REGULATIONS – 2023

CURRICULUM AND SYLLABI
(2023-2024)

MASTER OF COMPUTER APPLICATION (MCA)

KCG COLLEGE OF TECHNOLOGY
AUTONOMOUS
REGULATIONS 2023
MCA - MASTER OF COMPUTER APPLICATIONS
(2 YEARS)
CHOICE BASED CREDIT SYSTEM
CURRICULUM FOR SEMESTERS I TO VIII

SEMESTER–I

Sl. No.	Course Code	Course Title	Category	Periods Per Week L	T	P	Total Contact Periods	Credits
THEORY								
1	MA4151	Applied Probability and Statistics for Computer Science Engineers	FC	3	1	0	4	4
2	RM4151	Research Methodology and IPR	RMC	2	0	0	2	2
3	23MC4101	Advanced Data Structures and Algorithms	PCC	3	0	0	3	3
4	23MC4102	Object Oriented Programming	PCC	3	0	0	3	3
5	23MC4103	Software Engineering	PCC	3	0	0	3	3
6	23MC4104	Advanced Database Technology	PCC	3	0	2	5	4
7		Audit Course – I*	AC	2	0	0	2	0
PRACTICALS								
8	23MC4111	Advanced Data Structures and Algorithms Laboratory	PCC	0	0	4	4	2
9	23MC4112	Object Oriented Programming Laboratory	PCC	0	0	4	4	2
10	23MC4113	Communication Skills Enhancement–I	EEC	0	0	2	2	1
TOTAL				19	1	12	32	24

*Audit course is optional

SEMESTER –II

Sl. No.	Course code	Course Title	Category	L	T	P	Total Contact Periods	Credits
					Periods Per Week			
THEORY								
1	23MC4202	Advanced Computer Networks	PCC	3	0	0	3	3
2	23MC4203	Cloud Computing Technologies	PCC	3	0	0	3	3
3	23MC4204	Mobile Application Development	PCC	3	0	2	5	4
4	23MC4205	Advanced Operating Systems	PCC	3	0	0	3	3
5		Professional Elective I	PEC	3	0	0	3	3
6		Audit Course – II*	AC	2	0	0	2	0
7	23MC4202	Advanced Computer Networks	PCC	3	0	0	3	3
PRACTICALS								
8	23MC4211	Mobile Application Development Laboratory	PCC	0	0	4	4	2
9	23MC4212	Full Stack Web Development Laboratory	PCC	0	0	4	4	2
10	23MC4213	Communication Skills Enhancement– II	EEC	0	0	2	2	1
TOTAL				20	0	12	32	24

*Audit course is optional

SEMESTER-III

Sl. No.	Course code	Course Title	Category	L	T	P	Total Contact Periods	Credits
				Periods Per Week				
THEORY								
1	23MC4301	AI & Machine Learning	PCC	3	0	0	3	3
2	23MC4302	Internet of Things	PCC	3	0	0	3	3
3		Professional Elective II	PEC	3	0	0	3	3
4		Professional Elective III	PEC	3	0	0	3	3
5		Cryptography and Network Security	PEC	3	0	2	5	4
6		Open Elective	OEC	3	0	0	3	3
PRACTICALS								
7	23MC4311	AI & Machine Learning Laboratory	PCC	0	0	4	4	2
8	23MC4312	Internet of Things Laboratory	PCC	0	0	4	4	2
		TOTAL		18	0	10	28	23

*Audit course is optional

SEMESTER-IV

Sl. No.	Course code	Course Title	Category	L	T	P	Total Contact Periods	Credits
				Periods Per Week				
PRACTICALS								
1	23MC4411	Project Work	EEC	0	0	24	24	12
		TOTAL		0	0	24	24	12

TOTAL NO. OF CREDITS: 83

PROFESSIONAL ELECTIVE COURSES

SEMESTER II: ELECTIVE - I

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23MC4001	Software Project Management	PEC	3	3	0	0	3
2	23MC4002	Professional Ethics in IT	PEC	3	3	0	0	3
3	23MC4003	E - Learning	PEC	3	3	0	0	3
4	23MC4004	Compiler Design	PEC	3	3	0	0	3
5	23MC4005	Information Retrieval Techniques	PEC	3	3	0	0	3
6	23MC4006	Soft Computing Techniques	PEC	3	3	0	0	3
7	23MC4007	Operations Research	PEC	3	3	0	0	3
8	23MC4008	Business Data Analytics	PEC	3	3	0	0	3

SEMESTER III: ELECTIVE - II

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23MC4009	DevOps and Microservices	PEC	3	3	0	0	3
2	23MC4010	Mobile Computing	PEC	3	3	0	0	3
3	23MC4011	Digital Image Processing	PEC	3	3	0	0	3
4	23MC4012	Social Network Analytics	PEC	3	3	0	0	3
5	23MC4013	Cryptocurrency and Blockchain Technologies	PEC	3	3	0	0	3
6	23MC4014	Bio Inspired learning	PEC	3	3	0	0	3
7	23MC4015	Digital Marketing	PEC	3	3	0	0	3

SEMESTER III: ELECTIVE - III

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23MC4016	Software Architecture	PEC	3	3	0	0	3
2	23MC4017	Digital Forensics	PEC	3	3	0	0	3
3	23MC4018	Natural Language Processing	PEC	3	3	0	0	3
4	23MC4019	Data Visualization Techniques	PEC	3	3	0	0	3
5	23MC4020	Data Mining and Data Warehousing Techniques	PEC	3	3	0	0	3
6	23MC4021	Discrete Mathematics	PEC	3	3	0	0	3
7	23MC4022	Organizational Behavior	PEC	3	3	0	0	3

SEMESTER III: ELECTIVE - IV

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1	23MC4023	Advanced Python Programming	PEC	5	3	0	2	4
2	23MC4024	Computer Architecture	PEC	5	3	0	2	4
3	23MC4025	Big Data Analytics	PEC	5	3	0	2	4
4	23MC4026	Software Quality and Testing	PEC	5	3	0	2	4
5	23MC4027	Advanced Java Programming	PEC	5	3	0	2	4
6	23MC4028	UNIX Internals	PEC	5	3	0	2	4

PROFESSIONAL ELECTIVE COURSES [PEC]

