

ANNA UNIVERSITY
DISTANCE EDUCATION
REGULATIONS – 2018
CURRICULUM AND SYLLABUS I TO IV SEMESTERS
MASTER OF COMPUTER APPLICATIONS (MCA - 2 Years)

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
THEORY								
1.	DMC6101	Matrices, Probability and Statistics	FC	5	3	2	0	4
2.	DMC6102	Advanced Data Structures and Algorithms	PC	3	3	0	0	3
3.	DMC6103	Advanced Database Technology	PC	3	3	0	0	3
4.	DMC6104	Object Oriented Software Engineering	PC	3	3	0	0	3
5.	DMC6105	Python Programming	PC	3	3	0	0	3
6.	DMC6106	Research Methodology and Intellectual Property Rights	PC	2	2	0	0	2
PRACTICALS								
7.	DMC6111	Advanced Database Technology Laboratory	PC	4	0	0	4	2
8.	DMC6112	Advanced Data Structures and Python Programming Laboratory	PC	4	0	0	4	2
9.	DMC6113	Communication Skills Enhancement – I	EEC	2	0	0	2	1
TOTAL				29	17	2	10	23

SEMESTER - II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
THEORY								
1.	DMC6201	Internet Programming	PC	3	3	0	0	3
2.	DMC6202	Cloud Computing Technologies	PC	3	3	0	0	3
3.	DMC6203	Artificial Intelligence and Machine Learning	PC	3	3	0	0	3
4.	DMC6204	Mobile Application Development	PC	4	2	0	2	3
5.	DMC6205	Cyber Security	PC	3	3	0	0	3
6.	PE1	Professional Elective I	PEC	3	3	0	0	3
PRACTICALS								
7.	DMC6211	Internet Programming Laboratory	PC	4	0	0	4	2
8.	DMC6212	Artificial Intelligence and Machine Learning Laboratory	PC	4	0	0	4	2
9.	DMC6213	Communication Skills Enhancement– II	EEC	2	0	0	2	1
TOTAL				29	17	0	12	23

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
THEORY								
1.	DMC6301	Data Science	PC	3	3	0	0	3
2.	DMC6302	Embedded Systems and Internet of Things	PC	3	3	0	0	3
3.	DMC6303	Accounting and Financial Management for Application Development	PC	3	3	0	0	3
4.	PE2	Professional Elective II	PE	3	3	0	0	3
5.	PE3	Professional Elective III	PE	3	3	0	0	3
6.	PE4	Professional Elective IV	PE	3	3	0	0	3
7.	PE5	Professional Elective V:	PE	3	3	0	0	3
PRACTICALS								
1.	DMC6311	Data Science Laboratory	PC	4	0	0	4	2
2.	DMC6312	Internet of Things Laboratory	PC	4	0	0	4	2
TOTAL				29	21	0	8	25

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CONTACT HOURS	L	T	P	C
1.	DMC6411	Project Work	24	0	0	24	12
TOTAL			24	0	0	24	12

ELECTIVES

PROFESSIONAL ELECTIVE - I, Semester 2

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
1	DMC6001	Software Project Management	PE	3	3	0	0	3
2	DMC6002	Agile Methodologies	PE	3	3	0	0	3
3	DMC6003	E Learning	PE	3	3	0	0	3
4	DMC6004	Software Quality and Testing	PE	3	3	0	0	3
5	DMC6005	Advances in Operating Systems	PE	3	3	0	0	3
6	DMC6006	Digital Image Processing	PE	3	3	0	0	3

SEMESTER - III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
PROFESSIONAL ELECTIVE – II, Semester 3								
1	DMC6007	Compiler Optimization Techniques	PE	3	3	0	0	3
2	DMC6008	C# and .NET programming	PE	3	3	0	0	3
3	DMC6009	Wireless Networking	PE	3	3	0	0	3
4	DMC6010	Web Design	PE	3	3	0	0	3
5	DMC6011	Network Programming and Security	PE	3	3	0	0	3
6	DMC6012	Microservices and Devops	PE	3	3	0	0	3

ELECTIVE - III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
PROFESSIONAL ELECTIVE – III, Semester 3								
1	DMC6013	Social Network Analytics	PE	3	3	0	0	3
2	DMC6014	Bio Inspired Computing	PE	3	3	0	0	3
3	DMC6015	Information Retrieval Techniques	PE	3	3	0	0	3
4	DMC6016	Software Architecture	PE	3	3	0	0	3
5	DMC6017	Digital Forensics	PE	3	3	0	0	3
6	DMC6018	Data Mining and Data Warehousing Techniques	PE	3	3	0	0	3

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
PROFESSIONAL ELECTIVE – IV, Semester 3								
1	DMC6019	Data Visualization Techniques	PE	3	3	0	0	3
2	DMC6020	Operations Research	PE	3	3	0	0	3
3	DMC6021	Professional Ethics in IT	PE	3	3	0	0	3
4	DMC6022	Marketing Management	PE	3	3	0	0	3
5	DMC6023	Organizational Behavior	PE	3	3	0	0	3
6	DMC6024	Business Data Analytics	PE	3	3	0	0	3

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
PROFESSIONAL ELECTIVE – V, Semester 3								
1	DMC6025	Cryptocurrency and Blockchain Technologies	PE	3	3	0	0	3
2	DMC6026	Advances in Networking	PE	3	3	0	0	3
3	DMC6027	Soft Computing Techniques	PE	3	3	0	0	3
4	DMC6028	Deep Learning	PE	3	3	0	0	3
5	DMC6029	Big Data Processing	PE	3	3	0	0	3
6	DMC6030	Natural Language Processing	PE	3	3	0	0	3

OBJECTIVES:

- To provide methods for understanding the consistency and solving the equation as well as for finding the Eigenvalues and Eigenvectors of square matrix.
- To provide foundation on Applied Probability
- To introduce the concepts of correlation and regression of random variables
- To use various statistical techniques in Application problems
- To introduce the concept of Design of Experiments for data analysis

UNIT - I MATRICES AND EIGENVALUE PROBLEMS 15

Matrices - Rank of a Matrix - Consistency of a system of linear equations - Solution of the matrix equation $\Delta x = b$ - Row - reduced Echelon Form - Eigenvalues and Eigenvectors - Properties - Cayley - Hamilton Theorem - Inverse of a matrix.

UNIT - II PROBABILITY AND RANDOM VARIABLES 15

Probability - Axioms of Probability - Conditional Probability - Addition and multiplication laws of Probability - Baye's theorem - Random Variables - Discrete and continuous random variables - Probability mass function and Probability density functions - Cumulative distribution function - Moments and variance of random variables - Properties - Binomial, Poisson, Geometric, Uniform, Exponential, Normal distributions and their properties.

UNIT - III TWO-DIMENSIONAL RANDOM VARIABLES 15

Joint probability distributions - Marginal and conditional probability distributions - Covariance - Correlation - Linear regression lines - Regression curves - Transform of random variables - Central limit theorem (for independent identically random variables).

UNIT - IV TESTING OF HYPOTHESIS 15

Sampling distributions - Tests based on small and large samples - Normal, Student's t, Chi-square and F distributions for testing of mean, variance and proportion and testing of difference of means variances and proportions - Tests for independence of attributes and goodness of fit.

UNIT - V DESIGN OF EXPERIMENTS 15

Analysis of variance - Completely randomized design - Random block design (One-way and Two-way classifications) - Latin square design - 2^2 Factorial design.

TOTAL PERIODS:75**OUTCOMES:**

After the completion of the course the student will be able to

- Test the consistency and solve system of linear equations as well as find the Eigenvalues and Eigenvector.
- Apply the Probability axioms as well as rules and the distribution of discrete and continuous ideas in solving real world problems.
- Apply the concepts of correlation and regression of random variables in solving application problems.
- Use statistical techniques in testing hypothesis on data analysis.
- Use the appropriate statistical technique of design of experiments in data analysis.

REFERENCE BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, New Delhi, 2015.
2. R.K. Jain and S.R.K Iyenger, Advanced Engineering Mathematics, Narosa Publishing House, New Delhi, 2002.
3. Devore, J.L, Probability and Statistics for Engineering and Sciences, Cengage Learning, 8th Edition, New Delhi, 2014.
4. Miller and M. Miller, Mathematical Statistics, Pearson Education Inc., Asia 7th Edition, New Delhi, 2011.
5. Richard Johnson, Miller and Freund's Probability and Statistics for Engineer, Prentice Hall of India Private Ltd., 8th Edition, New Delhi, 2011.

OBJECTIVES:

- Understand and apply linear data structures-List, Stack and Queue
- Understand the graph algorithms.
- Learn different algorithm analysis techniques.
- Apply data structures and algorithms in real time applications
- Analyze the efficiency of an algorithm

UNIT I LINEAR DATA STRUCTURES**9**

Introduction - Abstract Data Types (ADT) – Stack – Queue – Circular Queue - Double Ended Queue - Applications of stack – Evaluating Arithmetic Expressions - Other Applications - Applications of Queue - Linked Lists - Singly Linked List - Circularly Linked List - Doubly Linked lists – Applications of linked list – Polynomial Manipulation.

UNIT II NON-LINEAR DATA STRUCTURES**9**

Binary Tree – expression trees – Binary tree traversals – applications of trees – HuffmanAlgorithm - Binary search tree - Balanced Trees - AVL Tree - B-Tree - Splay Trees – Heap- Heap operations- -Binomial Heaps - Fibonacci Heaps- Hash set.

UNIT III GRAPHS**9**

Representation of graph - Graph Traversals - Depth-first and breadth-first traversal - Applications of graphs - Topological sort – shortest-path algorithms - Dijkstra's algorithm – Bellman-Ford algorithm – Floyd's Algorithm - minimum spanning tree – Prim's and Kruskal's algorithms.

