTROL, SOURCES OF NOISE AND ITS CONTROL 9

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course the student will be able to
1. apply the basic concepts of vibration in damped and undamped systems
2. apply the basic concepts of noise and to understand its effects on systems
3. select the instruments required for vibration measurement and its analysis
4. select the instruments required for noise measurement and its analysis.
5. recognize the noise sources and to control the vibration levels in a body and to control noise under different strategies.

REFERENCES:

OME432 ENERGY CONSERVATION AND MANAGEMENT IN DOMESTIC SECTORS

COURSE OBJECTIVES:
1. To learn the present energy scenario and the need for energy conservation.
2. To understand the different measures for energy conservation in utilities.
3. Acquaint students with principle theories, materials, and construction techniques to create energy efficient buildings.
4. To identify the energy demand and bridge the gap with suitable technology for sustainable habitat
5. To get familiar with the energy technology, current status of research and find the ways to optimize a system as per the user requirement

UNIT I ENERGY SCENARIO

UNIT II HEATING, VENTILLATION & AIR CONDITIONING

UNIT III LIGHTING, COMPUTER, TV

UNIT IV ENERGY EFFICIENT BUILDINGS

UNIT V ENERGY STORAGE TECHNOLOGIES
Necessity & types of energy storage – Thermal energy storage – Battery energy storage, charging and discharging– Hydrogen energy storage & Super capacitors – energy density and safety issues – Applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Understand technical aspects of energy conservation scenario.
2. Energy audit in any type for domestic buildings and suggest the conservation measures.
3. Perform building load estimates and design the energy efficient landscape system.
4. Gain knowledge to utilize an appliance/device sustainably.
5. Understand the status and current technological advancement in energy storage field.

REFERENCES:

OME433 ADDITIVE MANUFACTURING L T P C
3 0 0 3

UNIT I INTRODUCTION

UNIT II DESIGN FOR ADDITIVE MANUFACTURING

UNIT III VAT POLYMERIZATION

UNIT IV MATERIAL EXTRUSION AND SHEET LAMINATION

POWDER BASED PROCESS

UNIT V CASE STUDIES AND OPPORTUNITIES ADDITIVE MANUFACTURING PROCESSES

TOTAL: 45 PERIODS

REFERENCES:
OME434            ELECTRIC VEHICLE TECHNOLOGY            L T P C
                                 3 0 0 3

UNIT I       NEED FOR ELECTRIC VEHICLES          9
History and need for electric and hybrid vehicles, social and environmental importance of hybrid
and electric vehicles, impact of modern drive-trains on energy supplies, comparison of diesel,
petrol, electric and hybrid vehicles, limitations, technical challenges

UNIT II      ELECTRIC VEHICLE ARCHITECTURE        9
Electric vehicle types, layout and power delivery, performance – traction motor characteristics,
tractive effort, transmission requirements, vehicle performance, energy consumption, Concepts of
hybrid electric drive train, architecture of series and parallel hybrid electric drive train, merits and
demersits, mild and full hybrids, plug-in hybrid electric vehicles and range extended hybrid electric
vehicles, Fuel cell vehicles.

UNIT III     ENERGY STORAGE                        9
Batteries – types – lead acid batteries, nickel based batteries, and lithium based batteries,
electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy
efficiency, Battery modeling and equivalent circuit, battery charging and types, battery cooling,
Ultra-capacitors, Flywheel technology, Hydrogen fuel cell, Thermal Management of the PEM fuel
cell

UNIT IV      ELECTRIC DRIVES AND CONTROL          9
Types of electric motors – working principle of AC and DC motors, advantages and limitations, DC
motor drives and control, Induction motor drives and control, PMSM and brushless DC motor
-drives and control, AC and Switch reluctance motor drives and control – Drive system efficiency –
Inverters – DC and AC motor speed controllers

UNIT V       DESIGN OF ELECTRIC VEHICLES           9
Materials and types of production, Chassis skate board design, motor sizing, power pack sizing,
component matching, Ideal gear box – Gear ratio, torque–speed characteristics, Dynamic equation
of vehicle motion, Maximum tractive effort – Power train tractive effort Acceleration performance,
rated vehicle velocity – maximum gradability, Brake performance, Electronic control system, safety
and challenges in electric vehicles. Case study of Nissan leaf, Toyota Prius, tesla model 3, and
Renault Zoe cars.

