

**S.A.ENGINEERING COLLEGE**  
**AUTONOMOUS INSTITUTION**  
**REGULATION – 2020**  
**CURRICULUM AND SYLLABUS I TO IV SEMESTERS (FULL TIME)**  
**MASTER OF COMPUTER APPLICATIONS**

**PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):**

- I. To prepare students to pursue constant learning and do research in computing field by providing solid technical foundations.
- II. To provide students with numerous computing skills like analysis, design and development of software products to meet the needs of business, engineering and manufacturing industries.
- III. To formulate students to communicate and to task effectively in teams in all aspects within the global, societal and environmental context

**PROGRAM OUTCOMES (POS) :**

**On successful completion of the program:**

1. **Knowledge Computing** : Use expertise of computing fundamentals, mathematics, and domain knowledge suitable to figure out solutions for the complex problems
2. **Problem analysis:** Classify, articulate, review and analyze research and computing problems to reach valid conclusions using computing sciences, mathematics and relevant domain fields.
3. **Design/development of solutions:** Design solutions to complex problems and plan system requirements or processes which meet the specific needs of the clients for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Apply research oriented methods to analyze, interpret and to do the design of experiments on the information to arrive at effective conclusions.
5. **Modern tool usage:** Build, select, and apply suitable techniques, resources and modern computing IT tools including prediction, analysis and modeling to computing systems .
6. **Research Ability** : Facility to independently carry out research / investigations, identify problems and develop solutions to solve practical problems
7. **Innovation and Entrepreneurship** Recognize and identify an opportunity for using innovation to pursue that opportunity to create value for the benefit of the individual and society at large.

8. **Ethics** Apply ethical principles and commit to professional ethics and responsibilities and norms of the professional computing practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex system building activities with the stake holders and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

### PROGRAM SPECIFIC OBJECTIVES (PSO)

**PSO 1:** Enable the students to select suitable data model, appropriate architecture, platform to implement a system with good performance.

**PSO 2:** Enable the students to design and integrate various system based components to provide user interactive solutions for various challenges.

### Mapping Of Programme Educational Objectives with Programme Outcomes And Programme Specific Objectives

Programme Educational Objectives	Programme Outcomes												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
<b>1</b>	√	√	√	√	√	√	√				√			√
<b>2</b>		√	√	√	√	√	√	√	√		√		√	
<b>3</b>		√		√	√	√			√	√	√	√	√	√

### 3. SEMESTER COURSE WISE PEO MAPPING

YEAR	SEMESTER	SUBJECT NAME	PEO1	PEO2	PEO3
YEAR 1	SEM 1	Matrices, Probability and Statistics	√		
		Advanced Data Structures and Algorithms	√	√	
		Advanced Database Technology	√	√	
		Object Oriented Software Engineering	√	√	√
		Python Programming	√	√	
		Research Methodology and Intellectual Property Rights	√		
		Advanced Database Technology Lab	√	√	
		Advanced Data Structures and Python Programming Lab	√	√	
		Communication Skills Enhancement – I			√
	SEM 2	Internet Programming	√	√	
		Cloud Computing Technologies	√	√	
		Artificial Intelligence and Machine Learning	√	√	
		Mobile Application Development	√	√	√
		Cyber Security	√	√	√
		<b>Elective I</b>			
		1. Software Project Management	√	√	√
		2. Agile Methodologies	√	√	√
		3. E Learning	√	√	√
		4. Accounting and Financial Management for Application Development	√	√	√
		5. Advances in Operating Systems	√	√	
		Internet Programming Laboratory	√	√	
		Artificial Intelligence and Machine Learning Laboratory	√	√	
		Communication Skills Enhancement– II			√
YEAR	SEMESTER	SUBJECT NAME	PEO1	PEO2	PEO3
YEAR 2	SEM 3	Data Science	√	√	√
		Embedded Systems and Internet of Things	√	√	√
		Software Testing and Quality Assurance	√	√	√
		<b>Elective II</b>			
		6. Compiler Optimization Techniques	√	√	
		7. C# and .NET programming		√	
		8. Wireless Networking	√	√	
		9. Web Design	√	√	√
		10. Big Data Analytics	√	√	
		<b>Elective III</b>			
		11. Social Network Analytics	√	√	√
		12. Bio Inspired Computing	√	√	

		13. Information Retrieval Techniques	√	√	
		14. Software Architecture	√	√	
		15. Data Mining and Data Warehousing Techniques	√	√	
		<b>Elective IV</b>			
		16. Data Visualization Techniques	√	√	
		17. Resource Management Techniques	√	√	
		18. Professional Ethics	√	√	√
		19. Organizational Behavior	√	√	√
		20. Business Data Analytics		√	
		<b>Elective V</b>			
		21. Cryptocurrency and Blockchain Technologies	√	√	
		22. Advances in Networking	√	√	
		23. Soft Computing	√	√	
		24. Deep Learning	√	√	
		25. Network Programming and Security	√	√	
		Data Science Laboratory	√	√	
		Internet of Things Laboratory	√	√	
		Mini Project			√
	<b>SEM 4</b>	Project Work	√	√	√

**S.A.ENGINEERING COLLEGE, CHENNAI -77**  
**AN AUTONOMOUS INSTITUTION**  
**REGULATION – 2020**  
**CHOICE BASED CREDIT SYSTEM**  
**MASTER OF COMPUTER APPLICATIONS**

**SEMESTER I**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
<b>THEORY</b>								
1.	MC 2101	Python Programming	FC	3	3	0	0	3
2.	MC 2102	Advanced Data Structures and Algorithms	PC	3	3	0	0	3
3.	MC 2103	Advanced Database Technology	PC	3	3	0	0	3
4.	MC 2104	Object Oriented Software Engineering	PC	3	3	0	0	3
5.	MA 2105	Matrices, Probability and Statistics	PC	5	3	2	0	4
6.	MC 2106	Research Methodology and Intellectual Property Rights	FC	2	2	0	0	2
<b>PRACTICALS</b>								
7.	MC 2111	Advanced Database Technology Lab	PC	4	0	0	4	2
8.	MC 2112	Advanced Data Structures and Python Programming Lab	PC	4	0	0	4	2
9.	MC 2113	Communication Skills Enhancement – I	PC	2	0	0	2	1
<b>TOTAL</b>				<b>29</b>	<b>17</b>	<b>2</b>	<b>10</b>	<b>23</b>

**SEMESTER II**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
<b>THEORY</b>								
1.	MC 2201	Internet Programming	PC	3	3	0	0	3
2.	MC 2202	Cloud Computing Technologies	PC	3	3	0	0	3
3.	MC 2203	Artificial Intelligence and Machine Learning	PC	3	3	0	0	3
4.	MC 2204	Mobile Application Development	PC	3	3	0	0	3
5.	MC 2205	Cyber Security	PC	3	3	0	0	3
6.	MC 200X	Elective I: 1. Software Project Management 2. Agile Methodologies 3. E Learning 4. Accounting and Financial	PE	3	3	0	0	3

		Management for Application Development 4.Advances in Operating Systems						
<b>PRACTICALS</b>								
7.	MC 2211	Internet Programming Laboratory	PC	4	0	0	4	2
8.	MC 2212	Artificial Intelligence and Machine Learning Laboratory	PC	4	0	0	4	2
9.	MC 2213	Communication Skills Enhancement– II	PC	2	0	0	2	1
<b>TOTAL</b>				<b>28</b>	<b>18</b>	<b>0</b>	<b>10</b>	<b>23</b>

### SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT HOURS	L	T	P	C
<b>THEORY</b>								
1.	MC 2301	Data Science	PC	3	3	0	0	3
2.	MC 2302	Embedded Systems and Internet of Things	PC	3	3	0	0	3
3.	MC 2303	Software Testing and Quality Assurance	PC	3	3	0	0	3
4.	MC 200X	Elective II 6. Compiler Optimization Techniques 7. C# and .NET programming 8. Wireless Networking 9. Web Design 10.Big Data Analytics	PE	3	3	0	0	3
5.	MC 200X	Elective III 11.Social Network Analytics 12. Bio Inspired Computing 13. Information Retrieval Techniques 14. Software Architecture 15. Data Mining and Data Warehousing Techniques	PE	3	3	0	0	3
6.	MC 200X	Elective IV 16.Data Visualization Techniques 17 Resource Management Techniques 18 Professional Ethics 19.Organizational Behavior 20.Business Data Analytics	PE	3	3	0	0	3
7.	MC 200X	Elective V: 21. Cryptocurrency and Blockchain Technologies 22. Advances in Networking 23. Soft Computing	PE	3	3	0	0	3

		24. Deep Learning 25. Network Programming and Security						
<b>PRACTICALS</b>								
1.	MC 2311	Data Science Laboratory	PC	4	0	0	4	2
2.	MC 2312	Internet of Things Laboratory	PC	4	0	0	4	2
3.	MC 2313	Mini Project	EEC					2
<b>TOTAL</b>				<b>29</b>	<b>21</b>	<b>0</b>	<b>8</b>	<b>27</b>

#### SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
<b>PRACTICALS</b>								
1.	MC 2401	Project Work	EEC	24	0	0	24	12
<b>TOTAL</b>				<b>24</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>

**TOTAL CREDITS: 85**

**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****5**

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.