UNIT IV ALGORITHM DESIGN AND ANALYSIS**9**

Algorithm Analysis – Asymptotic Notations - Divide and Conquer – Merge Sort – Quick Sort - Binary Search - Greedy Algorithms – Knapsack Problem – Dynamic Programming – Optimal Binary Search Tree - Warshall's Algorithm for Finding Transitive Closure.

UNIT V ADVANCED ALGORITHM DESIGN AND ANALYSIS**9**

Backtracking – N-Queen's Problem - Branch and Bound – Assignment Problem - P & NP problems – NP-complete problems – Approximation algorithms for NP-hard problems – Traveling salesman problem-Amortized Analysis.

TOTAL: 45 PERIODS**OUTCOMES:**

- Implement a program using stack, queue, linked list data structures
- Design and Implement Tree data structures and Sets
- Apply the Graph Data structure and to find shortest path among the several possibilities
- Perform analysis of various algorithms
- Analyze and design algorithms to appreciate the impact of algorithm design in practice.

REFERENCES:

1. AnanyLevitin "Introduction to the Design and Analysis of Algorithms" 3rdEditionPearson Education, 2015.
2. Jean Paul Tremblay and Paul G. Sorensen. "An Introduction to Data Structures with Applications", 2nd Edition, Tata McGraw Hill, New Delhi, 2017
3. Peter Drake, "Data Structures and Algorithms in Java", 4th Edition, Pearson Education 2014
4. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", 3rd Edition, PHI Learning Private Ltd, 2012
5. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", 1stEdition,Pearson Education, 1983.
6. Michael T.Goodrich, "Algorithm Design: Foundations, Analysis and Internet Examples", 2nd Edition, Wiley India Pvt. Ltd, 2006.

OBJECTIVES:

- To learn the fundamentals of data modeling and design in advanced databases.
- To study the working principles of distributed databases.
- To have an introductory knowledge about the query processing in object-based databases and its usage.
- To understand the basics of spatial, temporal and mobile databases and their applications.
- To learn emerging databases such as XML, Data warehouse and NoSQL.

UNIT I DISTRIBUTED DATABASES 9

Distributed Systems – Introduction – Architecture – Distributed Database Concepts – DistributedData Storage – Distributed Transactions – Commit Protocols – Concurrency Control – DistributedQuery Processing

UNIT II NOSQL DATABASES 9

NoSQL – CAP Theorem – Sharding - Document based – MongoDB Operation: Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding, Deployment – Using MongoDB with PHP / JAVA – Advanced MongoDB Features – Cassandra: Data Model, Key Space, Table Operations, CRUD Operations, CQL Types – HIVE: Data types, Database Operations, Partitioning – HiveQL – OrientDB Graph database – OrientDB Features

UNIT III ADVANCED DATABASE SYSTEMS 9

Object Oriented Databases-Need for Complex Data Types - The Object-Oriented Data Model-Object-Oriented Languages-Spatial Databases: Spatial Data Types, Spatial Relationships, Spatial Data Structures, Spatial Access Methods – Temporal Databases: Overview – Active Databases – Deductive Databases – RecursiveQueries in SQL – Mobile Databases: Location and Handoff Management, Mobile TransactionModels, Concurrency – Transaction Commit Protocols – Multimedia Databases.

UNIT IV XML AND DATAWAREHOUSE 9

XML Database: XML – XML Schema – XML DOM and SAX Parsers – XSL – XSLT – XPath and XQuery – Data Warehouse: Introduction – Multidimensional Data Modeling – Star and SnowflakeSchema – Architecture – OLAP Operations and Queries.

UNIT V INFORMATION RETRIEVAL AND WEB SEARCH 9

IR concepts – Retrieval Models – Queries in IR system – Text Preprocessing – Inverted Indexing – Evaluation Measures – Web Search and Analytics – Ontology based Search - Current trends.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Design a distributed database system and execute distributed queries.
2. Use NoSQL database systems and manipulate the data associated with it.
3. Design a data warehouse system and apply OLAP operations.
4. Design XML database systems and validating with XML schema.
5. Apply knowledge of information retrieval concepts on web databases.

REFERENCES:

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", 6th Edition, McGraw Hill, 2011.
2. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education/Addison Wesley, 2017.
3. C. J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
4. Jiawei Han, MichelineKamber ,Jian Pei, "Data Mining: Concepts and Techniques", Third Edition, Morgan Kaufmann, 2012.
5. Brad Dayley, "Teach Yourself NoSQL with MongoDB in 24 Hours", Sams Publishing, First Edition, 2014.
6. ShashankTiwari, "Professional NoSQL", O'Reilly Media, First Edition, 2011.
7. Vijay Kumar, "Mobile Database Systems", John Wiley & Sons, First Edition, 2006

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 LIFE CYCLE 9

Introduction – Object Orientation - Object Oriented Methodologies – Terminologies - Software Development Life Cycle – Conventional Software Life Cycle Models – Build and Fix Model – Waterfall Model – Prototyping Model – Iterative Enhancement Model – Spiral Model – Extreme Programming - Object Oriented Software Life Cycle Models – Selection of Software Development Life Cycle Models

UNIT II OBJECT ORIENTED REQUIREMENTS ELICITATION & ANALYSIS 9

Software Requirement - Requirements Elicitation Techniques – Initial Requirements Document – Use Case Approach – Characteristics of a Good Requirement – SRS Document – Requirements Change Management – Object Oriented Analysis : Identification of Classes and Relationships, Identifying State and Behavior – Case Study LMS - Managing Object Oriented Software Engineering: Projection Selection and Preparation – Product Development Organization – Project Organization and Management – Project Staffing

UNIT III OBJECT ORIENTED SOFTWARE DESIGN 9

Object Oriented Design – Interaction Diagrams – Sequence Diagram – Collaboration Diagrams – Refinement of Use Case Description – Refinement of Classes and Relationships – Construction of Detailed Class Diagram – Development of Detailed Design & Creation of Software Design Document - Object Oriented Methods : Object Oriented Analysis (OOA / Coad-Yourdon), Object Oriented Design (OOD/Booch) , Hierarchical Object Oriented Design (HOOD), Object Modeling Technique (OMT), Responsibility – Driven Design Case Studies : Warehouse Management System, Telecom

UNIT IV OBJECT ORIENTED TESTING AND MAINTENANCE 9

Software testing: Software Verification Techniques – Object Oriented Checklist :- Functional Testing – Structural Testing – Class Testing – Mutation Testing – Levels of Testing – Static and Dynamic Testing Tools - Software Maintenance – Categories – Challenges of Software Maintenance – Maintenance of Object Oriented Software – Regression Testing

UNIT V SOFTWARE QUALITY & METRICS 9

Need of Object Oriented Software Estimation – Lorenz and Kidd Estimation – Use Case Points Method – Class Point Method – Object Oriented Function Point – Risk Management – Software Quality Models – Analyzing the Metric Data – Metrics for Measuring Size and Structure – Measuring Software Quality - Object Oriented Metrics

TOTAL: 45 PERIODS

OUTCOMES:

- Able to identify the appropriate process model to develop the object oriented software
- Gain knowledge about requirement elicitation and analyzing techniques
- Able to choose and design suitable UML diagrams and methods
- Able to apply correct testing methods and maintain software systems.
- Able to estimate the object oriented application by applying metric data.

REFERENCES:

1. Yogesh Singh, RuchikaMalhotra, “ Object – Oriented Software Engineering”, PHI Learning Private Limited ,First edition,2012
2. Ivar Jacobson. Magnus Christerson, PatrikJonsson, Gunnar Overgaard, “Object Oriented Software Engineering, A Use Case Driven Approach”, Pearson Education, Seventh Impression, 2009
3. Craig Larman, “Applying UML and Patterns, an Introduction to Object-Oriented Analysis and Design and Iterative Development”, Pearson Education, Third Edition, 2008.
4. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, Kelli A. Houston, “Object Oriented Analysis & Design with Applications, Third Edition, Pearson Education,2010
5. Roger S. Pressman, “Software Engineering: A Practitioner’s Approach, Tata McGraw-Hill Education, 8th Edition, 2015.
6. Timothy C. Lethbridge and Robert Laganriere, “Object – Oriented Software Engineering, Practical Software Development using UML and Java”, Tata McGraw Hill Publishing Company Limited, Second Edition, 2004

OBJECTIVES:

- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I PYTHON BASICS 10

Introduction to Python Programming – Python Interpreter and InteractiveMode– Variables and Identifiers – Arithmetic Operators – Values and Types – Statements.Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If-ElseConstructs – Loop Structures/Iterative Statements – While Loop – For Loop – BreakStatement-Continue statement – Function Call and Returning Values – Parameter Passing – Local and GlobalScope – Recursive Functions.

UNIT II DATA TYPES IN PYTHON 10

Lists, Tuples, Sets, Strings, Dictionary, Modules: Module Loading and Execution – Packages – Making Your OwnModule – The Python Standard Libraries

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 9

Modules: Introduction – Module Loading and Execution – Packages – Making Your OwnModule – The Python Libraries for data processing, data mining and visualization- NUMPY, Pandas, Matplotlib, Plotly

UNIT V OBJECT ORIENTED PROGRAMMING IN PYTHON 8

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

TOTAL: 45 PERIODS**OUTCOMES:**

Upon completion of the course, students will be able to

- Develop algorithmic solutions to simple computational problems
- Structure simple Python programs for solving problems.
- Read and write data from/to files in Python Programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Decompose a Python program into functions.