TOTAL: 45 PERIODS

REFERENCES:
1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, 2nd edition CRC Press,
   2011.

## OME435 NEW PRODUCT DEVELOPMENT

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### COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
- Applying the principles of generic development process; and understanding the organization structure for new product design and development.
- Identifying opportunity and planning for new product design and development.
- Conducting customer need analysis; and setting product specification for new product design and development.
- Generating, selecting, and testing the concepts for new product design and development.
- Applying the principles of Industrial design and prototype for new product design and development.

### UNIT I INTRODUCTION TO PRODUCT DESIGN & DEVELOPMENT

### UNIT II OPPORTUNITY IDENTIFICATION & PRODUCT PLANNING

### UNIT III IDENTIFYING CUSTOMER NEEDS & PRODUCT SPECIFICATIONS

### UNIT IV CONCEPT GENERATION, SELECTION & TESTING

### UNIT V INDUSTRIAL DESIGN & PROTOTYPING

### TOTAL: 45 PERIODS

### COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
• Apply the principles of generic development process; and understand the organization structure for new product design and development.
• Identify opportunity and plan for new product design and development.
• Conduct customer need analysis; and set product specification for new product design and development.
• Generate, select, and test the concepts for new product design and development.
• Apply the principles of Industrial design and prototype for design and develop new products.

TEXT BOOK:

REFERENCES:

OBA431 SUSTAINABLE MANAGEMENT LT P C 3 0 0 3

COURSE OBJECTIVES:
• To provide students with fundamental knowledge of the notion of corporate sustainability.
• To determine how organizations impacts on the environment and socio-technical systems, the relationship between social and environmental performance and competitiveness, the approaches and methods.

UNIT I MANAGEMENT OF SUSTAINABILITY 9
Management of sustainability - rationale and political trends: An introduction to sustainability management, International and European policies on sustainable development, theoretical pillars in sustainability management studies.

UNIT II CORPORATE SUSTAINABILITY AND RESPONSIBILITY 9
Corporate sustainability parameter, corporate sustainability institutional framework, integration of sustainability into strategic planning and regular business practices, fundamentals of stakeholder engagement.

UNIT III SUSTAINABILITY MANAGEMENT: STRATEGIES AND APPROACHES 9
Corporate sustainability management and competitiveness: Sustainability-oriented corporate strategies, markets and competitiveness, Green Management between theory and practice, Sustainable Consumption and Green Marketing strategies, Environmental regulation and strategic
postures; Green Management approaches and tools; Green engineering: clean technologies and innovation processes; Sustainable Supply Chain Management and Procurement.

UNIT IV SUSTAINABILITY AND INNOVATION 9
Socio-technical transitions and sustainability, Sustainable entrepreneurship, Sustainable pioneers in green market niches, Smart communities and smart specializations.

UNIT V SUSTAINABLE MANAGEMENT OF RESOURCES, COMMODITIES AND COMMONS 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: An understanding of sustainability management as an approach to aid in evaluating and minimizing environmental impacts while achieving the expected social impact.
CO2: An understanding of corporate sustainability and responsible Business Practices
CO3: Knowledge and skills to understand, to measure and interpret sustainability performances.
CO4: Knowledge of innovative practices in sustainable business and community management
CO5: Deep understanding of sustainable management of resources and commodities

REFERENCES:
4. Margaret Robertson, Sustainability Principles and Practice, 2014
5. Peter Rogers, An Introduction to Sustainable Development, 2006

OBA432 MICRO AND SMALL BUSINESS MANAGEMENT
L T P C 3 0 0 3

COURSE OBJECTIVES
- To familiarize students with the theory and practice of small business management.
- To learn the legal issues faced by small business and how they impact operations.