Sl. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact periods	Credits
				L	T	P		
1		Software Project Management	PEC	5	3	0	2	4
2		Professional Ethics in IT	PEC	5	3	0	2	4
3		E – Learning	PEC	5	3	0	2	4
4		Discrete Mathematics	PEC	5	3	0	2	4
5		Information Retrieval Techniques	PEC	5	3	0	2	4
6		Soft Computing Techniques	PEC	5	3	0	2	4
7		Operations Research	PEC	5	3	0	2	4
8		Business Data Analytics	PEC	5	3	0	2	4
9		DevOps and Microservices	PEC	5	3	0	2	4
10		Advances in Networking	PEC	5	3	0	2	4
11		Digital Image Processing	PEC	5	3	0	2	4
12		Social Network Analytics	PEC	5	3	0	2	4
13		Cryptocurrency and Blockchain Technologies	PEC	5	3	0	2	4
14		Bio Inspired learning	PEC	5	3	0	2	4
15		Digital Marketing	PEC	5	3	0	2	4
16		Software Architecture	PEC	5	3	0	2	4
17		Digital Forensics	PEC	5	3	0	2	4

18		Wireless Networking	PEC	5	3	0	2	4
19		Data Visualization Techniques	PEC	5	3	0	2	4
20		Data Mining and Data Warehousing Techniques	PEC	5	3	0	2	4
21		Agile Methodologies	PEC	5	3	0	2	4
22		Organizational Behavior	PEC	5	3	0	2	4
23		Web Design	PEC	5	3	0	2	4
24		C# and .NET	PEC	5	3	0	2	4
25		Big Data Analytics	PEC	5	3	0	2	4
26		Software Quality and Testing	PEC	5	3	0	2	4
27		Advanced Java Programming	PEC	5	3	0	2	4
28		Network Programming and Security	PEC	5	3	0	2	4

AUDIT COURSES (AC)
Registration for any of these courses is optional to students

Sl. No.	Course Code	Course Title	Periods Per Week			Credits
			L	T	P	
1	23AX4091	English for Research Paper Writing	2	0	0	0
2	23AX4092	Disaster Management	2	0	0	0
3	23AX4093	Constitution of India	2	0	0	0

LIST OF OPEN ELECTIVES FOR PG PROGRAMMES

Sl. No.	Course Code	Course Title	Periods Per Week			Credits
			L	T	P	
1.	23OE431	Integrated Water Resources Management	3	0	0	3
2.	23OE432	Water, Sanitation and Health	3	0	0	3
3.	23OE433	Principles of Sustainable Development	3	0	0	3
4.	23OE434	Environmental Impact Assessment	3	0	0	3
5.	23OME431	Vibration and Noise Control Strategies	3	0	0	3
6.	23OME432	Energy Conservation and Management in Domestic Sectors	3	0	0	3
7.	23OME433	Additive Manufacturing	3	0	0	3
8.	23OME434	Electric Vehicle Technology	3	0	0	3
9.	23OME435	New Product Development	3	0	0	3
10.	23OBA431	Sustainable Management	3	0	0	3
11.	23OBA432	Micro and Small Business Management	3	0	0	3
12.	23OBA433	Intellectual Property Rights	3	0	0	3
13.	23OBA434	Ethical Management	3	0	0	3
14.	23ET4251	IoT for Smart Systems	3	0	0	3
15.	23ET4072	Machine Learning and Deep Learning	3	0	0	3
16.	23PX4012	Renewable Energy Technology	3	0	0	3
17.	23PS4093	Smart Grid	3	0	0	3

			L	T	P	
18.	23DS4015	Big Data Analytics	3	0	0	3
19.	23NC4201	Internet of Things and Cloud	3	0	0	3
20.	23MX4073	Medical Robotics	3	0	0	3
21.	23VE4202	Embedded Automation	3	0	0	3
22.	23CX4016	Environmental Sustainability	3	0	0	3
25.	23BY4016	IPR, Biosafety and Entrepreneurship	3	0	0	3

SUMMARY

	NAME OF THE PROGRAMME: M.CA					
Sl.No.	**SUBJECT AREA**	**CREDITS PER SEMESTER**				**CREDITS TOTAL**
		I	**II**	**III**	**IV**	
1.	FC	04	00	00	00	04
2.	PCC	17	20	10	00	49
3.	PEC	00	03	10	00	13
4.	RMC	02	00	00	00	02
5.	OEC	00	00	03	00	03
6.	EEC	01	01	00	12	12
7.	Non Credit/Audit Course	00	00	00	00	00
TOTAL CREDIT		**24**	**24**	**23**	**12**	**83**

MCA - MASTER OF COMPUTER APPLICATIONS
(2 YEARS)
CHOICE BASED CREDIT SYSTEM
SYLLABUS

SEMESTER –I

23MA4151	APPLIED PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE ENGINEERS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

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

UNIT I	LINEAR ALGEBRA	12

Vector spaces – norms – Inner Products – Eigenvalues using QR transformations – QR factorization – generalized eigenvectors – Canonical forms – singular value decomposition and applications – pseudo inverse – least square approximations.

UNIT II	PROBABILITY AND RANDOM VARIABLES	12

Probability – Axioms of probability – Conditional probability – Bayes theorem – Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson , Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

UNIT III	TWO DIMENSIONAL RANDOM VARIABLES	12
Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression curve – Correlation.		
UNIT IV	TESTING OF HYPOTHESIS	12
Sampling distributions – Type I and Type II errors – Small and Large samples – Tests based on Normal, t, Chi square and F distributions for testing of mean , variance and proportions – Tests for independence of attributes and goodness of fit.		
UNIT V	MULTIVARIATE ANALYSIS	12
Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components – Population principal components – Principal components from standardized variables.		
		TOTAL: 60 PERIODS

COURSE OUTCOMES:	
	After completion of the course, the students will be able to:
CO1:	Apply the concepts of Linear Algebra to solve practical problems.
CO2:	Use the ideas of probability and random variables in solving engineering problems.
CO3:	Be familiar with some of the commonly encountered two dimension random variables and be equipped for a possible extension to multivariate analysis.
CO4:	Use statistical tests in testing hypothesis on data.
CO5:	Develop critical thinking based on empirical evidence and the scientific approach to knowledge development.

REFERENCES:	
1	Dallas E Johnson, "Applied multivariate methods for data Analysis", Thomson and Duxbury press, Singapore, 1998.
2	Richard A. Johnson and Dean W. Wichern, "Applied multivariate statistical Analysis", Pearson Education, Fifth Edition, 6th Edition, New Delhi, 2013.