REFERENCES:

1. ReemaThareja, "Python Programming using Problem Solving Approach", Oxford University Press, First edition, 2017
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second Edition, Shroff,O'Reilly Publishers, 2016(<http://greenteapress.com/wp/thinkpython/>)
3. Guido van Rossum, Fred L. Drake Jr., "An Introduction to Python – Revised and Updated for Python 3.2, Network Theory Ltd., First edition, 2011
4. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and Expanded Edition, MIT Press, 2013
5. Charles Dierbach, "Introduction to Computer Science using Python", Wiley India Edition, First Edition, 2016
6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., First edition,2011
7. Kenneth A. Lambert, "Fundamentals of Python: First Programs", Cengage Learning, second edition,2012

COURSE OBJECTIVES:

The course should enable the students to:

- Identify an appropriate research problem in their interesting domain.
- Understand ethical issues; understand the Preparation of a research project thesis report.
- Understand the Preparation of a research project thesis report
- Understand the law of patent and copyrights.
- Acquire adequate knowledge of IPR.

UNIT I	RESEARCH METHODOLOGY	6
	Research Methodology – An Introduction, Objectives, Types of research, Research approaches, Significance, Research methods versus Methodology, Research and Scientific method, Importance, Research process, Criteria, Problems encountered by researchers.	
	Defining the research problem – Research problem, Selecting the problem, Necessity, Technique involved, An illustration.	
	Reviewing the Literature – The place of the literature review in research, How to review the Literature, Writing about the literature reviewed.	
UNIT II	RESEARCH DESIGN	6
	Research Design – Meaning, Need, Features, Different research design, Basic principles of experimental designs, Important experimental designs.	
	Measurement & Scaling techniques – Sampling Design, Measurement in research, Measurement scales, Error, Measurement tools, Scaling, Meaning, Scale classification, Scale construction techniques	
	Data Collection – Collection of primary data, Collection of secondary data, Selection of appropriate method for data collection.	
UNIT III	RESEARCH TECHNIQUE AND TOOLS	6
	Testing of Hypothesis – Basic concepts, Procedure, Test of Hypothesis, Important parametric Tests, Hypothesis Testing unifications.	
	Interpretation & Report writing – Meaning, techniques, Precaution in Interpretation, Significance of Report writing, steps, Layout, types, mechanics, precautions.	
	Use of Tools/ Techniques for research – Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline, Use of tools / techniques for Research methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism	
UNIT IV	INTELLECTUAL PROPERTY RIGHTS	6
	Intellectual Property – The concept, IPS in India, development, Trade secrets, utility Models, IPR & Bio diversity, CBD, WIPO, WTO, Right of Property, Common rules, PCT, Features of Agreement, Trademark, UNESCO.	
UNIT V	PATENTS	6
	Patents – Learning objectives, Concept, features, Novelty, Inventive step, Specification, Types of patent application, E-filing, Examination, Grant of patent, Revocation, Equitable Assignments, Licences, Licencing of related patents, patent agents, Registration of patent agents.	

TOTAL: 30 PERIODS

REFERENCE BOOKS:

1. Research Methodology: Methods and Techniques by C.R.Kothari, GauravGarg, New Age International 4th Edition 2018 (UNIT I to UNIT III)
2. Research Methodology a step-by-step guide for beginners by Ranjit Kumar, SAGE publications Ltd 3rd Edition 2011 (For the topic Reviewing the Literature under Unit I)
3. Stuart Melville and Wayne Goddard, "Research Methodology: An Introduction for Science & engineering students.Juta and Co., Limited, 1996, First edition
4. Research methods: The concise knowledge base-Trochim, Atomic Dog publishing, First edition,2005..
5. John W. Best & James V. Khan, "Research in Education", Pearson 8thEdition'year.
6. Professional Programme Intellectual Property Rights, Law and practice, The Institute of Company Secretaries of India, Statutory body under an Act of parliament, September 2013 (UNIT IV & UNIT V)

OUTCOMES: (Cos)**On completion of the course the student would be able to :**

- CO1: Understand the research problem and Literature review.
- CO2: Understand the various research designs and their characteristics.
- CO3: Prepare a well-structured research paper and scientific presentations.
- CO4: Explore on various IPR Components and process of filing.
- CO5 Develop awareness the patent law and procedural mechanism in obtaining a patent.

OBJECTIVES:

The student should be able:

- To understand the concepts of Open Source DBMS.
- 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

EXPERIMENTS IN THE FOLLOWING TOPICS:

1. NOSQL Exercises
 - a. MongoDB – CRUD operations ,Indexing, Sharding, Deployment
 - 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)

TOTAL: 60 PERIODS

OUTCOMES:

Upon completion of this course, the student should be able to:

- Design and Implement databases.
- Formulate complex queries using SQL
- Design and Implement applications that have GUI and access databases for backend connectivity
- To design and implement Mobile Databases
- To design and implement databases to store spatial and temporal data objects

**DMC6112 ADVANCED DATA STRUCTURES AND PYTHON PROGRAMMING
LABORATORY**

**L T P C
0 0 4 2**

OBJECTIVES:

- To learn the basic programming constructs in Python.
- To implement Recursive programming in Python
- To implement Divide and Conquer algorithmic technique in Python
- To implement Tree Data structures in Python
- To implement Graphs in Python
- To deploy the standard libraries in Python

EXPERIMENTS:

1. Towers of Hanoi using Recursion
2. To implement Binary Search
3. Merge Sort
4. To implement AVL Trees using Python
5. To implement Splay Trees using Python
6. To implement Red black Trees using Python
7. To implement Graphs using Python
8. Implementing programs using written modules and Python Standard Libraries.
9. Implementing real-time/technical applications using Files and Exception handling.

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Develop algorithmic solutions to simple computational problems
2. Develop and execute Python programs.
3. Decompose a Python program into functions.
4. Represent compound data using Python data structures.
5. Apply Python features in developing software applications.

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 enhance the performance of students listening, speaking, reading and writing and thereby develop their career opportunities.

LIST OF ACTIVITIES:

1. Listening:
 - Listening and practicing neutral accents
 - Listening to short talks and lectures and completing listening comprehension exercises
 - Listening to TED Talks
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

TOTAL: 30 PERIODS**REFERENCES / MANUALS / SOFTWARE:** Open Sources / websites**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

COURSE OBJECTIVES:

- To understand the fundamentals of web programming and client side scripting.
- To learn the server side development using servlets, websocket.
- 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 & CLIENT SIDE PROGRAMMING	9
	Introduction to Web: Server - Client - Communication Protocol (HTTP), JavaScript: Data Types and Variables - Expressions - Operators and Statements - Objects and Arrays - Functions - Classes - Modules - DOM - Events - Storage: LocalStorage, Cookies, IndexedDB, JSON, AJAX	
UNIT II	SERVER SIDE PROGRAMMING	9
	Web Server: Web Containers - Web Components, Servlet: Lifecycle - Request - Servlet Context - Response - Filter - Session - Dispatching Requests, WebSocket, Logging - Log4j2, Build tool - Gradle. Introduction to Spring: IoC Container and Dependency Injection (DI)	
UNIT III	SPRING	9
	Spring Configuration and Spring Boot, Spring MVC: DispatcherServlet and Configuration - Interceptors - Controllers - Views - Input Validation - File Upload, Building RESTful Web Services, Spring Security Architecture, Spring Cache.	
UNIT IV	JAVA PERSISTENCE API AND HIBERNATE	9
	Entity: Basic, Embeddable and Collection Types - Identifiers - Entity Relationship - Inheritance, Persistence Context and Entity Manager, JPQL, Criteria API, Spring Data JPA - Specification and Projection.	
UNIT V	ADVANCED CLIENT SIDE PROGRAMMING	9
	Asynchronous JavaScript: Callbacks - Promises - async and await, React JS: ReactDOM - JSX - Components - Properties - State and Lifecycle - Events - Lifting State Up - Composition and Inheritance - Higher Order Components.	

TOTAL: 45 PERIODS**Course Outcomes:**

Upon completion of the course the students should be able to:

- To write client side scripting.
- To implement the server side of the web application.
- To implement Web Application using Spring.
- To implement a Java application using Java Persistence API.
- To implement a full-stack Single Page Application using React, Spring and JPA.

REFERENCE BOOKS

1. David Flanagan, "Java Script: The Definitive Guide", O'Reilly Media, Inc, 7th Edition, 2020
2. Matt Frisbie, "Professional JavaScript for Web Developers", Wiley Publishing, Inc, 4th Edition, ISBN: 978-1-119-36656-0, 2019
3. Alex Banks, Eve Porcello, "Learning React", O'Reilly Media, Inc, 2nd Edition, 2020
<https://reactjs.org/docs>
4. David R. Heffelfinger, "Java EE 8 Application Development", Packt Publishing, First edition 2017
5. Benjamin Muschko, "Gradle in Action", Manning Publications, First edition 2014
6. Iuliana Cosmina, Rob Harrop, Chris Schaefer, Clarence Ho, "Pro Spring 5: An In-Depth Guide to the Spring Framework and Its Tools", Apress, Fifth edition 2017
7. Christian Bauer, Gavin King, and Gary Gregory, "Java Persistence with Hibernate", Manning Publications, 2nd Edition, 2015

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 9

Introduction to Distributed Systems – Characterization of Distributed Systems – Distributed Architectural Models – Remote Invocation – Request-Reply Protocols – Remote Procedure Call – Remote Method Invocation – Group Communication – Coordination in Group Communication – Ordered Multicast – Time Ordering – Physical Clock Synchronization – Logical Time and Logical Clocks

UNIT II INTRODUCTION TO CLOUD COMPUTING 9

Cloud Computing Basics – Desired features of Cloud Computing – Elasticity in Cloud – On demand provisioning – Applications – Benefits – Cloud Components: Clients, Datacenters & Distributed Servers – Characterization of Distributed Systems – Distributed Architectural Models – Principles of Parallel and Distributed computing – Applications of Cloud computing – Benefits – Cloud services – Open source Cloud Software: Eucalyptus, Open Nebula, Open stack, Aneka, Cloudsim.