UNIT I INTRODUCTION TO SMALL BUSINESS 9

UNIT II SCREENING THE BUSINESS OPPORTUNITY AND FORMULATING THE BUSINESS PLAN 9
Concepts of opportunity recognition; Key factors leading to new venture failure; New venture screening process; Applying new venture screening process to the early stage small firm Role
planning in small business – importance of strategy formulation – management skills for small business creation and development.

UNIT III BUILDING THE RIGHT TEAM AND MARKETING STRATEGY 9
Management and Leadership – employee assessments – Tuckman’s stages of group development - The entrepreneurial process model - Delegation and team building - Comparison of HR management in small and large firms - Importance of coaching and how to apply a coaching model.
Marketing within the small business - success strategies for small business marketing - customer delight and business generating systems, - market research, - assessing market performance-sales management and strategy - the marketing mix and marketing strategy.

UNIT IV FINANCING SMALL BUSINESS 9
Main sources of entrepreneurial capital; Nature of ‘bootstrap’ financing - Difference between cash and profit - Nature of bank financing and equity financing - Funding-equity gap for small firms. Importance of working capital cycle - Calculation of break-even point - Power of gross profit margin- Pricing for profit - Credit policy issues and relating these to cash flow management and profitability.

UNIT V VALUING SMALL BUSINESS AND CRISIS MANAGEMENT 9
Causes of small business failure - Danger signals of impending trouble - Characteristics of poorly performing firms - Turnaround strategies - Concept of business valuation - Different valuation measurements - Nature of goodwill and how to measure it - Advantages and disadvantages of buying an established small firm - Process of preparing a business for sale.

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1. Familiarise the students with the concept of small business
CO2. In depth knowledge on small business opportunities and challenges
CO3. Ability to devise plans for small business by building the right skills and marketing strategies
CO4. Identify the funding source for small start ups
CO5. Business evaluation for buying and selling of small firms

REFERENCES
3. Journal articles on SME’s.

OBA433 INTELLECTUAL PROPERTY RIGHTS L T P C
3 0 0 3

COURSE OBJECTIVE
➢ To understand intellectual property rights and its valuation.
UNIT I INTRODUCTION
Intellectual property rights - Introduction, Basic concepts, Patents, Copyrights, Trademarks, Trade Secrets, Geographic Indicators; Nature of Intellectual Property, Technological Research, Inventions and Innovations, History - the way from WTO to WIPO, TRIPS.

UNIT II PROCESS
New Developments in IPR, Procedure for grant of Patents, TM, GIs, Patenting under Patent Cooperation Treaty, Administration of Patent system in India, Patenting in foreign countries.

UNIT III STATUTES

UNIT IV STRATEGIES IN INTELLECTUAL PROPERTY
Strategies for investing in R&D, Patent Information and databases, IPR strength in India, Traditional Knowledge, Case studies.

UNIT V MODELS
The technologies Know-how, concept of ownership, Significance of IP in Value Creation, IP Valuation and IP Valuation Models, Application of Real Option Model in Strategic Decision Making, Transfer and Licensing.

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1: Understanding of intellectual property and appreciation of the need to protect it
CO2: Awareness about the process of patenting
CO3: Understanding of the statutes related to IPR
CO4: Ability to apply strategies to protect intellectual property
CO5: Ability to apply models for making strategic decisions related to IPR

REFERENCES
2. Intellectual Property rights and copyrights, EssEss Publications.

OBA434 ETHICAL MANAGEMENT

COURSE OBJECTIVE
➢ To help students develop knowledge and competence in ethical management and decision making in organizational contexts.
UNIT I  ETHICS AND SOCIETY  9
Ethical Management- Definition, Motivation, Advantages-Practical implications of ethical management. Managerial ethics, professional ethics, and social Responsibility-Role of culture and society’s expectations- Individual and organizational responsibility to society and the community.