3	Bronson, R.,"Matrix Operation"Schaum's outline series, Tata McGraw Hill, New York, 2011.
4	Oliver C. Ibe, "Fundamentals of Applied probability and Random Processes", Academic Press, Boston, 2014.
5	Johnson R. A. and Gupta C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson India Education, Asia, 9th Edition, New Delhi, 2017.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	-	2	2	1	2									
2	2	-	2	2	1	1									
3	2	-	2	1	1	2									
4	3	1	2	2	1	2									
5	3	-	2	3	2	3									
Overall Correlation	3	0.2	2	2	1.2	2.4									

23RM4151	RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTIES RIGHTS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

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UNIT I	RESEARCH DESIGN	6

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

UNIT II	DATA COLLECTION AND SOURCES	6

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III	DATA ANALYSIS AND REPORTING	6

Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV	INTELLECTUAL PROPERTY RIGHTS	6

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Biodiversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT V	PATENTS	6

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.

TOTAL: 30 PERIODS

COURSE OUTCOMES:	
	After completion of the course, the students will be able to:
CO1:	Formulate and Design research problem
CO2:	Understand and Comprehend the Data Collection Methods
CO3:	Perform Data analysis and acquire Insights
CO4:	Understand IPR and follow research ethics
CO5:	Understand and Practice Drafting and filing a Patent in research and development

REFERENCES:	
1	Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2	Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3	David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
4	The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	-	1	-	1									
2	3	2	-	2	-	1									
3	3	2	2	2	-	1									
4	3	2	-	1	-	-									
5	3	3	-	1	-	-									
Overall Correlation	3	2.4	0.4	1.4	-	0.6									

23MC4101	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I	ROLE OF ALGORITHMS IN COMPUTING & COMPLEXITY ANALYSIS	9

Algorithms – Algorithms as a Technology -Time and Space complexity of algorithms- Asymptotic analysis-Average and worst-case analysis-Asymptotic notation-Importance of efficient algorithms-

Program performance measurement - Recurrences: The Substitution Method – The Recursion- Tree Method- Data structures and algorithms.

UNIT II	HIERARCHICAL DATA STRUCTURES	9

Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of B - trees – Basic operations on B-Trees – Deleting a key from a B-Tree- Heap – Heap Implementation – Disjoint Sets - Fibonacci Heaps: structure – Mergeable-heap operations- Decreasing a key and deleting a node-Bounding the maximum degree.

UNIT III	GRAPHS	9

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra's Algorithm; Dynamic Programming - All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd-Warshall Algorithm

UNIT IV	ALGORITHM DESIGN TECHNIQUES	9
	Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: – Elements of the Greedy Strategy- An Activity-Selection Problem - Huffman Coding.	
UNIT V	NP COMPLETE AND NP HARD	9
	NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducibility – NP-Completeness Proofs – NP-Complete Problems.	

TOTAL: 45 PERIODS

SUGGESTED ACTIVITIES:

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

COURSE OUTCOMES:

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

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

	REFERENCES:
1	S.Sridhar," Design and Analysis of Algorithms", Oxford University Press, 1st Edition, 2014.
2	Adam Drozdex, "Data Structures and Algorithms in C++", Cengage Learning, 4th Edition, 2013.
3	T.H. Cormen, C.E.Leiserson, R.L. Rivest and C.Stein, "Introduction to Algorithms", Prentice Hall of India, 3rd Edition, 2012.
4	Mark Allen Weiss, "Data Structures and Algorithms in C++", Pearson Education, 3rd Edition, 2009.
5	E. Horowitz, S. Sahni and S. Rajasekaran, "Fundamentals of Computer Algorithms", University Press, 2nd Edition, 2008.
6	Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	3	2	1	2									
2	2	1	3	2	2	2									
3	2	1	3	2	2	2									
4	3	1	3	2	2	2									
5	3	1	3	2	2	2									
Overall Correlation	3	1	3	2	1.8	2									

23MC4101	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand object oriented principles like abstraction, encapsulation, inheritance, and polymorphism and apply them in solving problems.
- To understand the principles of inheritance and polymorphism and demonstrate how they relate to the design of abstract classes.
- To understand the implementation of packages and interfaces.
- To understand the concepts of exception handling, multithreading and collection classes.
- To understand how to connect to the database using JDBC.
- To understand the design of Graphical User Interface using applets and swing controls.

UNIT I	INTRODUCTION TO JAVA PROGRAMMING	9

Java Programming - Java Buzz words, Data types, variables, Constants, Scope and Lifetime of variables, Operators, Type conversion and casting, Enumerated types, Control flow- block scope, conditional statements, loops, break and continue statements, arrays, simple java standalone programs, class, object, and its methods constructors, methods, static fields and methods, access control, this reference, overloading constructors, recursion, exploring string class, garbage collection.

UNIT II	INHERITANCE AND INTERFACE	9

Inheritance – Inheritance types, super keyword, preventing inheritance: final classes and methods. Polymorphism – method overloading and method overriding, abstract classes and methods. Interfaces- Interfaces Vs Abstract classes, defining an interface, implement interfaces, accessing implementations through interface references, extending interface, inner class. Packages- Defining, creating and accessing a package, importing packages.

UNIT III	EXCEPTION HANDLING AND MULTITHREADING	9

Exception handling-Benefits of exception handling, the classification of exceptions - exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, creating own exception subclasses. Multithreading – Differences between multiple processes and multiple threads, thread life cycle, creating threads, interrupting threads, thread priorities, synchronizing threads, inter-thread communication, producer consumer problem.

UNIT IV	COLLECTION FRAMEWORK, I/O, GENERIC PROGRAMMING	9

Collection Framework in Java – Introduction to java collections, Overview of java collection framework, commonly used collection classes- Array List, Vector, Hash table, Stack, Lambda Expressions. Files- Streams- Byte streams, Character streams, Text input/output, Binary input/output, File management using File class. Generic Programming – Generic classes – generic methods.

UNIT V	EVENT HANDLING PROGRAMMING	9

Hierarchy for Swing components, Overview of some Swing components – Jbutton, JLabel, JTextField, JTextArea, simple Swing applications, Layout management – Layout manager types – border, grid and flow. Event Handling- Events, Event sources, Event classes, Event Listeners, Delegation event model, Examples: Handling Mouse and Key events, Adapter classes.

	TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain and apply the fundamentals of Java programming, including data types, control structures, arrays, classes, and methods.