CO/POs & PSOs														
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	√	√	-											
CO2	√	√	-	-									√	
CO3	√	√	√	√									√	
CO4	√	√	√	√	√	√							√	
CO5	√	√	√	√	√	√							√	

### REFERENCE BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43<sup>rd</sup> 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, 8<sup>th</sup> Edition, New Delhi, 2014.
4. Miller and M. Miller, Mathematical Statistics, Pearson Education Inc., Asia 7<sup>th</sup> Edition, New Delhi, 2011.
5. Richard Johnson, Miller and Freund's Probability and Statistics for Engineer, Prentice Hall of India Private Ltd., 8<sup>th</sup> Edition, New Delhi, 2011.

**MC 2102**

**ADVANCED DATA STRUCTURES AND ALGORITHMS**

**L T P C  
3 0 0 3**

### 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 – Huffman Algorithm - 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.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√										
CO2	√	√	√	√									√	
CO3	√	√	√	√									√	
CO4	√	√	√	√									√	
CO5	√	√	√	√									√	

#### **REFERENCES:**

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

## UNIT I DISTRIBUTED DATABASES 9

Distributed Systems – Introduction – Architecture – Distributed Database Concepts – Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing

<b>UNIT II</b>	<b>NOSQL DATABASES</b>	<b>9</b>
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Nosily – CAP Theorem – Sharding - Document based – Mongo DB Operation: Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding, Deployment – Using Mongo DB with PHP / JAVA – Advanced Mongo DB Features – Cassandra: Data Model, Key Space, Table Operations, CRUD Operations, CQL Types – HIVE: Data types, Database Operations, Partitioning – Havel – Orient DB Graph database – Orient DB Features

<b>UNIT III</b>	<b>ADVANCED DATABASE SYSTEMS</b>	<b>9</b>
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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, and Spatial Access Methods – Temporal Databases: Overview – Active Databases – Deductive Databases – Recursive Queries in SQL – Mobile Databases: Location and Handoff Management, Mobile Transaction Models, Concurrency – Transaction Commit Protocols – Multimedia Databases.

<b>UNIT IV</b>	<b>XML AND DATAWAREHOUSE</b>	<b>9</b>
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XML Database: XML – XML Schema – XML DOM and SAX Parsers – XSL – XSLT – Path and XQuery – Data Warehouse: Introduction – Multidimensional Data Modeling – Star and Snowflake Schema – Architecture – OLAP Operations and Queries.

<b>UNIT V</b>	<b>INFORMATION RETRIEVAL AND WEB SEARCH</b>	<b>9</b>
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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 Nosily 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.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√	√				√	√			√	√
CO2	√	√	√	√	√				√	√			√	√
CO3	√	√	√	√	√				√	√			√	√
CO4	√	√	√	√	√				√	√			√	√
CO5	√	√	√	√	√				√	√			√	√

## REFERENCES:

1. Henry F North, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", 6<sup>th</sup> 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, Micheline Kamber, 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. Shashank Tiwari, "Professional NoSQL", O'Reilly Media, First Edition, 2011.
7. Vijay Kumar, "Mobile Database Systems", John Wiley & Sons, First Edition, 2006

**MC2104**

**OBJECT ORIENTED SOFTWARE ENGINEERING**

**LTPC**

**3003**

## 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 DESIGN9**

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.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√	√							√	√		√	
CO 2		√	√	√	√					√	√		√	
CO 3			√		√	√			√	√				√
CO 4				√	√	√			√					√
CO 5	√		√		√			√	√			√		√

## REFERENCES:

1. Yogesh Singh, Ruchika Malhotra, “Object – Oriented Software Engineering”, PHI Learning Private Limited, First edition, 2012
2. Ivar Jacobson, Magnus Christerson, Patrik Jonsson, 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, 8<sup>th</sup> Edition, 2015.
6. Timothy C. Lethbridge and Robert Laganieri, “Object – Oriented Software Engineering, Practical Software Development using UML and Java”, Tata McGraw Hill Publishing Company Limited, Second Edition, 2004

**MC2105**

**PYTHON PROGRAMMING**

**L T P C**  
**3 0 0 3**

## 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 Interactive Mode– Variables and Identifiers – Arithmetic Operators – Values and Types – Statements. Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If-Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement-Continue

statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions.

## **UNIT II DATA TYPES IN PYTHON 10**

Lists, Tuples, Sets, Strings, Dictionary, Modules: Module Loading and Execution – Packages – Making Your Own Module – 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 Own Module – 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.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√	√				√	√			√	√
CO2	√	√	√	√	√				√	√			√	√
CO3	√	√	√	√	√				√	√			√	√
CO4	√	√	√	√	√				√	√			√	√
CO5	√	√	√	√	√				√	√			√	√

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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
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7. Kenneth A. Lambert, "Fundamentals of Python: First Programs", Cengage Learning, second edition, 2012

**MC2106**

**RESEARCH METHODOLOGY AND INTELLECTUAL  
PROPERTY RIGHTS**

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

**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**

### **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.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√		√	√	√	√			√		√	√	
CO 2		√	√		√	√	√					√		√
CO 3		√	√			√		√					√	
CO 4		√	√			√	√		√				√	
CO 5	√			√	√	√	√	√						√

### REFERENCE BOOKS:

1. Research Methodology: Methods and Techniques by C.R.Kothari, GauravGarg, New Age International 4<sup>th</sup> Edition 2018 (UNIT I to UNIT III)
2. Research Methodology a step-by-step guide for beginners by Ranjit Kumar, SAGE publications Ltd 3<sup>rd</sup> 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 8<sup>th</sup>Edition'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)

**MC2111      ADVANCED DATABASETECHNOLOGY LABORATORY**

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

### 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

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√	√				√	√			√	√
CO2	√	√	√	√	√				√	√			√	√
CO3	√	√	√	√	√				√	√			√	√
CO4	√	√	√	√	√				√	√			√	√
CO5	√	√	√	√	√				√	√			√	√

## MC2112 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.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√	√				√	√			√	√
CO2	√	√	√	√	√				√	√			√	√
CO3	√	√	√	√	√				√	√			√	√
CO4	√	√	√	√	√				√	√			√	√
CO5	√	√	√	√	√				√	√			√	√

**MC2113**

**COMMUNICATION SKILLS - I**

**L T P C**  
**0 0 2 1**

### 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

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									√	√				
CO2									√	√				
CO3									√	√				
CO4										√				
CO5										√				

**COURSE OBJECTIVES:**

1. To understand the fundamentals of web programming and client side scripting.
2. To learn the server side development using servlets, websocket.
3. To learn the Spring framework and build applications using Spring.
4. To learn and implement the concept of Java Persistence API.
5. 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:

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

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√	√		√								√	
CO 2	√	√	√										√	
CO 3	√	√	√	√	√	√	√	C	√	√	√		√	√
CO 4	√	√	√	√			√	√	√	√	√	√	√	√
CO 5	√	√	√	√	√		√					√	√	√

## 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

**MC2202**

**CLOUD COMPUTING TECHNOLOGIES**

**L T P C**

**3 00 3**

## 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 vsMicroservice – 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 –Adoptionof 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



COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√	√					√			√	√	√	
CO 2	√	√	√	√	√	√	√	√	√	√		√	√	√
CO 3	√		√		√	√		√	√	√	√	√		√
CO 4	√			√	√	√	√	√	√	√	√	√	√	√
CO 5	√	√			√	√		√			√	√	√	√

## REFERENCE BOOKS:

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.