UNIT II  ETHICAL DECISION MAKING AND MANAGEMENT IN A CRISIS  9
Managing in an ethical crisis, the nature of a crisis, ethics in crisis management, discuss case studies, analyze real-world scenarios, develop ethical management skills, knowledge, and competencies. Proactive crisis management.

UNIT III  STAKEHOLDERS IN ETHICAL MANAGEMENT  9
Stakeholders in ethical management, identifying internal and external stakeholders, nature of stakeholders, ethical management of various kinds of stakeholders: customers (product and service issues), employees (leadership, fairness, justice, diversity) suppliers, collaborators, business, community, the natural environment (the sustainability imperative, green management, Contemporary issues).

UNIT IV  INDIVIDUAL VARIABLES IN ETHICAL MANAGEMENT  9
Understanding individual variables in ethics, managerial ethics, concepts in ethical psychology- ethical awareness, ethical courage, ethical judgment, ethical foundations, ethical emotions/intuitions/intensity. Utilization of these concepts and competencies for ethical decision-making and management.

UNIT V  PRACTICAL FIELD-GUIDE, TECHNIQUES AND SKILLS  9
Ethical management in practice, development of techniques and skills, navigating challenges and dilemmas, resolving issues and preventing unethical management proactively. Role modelling and creating a culture of ethical management and human flourishing.

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1: Role modelling and influencing the ethical and cultural context.
CO2: Respond to ethical crises and proactively address potential crises situations.
CO3: Understand and implement stakeholder management decisions.
CO4: Develop the ability, knowledge, and skills for ethical management.
CO5: Develop practical skills to navigate, resolve and thrive in management situations

REFERENCES

ET4251  IoT FOR SMART SYSTEMS  LT P C
3 0 0 3

COURSE OBJECTIVES:
1. To study about Internet of Things technologies and its role in real time applications.
2. To introduce the infrastructure required for IoT
3. To familiarize the accessories and communication techniques for IoT.
4. To provide insight about the embedded processor and sensors required for IoT.
5. To familiarize the different platforms and attributes for IoT.

UNIT I INTRODUCTION TO INTERNET OF THINGS
Overview, Hardware and software requirements for IoT, Sensor and actuators, Technology drivers, Business drivers, Typical IoT applications, Trends and implications.

UNIT II IOT ARCHITECTURE

UNIT III PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT
PROTOCOLS:
NFC, SCADA and RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCle GSM, CDMA, LTE, GPRS, small cell.

Wireless technologies for IoT: WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary systems-Recent trends.

UNIT IV IOT PROCESSORS
Services/Attributes: Big-Data Analytics for IoT, Dependability, Interoperability, Security, Maintainability.
Embedded processors for IoT : Introduction to Python programming - Building IoT with RASPBERRY PI and Arduino.

UNIT V CASE STUDIES
Industrial IoT, Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IoT Defense.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Analyze the concepts of IoT and its present developments.
CO2: Compare and contrast different platforms and infrastructures available for IoT.
CO3: Explain different protocols and communication technologies used in IoT.
CO4: Analyze the big data analytic and programming of IoT.
CO5: Implement IoT solutions for smart applications.

REFERENCES:


ET4072 MACHINE LEARNING AND DEEP LEARNING

COURSE OBJECTIVES:
The course is aimed at
1. Understanding about the learning problem and algorithms
2. Providing insight about neural networks
3. Introducing the machine learning fundamentals and significance
4. Enabling the students to acquire knowledge about pattern recognition.
5. Motivating the students to apply deep learning algorithms for solving real life problems.

UNIT I LEARNING PROBLEMS AND ALGORITHMS
Various paradigms of learning problems, Supervised, Semi-supervised and Unsupervised algorithms

UNIT II NEURAL NETWORKS

UNIT III MACHINE LEARNING – FUNDAMENTALS & FEATURE SELECTIONS & CLASSIFICATIONS
Classifying Samples: The confusion matrix, Accuracy, Precision, Recall, F1-Score, the curse of dimensionality, training, testing, validation, cross validation, overfitting, under-fitting the data, early stopping, regularization, bias and variance. Feature Selection, normalization, dimensionality
reduction, Classifiers: KNN, SVM, Decision trees, Naïve Bayes, Binary classification, multi class classification, clustering.