UNIT III CLOUD INFRASTRUCTURE 9

Cloud Architecture and Design – Architectural design challenges – Technologies for Network based system – NIST Cloud computing Reference Architecture – Public, Private and Hybrid clouds – Cloud Models : IaaS, PaaS and SaaS – Cloud storage providers – Enabling Technologies for the Internet of Things – Innovative Applications of the Internet of Things.

UNIT IV CLOUD ENABLING TECHNOLOGIES 9

Service Oriented Architecture – Web Services – Basics of Virtualization – Emulation – Types of Virtualization – Implementation levels of Virtualization – Virtualization structures – Tools & Mechanisms – Virtualization of CPU, Memory & I/O Devices – Desktop Virtualization – Server Virtualization – Google App Engine – Amazon AWS – Federation in the Cloud.

UNIT V MICROSERVICES AND DEVOPS 9

Defining Microservices – Emergence of Microservice Architecture – Design patterns of Microservices – The Mini web service architecture – Microservice dependency tree – Challenges with Microservices – SOA vs Microservice – Microservice and API – Deploying and maintaining Microservices – Reason for having DevOps – Overview of DevOps – History of DevOps – Concepts and terminology in DevOps – Core elements of DevOps – Life cycle of DevOps – Adoption of DevOps – DevOps Tools – Build, Promotion and Deployment in DevOps – DevOps in Business Enterprises.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Use Distributed systems in Cloud Environment
- Articulate the main concepts, key technologies, strengths and limitations of Cloud computing
- Identify the Architecture, Infrastructure and delivery models of Cloud computing
- Install, choose and use the appropriate current technology for the implementation of Cloud
- Adopt Microservices and DevOps in Cloud environment

REFERENCES:

1. Kai Hwang, Geoffrey C. Fox & Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, First Edition, 2012
2. Andrew S. Tanenbaum & Maarten Van Steen, "Distributed Systems - Principles and Paradigms", Second Edition, Pearson Prentice Hall, 2006
3. Thomas Erl, Zaigham Mahood & Ricardo Puttini, "Cloud Computing, Concept, Technology & Architecture", Prentice Hall, Second Edition, 2013
4. Richard Rodger, "The Tao of Microservices", ISBN 9781617293146, Manning Publications, First Edition, December 2017.
5. Magnus Larsson, "Hands-On Microservices with Spring Boot and Spring Cloud: Build and deploy microservices using spring cloud, Istio and kubernetes", Packt Publishing Ltd, First Edition, September 2019.
6. Jim Lewis, "DEVOPS: A complete beginner's guide to DevOps best practices", ISBN-13: 978-1673259148, ISBN-10: 1673259146, First Edition, 2019.

OBJECTIVES:

- To familiarize with the principles of Artificial intelligence like problem solving, inference, perception, knowledge representation, and learning.
- To understand the various characteristics of Intelligent agents
- To design and implement the machine learning techniques for real world problems
- To gain experience in doing research using Artificial intelligence and Machine learning techniques.

UNIT I ARTIFICIAL INTELLIGENCE**9**

Foundation of AI-History of AI-State of Art.-Intelligent Agents: Agents and Environments-Concepts of Rationality-Nature of Environments-Structure of Agents. Problem Solving: Problem Solving by Search: Problem Solving Agents-Searching for Solutions-Uniform Search Strategies-Heuristic Search Strategies-local Search Algorithms and Optimization Problems.

UNIT II KNOWLEDGE AND REASONING**9**

Logical Agents: Knowledge Based Agents-Logic-Propositional Logic-Propositional Theorem Proving-Model Checking-Agent based on Propositional Logic. First-Order Logic: Syntax and Semantics- Using First-Order Logic-Knowledge Engineering. Inference in First-Order Logic: Propositional Vs. First-Order Inference-Unification and Lifting-Forward Chaining-Backward Chaining –Resolution.

UNIT III BAYESIAN LEARNING**9**

Basic Probability Notation- Inference – Independence - Bayes' Rule. Bayesian Learning: Maximum Likelihood and Least Squared error hypothesis-Maximum Likelihood hypotheses for predicting probabilities- Minimum description Length principle -Bayes optimal classifier - Naïve Bayes classifier - Bayesian Belief networks -EM algorithm.

UNIT IV PARAMETRIC MACHINE LEARNING**9**

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**9**

k- Nearest Neighbors- Decision Trees – Branching – Greedy Algorithm - Multiple Branches – Continuous attributes – Pruning. Random Forests: ensemble learning. Boosting – Adaboost algorithm. Support Vector Machines – Large Margin Intuition – Loss Function - Hinge Loss – SVM Kernels.

TOTAL: 45 PERIODS

REFERENCES:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , Third Edition Pearson Education Limited, 2015
2. CalumChace , "Surviving AI: The Promise and Peril of Artificial Intelligence", Three CS publication, Second Edition, 2015.
3. Christopher M Bishop, "Pattern Recognition and Machine Learning", Spring 2011 Edition.
4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning: Data Mining, Inference and Prediction", Springer 2nd Edition
5. EthemAlpaydin, "Introduction to Machine Learning", Second Edition, MIT Press, 2010.
6. Tom M. Mitchell, "Machine Learning", India Edition, 1st Edition, McGraw-Hill Education Private Limited, 2013
7. Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence", Third Edition, Tata McGraw-Hill Education, 2012
8. Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence", Third Edition, Tata McGraw-Hill Education, 2012

OUTCOME:

- Apply the techniques of Problem Solving in Artificial Intelligence.
- Implement Knowledge and Reasoning for real world problems.
- Model the various Learning features of Artificial Intelligence
- Analyze the working model and features of Decision tree
- Apply k-nearest algorithm for appropriate research problem.

OBJECTIVES:

- To understand the need and characteristics of mobile applications.
- To design the right user interface for mobile application.
- To understand the design issues in the development of mobile applications.
- To understand the development procedure for mobile application.
- To develop mobile applications using various tools and platforms.

UNIT I INTRODUCTION**12**

Mobile Application Model – Infrastructure and Managing Resources – Mobile Device Profiles – Frameworks and Tools.

UNIT II USER INTERFACE**12**

Generic UI Development - Multimodal and Multichannel UI –Gesture Based UI – Screen Elements and Layouts – Voice XML.

Lab Component:

- i. Implement mobile application using UI toolkits and frameworks.
- ii. Design an application that uses Layout Managers and event listeners.

UNIT III APPLICATION DESIGN**12**

Memory Management – Design Patterns for Limited Memory – Work Flow for Application development – Java API – Dynamic Linking – Plugins and rule of thumb for using DLLs –Concurrency and Resource Management.

Lab Component:

- i. Design a mobile application that is aware of the resource constraints of mobile devices.
- ii. Implement an android application that writes data into the SD card.

UNIT IV MOBILE OS**12**

Mobile OS: Android, iOS – Android Application Architecture – Android basic components –Intents and Services – Storing and Retrieving data – Packaging and Deployment – Security and Hacking.

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**12**

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

TOTAL: 60 PERIODS

OUTCOMES

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

- Understand the basics of mobile application development frameworks and tools
- To be able to develop a UI for mobile application
- To design mobile applications that manages memory dynamically
- To build applications based on mobile OS like Android, iOS
- To build location based services

REFERENCES:

1. Reto Meier, "Professional Android 4 Application Development", Wiley, First Edition, 2012
2. ZigurdMednieks, LairdDornin, G. Blake Meike, Masumi Nakamura, "ProgrammingAndroid", O'Reilly, 2ndEdition, 2012.
3. Alasdair Allan, "iPhone Programming", O'Reilly, First Edition, 2010.

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**9**

Best Practices-Standards and a plan of Action-Security Governance Principles, components and Approach-Information Risk Management-Asset Identification-Threat Identification-Vulnerability Identification-Risk Assessment Approaches-Likelihood and Impact Assessment-Risk Determination, Evaluation and Treatment-Security Management Function-Security Policy-Acceptable Use Policy-Security Management Best Practices.

UNIT II SECURITY CONTROLS**9**

People Management-Human Resource Security-Security Awareness and Education-Information Management- Information Classification and handling-Privacy-Documents and Record Management-Physical Asset Management-Office Equipment-Industrial Control Systems-Mobile Device Security- System Development-Incorporating Security into SDLC- Case study on information security policies.

UNIT III CYBER SECURITY FOR BUSINESS APPLICATIONS AND NETWORKS**9**

Business Application Management-Corporate Business Application Security-End user Developed Applications-System Access- Authentication Mechanisms-Access Control-System Management-Virtual Servers-Network Storage Systems-Network Management Concepts-Firewall-IP Security-Electronic Communications – Case study on OWASP vulnerabilities using OWASP ZAP tool.

UNIT IV TECHNICAL SECURITY**9**

Supply Chain Management-Cloud Security-Security Architecture-Malware Protection-Intrusion Detection-Digital Rights Management-Cryptographic Techniques-Threat and Incident Management-Vulnerability Management-Security Event Management-Forensic Investigations-Local Environment Management-Business Continuity. – Case study on cloud and cryptographic vulnerabilities.

UNIT V SECURITY ASSESSMENT**9**

Security Monitoring and Improvement-Security Audit-Security Performance-Information Risk Reporting-Information Security Compliance Monitoring-Security Monitoring and Improvement Best Practices. – Case study on vulnerability assessment using ACUNETIX.

