KCG

COLLEGE OF TECHNOLOGY

AFFILIATED TO ANNA UNIVERSITY | AUTONOMOUS

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 SEMESTERSITOIV

SEMESTER–I

Sl. No.	CourseCode	CourseTitle	Category	Periods PerWeek			Total ContactPeriods	Credits
				L	T	P		
THEORY								
1	23MA4151	AppliedProbabilityandStatisticsfor Computer Science Engineers	FC	3	1	0	4	4
2	23RM4151	ResearchMethodologyandIPR	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 DataStructuresand Algorithms Laboratory	PCC	0	0	4	4	2
9	23MC4112	ObjectOriented ProgrammingLaboratory	PCC	0	0	4	4	2
10	23MC4113	CommunicationSkillsEnhancement–I	EEC	0	0	2	2	1
TOTAL				19	1	12	32	24

*Auditcourseisoptional

SEMESTER–II

Sl. No.	Coursecode	CourseTitle	Category	Periods PerWeek			TotalContact Periods	Credits
				L	T	P		
THEORY								
1	23MC4202	Advanced Computer Networks	PCC	3	0	0	3	3
2	23MC4203	CloudComputingTechnologies	PCC	3	0	0	3	3
3	23MC4204	MobileApplicationDevelopment	PCC	3	0	2	5	4
4	23MC4205	Advanced Operating Systems	PCC	3	0	0	3	3
5		ProfessionalElectiveI	PEC	3	0	0	3	3
6		AuditCourse– II*	AC	2	0	0	2	0
7	23MC4202	Advanced Computer Networks	PCC	3	0	0	3	3

PRACTICALS								
8	23MC4211	MobileApplicationDevelopment Laboratory	PCC	0	0	4	4	2
9	23MC4212	FullStackWebDevelopmentLaboratory	PCC	0	0	4	4	2
10	23MC4213	CommunicationSkillsEnhancement–II	EEC	0	0	2	2	1
TOTAL				20	0	12	32	24

*Auditcourseisoptional

SEMESTER-III

Sl. No.	Coursecode	CourseTitle	Category	Periods PerWeek			TotalContactPeriods	Credits
				L	T	P		
THEORY								
1	23MC4301	AI & MachineLearning	PCC	3	0	0	3	3
2	23MC4302	InternetofThings	PCC	3	0	0	3	3
3	23MC4303	Cryptography and Network Security	PEC	3	0	2	5	4
4		ProfessionalElectiveII	PEC	3	0	0	3	3
5		Open Elective	OEC	3	0	0	3	3
PRACTICALS								
6	23MC4311	AI & Machine Learning Laboratory	PCC	0	0	4	4	2
7	23MC4312	Internet of Things Laboratory	PCC	0	0	4	4	2
8	23MC4313	Mini Project	EEC	0	0	6	6	3
TOTAL				18	0	10	28	23

*Auditcourseisoptional

SEMESTER-IV

Sl. No.	Coursecode	CourseTitle	Category	Periods PerWeek			TotalContact Periods	Credits
				L	T	P		
PRACTICALS								
1	23MC4411	Project Work	EEC	0	0	24	24	12
2		ProfessionalElectiveIII	PEC	3	0	0	3	3
TOTAL				0	0	24	24	15

TOTALNO.OFCREDITS:83

PROFESSIONAL ELECTIVECOURSES
SEMESTER II: ELECTIVE - I

Sl. No.	CourseCode	CourseTitle	Category	Periods PerWeek			TotalContactperiods	Credits
				L	T	P		
1	23MC4001	SoftwareProjectManagement	PEC	3	3	0	0	3
2	23MC4002	ProfessionalEthicsinIT	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	InformationRetrievalTechniques	PEC	3	3	0	0	3
6	23MC4006	SoftComputingTechniques	PEC	3	3	0	0	3
7	23MC4007	OperationsResearch	PEC	3	3	0	0	3
8	23MC4008	BusinessDataAnalytics	PEC	3	3	0	0	3

SEMESTER III: ELECTIVE - II

Sl. No.	CourseCode	CourseTitle	Category	Periods PerWeek			TotalContactperiods	Credits
				L	T	P		
1	23MC4009	DevOpsandMicroservices	PEC	3	3	0	0	3
2	23MC4010	Mobile Computing	PEC	3	3	0	0	3
3	23MC4011	DigitalImageProcessing	PEC	3	3	0	0	3
4	23MC4012	SocialNetworkAnalytics	PEC	3	3	0	0	3
5	23MC4013	CryptocurrencyandBlockchain Technologies	PEC	3	3	0	0	3
6	23MC4014	BioInspiredlearning	PEC	3	3	0	0	3
7	23MC4015	DigitalMarketing	PEC	3	3	0	0	3