UNIT IV DEEP LEARNING: CONVOLUTIONAL NEURAL NETWORKS 9
Feed forward networks, Activation functions, back propagation in CNN, optimizers, batch normalization, convolution layers, pooling layers, fully connected layers, dropout, Examples of CNNs.

UNIT V DEEP LEARNING: RNNS, AUTOENCODERS AND GANS 9
State, Structure of RNN Cell, LSTM and GRU, Time distributed layers, Generating Text, Autoencoders: Convolutional Autoencoders, Denoising autoencoders, Variational autoencoders, GANs: The discriminator, generator, DCGANs

TOTAL : 45 PERIODS

COURSE OUTCOMES (CO):
At the end of the course the student will be able to
CO1 : Illustrate the categorization of machine learning algorithms.
CO2: Compare and contrast the types of neural network architectures, activation functions
CO3: Acquaint with the pattern association using neural networks
CO4: Elaborate various terminologies related with pattern recognition and architectures of convolutional neural networks
CO5: Construct different feature selection and classification techniques and advanced neural network architectures such as RNN, Autoencoders, and GANs.

REFERENCES:

PX4012 RENEWABLE ENERGY TECHNOLOGY 3 0 0 3

OBJECTIVES:
To impart knowledge on
- Different types of renewable energy technologies
- Standalone operation, grid connected operation of renewable energy systems

UNIT I INTRODUCTION 9
Classification of energy sources – Co2 Emission - Features of Renewable energy - Renewable energy scenario in India -Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment Per Capital Consumption - CO₂ Emission - importance of renewable energy sources, Potentials – Achievements– Applications.
UNIT II  SOLAR PHOTOVOLTAICS  

UNIT III  PHOTOVOLTAIC SYSTEM DESIGN  
Block diagram of solar photo voltaic system : Line commutated converters (inversion mode) - Boost and buck-boost converters - selection of inverter, battery sizing, array sizing - PV systems classification- standalone PV systems - Grid tied and grid interactive inverters- grid connection issues.

UNIT IV  WIND ENERGY CONVERSION SYSTEMS  

UNIT V  OTHER RENEWABLE ENERGY SOURCES  
Qualitative study of different renewable energy resources: ocean, Biomass, Hydrogen energy systems, Fuel cells, Ocean Thermal Energy Conversion (OTEC), Tidal and wave energy, Geothermal Energy Resources.

OUTCOMES:  
After completion of this course, the student will be able to:
  CO1: Demonstrate the need for renewable energy sources.  
  CO2: Develop a stand-alone photo voltaic system and implement a maximum power point tracking in the PV system.  
  CO3: Design a stand-alone and Grid connected PV system.  
  CO4: Analyze the different configurations of the wind energy conversion systems.  
  CO5: Realize the basic of various available renewable energy sources.

REFERENCES:  

TOTAL : 45 PERIODS
COURSE OBJECTIVES

- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To know about the function of smart grid.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications
- To get familiarized with the communication networks for Smart Grid applications

UNIT I  INTRODUCTION TO SMART GRID
Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Comparison of Micro grid and Smart grid, Present development & International policies in Smart Grid, Smart Grid Initiative for Power Distribution Utility in India – Case Study.

UNIT II  SMART GRID TECHNOLOGIES
Technology Drivers, Smart Integration of energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV) – Grid to Vehicle and Vehicle to Grid charging concepts.

UNIT III  SMART METERS AND ADVANCED METERING INFRASTRUCTURE
Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit (PMU) & their application for monitoring & protection. Demand side management and demand response programs, Demand pricing and Time of Use, Real Time Pricing, Peak Time Pricing.