**MC2203**

**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

**L T P C**

**3 0 0 3**

## 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.

## 9

UNIT III BAYESIAN LEARNING 9

<b>UNIT IV</b>	<b>PARAMETRIC MACHINE LEARNING</b>	<b>9</b>
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<b>UNIT V</b>	<b>NON PARAMETRIC MACHINE LEARNING</b>	<b>9</b>
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**TOTAL: 45 PERIODS**

- 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.

[illegible]

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## 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 2<sup>nd</sup> Edition
5. EthemAlpaydin, "Introduction to Machine Learning", Second Edition, MIT Press, 2010.
6. Tom M. Mitchell, "Machine Learning", India Edition, 1<sup>st</sup> 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

**MC2204**

**MOBILE APPLICATION DEVELOPMENT**

**L T P C**  
**3 0 0 3**

## 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**

**9**

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

## **UNIT II USER INTERFACE**

**9**

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

## **UNIT III APPLICATION DESIGN**

**9**

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.

**UNIT IV MOBILE OS****9**

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

**UNIT V APPLICATION DEVELOPMENT****9**

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

**TOTAL: 45 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

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO 1		√			√	√			√		√		√	
CO 2	√	√	√		√				√	√	√		√	
CO 3	√	√		√							√	√	√	
CO 4	√	√	√	√							√	√		√
CO 5		√	√	√		√						√	√	

**REFERENCES:**

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

**MC2205****CYBER SECURITY****L T P C****3 0 0 3****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

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1		√			√	√			√		√		√	
CO 2	√	√	√		√				√	√	√		√	
CO 3	√	√		√							√	√	√	
CO 4	√	√	√	√							√	√		√
CO 5		√	√	√		√						√	√	

## 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/>

**MC2211**

**INTERNET PROGRAMMING LABORATORY**

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

## 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.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO 1	√	√	√	√	√	√	√	√	√				√	√
CO 2	√	√	√	√	√	√	√	√	√	√	√		√	√
CO 3	√	√	√	√	√				√			√	√	√
CO 4	√	√	√	√	√				√			√	√	√
CO 5	√	√	√	√	√		√		√	√	√	√	√	√

L T P C  
0 0 4 2

- 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.

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.

**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.

[illegible]



**OBJECTIVES:**

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

**1.      SOFT SKILLS**

- People skills
- Interpersonal skills
- Team building skills
- Leadership skills
- Problem solving skills

**2.      PRESENTATION SKILLS**

- Preparing slides with animation related to the topic
- Introducing oneself to the audience
- Introducing the topic
- Presenting the visuals effectively – 5 minute presentation

**3.      GROUP DISCUSSION SKILLS**

- Participating in group discussions
- Brainstorming the topic
- Activities to improve GD skills.

**4.      INTERVIEW SKILLS**

- Interview etiquette – dress code – body language
- Attending job interviews
- Answering questions confidently
- Technical interview – telephone/Skype interview
- Emotional and cultural intelligence
- Stress Interview

**TOTAL: 30 PERIODS**

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

**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.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									√	√				
CO2									√	√				
CO3									√	√				
CO4										√				
CO5										√				

**MC2301**

**DATA SCIENCE**

**L T P C**

**3 0 0 3**

**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 MapReduce programs for small problem solving methods.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√	√				√	√			√	√
CO2	√	√	√	√	√				√	√			√	√
CO3	√	√	√	√	√				√	√			√	√
CO4	√	√	√	√	√				√	√			√	√
CO5	√	√	√	√	√				√	√			√	√

## 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/>

## MC2302      EMBEDDED SYSTEMS AND INTERNET OF THINGS

L T P C

3 0 0 3

## 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.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1		√	√	√	√				√			√	√	
CO 2		√	√		√						√	√	√	
CO 3	√	√	√										√	√
CO 4	√	√	√			√							√	
CO 5	√	√	√	√					√		√		√	

#### **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.

**MC2303**

**SOFTWARE TESTING AND QUALITY ASSURANCE**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To know the behavior of the testing techniques and to design test cases to detect the errors in the software
- To get insight into the levels of testing in the user environment
- To understand standard principles to check the occurrence of defects and its removal.
- To learn the functionality of automated testing tools to apply in the specialized environment.
- To understand the models and metrics of software quality and reliability.

**UNIT I**

**TESTING TECHNIQUES & TEST CASE DESIGN**

**9**

Using White Box Approach to Test design - Test Adequacy Criteria – Static Testing Vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – Their Role in White box Based Test Design – Code Complexity Testing – Evaluating Test Adequacy Criteria. Test Case Design Strategies – Using Black Box Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis –Decision tables – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Error guessing –Case study for Control Flow Graph and State based Testing.

**UNIT II**

**LEVELS OF TESTING**

**9**

The Need for Levels of Testing- Unit Test Planning –Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording Results – Integration Tests – Designing Integration Tests – Integration Test Planning – Scenario Testing – Defect Bash Elimination. System Testing – Acceptance testing – Performance testing – Regression Testing - Internationalization testing - Ad-hoc testing – Alpha, Beta Tests- Usability and Accessibility Testing – Configuration Testing - Compatibility Testing – Testing the documentation – Website Testing - Case Study for Unit and Integration Testing.

**UNIT III**

**TESTING FOR SPECIALIZED ENVIRONMENT**

**9**

**Testing Client / Server Systems** – Testing in a Multiplatform Environment - Testing Object Oriented Software – Object Oriented Testing – Testing Web based systems – Challenges in

Testing for Web-based Software – Quality Aspects – Web Engineering – Case Study for Web Application Testing

#### **UNIT IV TEST AUTOMATION 9**

Selecting and Installing Software Testing Tools - Software Test Automation – Skills needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Tracking the Bug – Debugging – Case study using Bug Tracking Tool.

#### **UNIT V SOFTWARE TESTING AND QUALITY METRICS 9**

Six-Sigma – TQM - Complexity Metrics and Models –Availability Metrics - Defect Removal Effectiveness - FMEA - Quality Function Deployment – Taguchi Quality Loss Function – Cost of Quality. Case Study for Complexity and Object Oriented Metrics.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

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

- Able to test the software by applying various testing techniques.
- Able to debug the project and to test the entire computer based systems at all levels.
- Able to test the applications in the specialized environment using various automation tools.
- Able to evaluate the web applications using bug tracking tools.
- Able to apply quality and reliability metrics to ensure the performance of the software.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		√		√		√								
CO2			√	√										
CO3				√	√									
CO4			√		√									
CO5	√	√	√	√	√								1	

#### **REFERENCE BOOKS:**

1. William E.Lewis, “Software Testing and Continuous Quality Improvement”, 3<sup>rd</sup> Edition, Auerbach Publications, 2011
2. KshirasagarNaik and PriyadarshiTripathy, “Software Testing and Quality Assurance Theory and Practice”, 2<sup>nd</sup> Edition, John Wiley & Sons Publication, 2011
3. Ron Patton, “Software Testing”, 2<sup>nd</sup> Edition, Pearson Education, 2007
4. Glenford J. Myers, Tom Badgett, Corey Sandler, “The Art of Software Testing”, 3<sup>rd</sup> Edition, John Wiley & Sons Publication, 2012.
5. Paul C. Jorgensen, “Software Testing, A Craftman’s Approach”, CRC Press Taylor & Francis Group, Fourth Edition, 2018

**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, Socialtweet 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.

**MC2312**

**INTERNET OF THINGS LABORATORY**

**L T P C**

**0 04 2**

### **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, infrared sensor)
  - (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.

**MC2001**

**SOFTWARE PROJECT MANAGEMENT**

**LTPC  
3003**

### **OBJECTIVES:**

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

### **UNIT I SOFTWARE PROJECT MANAGEMENT CONCEPTS 9**

Introduction to Software Project Management: An Overview of Project Planning: Select Project, Identifying Project scope and objectives, infrastructure, project products and Characteristics. Estimate efforts, Identify activity risks, and allocate resources- TQM, Six Sigma, Software Quality: defining software quality, ISO9126, External Standards.

### **UNIT II SOFTWARE EVALUATION AND COSTING 9**

Project Evaluation: Strategic Assessment, Technical Assessment, cost-benefit analysis, Cash flow forecasting, cost-benefit evaluation techniques, Risk Evaluation. Selection of Appropriate Project approach: Choosing technologies, choice of process models, structured methods

### **UNIT III SOFTWARE ESTIMATION TECHNIQUES 9**

Software Effort Estimation: Problems with over and under estimations, Basis of software Estimation, Software estimation techniques, expert Judgment, Estimating by analogy. Activity Planning: Project schedules, projects and activities, sequencing and scheduling Activities, networks planning models, formulating a network model, Agile estimation- estimating size with story points, estimating in ideal days, techniques for estimating, re-estimating.