CO2:	Demonstrate object-oriented programming concepts such as inheritance, polymorphism, interfaces, and packages to design robust applications.
CO3:	Implement exception handling and multithreading to build efficient and error-resilient Java programs.
CO4:	Utilize Java Collection Framework, file I/O mechanisms, and generics to manage and process data effectively.
CO5:	Design graphical user interfaces and handle events using Java Swing to create interactive desktop applications.

REFERENCES:	
1	Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2019.
2	Herbert Schildt, "Introducing JavaFX 8 Programming", 1st Edition, McGraw Hill Education, New Delhi, 2015.
3	E. Balagurusamy , "Programming with Java", 7th Edition, Mc Grow Hill, 2023.
4	Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
5	Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 2018.
6	R . Nageswara Rao, "Core Java: An Integrated Approach", Dreamtech Press. 2016.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	-	-	-	-	1	-	-	-	1	2	2	2
2	3	2	1	-	-	-	-	1	1	1	-	1	3	3	2
3	3	2	1	-	-	-	-	1	1	1	-	1	2	2	3
4	3	2	1	1	1	-	-	1	1	1	-	1	3	3	2
5	3	2	1	1	1	-	-	1	1	1	-	1	2	3	3
Overall Correlation	3	2	1	1	1	-	-	2		1	-	2	3	3	3

23MC4103	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand Software Engineering Process and Models.
- To perform software requirements analysis.
- To gain knowledge of the System Analysis and Design concepts using Design and Data flow model.
- To understand software testing and maintenance approaches.
- To work on software metrics process.

UNIT I	SOFTWARE PROCESS	9

Introduction-The software process-software Engineering Practice-A generic process model-prescriptive process models specialized process models. -Unified process-Personal and Team Process Models –process technology - product and process Agility-Agile Process-Extreme Programming (XP)-Other Agile Process models.

UNIT II	UNDERSTANDING REQUIREMENTS	9

Requirements Engineering -Establishing the Groundwork - Eliciting Requirements -Developing Use Cases - Building the Requirements Model -Negotiating Requirements - Validating Requirements-Requirements Analysis - Scenario-Based Modeling - UML Models That Supplement the Use Case -Data Modeling Concepts- Class-Based Modeling.

UNIT III	DESIGN CONCEPTS AND PRINCIPLES	9

Design within the Context of Software Engineering - The Design Process - Design -The Design Model - Software Architecture - Architectural Genres - Architectural Styles -Architectural Design –Assessing – Alternative Architectural Designs -Architectural Mapping Using Data Flow.

UNIT IV	TESTING	9

A Strategic Approach to Software Testing - Strategic Issues -Test

Strategies for Conventional Software - Test Strategies for Object-Oriented Software - Test Strategies for WebApps - Validation Testing –System- -The Art of Debugging- White Box Testing-Basis Path Testing-Control Structure Testing-Black Box Testing-Model Based Testing-Object Oriented Testing Strategies-Object Oriented Testing Methods-Testing Concepts for WebApps-The Testing Process.

UNIT V	SOFTWARE METRICS	9

The Management Spectrum - The People - The Product - The Process -The WHH Principle - Metrics in the Process and Project Domains - Software Measurement - Metrics for Software Quality - Integrating Metrics within the Software - Metrics for Small Organizations - Establishing a Software Metrics Program - Decomposition - Empirical Estimation Models - Specialized Estimation Techniques -The Make/Buy Decision.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Compare various Software Development Lifecycle Models
CO2:	Evaluate project management approaches as well as cost and schedule estimation strategies.
CO3:	Develop formal analysis on specifications.
CO4:	Make use of UML diagrams for analysis and design.
CO5:	Develop architectural styles and design patterns, and test the system

REFERENCES:

1	Roger S. Pressman, "Software Engineering: A Practitioners Approach", Sixth Edition, Mc Graw-Hill International Edition, 2017.
2	Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010.

3	Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: Using UML, Patterns and Java", Third Edition, Pearson Education, 2009.
4	Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.
5	Len Bass, Ingo Weber and Liming Zhu, "DevOps: A Software Architect's Perspective", Pearson Education, 2016
6	Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2009.
7	Stephen Schach, Object-Oriented and Classical Software Engineering, 8th ed, McGraw-Hill, 2010.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	1	-	-	-	2	3	1	3	3	1	-
2	3	2	1	1	1	-	-	-	1	2	1	3	3	2	-
3	3	2	1	1	1	-	-	-	3	1	1	3	3	1	-
4	3	2	1	1	3	-	-	-	3	3	1	2	3	3	-
5	3	2	1	1	3	-	-	-	2	2	1	2	3	2	-
Overall Correlation	3	2	1	1	2	-	-	-	3	3	2	3	3	3	-

23MC4202	ADVANCED DATABASE	L	T	P	C
	TECHNOLOGY	3	0	0	3

COURSE OBJECTIVES:

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

UNIT I	DISTRIBUTED DATABASES	9

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

UNIT II	SPATIAL AND TEMPORAL DATABASES	9

Active Databases Model – Design and Implementation Issues - Temporal Databases - Temporal Querying - Spatial Databases: Spatial Data Types, Spatial Operators and Queries – Spatial Indexing and Mining – Applications -– Mobile Databases: Location and Handoff Management, Mobile Transaction Models – Deductive Databases - Multimedia Databases.

UNIT III	NOSQL DATABASES	9

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

UNIT IV	XML DATABASES	9

Structured, Semi structured, and Unstructured Data – XML Hierarchical Data Model – XML Documents – Document Type Definition – XML Schema – XML Documents and Databases – XML Querying – XPath – XQuery

UNIT V	INFORMATION RETRIEVAL AND WEB SEARCH	9

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

TOTAL: 45 PERIODS

SUGGESTED ACTIVITIES:

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

COURSE OUTCOMES:

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

CO1:	Design a distributed database system and execute distributed queries.
CO2:	Manage Spatial and Temporal Database systems and implement it in corresponding applications.
CO3:	Use NoSQL database systems and manipulate the data associated with it.

CO4:	Design XML database systems and validate with XML schema.
CO5:	Apply knowledge of information retrieval concepts on web databases.

REFERENCES:	
1	Abraham Silberschatz, Henry F Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2019.
2	R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education/Addison Wesley, 2017.
3	Guy Harrison, "Next Generation Databases, NoSQL, NewSQL and Big Data", First Edition, Apress publishers, 2015
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	C. J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	2	2	2	2									
2	2	1	3	2	2	2									
3	2	1	3	2	2	3									
4	2	1	3	2	3	3									
5	2	1	3	2	2	2									
Overall Correlation	2	1	2.8	2	2.2	2.4									

23MC4111	ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To acquire the knowledge of using advanced tree structures
- To learn the usage of heap structures
- To understand the usage of graph structures and spanning trees
- To understand the problems such as matrix chain multiplication, activity selection and Huffman coding
- To understand the necessary mathematical abstraction to solve problems.