TOTAL: 45 PERIODS

OUTCOMES

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

- Develop a set of risk and security requirements to ensure that there are no gaps in an organization's security practices.
- Achieve management, operational and technical means for effective cyber security.
- Audit and monitor the performance of cyber security controls.
- To spot gaps in the system and devise improvements.
- Identify and report vulnerabilities in the system

REFERENCES:

1. William Stallings, "Effective Cyber Security- A guide to using Best Practices and Standards", Addison-Wesley Professional, First Edition, 2018.
2. Adam Shostack, "Threat Modelling- Designing for Security", Wiley Publications, First Edition, 2014.
3. Gregory J. Touhill and C. Joseph Touhill, "Cyber Security for Executives- A Practical guide", Wiley Publications, First Edition, 2014.
4. [Raef Meeuwisse](#), "Cyber Security for Beginners", Second Edition, Cyber Simplicity Ltd, 2017.
5. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", 2nd Edition, Syngress, 2013.
6. OWASP ZAP : <https://owasp.org/www-project-zap/>
7. ACUNETIX: <https://www.acunetix.com/>

Course Objectives:

1. To implement the client side of the web application using javascript.
 2. To implement the server side of the web application using Servlets and WebSockets.
 3. To develop a web application using Spring.
 4. To implement a Persistence layer using Hibernate and Spring Data JPA.
 5. To develop a full stack single page application using React, Spring and Hibernate.
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.
 2. Create a javascript application in an Object Oriented way using Classes and Modules. It should also use browser storage for persistence.
 3. 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.
 4. Build a chat application using WebSocket.
 5. Create a Spring MVC application. The application should handle form validation, file upload, session tracking.
 6. Implement a RESTful Spring Boot application using Spring REST, Spring Security and Spring Cache.
 7. Design a complex 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.
 8. Create a Spring RESTful Application with Spring Data JPA. Support pagination and searching using Specifications.
 9. Create a React application with different components and interactions between the components.
 10. Develop a full-stack application using React and Spring. Make use of Spring REST, Spring Security, Spring Data JPA, Hibernate, Spring Boot, Gradle and React's higher order component.

TOTAL : 60 PERIODS**Course Outcomes:**

1. To implement client and server side of the web application.
2. To implement a real time application using WebSocket.
3. To use Spring framework in web development.
4. To implement applications using Java Persistence API.
5. To implement applications using the JavaScript framework React.

OBJECTIVES:

- To familiarize with the machine learning algorithms and implement in practical situations.
- To involve the students to practice AI algorithms and techniques.
- Learn to use different algorithms for real time data sets.

List of Experiments :

1. Write a program to illustrate problem solving as a search.
2. Write a program to illustrate local search algorithms.
3. Write a program to demonstrate logical agents.
4. Evaluate forward chainer and rule base on at least four different databases. Try to create at least one database that demonstrates an interesting feature of the domain, or an interesting feature of forward chaining in general.
5. Demonstrate agent based on propositional logic.
6. Write a program to implement the naïve Bayesian classifier for a sample training data set. Compute the accuracy of the classifier, considering few test data sets.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file.
9. Write a program to implement k-Nearest Neighbor algorithm to classify the data set.
10. 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.
11. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets
12. Implement Support Vector Classification for linear kernel.
13. Implement Logistic Regression to classify the problems such as spam detection. Diabetes predictions so on.

Total: 60 Periods**OUTCOMES:**

- Apply the techniques of Problem Solving in Artificial Intelligence.
- Implement Knowledge and Reasoning for real world problems.
- Model the various Learning features of Artificial Intelligence
- Analyze the working model and features of Decision tree
- Apply k-nearest algorithm for appropriate research problem.

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

REFERENCES / MANUALS / SOFTWARE: Open Sources / websites

TOTAL: 30 PERIODS

OUTCOMES:

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

- Students will be able to make presentations and participate in Group discussions with confidence.
- Students will be able to perform well in the interviews.
- Students will make effective presentations.

OBJECTIVES:

- To know the fundamental concepts of data science and analytics.
- To learn fundamental data analysis using R.
- To understand various data modeling techniques.
- To learn the basic and advanced features of open source big data tools and frameworks.
- To study various analytics on stream data.

UNIT I INTRODUCTION TO DATA SCIENCE AND BIG DATA**9**

Introduction to Data Science – Data Science Process – Exploratory Data analysis – Big data: Definition, Risks of Big Data, Structure of Big Data – Web Data: The Original Big Data – Evolution Of Analytic Scalability – Analytic Processes and Tools – Analysis versus Reporting – Core Analytics versus Advanced Analytics– Modern Data Analytic Tools – Statistical Concepts: Sampling Distributions – Re-Sampling – Statistical Inference – Introduction to Data Visualization.

UNIT II DATA ANALYSIS USING R**9**

Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis – Bivariate Analysis: Correlation – Regression Modeling: Linear and Logistic Regression – Multivariate Analysis – Graphical representation of Univariate, Bivariate and Multivariate Analysis in R: Bar Plot, Histogram, Box Plot, Line Plot, Scatter Plot, Lattice Plot, Regression Line, Two-Way cross Tabulation.

UNIT III DATA MODELING**9**

Bayesian Modeling – Support Vector and Kernel Methods – Neuro – Fuzzy Modeling – Principal Component Analysis – Introduction to NoSQL: CAP Theorem, MongoDB: RDBMS VsMongoDB, Mongo DB Database Model, Data Types and Sharding – Data Modeling in HBase: Defining Schema – CRUD Operations

UNIT IV DATA ANALYTICAL FRAMEWORKS**10**

Introduction to Hadoop: Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System): Components and Block Replication – Introduction to MapReduce – Running Algorithms Using MapReduce – Introduction to HBase: HBase Architecture, HLog and HFile, Data Replication – Introduction to Hive, Spark and Apache Sqoop.

UNIT V STREAM ANALYTICS**8**

Introduction To Streams Concepts – Stream Data Model and Architecture – Stream Computing – Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window.

TOTAL: 45 PERIODS**OUTCOMES:**

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

1. Convert real world problems to hypothesis and perform statistical testing.
2. Perform data analysis using R.
3. Design efficient modeling of very large data and work with big data platforms..
4. Implement suitable data analysis for stream data.
5. Write efficient Map Reduce programs for small problem solving methods.

REFERENCES:

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, First Edition,2013.
2. Umesh R Hodeghatta, UmeshaNayak, "Business Analytics Using R – A Practical Approach", Apress, First Edition,2017.
3. J. Leskowec, AnandRajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, Second Edition,2014.
4. NishantGarg, "HBase Essentials", Packt, First Edition, 2014.
5. Rachel Schutt, Cathy O'Neil, "Doing Data Science", O'Reilly, First Edition,2013
6. Foster Provost, Tom Fawcet, "Data Science for Business", O'Reilly, First Edition,2013.
7. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley, First Edition,2014.
8. <https://www3.cs.stonybrook.edu/~skiena/519/>

OBJECTIVES:

- To learn the internal architecture and programming of an embedded processor.
- To introduce interfacing I/O devices to the processor and to run, debug programs in an IDE.
- To build a small low cost embedded system using Open Hardware Platforms.
- To apply the concept of Internet of Things in real world scenario.
- To deploy IoT application and connect to the cloud.

UNIT I EMBEDDED CONTROLLER**9**

Microcontrollers and Embedded Processors, Introduction to 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM. 8051 Addressing Modes.

UNIT II EMBEDDED C PROGRAMMING**9**

Memory and I/O Devices Interfacing – Programming Embedded Systems in C – Need for RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNIT III FUNDAMENTALS OF IOT**9**

Introduction and Characteristics – Physical and Logical Design – IoT Protocols: Link Layer Protocols, Network Layer Protocols, Transport Layer and Application Layer Protocols – IoT Levels – IoT versus M2M – Sensors and Actuators – Power Sources.

UNIT IV BUILDING IOT**9**

Open Hardware Platforms: Interfaces, Programming, APIs and Hacks – Web Services – Integration of Sensors and Actuators with Arduino/ Raspberry Pi/ Other Light Weight Boards.

UNIT V APPLICATIONS**9**

Complete Design of Embedded Systems – Smart Cities: Smart Parking, Smart Traffic Control, Surveillance – Home Automation: Smart Appliances, Intrusion Detection, Smoke/Gas Detectors – Cloud Storage and Communication APIs: WAMP, Xively, Django – Data and Analytics for IoT.

TOTAL: 45 PERIODS**OUTCOMES:**

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

- Analyze architecture of embedded processors and micro controllers.
- Design and deploy timers and interrupts.
- Design and develop the prototype of embedded and IoT systems.
- Design portable IoT using Arduino/Raspberry Pi /equivalent boards.
- Analyze and develop applications of IoT in real time scenario.

REFERENCES:

1. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, First Edition, 2006.
2. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition, 2007.
3. ArshdeepBahga, Vijay Madiseti, "Internet of Things: A Hands-on-Approach", VPT First Edition, 2014.
4. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals, Networking Technologies, Protocols, and Use cases for the Internet of Thing", Cisco Press, First Edition, 2017.

OBJECTIVES:

- To understand the basic principles of Double entry system and preparation of balance sheet.
- To understand partnership accounts
- To understand the process of estimating the depreciation of a particular asset.
- To understand single entry accounting

UNIT I INTRODUCTION TO ACCOUNTING**9**

Meaning and scope of Accounting, Basic Accounting Concepts and Conventions – Objectives of Accounting – Accounting Transactions – Double Entry Book Keeping – Journal, Ledger, Preparation of Trial Balance – Preparation of Cash Book.