**UNIT IV RISK MANAGEMENT****9**

Risk Management: Nature of Risk, Managing Risk, Risk Identification and Analysis, Reducing the Risk. Resource Allocation: Scheduling resources, Critical Paths, Cost scheduling, Monitoring and Control: Creating Framework, cost monitoring, prioritizing monitoring

**UNIT V GLOBALIZATION ISSUES IN PROJECT MANAGEMENT****9**

Globalization issues in project management: Evolution of globalization- challenges in building global teams-models for the execution of some effective management techniques for managing global teams. Impact of the internet on project management: Introduction – the effect of internet on project management – managing projects for the internet – effect on project management activities. Comparison of project management software's: dot Project, Launch pad, openProj. Case study: PRINCE2

**TOTAL: 45 PERIODS****OUTCOMES:**

- Understand the activities during the project scheduling and quality standards of the software projects of any software application.
- Learn the evaluation techniques and the risk management activities for the projects.
- Can apply the software estimation and resource allocation of any software application
- Acquire knowledge and skills needed for the construction of highly reliable software project
- Able to create reliable, replicable cost estimation that links to the requirements of project planning and managing

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√			√	√			√	√	√		√	
CO 2		√		√	√			√	√	√	√			√
CO 3	√		√		√			√	√			√		√
CO 4	√	√		√			√	√			√		√	
CO 5		√			√					√	√			√

**REFERENCES:**

1. Bob Hughes & Mike Cotterell, "Software Project Management", Tata McGraw- Hill Publications, Fifth Edition 2012
2. Mike Cohn, "Agile Estimating & Planning", Pearson Education, Third Impression, 2012

3. GopalaswamyRamesh, "Managing Global Software Projects", Tata McGraw Hill Publishing Company, First Edition,2006
4. S. A. Kelkar," Software Project Management" PHI, New Delhi, Third Edition ,2013
5. Marvin Gechman, "Project Management of Large Software-Intensive Systems, Controlling the Software Development Process", CRC Press, Taylor & Francis Group,FirstEdition,2019.
6. Darrell Harris, "Agile Project Management: Complete Beginner's Guide to Software Development and Step-By-Step Agile Project Management", Independently Published, First Edition,2020

**MC2002**

**AGILE METHODOLOGIES**

**L TP C**

**3 00 3**

**OBJECTIVES:**

- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of Agile development and testing techniques.
- To understand the benefits and pitfalls of working in an Agile team.
- To understand Agile development and testing

**UNIT I            AGILE METHODOLOGY**

**9**

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

**UNIT II            AGILE PROCESSES**

**9**

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices

**UNIT III            AGILITY AND KNOWLEDGE MANAGEMENT**

**9**

Agile Information Systems – Agile Decision Making – Earl's Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment, Leveraging – KM in Software Engineering – Managing Software Knowledge –

1. David J. Anderson and Eli Schragenheim,, “Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results”, Illustrated Edition, Prentice Hall PTR, 2004

2. Orit Hazza and Yaepl Dubinsky, "Agile Software Engineering,: Undergraduate Topics in Computer Science, Springer Verlag, First Edition,2009
3. Craig Larman, "Agile and Iterative Development: A Manager's Guide", Pearson Education, Second Impression, 2007
4. Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management", Elsevier, Butterworth-Heinemann, FirstEdition,2007
5. Ken Schwaber, "Agile Project Management with Scrum", Illustrated, Revised Edition Microsoft Press, 2004
6. KonnorCluster, "Agile Project Management: Learn How To Manage a Project With Agile Methods, Scrum, Kanban and Extreme Programming", Independently Published,FirstEdition,2019

**MC2003**

**E-LEARNING**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To learn the various E-learning approaches andComponents.
- To explore DesignThinking.
- To understand the types of design models ofE-learning.
- To learn about E-learning Authoringtools.
- To know about evaluation and management of E-learning solutions

**UNITI INTRODUCTION 9**

Need for E-Learning – Approaches of E-Learning – Components of E-Learning – synchronous and Asynchronous Modes of Learning – Quality of E-Learning – Blended Learning: Activities, Team and Technology – Work Flow to Produce and Deliver E-Learning Content – Design Thinking: Introduction – Actionable Strategy – Act to Learn – Leading Teams to Win.

**UNITII DESIGNING E-LEARNINGCOURSECONTENT 9**

Design Models of E-Learning – Identifying and Organizing E-Learning Course Content: Needs Analysis – Analyzing the Target Audience – Identifying Course Content – Defining Learning Objectives – Defining the Course Sequence – Defining Instructional Methods – Defining Evaluation and Delivery Strategies – Case Study.

**UNITIII CREATINGINTERACTIVECONTENT 9**

Preparing Content: Tips for Content Development and Language Style – Creating Storyboards: Structure of an Interactive E-Lesson – Techniques for Presenting Content – Adding Examples – Integrating Multimedia Elements – Adding Examples – Developing

Practice and Assessment Tests – Adding Additional Resources – Courseware Development  
 Authoring Tools – Types of Authoring Tools – Selecting an Authoring Tool.

**UNIT IV LEARNING PLATFORMS 9**

Types of Learning Platforms – Proprietary Vs. Open – Source LMS – LMS Vs LCMS – Internally Handled and Hosted LMS – LMS Solutions – Functional Areas of LMS.

**UNIT V COURSE DELIVERY AND EVALUATION 9**

Components of an Instructor-Led or Facilitated Course – Planning and Documenting Activities – Facilitating Learners Activities – E-Learning Methods and Delivery Formats – Using Communication Tools for E-Learning – Course Evaluation.

**TOTAL: 45 PERIODS**

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

- Distinguish the phases of activities in models of E-learning.
- Identify appropriate instructional methods and delivery strategies.
- Choose appropriate E-learning Authoring tools.
- Create interactive E-learning courseware.
- Evaluate the E-learning courseware.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√										
CO2	√	√	√	√	√								√	
CO3	√	√	√	√									√	
CO4	√	√	√	√									√	
CO5	√	√	√										√	

**REFERENCE BOOKS:**

1. Clark, R. C., Mayer, R. E., "E-Learning and the Science of Instruction". Third Edition, 2011.
2. Crews, T. B., Sheth, S. N., Horne, T. M., "Understanding the Learning Personalities of Successful Online Students", 1<sup>st</sup> Edition, Educause Review, 2014.
3. Johnny Schneider, "Understanding Design Thinking, Lean and Agile", 1<sup>st</sup> Edition, O'Reilly Media, 2017.
4. Madhuri Dubey, "Effective E-learning Design, Development and Delivery", 1<sup>st</sup> Edition, University Press, 2011.

**MC2004 ACCOUNTING AND FINANCIAL MANAGEMENT FOR APPLICATION DEVELOPMENT**

**L T P C  
3 0 0 3**

**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

Cos /POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1				√						√	√	√		
CO 2				√						√	√	√		
CO 3				√						√	√	√		
CO 4				√						√	√	√		
CO 5				√						√	√	√		

#### **RECOMMENDED TEXTS**

1. R.L.Gupta & V.K.Gupta, Advanced Accounting - Sultan Chand & Sons - New Delhi. Fourteenth Revised and Enlarged Edition, 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. 6<sup>th</sup> Edition, 2012
4. Shukla & Grewal, Advanced Accounting – S Chand - New Delhi, 19<sup>th</sup> Edition, 2017
5. Nirmal Gupta, Financial Accounting - Ane Books India – New Delhi. Fifth Edition, 2012

**MC2005**

**ADVANCES IN OPERATING SYSTEMS**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To learn the fundamentals of Operating Systems
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
- To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols
- To know the components and management aspects of Real time, Mobile operating systems

**UNIT I FUNDAMENTALS OF OPERATING SYSTEMS**

**9**

Overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling – Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques.

**UNIT II DISTRIBUTED OPERATING SYSTEMS**

**9**

Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols

**UNIT III DISTRIBUTED RESOURCE MANAGEMENT**

**9**

Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory – Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Nonblocking Commit Protocol – Security and Protection

**UNIT IV REAL TIME AND MOBILE OPERATING SYSTEMS**

**9**

Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems – Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system.