PRACTICALS :

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

TOTAL: 60 PERIODS

LABORATORY REQUIREMENT:

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

COURSE OUTCOMES:

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

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

REFERENCES:	
1	Lipschutz Seymour, "Data Structures Schaum's Outlines Series", Tata McGraw Hill, 3rd Edition, 2014.
2	Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3	http://www.coursera.org/specializations/data-structures-algorithms
4	http://www.tutorialspoint.com/data_structures_algorithms
5	http://www.geeksforgeeks.org/data-structures/

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	3	3	2	2									
2	2	1	3	3	3	3									
3	3	1	3	3	3	3									
4	3	1	3	3	3	3									
5	3	1	3	3	3	3									
Overall Correlation	2.6	1	3	3	2.8	2.8									

23MC4113	COMMUNICATION SKILLS ENHANCEMENT – I	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

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

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

COURSE OUTCOMES:

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

CO1:	Listen and comprehend lectures in English
CO2:	Articulate well and give presentations clearly

CO3:	Participate in Group Discussions successfully
CO4:	Communicate effectively in formal and informal writing
CO5:	Write proficient essays and emails

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	2	1	1	1									
2	1	3	2	1	1	1									
3	1	2	3	1	1	1									
4	1	3	2	1	1	1									
5	1	3	2	1	1	1									
Overall Correlation	1	2.6	2.2	1	1	1									

23MC4201	FULL STACK WEB DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I	INTRODUCTION TO CSS AND JAVASCRIPT	9

Introduction to Web: Server - Client - Communication Protocol (HTTP) – Structure of HTML Documents – Basic Markup tags – Working with Text and Images with CSS– CSS Selectors – CSS Flexbox - JavaScript: Data Types and Variables - Functions - Events – AJAX: GET and POST

UNIT II	SERVER SIDE PROGRAMMING WITH NODE JS	9

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

UNIT III	ADVANCED NODE JS AND DATABASE	9

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

UNIT IV	ADVANCED CLIENT SIDE PROGRAMMING	9

React JS: ReactDOM - JSX - Components - Properties – Fetch API - State and Lifecycle - -JS Localstorage - Events - Lifting State Up - Composition and Inheritance

UNIT V	APP IMPLEMENTATION IN CLOUD	9

Cloud providers Overview – Virtual Private Cloud – Scaling (Horizontal and Vertical) – Virtual Machines, Ethernet and Switches – Docker Container – Kubernetes

TOTAL: 45 PERIODS

SUGGESTED ACTIVITIES:

1. Build an online MCQ quiz app. The questions and options should be fetched based on the chosen topic from a NodeJS server. The questions can be stored in a JSON file in the backend. Once the user has answered the questions, the frontend must send the chosen options to the backend and the backend must identify the right answers and send the score back to the front end. The frontend must display the score in a separate neatly designed page.

2. Build a blog website where you can add blog posts through a simple admin panel and the users can view the blog posts. The contents of the blog posts can be stored in either MongoDB or MySQL database. The home page should contain the titles of the blog post and the full post can be viewed by clicking the title. Frontend can be built either using React or through template engines served by the NodeJS server.

3. Take any ecommerce or social media website/app. Analyze what the API endpoints would have been used for and how the frontend interacts with the backend. The networks tab in the browser's developer tools can be used if required.

4. Architect an entire database structure for an E-Commerce application for MongoDB. Discuss how the database would have been structured if you were using a SQL database.

5. Build a simple calculator app with React. The user should be able to add numbers and operations to the app by clicking on buttons, just like you would do in a mobile phone. The moment the operation and the two operations are defined, the answer should be displayed

COURSE OUTCOMES:

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

CO1:	Write client side scripting HTML, CSS and JS.

CO2:	Implement and architect the server side of the web application.
CO3:	Implement Web Application using NodeJS.
CO4:	Architect NoSQL databases with MongoDB.
CO5:	Implement a full-stack Single Page Application using React, NodeJS and MongoDB and deploy on Cloud.

REFERENCES:	
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
4	Marc Wandschneider, "Learning Node", Addison-Wesley Professional, 2nd Edition, 2016
5	Joe Beda, Kelsey Hightower, Brendan Burns, "Kubernetes: Up and Running", O'Reilly Media, 1st edition, 2017
6	Paul Zikopoulos, Christopher Bienko, Chris Backer, Chris Konarski, Sai Vennam, "Cloud Without Compromise", O'Reilly Media, 1st edition, 2021

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	2	2	2	2									
2	2	1	2	2	2	2									
3	2	1	3	2	3	2									
4	2	1	3	2	3	3									
5	2	1	3	2	3	3									
Overall Correlation	1.8	1	2.6	2	2.6	2.4									

23MC4202	ADVANCED COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To focus on information sharing and networks.
- To introduce flow of data, categories of network, different topologies.
- To focus on different coding schemes.
- To brief the students regarding protocols and standards.
- To give a clear idea of signals, transmission media, errors in data communications.

UNIT I	FUNDAMENTALS AND LINK LAYER	9

Overview of Data Communications- Networks — Building Network and its types– Overview of Internet — Protocol Layering — OSI Model — Physical Layer — Overview of Data and Signals.

UNIT II	MEDIA ACCESS AND INTERNETWORKING	9

Introduction to Data Link Layer — Link layer Addressing — Error Detection and Correction— Medium Access Control — Ethernet (802.3) — Wireless LANs —Bluetooth —WiFi — Network layer services — Packet Switching — IPV4 Address — Network layer protocols (IP, ICMP, Mobile IP.

UNIT III	ROUTING	9

Routing — Unicast Routing — Algorithms — Protocols — Multicast Routing and its basics — Overview of Intradomain and interdomain protocols — Overview of IPv6 Addressing — Transition from IPv4 to IPv6.

UNIT IV	TRANSPORT LAYER	9

Introduction to Transport layer –Protocols- User Datagram Protocols (UDP) and Transmission Control Protocols (TCP) - Services — Features — TCP Connection — State Transition Diagram — Flow, Error and Congestion Control — Congestion avoidance.