UNIT II FINAL ACCOUNTS**9**

Preparation of Final Accounts of a Sole Trading Concern – Adjustments Receipts and Payments Account, Income & Expenditure Account and Balance Sheet of Non Trading Organizations

UNIT III PARTNERSHIP ACCOUNTS**9**

Partnership Accounts-Final accounts of partnership firms – Basic concepts of admission, retirement and death of a partner including treatment of goodwill - rearrangement of capitals. (Simple problems on Partnership Accounts).

UNIT IV DEPRECIATION**9**

Depreciation – Meaning, Causes, Types – Straight Line Method – Written Down Value Method, Insurance Policy Method, Sinking Fund Method & Annuity Method. Insurance claims – Average Clause (Loss of stock & Loss of Profit)

UNIT V SINGLE ENTRY ACCOUNTING**9**

Single Entry – Meaning, Features, Defects, Differences between Single Entry and Double Entry System – Statement of Affairs Method – Conversion Method

TOTAL: 45 PERIODS**OUTCOMES:**

- Able to understand the basics of accounting
- Able to understand balance sheet preparation and do analysis
- Able to understand the partnership accounts
- Able to appreciate and depreciate the assets of an organization in accounting
- Able to understand Single Entry Accounting

REFERENCES:

1. R.L.Gupta&V.K.Gupta,Advanced Accounting - Sultan Chand& Sons - New Delhi. Fourteenth Revised and EnlargedEdition,2019
2. Jain &Narang, Financial Accounting - Kalyani Publishers - New Delhi, Twelfth edition -2014
3. T.S. Reddy &A.Murthy, Financial Accounting - Margham Publications –Chennai-17. 6thEdition,2012
4. Shukla&Grewal, Advanced Accounting – S Chand - New Delhi, 19thEdition,2017
5. Nirmal Gupta, Financial Accounting-Ane Books India – New Delhi. Fifth Edition, 2012

DMC6311**DATA SCIENCE LABORATORY****L T P C
0 0 4 2****OBJECTIVES:**

- To provide hands-on cloud and data analytics frameworks and tools.
- To use the Python/R packages for performing analytics.

- To learn using analytical tools for real world problems.
- To familiarize the usage of distributed frameworks for handling voluminous data.
- To write and deploy analytical algorithms as MapReduce tasks.

EXPERIMENTS:

Do the following experiments using R/Python:

1. Download, install and explore the features of R/Python for data analytics.
2. Use the Diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
 - a. Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
 - b. Bivariate Analysis: Linear and logistic regression modeling.
 - c. Multiple Regression Analysis
 - d. Also compare the results of the above analysis for the two data sets.
3. Apply Bayesian and SVM techniques on Iris and Diabetes data set.
4. Apply and explore various plotting functions on UCI data sets. Implement the following using Hadoop, Map Reduce, HDFS, Hive:
 1. Perform setting up and Installing Hadoop in its two operating modes: pseudo-distributed and fully distributed.
 2. Implement the following file management tasks in Hadoop: adding files and directories, Retrieving files and Deleting files
 3.
 - (i) Performing a MapReduce Job for word search count (look for specific keywords in a file)
 - (ii) Implement stop word elimination problem: Input a large textual file containing one sentence per line and a small file containing a set of stop words (one stop word per line) and save the results in an output textual file containing the same sentences of the large input file without the words appearing in the small file.
 4. Implement a MapReduce program that processes a weather data set to:
 - (i) Find average, max and min temperature for each year in National Climate Data Centre data set.
 - (ii) Filter the readings of a set based on value of the measurement. The program must save the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.
 5. Install, deploy & configure Apache Spark cluster. Run Apache Spark applications using Scala.
 6. Install and run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
7. Mini projects on the following:
 - (i) Simulate a simple recommender system with Amazon product dataset, Social tweet data set etc. on Hadoop.
 - (ii) Perform a very large text classification run on Hadoop.

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Install analytical tools and configure distributed file system.
2. Have skills in developing and executing analytical procedures in various distributed frameworks and databases.
3. Develop, implement and deploy simple applications on very large datasets.
4. Implement simple to complex data modeling in NoSQL databases.
5. Develop and deploy simple applications in cloud.

OBJECTIVES:

- To learn tools relevant to embedded system and IoT development.
- To write simple assembly programs that uses various features of the processor.
- To design and develop IoT application Arduino/Raspberry pi for real world scenario.

EXPERIMENTS:**PART I:**

1. Implement assembly and Interfacing Programs Using Embedded C.
2. Embedded Application Development
 - (i) Using Arduino and Raspberry Pi
 - (ii) Using Bluemix platform
3. IoT Application Development
 - (i) Using sensors and actuators (temperature sensor, light sensor, infraredsensor)
 - (ii) Interfacing sensors with Arduino/Raspberry Pi/other equivalent boards
 - (iii) Reading data from sensors
4. Explore different communication methods with IoT devices.
5. Collecting and processing data from IoT systems in the cloud using XivelyPaaS.
6. Develop IoT applications using Django Framework and Firebase/ Bluemix platform.

TOTAL: 60 PERIODS**OUTCOMES:**

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

1. Write and implement simple assembly programs that use various features of the processor.
2. Test and experiment different sensors for application development Arduino/Raspberry Pi/ Equivalent boards.
3. Develop IOT applications with different platform and frameworks.

Elective II

DMC6007

COMPILER OPTIMIZATION TECHNIQUES

L T P C
3 0 0 3

OBJECTIVES:

- To understand the optimization techniques used in compiler design.
- To be aware of the various computer architectures that support parallelism.
- To become familiar with the theoretical background needed for code optimization.
- To understand the techniques used for identifying parallelism in a sequential program.
- To learn the various optimization algorithms.

UNIT I INTRODUCTION

9

Language Processors - The Structure of a Compiler – The Evolution of Programming Languages - The Science of Building a Compiler – Applications of Compiler Technology Programming Language Basics - The Lexical Analyzer Generator -Parser Generator - Overview of Basic Blocks and Flow Graphs - Optimization of Basic Blocks - Principle Sources of Optimization.

UNIT II INSTRUCTION-LEVEL PARALLELISM

9

Processor Architectures – Code-Scheduling Constraints – Basic-Block Scheduling –Global Code Scheduling – Software Pipelining.

UNIT III OPTIMIZING FOR PARALLELISM AND LOCALITY-THEORY

9

Basic Concepts – Matrix-Multiply: An Example - Iteration Spaces - Affine Array Indexes – Data Reuse Array data dependence Analysis.

UNIT IV OPTIMIZING FOR PARALLELISM AND LOCALITY APPLICATION

9

Finding Synchronization - Free Parallelism – Synchronization between Parallel Loops – Pipelining – Locality Optimizations – Other Uses of Affine Transforms.

UNIT V INTERPROCEDURAL ANALYSIS

9

Basic Concepts – Need for Interprocedural Analysis – A Logical Representation of Data Flow – A Simple Pointer-Analysis Algorithm – Context Insensitive Interprocedural Analysis - Context - Sensitive Pointer-Analysis - Datalog Implementation by Binary Decision Diagrams.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course the students should be able to:

- Identify the various sources of optimization
- identify the constraints and architectures of parallel execution of instructions
- identify the sources of optimization of parallel execution of instructions
- apply the process of optimization using various techniques
- Implement optimization techniques

REFERENCES:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", Second Edition, Pearson Education, 2008.
2. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufmann Publishers, First Edition, 2002.
3. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.

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 C# LANGUAGE BASICS 9

.Net Architecture – Core C# – Variables – Data Types – Flow control – Objects and Types- Classes and Structs – Inheritance- Generics – Arrays and Tuples – Operators and Casts – Indexers- Assemblies – SharedAssemblies – CLR Hosting – Appdomains.

UNIT II C# ADVANCED FEATURES 9

Delegates – Lambdas – Lambda Expressions – Events – Event Publisher – Event Listener – Strings and Regular Expressions – Generics – Collections – Memory Management and Pointers – Errors and Exceptions – Reflection.

UNIT III BASE CLASS LIBRARIES AND DATA MANIPULATION 9

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 and the Entity Data Model – Dynamically Binding Query Results.

UNIT IV WINDOW AND WEB BASED APPLICATIONS 9

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) – Introduction to Web Services.

UNIT V .NET COMPACT FRAMEWORK 9

Reflection – .Net Remoting-.Net Security – Localization – Peer-to-Peer Networking – Building P2P Applications – .Net Compact Framework – Compact Edition DataStores – Testing and Debugging – Optimizing performance – Packaging and Deployment.

TOTAL: 45 PERIODS**OUTCOMES:**

Up on completion of the course, the student will be able to:

- Understand the difference between .NET and Java framework.
- Work with the basic and advanced features of C# language.
- Create applications using various data providers.
- Create web application using ASP.NET.
- Create mobile application using .NET compact framework.

REFERENCES:

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, "Professional C# and .NET 4.5", Wiley, First Edition 2012
2. Andrew Troelsen, "Pro C# 5.0 and the .NET 4.5 Framework", A press publication, First Edition 2012
3. Ian Gariffiths, Mathew Adams, Jesse Liberty, "Programming C# 4.0", O'Reilly, Sixth Edition, 2010
4. Andy Wigley, Daniel Moth, "Peter Foot, —Mobile Development Handbook", Microsoft Press, 2nd Edition, 2011
5. Herbert Schildt, "C# - The Complete Reference", Tata McGraw Hill, First Edition 2010.