SEMESTER III: ELECTIVE - III

Sl. No.	CourseCode	CourseTitle	Category	Periods PerWeek			TotalContactperiods	Credits
				L	T	P		
1	23MC4016	SoftwareArchitecture	PEC	3	3	0	0	3
2	23MC4017	DigitalForensics	PEC	3	3	0	0	3
3	23MC4018	Natural Language Processing	PEC	3	3	0	0	3
4	23MC4019	DataVisualizationTechniques	PEC	3	3	0	0	3
5	23MC4020	DataMiningandDataWarehousing Techniques	PEC	3	3	0	0	3
6	23MC4021	Discrete Mathematics	PEC	3	3	0	0	3
7	23MC4022	OrganizationalBehavior	PEC	3	3	0	0	3

SEMESTER III: ELECTIVE - IV

Sl. No.	CourseCode	CourseTitle	Category	Periods PerWeek			TotalContactperiods	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	BigDataAnalytics	PEC	5	3	0	2	4
4	23MC4026	SoftwareQualityandTesting	PEC	5	3	0	2	4
5	23MC4027	AdvancedJavaProgramming	PEC	5	3	0	2	4
6	23MC4028	UNIX Internals	PEC	5	3	0	2	4

PROFESSIONALELECTIVECOURSES[PEC]

Sl. No.	CourseCode	CourseTitle	Category	Periods PerWeek			TotalContactperiods	Credits
				L	T	P		
1		SoftwareProjectManagement	PEC	5	3	0	2	4
2		ProfessionalEthicsinIT	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		InformationRetrievalTechniques	PEC	5	3	0	2	4
6		SoftComputingTechniques	PEC	5	3	0	2	4
7		OperationsResearch	PEC	5	3	0	2	4

8		BusinessDataAnalytics	PEC	5	3	0	2	4
9		DevOpsandMicroservices	PEC	5	3	0	2	4
10		AdvancesinNetworking	PEC	5	3	0	2	4
11		DigitalImageProcessing	PEC	5	3	0	2	4
12		SocialNetworkAnalytics	PEC	5	3	0	2	4
13		CryptocurrencyandBlockchainTechnologies	PEC	5	3	0	2	4
14		BioInspiredlearning	PEC	5	3	0	2	4
15		DigitalMarketing	PEC	5	3	0	2	4
16		SoftwareArchitecture	PEC	5	3	0	2	4
17		DigitalForensics	PEC	5	3	0	2	4
18		WirelessNetworking	PEC	5	3	0	2	4
19		DataVisualizationTechniques	PEC	5	3	0	2	4
20		DataMiningandDataWarehousingTechniques	PEC	5	3	0	2	4
21		AgileMethodologies	PEC	5	3	0	2	4
22		OrganizationalBehavior	PEC	5	3	0	2	4
23		WebDesign	PEC	5	3	0	2	4
24		C#and.NET	PEC	5	3	0	2	4
25		SoftwareQualityandTesting	PEC	5	3	0	2	4
26		AdvancedJavaProgramming	PEC	5	3	0	2	4
27		NetworkProgrammingandSecurity	PEC	5	3	0	2	4

AUDITCOURSES(AC)

Registrationforanyofthesecoursesisoptionaltostudents

Sl. No.	CourseCode	CourseTitle	Periods PerWeek			Credits
			L	T	P	
1	23AX4091	EnglishforResearchPaperWriting	2	0	0	0
2	23AX4092	Disaster Management	2	0	0	0
3	23AX4093	ConstitutionofIndia	2	0	0	0

LISTOFOPENELECTIVESFORPG PROGRAMMES

Sl. No.	CourseCode	CourseTitle	Periods PerWeek			Credits
			L	T	P	
1.	23OE431	IntegratedWaterResourcesManagement	3	0	0	3
2.	23OE432	Water,SanitationandHealth	3	0	0	3
3.	23OE433	Principlesof Sustainable Development	3	0	0	3
4.	23OE434	EnvironmentalImpactAssessment	3	0	0	3
5.	23OME431	VibrationandNoiseControlStrategies	3	0	0	3
6.	23OME432	EnergyConservationandManagementin DomesticSectors	3	0	0	3
7.	23OME433	AdditiveManufacturing	3	0	0	3
8.	23OME434	ElectricVehicleTechnology	3	0	0	3
9.	23OME435	NewProduct Development	3	0	0	3
10.	23OBA431	SustainableManagement	3	0	0	3
11.	23OBA432	MicroandSmallBusinessManagement	3	0	0	3
12.	23OBA434	EthicalManagement	3	0	0	3
13.	23ET4251	IoTforSmartSystems	3	0	0	3
14.	23ET4072	MachineLearningandDeepLearning	3	0	0	3
15.	23PX4012	RenewableEnergyTechnology	3	0	0	3
16.	23PS4093	SmartGrid	3	0	0	3
17.	23NC4201	InternetofThingsandCloud	3	0	0	3
18.	23MX4073	MedicalRobotics	3	0	0	3
19.	23VE4202	EmbeddedAutomation	3	0	0	3
20.	23CX4016	EnvironmentalSustainability	3	0	0	3
21.	23BY4016	IPR,BiosafetyandEntrepreneurship	3	0	0	3