UNIT V	DATA LINK LAYER AND PHYSICAL LAYER	9

Application Layer Paradigms — Client Server Programming — World Wide Web and HTTP — DNS- -Electronic Mail (SMTP, POP3, IMAP, MIME) — Introduction to Peer to Peer Networks — Need for Cryptography and Network Security — Firewalls.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Discuss the categories and functions of various Data communication Networks.
CO2:	Develop various error detection techniques and network layer services.
CO3:	Explain the mechanism of Media access control in the data layer.
CO4:	Apply different routing algorithms in Network Layer
CO5:	Discuss the significance of various Flow control and Congestion control mechanisms.

REFERENCES:

1	Kurose James F, Keith W. "Computer Networking A Top-Down Approach." ,7th Edition, Pearson, 2016.
2	Behrouz A. Forouzan. "Data Communications and Networking." ,5th Edition McGraw-Hill Education, 2017.
3	Bhusan Trivedi. "Data communication and Networks.", Oxford University Press, 2016.
4	Andrew S Tanenbaum. "Computer Networks.", 4th Edition, Pearson Education, 2002.
5	W. A. Shay. "Understanding Communications and Networks.", 3rd Edition, Cengage Learning, 2004.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	-	-									
2	3	2	1	1	1	-									
3	2	1	-	-	1	-									
4	3	2	1	1	1	-									
5	2	1	-	-	1	-									
Overall Correlation	3	2	1	1	1	-									

23MC4203	CLOUD COMPUTING TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I	DISTRIBUTED SYSTEMS	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	BASICS OF CLOUD COMPUTING	9

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

UNIT III	CLOUD INFRASTRUCTURE	9

Cloud Architecture and Design – Architectural design challenges – Technologies for Network based system - NIST Cloud computing Reference Architecture – Public, Private and Hybrid clouds – Cloud Models : IaaS, PaaS and SaaS – Cloud storage providers -

Enabling Technologies for the Internet of Things – Innovative Applications of the Internet of Things.

UNIT IV	CLOUD ENABLING TECHNOLOGIES	9

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

UNIT V	MICROSERVICES AND DEVOPS	9

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

TOTAL: 45 PERIODS

SUGGESTED ACTIVITIES:

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

COURSE OUTCOMES:	
	After completion of the course, the students will be able to:
CO1:	Use Distributed systems in Cloud Environment.
CO2:	Articulate the main concepts, key technologies, strengths and limitations of Cloud computing.
CO3:	Identify the Architecture, Infrastructure and delivery models of Cloud computing.
CO4:	Install, choose and use the appropriate current technology for the
CO5:	Adopt Microservices and DevOps in Cloud environments.
REFERENCES:	
1	Kai Hwang, Geoffrey C. Fox & Jack J.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", Third Edition, Pearson, 2017.
3	Thomas Erl, Zaigham Mahood & Ricardo Puttini, "Cloud Computing, Concept, Technology & Architecture", Prentice Hall, SecondEdition, 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

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	2	2	2	2									
2	2	1	2	2	2	2									
3	3	1	3	2	2	2									
4	2	1	2	2	2	2									
5	2	1	2	2	2	2									
Overall Correlation	2.2	1	2.2	2	2	2									

23MC4204	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

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

UNIT I	INTRODUCTION	15

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

- Installation of necessary components and software

UNIT II	USER INTERFACE	15

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

Lab Component:

i. Implement mobile applications using UI toolkits and frameworks.

ii. Design an application that uses Layout Managers and event listeners

UNIT III	APPLICATION DESIGN	15

Memory Management – Design Patterns for Limited Memory – Workflow for Application development – Java API – Dynamic Linking – Plugins and rule of thumb for using DLLs – Multithreading in Java - Concurrency and Resource Management.

Lab Component:

i. Design a mobile application that is aware of the resource constraints of mobile devices.

ii. Design an application that uses Dynamic Linking

UNIT IV	MOBILE OS	15

Mobile OS: Android, iOS – Android Application Architecture – Understanding the anatomy of a mobile application - Android basic components –Intents and Services – Storing and Retrieving data – Packaging and Deployment – Security and Hacking.

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

UNIT V	APPLICATION DEVELOPMENT	15

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

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

TOTAL: 75 PERIODS

SOFTWARE REQUIREMENTS
JDK, ECLIPSE IDE / equivalent, ANDROID STUDIO

COURSE OUTCOMES:

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

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

REFERENCES:

1	Reto Meier, Ian Lake, "Professional Android", 4th Edition, Wrox, 2018.
2	Zigurd Mednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, "Programming Android", O'Reilly, 2nd Edition, 2012.

3	Alasdair Allan, "Learning iOS Programming", O'Reilly, Third Edition, 2013.
4	Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, Android Programming: The Big Nerd Ranch Guide, 4th edition, 2019.
5	Christian Keur, Aaron Hillegass, iOS Programming: The Big Nerd Ranch Guide, 6th Edition, O'Reilly, 2016.
6	Barry Burd, "Android Application Development All-In-One for Dummies", 3rd Edition, 2021.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	2	2	2	2									
2	2	1	2	2	2	2									
3	2	1	2	2	2	2									
4	3	1	3	3	2	3									
5	3	1	3	3	2	3									
Overall Correlation	2.4	1	2.4	2.4	2	2.4									

23MC4205	ADVANCED OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide a deep understanding of the structure, functions, and design approaches of advanced operating systems including synchronization, deadlocks, and process management.
- To study the fundamentals of distributed operating systems, communication mechanisms, mutual exclusion, deadlock detection, and agreement protocols.
- To analyze the architecture, design issues, and implementation techniques for distributed file systems, shared memory, and scheduling algorithms.
- To gain knowledge about different types of failures, recovery techniques, checkpointing methods, and fault-tolerant strategies in distributed systems.
- To understand the structure, design, synchronization, scheduling, and memory management in multiprocessor systems, and explore concurrency control in distributed database operating systems.

UNIT I	INTRODUCTION	9

Overview - Functions of an Operating System – Design Approaches – Types of Advanced Operating System - Synchronization Mechanisms – Concept of a Process, Concurrent Processes – The Critical Section Problem, Other Synchronization Problems – Language Mechanisms for Synchronization – Axiomatic Verification of Parallel Programs - Process Deadlocks - Preliminaries – Models of Deadlocks, Resources, System State – Necessary and Sufficient conditions for a Deadlock – Systems with Single-Unit Requests, Consumable Resources, Reusable Resources.