**UNIT V CASE STUDIES**

**9**

Linux System: Design Principles - Kernel Modules - Process Management Scheduling - Memory Management - Input-Output Management - File System – Interprocess Communication. iOS and Android: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

**TOTAL: 45 PERIODS**

## OUTCOMES:

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

- Discuss the various synchronization, scheduling and memory management issues
- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
- Discuss the various resource management techniques for distributed systems
- Identify the different features of real time and mobile operating systems
- Install and use available open source kernel

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		√		√		√						√		
CO2			√	√								√		
CO3				√	√							√		
CO4			√		√							√		
CO5	√	√	√	√	√						√	√	√	√

## REFERENCES:

1. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, “Operating System Concepts-Essentials”, ninth Edition, John Wiley & Sons, 2013.
2. MukeshSinghal, NiranjanaG. Shivaratri, “Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems”, Tata McGraw-Hill,FirstEdition, 1994.
3. Love Robert,” Linux Kernel Development”, Pearson Education India, Third Edition, 2018.
4. Neil Smyth, “iPhone/iOS 4 Development Essentials – Xcode”, Fourth Edition, Payload media, 2011.
5. Rajib Mall, “Real-Time Systems: Theory and Practice”, Pearson Education India, First Edition2006.
6. Daniel P Bovet and Marco Cesati, “Understanding the Linux kernel”, 3rd edition, O’Reilly, 2005.

**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

COs/ POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO 1		√	√	√								√	√	
CO 2		√	√								√	√	√	
CO 3	√	√	√									√	√	√
CO 4	√	√	√									√	√	
CO 5	√	√	√	√	√						√	√	√	

#### 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.

**MC2007**

**C# AND .NET PROGRAMMING**

**L T P C**

**3 0 0 3**

#### 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**

UNIT II C# ADVANCED FEATURES 9

UNIT III      BASE CLASS LIBRARIES AND DATA MANIPULATION      9

<b>UNIT IV</b>	<b>WINDOW AND WEB BASED APPLICATIONS</b>	<b>9</b>
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UNIT V .NET COMPACT FRAMEWORK 9

**TOTAL: 45 PERIODS**

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.

COs/ POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	√	√	√	√	√	√	√	√	√			√	√	√
CO 2	√	√	√	√	√	√	√	√	√	√	√	√	√	√
CO 3	√	√	√	√	√				√			√	√	√
CO 4	√	√	√	√	√				√			√	√	√
CO 5	√	√	√	√	√		√		√	√	√	√	√	√

## 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", Apress 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, 2<sup>nd</sup> Edition, 2011
5. Herbert Schildt, "C# - The Complete Reference", Tata McGraw Hill, First Edition 2010.

**MC2008**

**WIRELESS NETWORKING**

**L T P C**

**3 0 0 3**

## 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-Network layer 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 UMTS 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:****At 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

COs/ POs &	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√		√	√				√			√	√	
CO 2		√	√		√						√	√	√	
CO 3	√	√	√										√	√
CO 4	√	√	√			√							√	
CO 5	√	√	√	√					√		√		√	

## REFERENCES:

1. Jochen Schiller, Mobile Communications, Second Edition, Pearson Education 2012.
2. Vijay Garg, —Wireless Communications and networkingll, First Edition, Elsevier 2007.
3. AfifOsseiran, Jose.F.Monserat and Patrick Marsch, "5G Mobile and Wireless Communications Technology", 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 EditionCRC Press
8. Thomas L. Marzetta, Erik G. Larsson, Hong Yang,HienQuoc Ngo, "Fundamentals of Massive MIMO", Cambridge University Press, First Edition2018.

**MC2009**

**WEB DESIGN**

**L T P C**

**3 0 0 3**

## 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

COs/ POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√				√									√
CO 2		√	√	√									√	
CO 3						√	√							√
CO 4				√	√								√	
CO 5							√				√			

## 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, 3<sup>rd</sup> Edition, 2007
3. Robin Nixon; "Learning PHP, MySQL, JavaScript & CSS: A Step-by-Step Guide to Creating Dynamic Websites", O'Reilly Publications, 2<sup>nd</sup> 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, 7<sup>th</sup> 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/>

**MC2010**

**BIG DATA ANALYTICS**

**LT P C  
3 0 0 3**

## OBJECTIVES:

- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.

### **UNIT I INTRODUCTION TO BIG DATA**

**9**

Evolution of Big data – Best Practices for Big data Analytics – Big data characteristics – Validating – The Promotion of the Value of Big Data – Big Data Use Cases- Characteristics of Big Data Applications – Perception and Quantification of Value -Understanding Big Data Storage – A General Overview of High-Performance Architecture – HDFS – MapReduce and YARN – Map Reduce Programming Model

### **UNIT II CLUSTERING AND CLASSIFICATION**

**9**

Advanced Analytical Theory and Methods: Overview of Clustering – K-means – Use Cases – Overview of the Method – Determining the Number of Clusters – Diagnostics – Reasons to Choose and Cautions .- Classification: Decision Trees – Overview of a Decision Tree – The General Algorithm – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Trees in R – Naïve Bayes – Bayes' Theorem – Naïve Bayes Classifier.

### **UNIT III ASSOCIATION AND RECOMMENDATION SYSTEM**

**9**

Advanced Analytical Theory and Methods: Association Rules – Overview – Apriori Algorithm – Evaluation of Candidate Rules – Applications of Association Rules – Finding Association & finding similarity – Recommendation System: Collaborative Recommendation- Content

Based Recommendation – Knowledge Based Recommendation- Hybrid Recommendation Approaches.

#### UNIT IV STREAM MEMORY

9

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 – Real time Analytics Platform(RTAP) applications – Case Studies – Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics

#### UNIT V NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION 9

NoSQL Databases : Schema-less Models: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores – Tabular Stores – Object Data Stores – Graph Databases Hive – Sharding –Hbase – Analyzing big data with twitter – Big data for E-Commerce Big data for blogs – Review of Basic Data Analytic Methods using R.

**TOTAL: 45 PERIODS**

#### OUTCOMES:

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

- Work with big data tools and its analysis techniques
- Analyze data by utilizing clustering and classification algorithms
- Learn and apply different mining algorithms and recommendation systems for large volumes of data
- Perform analytics on data streams
- Learn NoSQL databases and management.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√	√	√	√				√	√		√	√	√
CO 2	√	√	√	√	√				√	√		√	√	√
CO 3	√	√	√	√	√				√	√		√	√	√
CO 4	√	√	√	√	√				√	√		√	√	√
CO 5	√	√	√	√	√				√	√	√	√	√	√

#### REFERENCES:

1. Jure Leskovec, Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2<sup>nd</sup> Edition 2016.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/Elsevier Publishers, First Edition 2013.
3. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, First Edition, 2015.
4. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, First Edition 2014.
5. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, First Edition 2010.

6. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers "CRC Press,FirstEdition2015.

#### **MOOC REFERENCES:**

1. **www.swayam.gov.in:** Big Data Computing
2. **www.coursera.org:**Big Data Essentials: HDFS, MapReduce and Spark RDD
3. **www.udemy.com:** Big Data and Hadop: Interactive Intense Course
4. **www.edx.org:** Big Data Fundamentals, Processing Big Data with Hadoop in Azure HDInsight

**MC2011**

**SOCIAL NETWORK ANALYTICS**

**L T P C**  
**3 0 0 3**

#### **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.

COs/ POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√												√	
CO 2	√	√		√										√
CO 3	√	√		√										√
CO 4			√				√		√	√	√		√	
CO 5	√	√		√	√	√	√			√		√		√

### REFERENCES:

1. Matthew A. Russell, "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, Github and more", O'REILLY, Third Edition, 2018.
2. Charu Aggarwal, "Social Network Data Analytics," Springer, First Edition, 2014
3. Jennifer Golbeck, "Analyzing the social web", Waltham, MA: Morgan Kaufmann (Elsevier), First Edition, 2013.
4. Borko Furht, "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.