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**9**

Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum, IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, WirelessHART- IEEE802.16- WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX

UNIT II MOBILE NETWORK LAYER**9**

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Networklayer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing: Destination Sequence distance vector, Dynamic source routing, IoT: CoAP. TCP enhancements for wireless protocols

UNIT III 3G OVERVIEW**9**

Overview of UMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, 3GPP Architecture, SMS-GMSC/SMS-IW MSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA

UNIT IV 4G NETWORKS**9**

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Cognitive Radio, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.

UNIT V 5G NETWORKS**9**

Introduction to 5G, vision and challenges, 5G NR – New Radio – air interface of 5G, radio access, Ultra- Dense Network Architecture and Technologies for 5G- Generalized frequency division multicarrier (GFDM)- Principles, Transceiver Block diagram-MIMO in LTE, Theoretical background, Single user MIMO, Multi-user MIMO, Capacity of massive MIMO: a summary, Basic forms of massive MIMO implementation.

TOTAL: 45 PERIODS

OUTCOMES: outcomes to be changed with respect to contentsAt the end of the course, the student should be able to:

- Conversant with the latest 3G/4G networks and its architecture
- Design and implement wireless network environment for any application using latest wireless protocols and standards
- Ability to select the suitable network depending on the availability and requirement
- Implement different type of applications for smart phones and mobile devices with latest network strategies

REFERENCES:

1. Jochen Schiller, Mobile Communications, Second Edition, Pearson Education 2012.
2. Vijay Garg, —Wireless Communications and networkingI, First Edition, Elsevier 2007.
3. AfifOsseiran, Jose.F.Monserrat and Patrick Marsch, "5G Mobile and Wireless CommunicationsTechnology", Cambridge University Press, First Edition2016.
4. Clint Smith, Daniel Collins, "Wireless Networks", 3rd Edition, McGraw-Hill Education, 2014.
5. Anurag Kumar, D.Manjunath, Joy kuri, —Wireless Networking, First Edition, Elsevier 2011.
6. Xiang, W; Zheng, K; Shen, X.S; "5G Mobile Communications", Springer, First Edition2016
7. Saad Z Asif, "5G Mobile Communication, Concepts and Challenges", First Edition CRC Press
8. Thomas L. Marzetta, Erik G. Larsson, Hong Yang, HienQuoc Ngo, "Fundamentals of Massive MIMO", Cambridge University Press, First Edition2018.

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.
- The objective is to enable the students to understand the Organizational Behaviour, and Organizational Change and dynamic of groups.

UNIT I INTRODUCTION TO WWW**9**

Understanding the working of Internet-Web Application Architecture-Brief history of Internet-Web Standards – W3C-Technologies involved in Web development – Protocols-Basic Principles involved in developing a website-Five Golden Rules of Web Designing.

UNIT II UI DESIGN**9**

HTML Documents-Understanding markup languages-Structure of HTML Documents-Markup Tags-Basic markup tags-Working with Text-Working with Images-Hyperlinks -Images-Tables-List-SVG-Advanced HTML-Iframes-HTML5 Video and Audio tags

Cascading Style Sheet: Need for CSS - Importance of separating document structuring and styling-Basic CSS selectors and properties-CSS properties for text (Color, font, weight, align, etc.) and working with colors-Selecting with classes, IDs, tags-CSS Specificity-Ways of linking CSS to HTML-CSS Pseudo selectors-Understanding the box model - Margins, padding and border – Inline and block elements -Structuring pages using Semantic Tags

UNIT III WEB PAGE LAYOUTS WITH CSS3**9**

Positioning with CSS – Positions, Floats, z-index-Layouts with 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**

Basic JavaScript syntax-JavaScript Objects and JSON-Understanding the DOM-JavaScript Events and Input validation-Modifying CSS of elements using JavaScript-JavaScript Local Storage and Session Storage-Cross domain data transfer with AJAX-Using JQuery to add interactivity-JQuery Selectors-JQuery Events-Modifying CSS with JQuery -Adding and removing elements with JQuery-AJAX with JQuery-Animations with JQuery (hide, show, animate, fade methods, Slide Method)

UNIT V SERVER-SIDE PROGRAMMING WITH PHP**9**

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

.TOTAL: 45 PERIODS**OUTCOMES:**

- Create a basic website using HTML and Cascading Style Sheets.
- Create websites with complex layouts
- Add interactivity to websites using simple scripts
- Design rich client presentation using AJAX.
- Add business logic to websites using PHP and databases

REFERENCES:

1. David Flanagan, "JavaScript: The Definitive Guide", 7th Edition, O'Reilly Publications,2020
2. Danny Goodman, "Dynamic HTML: The Definitive Reference: A Comprehensive Resource for XHTML, CSS, DOM, JavaScript" , O'Reilly Publications, 3rd Edition,2007
3. Robin Nixon; "Learning PHP, MySQL, JavaScript & CSS: A Step-by-Step Guide to Creating Dynamic Websites", O'Reilly Publications, 2nd Edition,2018
4. Keith J Grant; "CSS in Depth", Manning Publications. 1st edition,2018
5. Elizabeth Castrol, "HTML5 & CSS3 Visual Quick start Guide", Peachpit Press, 7th Edition, 2012.
6. Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web - How to Program", Fifth Edition, Pearson Education, 2012
7. <https://developer.mozilla.org/en-US/>
8. <https://learn.shayhowe.com/>

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 9

TCP/IP Layer Model – Multicast, broadcast and Any cast - 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

UNIT II ELEMENTARY TCP SOCKETS 9

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

UNIT III SOCKET OPTIONS AND MULTIPLEXING 9

Socket options – getsockopt and setsockopt functions – generic socket options – IP socket options – ICMP socket options – TCP socket options I/O multiplexing – I/O Models – select function – shutdown function – TCP echo Server (with multiplexing) – poll function – TCP echo Client (with Multiplexing)

UNIT IV ELEMENTARY UDP SOCKETS 9

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.

UNIT V NETWORK SECURITY 9

SSL - SSL Architecture, SSL Protocols, SSL Message , Secure Electronic Transaction (SET). TLS –TLS Protocols,DTLS Protocols, PKI – Fundamentals, Standards and Applications

TOTAL: 45 PERIODS**REFERENCE BOOKS:**

1. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff ,”Unix Network Programming, Volume 1: The Sockets Networking API”, Third Edition, ISBN:0-13-141155-1, Addison Wesley Pearson Education,2004
2. Behrouz A Forouzan,DebdeepMukhopadhyay “Cryptography and Network Security” ,Second Edition, ISBN -13:978-0-07—070208-0 Tata McGraw Hill Education Private Limited 2010
3. William Stallings, “Cryptographic and network security Principles and Practices”,Fourth Edition, Publisher Prentice Hall, November 2005
4. Andre Perez, ”Network Security”, First Edition, Publisher John Wiley & Sons, 2014
5. Gary R. Wright , W. Richard Stevens, ”TCP/IP Illustrated: The Implementation” , ISBN 0-201-63354-X , Vol. 2, 1st Edition , Addison Wesley Professional, January 2008
6. Michael J. Donahoo, Kenneth L. Calvert “TCP/IP Sockets in C: Practical Guide for Programmers “, Morgan Kaufmann Publishers 2ndEdition. 2009
7. Lewis Van Winkle ,”Hands-On Network Programming with C: Learn socket programming in C and write secure and optimized network code” ,ISBN -978-1-78934-986-3, Packt Publishing 2019 First Edition.

OUTCOMES:

Upon completion of the course, the student will be able to

- Design and implement the client/server programs using variety of protocols
- Understand the key protocols which support Internet
- Demonstrate advanced knowledge of programming interfaces for network communication
- Use the basic tools for design and testing of network programs in Unix environment.
- Identify some of the factors driving the need for network security

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 framework

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- Microservice architectural style- Benefits - Drawbacks of Microservice architectural style - decomposing monolithic applications into Microservices.

UNIT III BASICS OF DEVOPS

9

History of DevOps- DevOps and software development life cycle- water fall model – agile model –DevOps life cycle – DevOps tools: distributed version control tool –**Git**- automation testing tools – **Selenium** - reports generation – **TestNG** - User Acceptance Testing – **Jenkins**.

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 VELOCITYAND 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**OUTCOMES:**

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

- Understand the Microservices and containers.
- apply Microservices in DevOps
- Understand about DevOps and the common tools used in DevOps.
- Develop and integrate projects using DevOps
- Deploy and monitor projects using DevOps.

REFERENCES:

1. NamitTanasseri, RahulRai, Microservices with Azure, 1st Edition, Packt Publishing, UK, 2017
2. Eberhard Wolff, Microservices: Flexible Software Architecture, 1st Edition, Pearson Education, 2017
3. James A Scott, A Practical Guide to Microservices and Containers, MapR Data Technologies e – book. <https://mapr.com/ebook/microservices-and-containers/assets/microservices-and-containers.pdf>
4. Joyner Joseph, Devops for Beginners, First Edition, MihailsKonoplovs publisher, 2015.
5. Gene Kim, Kevin Behr, George Spafford, The Phoenix Project, A Novel about IT, DevOps, 5th Edition, IT Revolution Press, 2018 .
6. Michael Hüttermann, DevOps for Developers, 1st Edition, APress, e-book, 2012.

OBJECTIVES:

- To gain knowledge about social networks, its structure and their data sources.
- To study about the knowledge representation technologies for social network analysis.
- To analyse the data left behind in social networks.
- To gain knowledge about the community maintained social media resources.
- To learn about the visualization of social networks.

UNIT I INTRODUCTION TO SEMANTIC WEB 9

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, Web-based Networks.

UNIT II KNOWLEDGE REPRESENTATION ON THE SEMANTIC WEB 9

Ontology-based knowledge Representation – Ontology languages for the Semantic Web: RDF and OWL– Modeling Social Network Data – Network Data Representation, Ontological Representation of Social Individuals and Relationships –Aggregating and Reasoning with Social Network Data.