UNIT IV  POWER QUALITY MANAGEMENT IN SMART GRID

UNIT V  HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS
Architecture and Standards - Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), PLC, Zigbee, GSM, IP based Protocols, Basics of Web Service and CLOUD Computing, Cyber Security for Smart Grid.

COURSE OUTCOME:
Students able to
CO1: Relate with the smart resources, smart meters and other smart devices.
CO2: Explain the function of Smart Grid.
CO3: Experiment the issues of Power Quality in Smart Grid.
CO4: Analyze the performance of Smart Grid.
CO5: Recommend suitable communication networks for smart grid applications

TOTAL : 45 PERIODS
REFERENCES

DS4015 BIG DATA ANALYTICS
L T P C 3 0 0 3

COURSE OBJECTIVES:
- To understand the basics of big data analytics
- To understand the search methods and visualization
- To learn mining data streams
- To learn frameworks
- To gain knowledge on R language

UNIT I INTRODUCTION TO BIG DATA

UNIT II SEARCH METHODS AND VISUALIZATION

UNIT III MINING DATA STREAMS
UNIT IV  FRAMEWORKS  9
MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed File Systems – Case Study- Preventing Private Information Inference Attacks on Social Networks- Grand Challenge: Applying Regulatory Science and Big Data to Improve Medical Device Innovation

UNIT V  R LANGUAGE  9

COURSE OUTCOMES:
CO1: understand the basics of big data analytics
CO2: Ability to use Hadoop, Map Reduce Framework.
CO3: Ability to identify the areas for applying big data analytics for increasing the business outcome.
CO4: gain knowledge on R language
CO5: Contextually integrate and correlate large amounts of information to gain faster insights.

REFERENCE:

NC4201  INTERNET OF THINGS AND CLOUD  L T P C 3 0 0 3

COURSE OBJECTIVES:
• To understand Smart Objects and IoT Architectures
• To learn about various IoT-related protocols
• To build simple IoT Systems using Arduino and Raspberry Pi.
• To understand data analytics and cloud in the context of IoT
• To develop IoT infrastructure for popular applications

UNIT I  FUNDAMENTALS OF IoT  9
UNIT II  PROTOCOLS FOR IoT  9

UNIT III  CASE STUDIES/INDUSTRIAL APPLICATIONS  9
Case studies with architectural analysis: IoT applications – Smart City – Smart Water – Smart Agriculture – Smart Energy – Smart Healthcare – Smart Transportation – Smart Retail – Smart waste management.

UNIT IV  CLOUD COMPUTING INTRODUCTION  9

UNIT V  IoT AND CLOUD  9

TOTAL:45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student will be able to:
CO1: Understand the various concept of the IoT and their technologies.
CO2: Develop IoT application using different hardware platforms
CO3: Implement the various IoT Protocols
CO4: Understand the basic principles of cloud computing.
CO5: Develop and deploy the IoT application into cloud environment

REFERENCES

MX4073  MEDICAL ROBOTICS  L T P C
3 0 0 3

COURSE OBJECTIVES:
- To explain the basic concepts of robots and types of robots
- To discuss the designing procedure of manipulators, actuators and grippers
- To impart knowledge on various types of sensors and power sources
- To explore various applications of Robots in Medicine
- To impart knowledge on wearable robots
UNIT I INTRODUCTION TO ROBOTICS
Introduction to Robotics, Overview of robot subsystems, Degrees of freedom, configurations and concept of workspace, Dynamic Stabilization

Sensors and Actuators
Sensors and controllers, Internal and external sensors, position, velocity and acceleration sensors, Proximity sensors, force sensors Pneumatic and hydraulic actuators, Stepper motor control circuits, End effectors, Various types of Grippers, PD and PID feedback actuator models

UNIT II MANIPULATORS & BASIC KINEMATICS
Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and pneumatic manipulator, Forward Kinematic Problems, Inverse Kinematic Problems, Solutions of Inverse Kinematic problems

Navigation and Treatment Planning
Variable speed arrangements, Path determination – Machinery vision, Ranging – Laser – Acoustic, Magnetic, fiber optic and Tactile sensor