COs/ POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	√	√	√	√	√				√			√	√	√
CO 2	√	√	√	√	√				√			√		√
CO 3	√	√	√	√	√				√			√		√
CO 4	√	√	√	√	√		√		√	√	√	√	√	√
CO 5	√	√	√	√	√	√	√		√	√		√		√

## REFERENCES:

1. Eiben,A.E.Smith,James E, "Introduction to Evolutionary Computing", Springer 2<sup>nd</sup>Edition2015.
2. Helio J.C. Barbosa, "Ant Colony Optimization - Techniques and Applications", IntechFirst 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

**MC2013**

**INFORMATION RETRIEVAL TECHNIQUES**

**L T P C**

**3 0 0 3**

## 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.

COs/ POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	√	√	√	√	√				√			√	√	√
CO 2	√	√	√	√	√				√			√	√	√
CO 3	√	√	√	√	√				√			√	√	√
CO 4	√	√	√	√	√		√		√	√	√	√	√	√
CO 5	√	√	√	√	√				√	√		√	√	√



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

**MC2014**

**SOFTWARE ARCHITECTURE**

**L T P C**

**3 00 3**

## 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

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		√	√											
CO2	√	√												
CO3	√	√												
CO4	√	√												
CO5	√	√	√											

**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", 1<sup>st</sup> 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", 2<sup>nd</sup> Edition, Addison-Wesley, 2010
4. Paul Clements, Rick Kazman, and Mark Klein, "Evaluating software architectures: Methods and case studies.", 1<sup>st</sup> Edition, Addison-Wesley, 2001.
5. Mark Hansen, "SOA Using Java Web Services", 1<sup>st</sup> 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".1<sup>st</sup> Edition, Springer Verlag 2009.

**OBJECTIVES:**

- To gain knowledge on data mining and the need for pre-processing.
- To characterize the kinds of patterns that can be discovered by association rule mining.
- To implement classification techniques on large datasets.
- To analyze various clustering techniques in real world applications.
- To get exposed to the concepts of data warehousing architecture and implementation.

**UNIT I DATA MINING & DATA PREPROCESSING 9**

Data Mining–Concepts , DBMS versus Data mining , kinds of Data, Applications, Issues and Challenges–Need for Data Pre-processing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation.

**UNIT II ASSOCIATION RULE MINING AND CLASSIFICATION BASICS 9**

Introduction to Association rules – Association Rule Mining – Mining Frequent Itemsets with and without Candidate Generation – Mining Various Kinds of Association Rules - Classification versus Prediction – Data Preparation for Classification and Prediction.

**UNIT III CLASSIFICATION AND PREDICTION TECHNIQUES 9**

Classification by Decision Tree – Bayesian Classification – Rule Based Classification – Bayesian Belief Networks – Classification by Back Propagation – Support Vector Machines – K-Nearest Neighbor Algorithm –Linear Regression, Nonlinear Regression, Other Regression-Based Methods

**UNIT IV CLUSTERING TECHNIQUES 9**

Cluster Analysis – Partitioning Methods: k-Means and k- Mediods – Hierarchical Methods: Agglomerative and Divisive – Density–Based Method: DBSCAN –Model Based Clustering Methods: Fuzzy clusters and Expectation-Maximization Algorithm – Clustering High-Dimensional Data: Biclustering – Outlier Analysis.

**UNIT V DATA WAREHOUSE 9**

Need for Data Warehouse – Database versus Data Warehouse – Multidimensional Data Model – Schemas for Multidimensional Databases – OLAP operations – OLAP versus OLTP – Data Warehouse Architecture – Extraction, Transformation and Loading (ETL).

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

1. Identify data mining techniques in building intelligent model.

2. Illustrate association mining techniques on transactional databases.
3. Apply classification and clustering techniques in real world applications.
4. Evaluate various mining techniques on complex data objects.
5. Design, create and maintain data warehouses.

COs/POs & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√											√	
CO 2		√											√	
CO 3	√	√	√		√	√			√					√
CO 4	√	√		√	√				√					√
CO 5	√	√			√	√	√		√	√	√	√		√

## REFERENCES:

1. Daniel T. Larose, Chantal D. Larose, "Data mining and Predictive analytics," Second Edition, Wiley Publication, 2015
2. G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, Third Edition, 2014

**MC2016**

**DATA VISUALIZATION TECHNIQUES**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

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

## UNIT I INTRODUCTION

**9**

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

## UNIT II VISUALIZATION FOUNDATIONS

**9**

Semiology of graphical Symbols – Eight Visual Variables – Historical Perspective- Visualization Techniques for spatial data – One-dimensional data- two dimensional data – Three dimensional data-

1. Matthew O. Ward , Georges Grinstein , Daniel Keim “Interactive Data Visualization: Foundations, Techniques, and Applications”, CRC Press; 2<sup>nd</sup> edition, 2015

2. Stephen Few, "Now you see it: Simple Visualization Techniques for Quantitative Analysis", 1<sup>st</sup> Edition, Analytics Press, 2009.
3. Stephen Few, "Information Dashboard Design: The Effective Visual Communication of Data", 1<sup>st</sup> Edition, O'Reilly, 2006.
4. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", 1<sup>st</sup> Edition, O'Reilly, 2008.

**MC2017                      RESOURCE MANAGEMENT TECHNIQUES                      L T P C**  
**3 0 0 3**

**OBJECTIVES:**

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

**UNIT I                      LINEAR PROGRAMMING MODELS                      9**

Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables: big-M method, degeneracy and unbound solutions.

**UNIT II                      TRANSPORTATION AND ASSIGNMENT MODELS                      9**

Formulation - Methods for finding basic Feasible Solution - Optimality Test - MODI method - Degeneracy in Transportation Problem - Unbalanced Transportation Problem. Assignment Method: Mathematical formulation of assignment models – Hungarian Algorithm – Variants of the Assignment problem

**UNIT III                      SCHEDULING BY PERT AND CPM                      9**

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

**UNIT IV                      QUEUEING MODELS                      9**

Characteristics of Queueing Models – Poisson Queues –  $(M/M/1):(FIFO/\infty/\infty)$ ,  $(M/M/1):(FIFO/N/\infty)$ ,  $(M/M/C):(FIFO/\infty/\infty)$ ,  $(M/M/C):(FIFO/N/\infty)$  models.

## UNIT V GAME THEORY

9

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

**TOTAL: 45 PERIODS**

### OUTCOMES:

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

- Understand and apply linear programming to solve operational problem with constraints
- Apply transportation and assignment models to find optimal solution
- To prepare project scheduling using PERT and CPM
- Identify and analyze appropriate queuing model to reduce the waiting time in queue.
- To choose the best strategy using decision making methods under game theory.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√										
CO2	√	√	√	√	√									
CO3	√	√	√	√										
CO4	√	√	√	√		√								
CO5	√	√	√	√										

### REFERENCES:

1. Taha H.A., "Operations Research: An Introduction", 10th Edition, Prentice Hall of India, New Delhi, 2017
2. KantiSwarup, P.K. Gupta, Man Mohan, "Operations Research", 15th Revised Edition, S. Chand & Sons Education Publications, New Delhi, 2017
3. Ronald L Rardin, Optimization In Operations Research, 2nd Edition, Pearson Education, India, 2018
4. Jatinder Kumar, Optimization Techniques in Operations Research, LAP LAMBERT Academic Publishing, 2015
5. D.S.Hira and P.K.Gupta, Operations Research, 5th Edition, S.Chand & Sons, 2015.

**OBJECTIVES:**

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

**UNIT I INTRODUCTION TO ETHICS****9**

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

**UNIT II ETHICS IN INFORMATION TECHNOLOGY, INTERNET CRIME 9**

IT Professionals - Are IT Workers Professionals- Professional Relationships That Must Be Managed -Professional Codes of Ethics - Professional Organizations - Certification - IT Professional Ethics, Three Codes of Ethics, Management Conflicts. The RevetonRansomware Attacks -IT Security Incidents: A Major Concern - Why Computer Incidents Are So Prevalent -Types of Exploits -Types of Perpetrators-Federal Laws for Prosecuting Computer Attacks-Implementing Trustworthy Computing -Risk Assessment - Establishing a Security Policy -Educating Employees and Contract Workers

**UNIT III FREEDOM OF EXPRESSION, PRIVACY****9**

First Amendment Rights -Obscene Speech-Defamation -Freedom of Expression: Key Issues -Controlling Access to Information on the Internet -Strategic Lawsuit Against Public Participation (SLAPP)-Anonymity on the Internet-Hate Speech- Privacy Protection and the Law- Information Privacy- Privacy Laws, Applications, and Court Rulings-Key Privacy and Anonymity Issues- Data Breaches -Electronic Discovery-Consumer Profiling- Workplace Monitoring -Advanced Surveillance Technology

**UNIT IV FREEDOM OF EXPRESSION, INTELLECTUAL PROPERTY RIGHTS 9**

Intellectual Property Rights-Copyrights-Copyright Term - Eligible Works -Fair Use Doctrine - Software Copyright Protection -Copyright Laws and the internet-Copyright and Piracy- Patents- -Software Patents -Cross-Licensing Agreements -Trade Secrets-Trade Secret Laws -Employees and Trade Secrets-Key Intellectual Property Issues-Plagiarism -Reverse



Engineering-Open Source Code- Competitive Intelligence -Trademark Infringement -Cyber squatting

## UNIT V SOCIAL NETWORKING ETHICS AND ETIQUETTES

9

Social Networking Web Site- Business Applications of Online Social Networking-Social Network Advertising-The Use of Social Networks in the Hiring Process-Social Networking Ethical Issues –Cyber bullying- Online Virtual Worlds-Crime in Virtual Worlds-Educational and Business Uses of Virtual Worlds

**TOTAL: 45 PERIODS**

### OUTCOMES:

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

- Helps to examine situations and to internalize the need for applying ethical principles, values to tackle with various situations.
- Develop a responsible attitude towards the use of computer as well as the technology.
- Able to envision the societal impact on the products/ projects they develop in their career
- Understanding the code of ethics and standards of computer professionals.
- Analyze the professional responsibility and empowering access to information in the work place.