UNIT III SOCIAL NETWORK MINING 9

Detecting Communities in Social Network – Evaluating Communities –Methods for Community Detection – Applications of Community Mining Algorithms – Tools for detecting communities – Application: Mining Facebook - Exploring Facebook’s social Graph API – Analyzing social graph connections

UNIT IV COMMUNITY MAINTAINED SOCIAL MEDIA RESOURCES 9

Community Maintained Resources – Supporting technologies for community maintained resources– User motivations-Location based social interaction – location technology– mobile location sharing – Social Information Sharing and social filtering – Automated recommender system.

UNIT V VISUALIZATION OF SOCIAL NETWORKS 9

Visualization of Social Networks - Node-Edge Diagrams – Random Layout – Force-Directed Layout – Tree Layout – Matrix Representations –Matrix and Node-Link Diagrams – Hybrid Representations – Visualizing Online Social Networks.

TOTAL: 45 PERIODS**OUTCOMES:**

Up on completion of the course, the students will be able to:

- Explain the basic principles behind network analysis algorithms.
- Model and represent knowledge for social semantic Web.
- Use extraction and mining tools for analyzing Social networks.
- Discuss about community maintained social media resources.
- Develop personalized visualization for Social networks.

REFERENCES:

1. Matthew A. Russell,“Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, Githuband more”, O’REILLY, Third Edition, 2018.
2. CharuAggarwal, "Social Network Data Analytics," Springer, First Edition, 2014
3. Jennifer Golbeck, "Analyzing the social web", Waltham, MA: Morgan Kaufmann (Elsevier), First Edition, 2013.
4. BorokoFurht, “Handbook of Social Network Technologies and Applications”, Springer, First Edition, 2010
5. Peter Mika, “Social Networks and the Semantic Web”, Springer, First Edition, 2007
6. Stanley Wasserman and Katherine Faust, “Social network analysis: methods and applications”, Cambridge University Press, First Edition, 1999.

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**

Introduction to algorithm - Newton ' s method - optimization algorithm - No-Free-Lunch Theorems - Nature-Inspired Metaheuristics -Analysis of Algorithms -Nature Inspires Algorithms -Parameter tuning and parameter control.

UNIT II RANDOM WALK AND ANEALING**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 ALGORITHM AND DIFFERENTIAL EVOLUTION**9**

Introduction to genetic algorithms and - role of genetic operators - choice of parameters - GA variants - schema theorem - convergence analysis - introduction to differential evolution - variants - choice of parameters - convergence analysis - implementation.

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**

Improved Weighted Thresholded Histogram Equalization Algorithm for Digital Image Contrast Enhancement Using Bat Algorithm - Ground Glass Opacity Nodules Detection and Segmentation using Snake Model - Mobile Object Tracking Using Cuckoo Search- Bio inspired algorithms in cloud computing- Wireless Sensor Networks using Bio inspired Algorithms

TOTAL: 45 PERIODS**OUTCOMES:**

Upon completion of the course, the students should be able to

- Implement and apply bio-inspired algorithms
- Explain random walk and simulated annealing
- Implement and apply genetic algorithms
- Explain swarm intelligence and ant colony for feature selection
- Apply bio-inspired techniques in various fields.

REFERENCES:

1. Eiben, A.E. Smith, James E, "Introduction to Evolutionary Computing", Springer 2nd Edition 2015.
2. Helio J.C. Barbosa, "Ant Colony Optimization - Techniques and Applications", Intech First Edition, 2013
3. Xin-She Yang, Jaao Paulo papa, "Bio-Inspired Computing and Applications in Image Processing", Elsevier First Edition, 2016
4. Xin-She Yang, "Nature Inspired Optimization Algorithm", Elsevier First Edition 2014
5. Yang, Cui, Xlao, Gandomi, Karamanoglu, "Swarm Intelligence and Bio-Inspired Computing", Elsevier First Edition 2013

OBJECTIVES:

- To understand the basics of information retrieval with pertinence to modeling, query operations and indexing
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the various applications of information retrieval giving emphasis to multimedia IR, web search
- To understand the concepts of digital libraries

UNIT I INTRODUCTION: MOTIVATION 9

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval – Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR —IR Versus Web Search–Components of a Search engine

UNIT II MODELING 9

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing

UNIT III INDEXING 9

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 9

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 9

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries

TOTAL: 45 PERIODS**OUTCOMES:**

Upon completion of this course, the students should be able to:

- Build an Information Retrieval system using the available tools.
- Identify and design the various components of an Information Retrieval system.
- Model an information retrieval system
- Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.
- Design an efficient search engine and analyze the Web content structure.

REFERENCES:

1. Implementing and Evaluating Search EnginesI, The MIT Press, Cambridge, Massachusetts London, England, First Edition2010
2. Ricardo Baeza – Yates, BerthierRibeiro – Neto, —Modern Information Retrieval: The concepts and Technology behind SearchI (ACM Press Books), Second Edition, 2011.
3. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, —Information RetrievalFirstEdition 2010
4. Manning Christopher D., RaghavanPrabhakar&SchutzeHinrich, “ Introduction to Information Retrieval”, Cambridge University Press, Online Edition,2009

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	9
Introduction – Software architecture - Architectural structures – Influence of software architecture on organization - both business and technical – Architecture Business Cycle- Functional requirements – Technical constraints – Quality Attributes.		
UNIT II	QUALITY ATTRIBUTE WORKSHOP	9
Quality Attribute Workshop – Documenting Quality Attributes – Six part scenarios – Case studies.		
UNIT III	ARCHITECTURAL VIEWS	9
Introduction – Standard Definitions for views – Structures and views – Representing views-available notations – Standard views – 4+1 view of RUP, Siemens 4 views, SEI’s perspectives and views – Case studies		
UNIT IV	ARCHITECTURAL STYLES	9
Introduction – Data flow styles – Call-return styles – Shared Information styles – Event styles – Case studies for each style.		
UNIT V	DOCUMENTING THE ARCHITECTURE	9
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		

TOTAL: 45 PERIODS**OUTCOMES:**

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

- Explain influence of software architecture on business and technical activities
- Summarize quality attribute workshop
- Identify key architectural structures
- Use styles and views to specify architecture
- Design document for a given architecture

REFERENCES:

1. Len Bass, Paul Clements, and Rick Kazman, “Software Architectures Principles and Practices”, 2ⁿ Edition, Addison-Wesley, 2003.
2. Anthony J Lattanze, “Architecting Software Intensive System. A Practitioner's Guide”, 1st Edition, Auerbach Publications, 2010.
3. Paul Clements, Felix Bachmann, Len Bass, David Garlan, James Ivers, Reed Little, Paulo Merson, Robert Nord, and Judith Stafford, “Documenting Software Architectures. Views and Beyond”, 2nd Edition, Addison-Wesley, 2010
4. Paul Clements, Rick Kazman, and Mark Klein, “Evaluating software architectures: Methods and case studies.”, 1st Edition, Addison-Wesley, 2001.
5. Mark Hansen, “SOA Using Java Web Services”, 1st Edition, Prentice Hall, 2007
6. David Garlan, Bradley Schmerl, and Shang-Wen Cheng, “Software Architecture-Based Self-Adaptation,” 31-56. Mieso K Denko, Laurence Tianruo Yang, and Yan Zang (eds.), “Autonomic Computing and Networking”. 1st Edition, Springer Verlag 2009.

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**9**

Digital Forensics – Uses- Digital Forensics Process – Locard's Exchange Principle – Scientific 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

UNIT II ANTI-FORENSICS & LEGAL**9**

Introduction – Hiding data – Password attacks – Additional resources – Steganography – Data destruction. Legal: Fourth Amendment – Criminal law-searches without a warrant – searching with a warrant- Electronic discovery-Expert testimony.

UNIT III EVIDENCE COLLECTION**9**

Evidence Collection – Collection option – Obstacles – Types of Evidence – The rules of Evidence – General Procedure – Collection and archiving – Methods of collection – Artifacts – Collection steps – Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the digital Crime Scene – Computer Evidence processing steps - Legal Aspects of Collecting and Preserving Computer Forensic Evidence - Computer ImageVerification and Authentication.

UNIT IV COMPUTER FORENSICS**9**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques – Incident and incident response methodology – Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. – Forensics Technology and Systems – Understanding Computer Investigation – Data Acquisition.

UNIT V NETWORK FORENSICS & MOBILE DEVICE FORENSICS**9**

Introduction – Network fundamentals – Network Security tools – Network evidence and investigations. Mobile device forensics: Cellular Network – Cell phone evidence – Cell phone forensic tools- Global Positioning systems.

TOTAL: 45 PERIODS

OUTCOME:

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

- Explain digital forensic process and role of forensic examiner.
- Explore Legal amendments.
- Demonstrate evidence collection
- Explore computer forensics, network forensics and mobile device forensics.
- Make Use forensics tools.

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1. John Sammons, The Basics of Digital Forensics The Primer for Getting Started in Digital Forensics, Second Edition, Syngress, 2015.
2. Cory Altheide and Harlan Carvey, —Digital Forensics with Open Source Tools, 1st Edition, Elsevier publication, April 2011.
3. Nihad A. Hassan, Digital Forensics Basics: A Practical Guide Using Windows OS, 1st Edition, APress, 2019
4. ThmasJ.Holt, Adam M.Bossler, K.C.Seigfried – Spellar, Cybercrime and Digital Forensics An Introduction, 1st Edition, Taylor and Francis, New York, 2015.
5. Darren R. Hayes, A Practical Guide to Digital Forensics Investigations, 2nd Edition , Pearson Education, 2020.