UNIT II	DISTRIBUTED OPERATING SYSTEMS	9

Introduction – Issues – Communication Primitives – Inherent Limitations - Lamport's Logical Clock; Vector Clock; Causal

Ordering; Global State; Cuts; Termination Detection. Distributed Mutual Exclusion – Non-Token Based Algorithms – Lamport's Algorithm - Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm – Distributed Deadlock Detection – Issues – Centralized Deadlock-Detection Algorithms - Distributed Deadlock-Detection Algorithms. Agreement Protocols – Classification - Solutions –Applications.

UNIT III	DISTRIBUTED RESOURCE MANAGEMENT	9

Distributed File systems – Architecture – Mechanisms – Design Issues – Distributed Shared Memory – Architecture – Algorithm – Protocols - Design Issues. Distributed Scheduling – Issues – Components – Algorithms.

UNIT IV	FAILURE RECOVERY AND FAULT TOLERANCE	9

Basic Concepts-Classification of Failures – Basic Approaches to Recovery; Recovery in Concurrent System; Synchronous and Asynchronous Checkpointing and Recovery; Check pointing in Distributed Database Systems; Fault Tolerance; Issues - Two-phase and Non-blocking Commit Protocols; Voting Protocols; Dynamic Voting Protocols.

UNIT V	MULTIPROCESSOR AND DATABASE OPERATING SYSTEMS	9

Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling – Memory Management – Reliability / Fault Tolerance; Database Operating Systems – Introduction – Concurrency Control – Distributed Database Systems – Concurrency Control Algorithms.

	TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Demonstrate an understanding of the core concepts, functions, and design approaches of advanced operating

	systems, including process synchronization and deadlock management.
CO2:	Analyze and apply synchronization mechanisms, including the critical section problem, and design solutions for concurrent processes and deadlock handling in multi-process systems.
CO3:	Develop and implement distributed systems solutions, focusing on mutual exclusion algorithms, logical clocks, distributed file systems, and distributed deadlock detection mechanisms.
CO4:	Evaluate and design fault tolerance and failure recovery strategies in distributed systems, using techniques like checkpointing, recovery protocols, and voting protocols for maintaining system reliability.
CO5:	Understand and apply concepts related to multiprocessor operating systems and database operating systems, including memory management, processor scheduling, and concurrency control in distributed database systems.
REFERENCES:	
1	Mukesh Singhal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", McGraw-Hill, 2000
2	Abraham Silberschatz, Peter B. Galvin, G. Gagne, "Operating System Concepts", Sixth Edition, Addison Wesley Publishing Co., 2003.
3	Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	2	2	2	2									
2	2	1	2	2	2	2									
3	2	1	2	2	2	2									
4	3	1	3	3	2	3									
5	3	1	3	3	2	3									
Overall Correlation	2.4	1	2.4	2.4	2	2.4									

23MC4212	FULL STACK WEB DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To implement the client side of the web application using javascript.
- To understand Javascript on the desktop using NodeJS.
- To develop a web application using NodeJS and Express.
- To implement a SPA using React.
- To develop a full stack single page application using React, NodeJS, and a Database (MongoDB or SQL).

PRACTICALS :

1. Create a form and validate the contents of the form using JavaScript.
2. Get data using Fetch API from an open-source endpoint and display the contents in the form of a card.
3. Create a NodeJS server that serves static HTML and CSS files to the user without using Express.
4. Create a NodeJS server using Express that stores data from a form as a JSON file and displays it in another page. The redirect page should be prepared using Handlebars.
5. Create a NodeJS server using Express that creates, reads, updates and deletes students' details and stores them in MongoDB database. The information about the user should be obtained from a HTML form.
6. Create a NodeJS server that creates, reads, updates and deletes event details and stores them in a MySQL database. The information about the user should be obtained from a HTML form.
7. Create a counter using ReactJS
8. Create a Todo application using ReactJS. Store the data to a JSON file using a simple NodeJS server and retrieve the information from the same during page reloads.

	9.	Create a simple Sign up and Login mechanism and authenticate the user using cookies. The user information can be stored in either MongoDB or MySQL and the server should be built using NodeJS and Express Framework.
	10.	Create and deploy a virtual machine using a virtual box that can be accessed from the host computer using SSH.
	11.	Create a docker container that will deploy a NodeJS ping server using the NodeJS image.

| | | **TOTAL: 60 PERIODS** |

LABORATORY REQUIREMENT:

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

COURSE OUTCOMES:

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

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

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	1	3	2	3	3									
2	2	1	2	2	3	3									
3	2	1	2	2	3	2									
4	2	1	3	2	2	3									
5	2	1	2	2	2	2									
Overall Correlation	2.2	1	2.4	2	2.6	2.6									

23MC4213	COMMUNICATION SKILLS ENHANCEMENT – II	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

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

1. Soft Skills
  - People skills
  - Interpersonal skills
  - Team building skills
  - Leadership skills
  - Problem solving skills

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

3. Group Discussion Skills
  - Participating in group discussions
  - Brainstorming the topic
  - Activities to improve GD skills.

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

TOTAL: 30 PERIODS

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

CO1:	Students will be able to make presentations and participate in Group discussions with confidence.
CO2:	Students will be able to perform well in the interviews.
CO3:	Students will make effective presentations.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	1	1	1	1									
2	1	2	1	1	1	1									
3	1	2	1	1	1	1									
Overall Correlation	1	2	1	1	1	1									

SEMESTER –III

23MC4301	AI & MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I	INTRODUCTION	9

Introduction–Definition – Foundation and History of AI - Future of Artificial Intelligence – Intelligent Agents– Environments – Structure of Agents – Typical Intelligent Agents - Problem solving Methods – AI Problems - Search Strategies – Uninformed Search Techniques.