COs/POs & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1						√		√	√	√				√
CO 2						√		√	√	√				
CO 3						√		√	√	√				
CO 4						√		√	√	√				√
CO 5						√		√	√	√				

### REFERENCES:

1. Caroline Whitback," Ethics in Engineering Practice and Research ", Cambridge University Press, 2<sup>nd</sup>Edition2011.
2. George Reynolds, "Ethics in Information Technology", Cengage Learning, 6<sup>th</sup>Edition2018.
3. Barger, Robert. (2008). Computer ethics: A case-based approach.Cambridge University Press 1<sup>st</sup>Edition.
4. John Weckert and Douglas Adeney, Computer and Information Ethics, Greenwood Press,FirstEdition1997.

5. Penny Duquenoy, Simon Jones and Barry G Blundell, "Ethical, legal and professional issues in computing", Middlesex University Press, First Edition 2008.
6. Sara Baase, "A Gift of Fire: Social, Legal, and Ethical Issues for Computing and the Internet", 3rd Edition, Prentice Hall, 2008.
7. [http://www.infosectoday.com/Articles/Intro\\_Computer\\_Ethics.html](http://www.infosectoday.com/Articles/Intro_Computer_Ethics.html)

**MC2019**

**ORGANIZATIONAL BEHAVIOR**

**L T P C**

**3 0 0 3**

**OBJECTIVE:**

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

**UNIT I ORGANISATIONAL BEHAVIOUR**

**9**

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

**UNIT II INDIVIDUAL PROCESSES**

**9**

Personality – types – Factors influencing personality– Theories. Emotions - Theories – Emotional Intelligence- Learning – Types of learners – The learning process – Learning theories.

Perceptions – Importance – Factors influencing perception- Attitudes – Nature of Attitudes Components of Attitudes Formation of Attitude Benefits of Positive Attitude Functions of Attitudes– Measurement-Motivation – Importance – Types – Theories.

**UNIT III LEADERSHIP AND POWER**

**9**

Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centers – Power and Politics.

**UNIT IV GROUP DYNAMICS**

**9**

Meaning – Types of Groups – Functions of Small Groups – Group Size Status – Managerial Implications – Group Behaviour – Group Norms – Cohesiveness – Group Thinking

**UNIT V ORGANISATIONAL CHANGE AND DEVELOPMENT**

**9**

Organizational Change: Meaning – Nature of Work Change – Need for Change – Change Process – Types of Change – Factors Influencing Change – Resistance to Change – Overcoming Resistance – Organizational Development: Meaning and Different Types of OD Interventions.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

On completion of the course should be able to:

- Students will have a better understanding of human behavior in organization.
- They will know the framework for managing individual and group performance.
- Characteristics of attitudes and components of attitudes — A brief discussion
- List the determinants of personality
- List the characteristics of various leadership styles.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1			√	√			√							
CO 2		√		√									√	
CO 3								√				√		√
CO 4							√			√				√
CO 5									√		√		√	

**REFERENCES:**

1. K. Aswathappa, "Organizational behaviour", Himalaya Publishing House Pvt. Ltd. 11<sup>th</sup> Edition.
2. Stephen P. Robins, "Organizational Behavior", PHI Learning / Pearson Education, Edition 17, 2016 (Global edition)
3. Fred Luthans, "Organizational Behavior", McGraw Hill, 12<sup>th</sup> Edition
4. Nelson, Quick, Khandelwal. "ORGB – An innovative approach to learning and teaching". Cengage, 2<sup>nd</sup> edition 2012
5. Ivancevich, Konopaske & Maheson, "Organizational Behaviour & Management", Tata McGraw Hill, 7<sup>th</sup> edition, 2008
6. Robert Kreitner and Angelo Kinicki, "Organizational Behaviour", Tata McGraw Hill, 10<sup>th</sup> Edition, 2016

**OBJECTIVES:**

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

**UNIT I                      OVERVIEW OF BUSINESS ANALYTICS                      9**

Introduction – Drivers for Business Analytics – Applications of Business Analytics: Marketing and Sales, Human Resource, Healthcare, Product Design, Service Design, CustomerService and Support – Skills Required for a Business Analyst – Framework for BusinessAnalytics Life Cycle for Business Analytics Process.

**UNIT II                      ESSENTIALS OF BUSINESS ANALYTICS                      9**

Descriptive Statistics – Using Data – Types of Data – Data Distribution Metrics: Frequency,Mean, Median, Mode, Range, Variance, Standard Deviation, Percentile, Quartile, z-Score,Covariance, Correlation – Data Visualization: Tables, Charts, Line Charts, Bar and ColumnChart, Bubble Chart, Heat Map – Data Dashboards.

**UNIT III                      MODELING UNCERTAINTY AND STATISTICAL INFERENCE                      9**

Modeling Uncertainty: Events and Probabilities – Conditional Probability – RandomVariables – Discrete Probability Distributions – Continuous Probability Distribution –Statistical Inference: Data Sampling – Selecting a Sample – Point Estimation – SamplingDistributions – Interval Estimation – Hypothesis Testing.

**UNIT IV                      ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK                      9**

Introducing Hadoop – RDBMS versus Hadoop – Hadoop Overview – HDFS (HadoopDistributed File System) – Processing Data with Hadoop – Introduction to MapReduce –Features of MapReduce – Algorithms Using Map-Reduce: Matrix-Vector Multiplication,Relational Algebra Operations, Grouping and Aggregation – Extensions to MapReduce

**UNIT V                      OTHER DATA ANALYTICAL FRAMEWORKS                      9**

Overview of Application development Languages for Hadoop – PigLatin – Hive – Hive QueryLanguage (HQL) – Introduction to Pentaho, JAQL – Introduction to Apache: Sqoop, Drill andSpark, Cloudera Impala – Introduction to NoSQL Databases – Hbase and MongoDB.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

- Identify the real world business problems and model with analytical solutions.
- Solve analytical problem with relevant mathematics background knowledge.
- Convert any real world decision making problem to hypothesis and apply suitable statistical testing.
- Write and Demonstrate simple applications involving analytics using Hadoop and MapReduce
- Use open source frameworks for modeling and storing data.

COs/ POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√	√	√	√				√	√		√	√	√
CO 2	√	√	√	√	√				√	√		√	√	√
CO 3	√	√	√	√	√				√	√		√	√	√
CO 4	√	√	√	√	√				√	√		√	√	√
CO 5	√	√	√	√	√				√	√	√	√	√	√

**REFERENCES:**

1. U. Dinesh Kumar, "Business Analytics: The Science of Data-Driven Decision Making", Wiley, First Edition, 2017.
2. Umesh R Hodeghatta, UmeshaNayak, "Business Analytics Using R – A Practical Approach", Apress, First Edition 2017.
3. Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R. Anderson, "Essentials of Business Analytics", Cengage Learning, second Edition, 2016.
4. Rui Miguel Forte, "Mastering Predictive Analytics with R", Packt Publication, First Edition 2015.
5. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", Packt Publishing, First Edition 2013.
6. Anand Rajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, First Edition 2012.
7. A. Ohri, "R for Business Analytics", Springer, First Edition, 2012

**MC2021 CRYPTOCURRENCY AND BLOCK CHAIN TECHNOLOGIES**

**L T P C  
3 0 0 3**

**Objectives:**

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

Why Blockchain - The Structure of Blockchain - Data Structure of Blockchain - Data Distribution in Blockchain - Block Validation. **Block Validators:** Proof of Work – Proof of Stake - Proof of Activity - Proof of Elapsed Time - Proof of Burn.