UNIT III SURGICAL ROBOTS
Da Vinci Surgical System, Image guided robotic systems for focal ultrasound based surgical applications, System concept for robotic Tele-surgical system for off-pump, CABG surgery, Urologic applications, Cardiac surgery, Neuro-surgery, Pediatric and General Surgery, Gynecologic Surgery, General Surgery and Nanorobotics. Case Study

UNIT IV REHABILITATION AND ASSISTIVE ROBOTS
Pediatric Rehabilitation, Robotic Therapy for the Upper Extremity and Walking, Clinical-Based Gait Rehabilitation Robots, Motion Correlation and Tracking, Motion Prediction, Motion Replication. Portable Robot for Tele rehabilitation, Robotic Exoskeletons – Design considerations, Hybrid assistive limb. Case Study

UNIT V WEARABLE ROBOTS
Augmented Reality, Kinematics and Dynamics for Wearable Robots, Wearable Robot technology, Sensors, Actuators, Portable Energy Storage, Human–robot cognitive interaction (cHRI), Human–robot physical interaction (pHRI), Wearable Robotic Communication - case study

TOTAL:45 PERIODS

COURSE OUTCOMES:
CO1: Describe the configuration, applications of robots and the concept of grippers and actuators
CO2: Explain the functions of manipulators and basic kinematics
CO3: Describe the application of robots in various surgeries
CO4: Design and analyze the robotic systems for rehabilitation
CO5: Design the wearable robots

REFERENCES
VE4202 EMBEDDED AUTOMATION

COURSE OBJECTIVES:
- To learn about the process involved in the design and development of real-time embedded system
- To develop the embedded C programming skills on 8-bit microcontroller
- To study about the interfacing mechanism of peripheral devices with 8-bit microcontrollers
- To learn about the tools, firmware related to microcontroller programming
- To build a home automation system

UNIT - I INTRODUCTION TO EMBEDDED C PROGRAMMING 9
C Overview and Program Structure - C Types, Operators and Expressions - C Control Flow - C Functions and Program Structures - C Pointers And Arrays - FIFO and LIFO - C Structures - Development Tools

UNIT - II AVR MICROCONTROLLER 9
ATMEGA 16 Architecture - Nonvolatile and Data Memories - Port System - Peripheral Features : Time Base, Timing Subsystem, Pulse Width Modulation, USART, SPI, Two Wire Serial Interface, ADC, Interrupts - Physical and Operating Parameters

UNIT – III HARDWARE AND SOFTWARE INTERFACING WITH 8-BIT SERIES CONTROLLERS 9
Lights and Switches - Stack Operation - Implementing Combinational Logic - Expanding I/O - Interfacing Analog To Digital Convertors - Interfacing Digital To Analog Convertors - LED Displays : Seven Segment Displays, Dot Matrix Displays - LCD Displays - Driving Relays - Stepper Motor
UNIT – IV VISION SYSTEM 9

UNIT – V HOME AUTOMATION 9
Home Automation - Requirements - Water Level Notifier - Electric Guard Dog - Tweeting Bird Feeder - Package Delivery Detector - Web Enabled Light Switch - Curtain Automation - Android Door Lock - Voice Controlled Home Automation - Smart Lighting - Smart Mailbox - Electricity Usage Monitor - Proximity Garage Door Opener - Vision Based Authentic Entry System

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On successful completion of this course, students will be able to
CO1: analyze the 8-bit series microcontroller architecture, features and pin details
CO2: write embedded C programs for embedded system application
CO3: design and develop real time systems using AVR microcontrollers
CO4: design and develop the systems based on vision mechanism
CO5: design and develop a real time home automation system

REFERENCES:

CX4016 ENVIRONMENTAL SUSTAINABILITY L T P C 3 0 0 3
UNIT I INTRODUCTION 9
Valuing the Environment: Concepts, Valuing the Environment: Methods, Property Rights, Externalities, and Environmental Problems

UNIT II CONCEPT OF SUSTAINABILITY 9
Sustainable Development: Defining the Concept, the Population Problem, Natural Resource Economics: An Overview, Energy, Water, Agriculture
UNIT III SIGNIFICANCE OF BIODIVERSITY
Biodiversity, Forest Habitat, Commercially Valuable Species, Stationary - Source Local Air Pollution, Acid Rain and Atmospheric Modification, Transportation

UNIT IV POLLUTION IMPACTS
Water Pollution, Solid Waste and Recycling, Toxic Substances and Hazardous Wastes, Global Warming.