UNIT II	MODEL EVALUATION AND FEATURE ENGINEERING	9

Human Learning - Types – Machine Learning - Types - Problems not to be solved - Applications - Languages/Tools– Issues. Preparing to Model: Introduction - Machine Learning Activities - Types of data - Exploring structure of data - Data quality and remediation - Data Pre-processingModel Selection - Training Model - Model Representation and Interpretability - Evaluating Performance of a Model - Improving Performance of a Model - Feature Engineering: Feature

UNIT III	BAYESIAN LEARNING	9

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

UNIT IV	PARAMETRIC MACHINE LEARNING	9

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

UNIT V	NON PARAMETRIC MACHINE LEARNING	9

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

		TOTAL: 45 PERIODS

SUGGESTED ACTIVITIES:

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

COURSE OUTCOMES:

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

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

REFERENCES:

1	Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2022.
2	Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", Third Edition, MIT Press, 2014
3	Tom M. Mitchell, "Machine Learning", India Edition, 1st Edition, McGraw-Hill Education Private Limited, 2013
4	Saikat Dutt, Subramanian Chandramouli and Amit Kumar Das, "Machine Learning", 1st Edition, Pearson Education, 2019
5	Christopher M. Bishop, "Pattern Recognition and Machine Learning", Revised Edition, Springer, 2016.
6	Aurelien Geron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2nd Edition, O"Reilly, 2019

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	2	2	2	2									
2	1	1	2	2	2	2									
3	2	1	2	2	2	2									
4	2	1	2	2	2	2									
5	2	1	2	2	2	2									
Overall Correlation	1.6	1	2	2	2	2									

23MC4302	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I	FUNDAMENTALS OF IOT	9

Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

UNIT II	IOT PROTOCOLS	9

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFIDProtocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

UNIT III	IOT PHYSICAL DEVICES AND ENDPOINTS	9

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

UNIT IV	INTERNET OF THINGS PRIVACY, SECURITY AND GOVERNANCE	9

Introduction, Overview of Governance, Privacy and Security

Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security

UNIT V	APPLICATIONS	9

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

TOTAL: 45 PERIODS

SUGGESTED ACTIVITIES:

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

COURSE OUTCOMES:

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

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

REFERENCES:	
1	Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2	Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012. .
3	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals, Networking Technologies, Protocols, and Use cases for the Internet of Things", Cisco Press, First Edition,2017.
4	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet ofThings", Springer, 2011
5	Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895
6	Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	2	2	2	2									
2	2	1	2	2	2	2									
3	2	1	3	2	2	3									
4	2	1	2	2	2	2									
5	2	1	3	2	2	3									
Overall Correlation	2	1	2.4	2	2	2.4									

23IT601	CRYPTOGRAPHY AND SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the basic categories of threats to computers and networks
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand various symmetric key cryptographic algorithms.
- Describe public-key cryptosystem
- Describe various message authentication models.
- Understand Intrusions and intrusion detection

UNIT I	INTRODUCTION	9

Overview of Cryptography and Its Applications - Secure Communications - Cryptographic Applications - Classical Cryptosystems - Shift Ciphers - Affine Ciphers - The Vigenère Cipher - Substitution Ciphers - Sherlock Holmes - The Playfair and ADFGX Ciphers - Enigma - Basic Number Theory - The Extended Euclidean Algorithm - The Chinese Remainder Theorem - Modular Exponentiation - Fermat's Theorem and Euler's Theorem - Primitive Roots.

UNIT II	SYMMETRIC KEY CRYPTOGRAPHY	9

Block Cipher and Data Encryption Standards: Block Cipher Principles, Data Encryption Standards, the Strength of DES. Advanced Encryption Standards: Evaluation Criteria for AES, the AES Cipher.

UNIT III	PUBLIC KEY CRYPTOGRAPHY	9

Asymmetric Key Ciphers: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT IV	MESSAGE AUTHENTICATION AND INTEGRITY	9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA – Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications – Kerberos, X.509.

UNIT V	SECURITY PRACTICE AND SYSTEM SECURITY	9

Electronic Mail security – PGP, S/MIME – IP security – Web Security – System Security: Intruders – Malicious software – viruses – Firewalls.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Infer basic security attacks and services.
CO2:	Illustrate confidentiality, integrity, authentication and availability concepts
CO3:	Make use of symmetric key algorithms for cryptography
CO4:	Make use of asymmetric key algorithms for cryptography and apply the knowledge of Key Management techniques
CO5:	Utilize the Authentication functions the manner in which Message Authentication Codes and Hash Functions works.
CO6:	Examine the issues and structure of Authentication Service and Electronic Mail Security

REFERENCES:

1	Wade Trappe and Lawrence C. Washington. "Introduction to Cryptography with Coding Theory.", 3rd edition, Pearson, 2020
2	William Stallings. "Cryptography and Network Security: Principles and Practice.", 8th edition, Pearson Education, India, 2020.

3	Charlie Kaufman. "Network Security: Private Communication in a Public World.", 2nd edition, Prentice Hall of India, 2002.
4	Atul Kahate. "Cryptography and Network Security.", 2nd edition, Tata Mc Grawhill, 2008.
5	Robert Bragg, Mark Rhodes. "Network Security: The complete reference.", Tata Mc Grawhill, 2004.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	-	-									
2	2	1	-	-	-	-									
3	3	2	1	1	-	-									
4	3	2	1	1	-	-									
5	3	3	1	1	-	-									
Overall Correlation	3	3	2	2	1	1									

23MC4311	AI & MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS:

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

	11. Implement Support Vector Classification for linear kernels.
	12. Implement Logistic Regression to classify problems such as spam detection. Diabetes predictions and so on.
	TOTAL: 60 PERIODS

LABORATORY REQUIREMENT:

Python or any ML tools like R

COURSE OUTCOMES:

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

CO1:	Apply data preprocessing technique and explore the structure of data to prepare for predictive modeling
CO2:	Understand how to select and train a model and measure the performance.
CO3:	Apply feature selection techniques in Machine Learning
CO4:	Construct Bayesian Network for appropriate problem
CO5:	Learn about parametric and non-parametric machine Learning algorithms and implement to practical situations

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	2	2	2	2									
2	2	1	2	2	2	2									
3	2	1	2	2	2	2									
4	2	1	2	2	2	2									
5	2	1	2	2	2	2									
Overall Correlation	2	1	2	2	2	2									

23MC4312	INTERNET OF THINGS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS:

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

TOTAL: 60 PERIODS

LABORATORY REQUIREMENT:

1. The universal microcontroller development board

	2.	8051 Daughter Board

2. 8051 Daughter Board
3. Raspberry Pi 3B+ Original
4. Arduino Daughter Board
5. Humidity + IR Sensor Interface
6. Ultrasonic Sensors
7. Open source softwares Django Framework
8. Open cloud architectures like Bluemix, Development platforms like Firebase

COURSE OUTCOMES:

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

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

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	2	2	2	2									
2	2	1	2	2	2	2									
3	2	1	2	2	2	2									
4	2	1	2	2	2	2									
5	2	1	2	2	2	2									
Overall Correlation	2	1	2	2	2	2									