Overview.**Bitcoin:** Bitcoin Working - Bitcoin Transactions - Bitcoin Mining - Value of Bitcoin - Community, Politics and Regulations – Advantages – Disadvantages. **Ethereum:** Overview – Decentralized Application. **Components of Ethereum:** Smart contracts – Ether - Ethereum Clients - Ethereum Virtual Machine – Etherscripter.

Introduction. **Digital Tokens:** Overview - Initial Coin Offering – OmiseGO – EOS – Tether. **MetaMask:** Wallet Seed - MetaMask Transactions. **Mist:** Overview - Mist wallet. **Truffle:** Features of Truffle – Development Truffle boxes - Community truffle box.

Smart Contracts - Contract and Interfaces - **Hyperledger Fabric**: Introduction - Fabric v/s Ethereum - HyperledgerIroha - Features of Iroha.**HyperledgerSawtooth**: Components of sawtooth - Proof of Elapsed time.

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

**OUTCOME:**

- describe the Basics of Block chain Technology concepts and its applications
- know about the implementation of Crypto currency
- identify the different ways to achieve Block chain Technology
- Illustrate how to design and build smart contracts using various platforms
- understand about the future of Block chain technology

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√												
CO2	√	√												
CO3	√	√												
CO4	√	√												
CO5	√	√												

#### REFERENCES:

1. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 1<sup>st</sup> Edition, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. 1<sup>st</sup> Edition, Princeton University Press, 2016.
3. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 1<sup>st</sup> Edition, 2015.
- 4 <https://www.blockchainexpert.uk/book/blockchain-book.pdf>

MOOC Website references (Example website references are only given; it's not an exhaustive list)

1. [www.coursera.org](http://www.coursera.org)
  - a. Blockchain
  - b. Blockchain and cryptocurrency explained
  - c. Blockchain revolution
  - d. Bitcoin and Cryptocurrency technologies
  - e. Blockchain basics
  - f. Introduction to Blockchain
  - g. Introduction to Blockchain technologies
  - h. Blockchain foundations and use cases
2. [www.udemy.com](http://www.udemy.com)
  - a. Build a blockchain and cryptocurrency from scratch
  - b. The Basics of Blockchain
  - c. Blockchain advanced level
  - d. Learn Blockchain technology and cryptocurrency in Java
  - e. Full Cryptocurrency courses: Ethereum, bitcoin and blockchain

**MC2022**

**ADVANCES IN NETWORKING**

**L T P C  
3 0 0 3**

#### OBJECTIVES:

The student should be made:

- To understand the theme underlying IPv6 Structure and addressing methods
- To understand and analyse the protocols for IPv6 Implementation

- |               |                                      |          |
|---------------|--------------------------------------|----------|
| <b>UNIT I</b> | <b>IPv6 STRUCTURE AND ADDRESSING</b> | <b>9</b> |
|---------------|--------------------------------------|----------|

UNIT II IPv6 NETWORKING 9

UNIT III QoS, PROVISIONING AND SECURITY WITH IPv6 9

UNIT IV SOFTWARE DEFINED NETWORKING 9

UNIT V NETWORK FUNCTION VIRTUALIZATION 9

**TOTAL: 45 PERIODS**

**At the end of the course, the student should be able to:**

- Understand the fundamentals of IPv6 and IPv6 Protocols
- Analyze the need for separation of data and control plane



- Understand the functionality of NFV
- Be Conversant with the latest networks and its architecture
- Gain an in-depth coverage of various networking technologies

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√				√							√	
CO 2	√	√	√	√		√						√	√	
CO 3	√	√				√				√		√	√	√
CO 4	√	√	√			√						√	√	
CO 5	√	√	√	√	√	√	√			√		√	√	

#### REFERENCES:

1. Rick Graziani, "IPv6 Fundamentals: A Straightforward Approach to Understanding IPv6" Second Edition, Cisco Press, 2017
2. Peter Loshin, "IPv6: Theory, Protocol and Practice" Second Edition, Morgan Kaufmann Publishers, 2004
3. William Stallings, "Foundations of Modern Networking – SDN, NFC, QoE, IoT and Cloud" Third Edition, Pearson Publications, 2019.
4. Oswald Coker, Siamak Azodolmolky, "Software-Defined Networking with OpenFlow", Second Edition, Packt Publishing, 2017.
5. Paul Goransson, Chuck Black, "Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann Publisher, First Edition 2014.
6. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks, an Authoritative Review of Network Programmability Technologies", O'Reilly Media, First Edition August 2013.

**MC2023**

**SOFT COMPUTING**

**L T P C**

**3 0 0 3**

#### OBJECTIVES:

- To gain knowledge of soft computing theories and its fundamentals.
- To design a soft computing system required to address a computational task.
- To learn and apply artificial neural networks, fuzzy sets and fuzzy logic and genetic algorithms in problem solving and use of heuristics based on human experience.
- To introduce the ideas of fuzzy sets, fuzzy logic and to become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
- To familiarize with genetic algorithms and other random search procedures while seeking global optimum in self – learning situations.

## 9

## UNIT II      FUNDAMENTALS OF NEURAL NETWORKS

9

## UNIT III BACKPROPAGATION NETWORKS

9

## UNIT IV COMPETETIVE NEURAL NETWORKS

9

## UNIT V GENETIC ALGORITHM

9

**TOTAL: 45 PERIODS**

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

1. Identify and describe soft computing techniques and their roles in building intelligent machines.
2. Recognize the feasibility of applying a soft computing methodology for a particular problem.
3. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
4. Apply genetic algorithms to optimization problems.
5. Design neural networks to pattern classification and regression problems using soft computing approach.

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PSOCO1	√	√											√	
CO2	√	√	√										√	
CO3	√	√											√	
CO4	√	√											√	
CO5	√	√											√	

## REFERENCES:

1. S. Rajasekaran and G.A. VijayalakshmiPai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall of India, 2003.
2. J.S.R. Jang, C.T. Sun and E. Mizutani, "Neuro – Fuzzy and Soft Computing", Pearson Education, ,2004
3. S. N. Sivanandam, S. N. Deepa, "Principles of Soft Computing", Second Edition, Wiley, 2007.
4. SimonHaykin, "Neural Networks", Prentice Hall, 2<sup>nd</sup> Edition,1999.
5. Timothy Ross, "Fuzzy Logic with Engineering Applications", Wiley Publications,4<sup>th</sup> Edition 2016.
6. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Pearson Education, First Edition,2008.

**MC2024**

**DEEP LEARNING**

**L T P C**

**3 0 0 3**

## OBJECTIVES:

- To understand how to represent the high-dimensional data, images, text and data.
- To explain convolution neural network
- To introduce major deep learning algorithms and their applications to solve real world problems.
- To explore about optimization and generalization in Deep learning
- To understand about deep reinforcement learning

## UNIT I NEURAL NETWORK

**9**

Building Intelligence Machine-Expressing Linear Perceptron as Neurons-Feed Forward Neural Networks - Activation function. Supervised and Unsupervised Learning:Single Layer Perceptron – Perceptron Learning Algorithm – Least Mean Square Learning Algorithm - Multilayer Perceptron – Back Propagation Algorithm – XOR problem – Limitations of Back Propagation Algorithm- Implementing Neural Networks in TensorFlow.

## 9

UNIT III DEEP NETWORKS

9

## UNIT IV OPTIMIZATION AND GENERALIZATION

9

## UNIT V DEEP REINFORCEMENT LEARNING

9

**TOTAL: 45 PERIODS**

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

- [illegible]

## REFERENCES

1. Nikhil Buduma, Nicholas Locascio, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", First Edition, O'ReillyMedia, 2017.
2. SudharsanRavichandiran, Hands on Deep Learning Algorithms with Python, FirstEdition, Packt Publishing Limited, 2019.
3. François Chollet, Deep Learning with Python, First Edition,Manning Publications Company, 2017.
4. Ian Goodfellow, YoshuaBengio and Aaron Courville, Deep Learning, First editionMIT Press, London, 2016

**MC2025**

**NETWORK PROGRAMMING AND SECURITY**

**L T P C**

**3 0 0 3**

## 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 – getsocket and setsocket 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**

### **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

COs/ POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√	√	√				√	√			√	√	√
CO 2	√	√					√					√	√	
CO 3	√	√	√	√		√				√	√	√	√	√
CO 4	√	√	√		√						√	√	√	√
CO 5	√		√		√	√	√	√	√	√			√	√

### **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,DebddeepMukhopadhyay “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 2<sup>nd</sup> Edition. 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.