UNIT V ENVIRONMENTAL ECONOMICS
Development, Poverty, and the Environment, Visions of the Future, Environmental economics and policy by Tom Tietenberg, Environmental Economics

REFERENCES

TOTAL: 45 PERIODS

UNIT I REINFORCEMENTS
Introduction – composites – classification and application; reinforcements- fibres and its properties; preparation of reinforced materials and quality evaluation; preforms for various composites

UNIT II MATRICES
Preparation, chemistry, properties and applications of thermoplastic and thermoset resins; mechanism of interaction of matrices and reinforcements; optimization of matrices

UNIT III COMPOSITE MANUFACTURING
Classification; methods of composites manufacturing for both thermoplastics and thermosets- Hand layup, Filament Winding, Resin transfer moulding, prepregs and autoclave moulding, pultrusion, vacuum impregnation methods, compression moulding; post processing of composites and composite design requirements

UNIT IV TESTING
Fibre volume and weight fraction, specific gravity of composites, tensile, flexural, impact, compression, inter laminar shear stress and fatigue properties of thermoset and thermoplastic composites.

UNIT V MECHANICS
Macro mechanics, macro mechanics of single layer, macro mechanics of laminate, classical lamination theory, failure theories and prediction of inter laminar stresses using at ware

TOTAL: 45 PERIODS
REFERENCES

NT4002        NANOCOMPOSITE MATERIALS        L T P C
                        3 0 0 3

UNIT I          BASICS OF NANOCOMPOSITES         9

UNIT II METALED BASED NANOCOMPOSITES         9
Metal-metal nanocomposites, some simple preparation techniques and their properties. Metal-Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality. Fractal based glass-metal nanocomposites, its designing and fractal dimension analysis. Core-Shell structured nanocomposites

UNIT III POLYMER BASED NANOCOMPOSITES         9
Preparation and characterization of diblock Copolymer based nanocomposites; Polymer Carbon nanotubes based composites, their mechanical properties, and industrial possibilities.

UNIT IV NANOCOMPOSITE FROM BIOMATERIALS         9
Natural nanocomposite systems - spider silk, bones, shells; organic-inorganic nanocomposite formation through self-assembly. Biomimetic synthesis of nanocomposites material; Use of synthetic nanocomposites for bone, teeth replacement.

UNIT V     NANOCOMPOSITE TECHNOLOGY         9
REFERENCES:
5. The search for novel, superhard materials- Stan Vepřej (Review Article) JVST A, 1999

TOTAL : 45 PERIODS

UNIT I

IPR, BIOSAFETY AND ENTREPRENEURSHIP

BY4016

UNIT I

IPR

3 0 0 3

9


UNIT II

AGREEMENTS, TREATIES AND PATENT FILING PROCEDURES

9


UNIT III

BIOSAFETY

9


UNIT IV

GENETICALLY MODIFIED ORGANISMS

9

Definition of GMOs & LMOs – Roles of Institutional Biosafety Committee – RCGM – GEAC etc. for GMO applications in food and agriculture – Environmental release of GMOs – Risk Analysis – Risk Assessment – Risk management and communication – Overview of National Regulations and relevant International Agreements including Cartegana Protocol.

UNIT V

ENTREPRENEURSHIP DEVELOPMENT

9

Introduction – Entrepreneurship Concept – Entrepreneurship as a career – Entrepreneurial

TOTAL : 45 PERIODS

REFERENCES