SUMMARY

Sl. No.	NAMEOFTHEPROGRAMME:M.CA					
	SUBJECTAREA	CREDITS PERSEMESTER				CREDITS TOTAL
		I	II	III	IV	
1.	FC	04	00	00	00	04
2.	PCC	17	20	10	00	49
3.	PEC	00	03	7	03	13
4.	RMC	02	00	00	00	02
5.	OEC	00	00	03	00	03
6.	EEC	01	01	03	12	12
7.	NonCredit/AuditCourse	00	00	00	00	00
TOTALCREDIT		24	24	23	15	86

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

23MA4151	APPLIED PROBABILITY AND STATISTICS FOR COMPUTERSCIENCEENGINEERS	L	T	P	C
		3	1	0	4

COURSEOBJECTIVES:

- **Toencouragestudentstodevelopaworkingknowledgeofthecentralideasof Linear Algebra.**
- **ToenablestudentstounderstandtheconceptsofProbabilityandRandomVariables.**
- **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.**
- **Toapplythesmall/largesampleteststhrough Testsofhypothesis.**
- **To enable the students to use the concepts of multivariate normal distribution and principal components analysis.**

UNITI	LINEAR ALGEBRA	12

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

UNITII	PROBABILITYANDRANDOMVARIABLES	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 and Normal distributions.

UNITIII	TWODIMENSIONALRANDOMVARIABLES	12

Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression curve – Correlation.

UNITIV	TESTINGOFHYPOTHESIS	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.		
UNITV	**MULTIVARIATEANALYSIS**	**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:60PERIODS

COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	**ApplytheconceptsofLinearAlgebratosolvepracticalproblems.**
CO2:	**Usetheideasofprobabilityandrandomvariablesinsolvingengineeringproblems.**
CO3:	**Be familiar with some of the commonly encountered two dimension random variables and be equipped for a possible extension to multivariate analysis.**
CO4:	**Usestatisticaltestsintestinghypothesisondata.**
CO5:	**Developcriticalthinkingbasedonempiricalevidenceandthescientificapproachto 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.,"MatrixOperation"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	RESEARCHMETHODOLOGYANDINTELLECTUAL PROPERTIES RIGHTS	L	T	P	C
		2	0	0	2

COURSEOBJECTIVES:

- 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.

UNITI	RESEARCHDESIGN	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.

UNITII	DATACOLLECTIONANDSOURCES	6

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

UNITIII	DATAANALYSISANDREPORTING	6

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

UNITIV	INTELLECTUALPROPERTYRIGHTS	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.

UNITV	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: 30PERIODS

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	ADVANCEDDATASTRUCTURESANDALGORITHMS	L	T	P	C
		3	0	0	3

COURSEOBJECTIVES:

- **Tounderstandtheusageofalgorithmsincomputing**
- **Tolearnandusehierarchicaldatastructuresandits operations**
- **Tolearntheusageofgraphsanditsapplications**
- **Toselectanddesigndatastructuresandalgorithmsthatisappropriateforproblems**
- **TostudyaboutNPCompletenessofproblems.**

UNITI	ROLEOFALGORITHMSINCOMPUTING&COMPLEXITYANALYSIS	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.

UNITII	HIERARCHICALDATASTRUCTURES	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.

UNITIII	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

UNITIV	ALGORITHMDESIGNTECHNIQUES	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.

UNITV	NPCOMPLETEANDNP 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**									

23MC4102	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

COURSEOBJECTIVES:

- 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.

UNITI	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.

UNITII	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.

UNITIII	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.

UNITIV	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.

UNITV	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

COURSEOBJECTIVES:

- 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.

UNITI	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.

UNITII	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.

UNITIII	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.

UNITIV	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.

UNITV	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	-

23MC4104	ADVANCEDDATABASETECHNOLOGY	L	T	P	C
		3	0	0	3

COURSEOBJECTIVES:

- **Tounderstandtheworkingprinciplesandqueryprocessingofdistributeddatabases.**
- **Tounderstandthebasicsofspatial,temporalandmobiledatabasesandtheirapplications.**
- **TodistinguishthedifferenttypesofNoSQLdatabases.**
- **TounderstandthebasicsofXMLandcreatewell-formedandvalidXMLdocuments.**
- **Togainknowledgeaboutinformationretrievalandwebsearch.**

UNITI	DISTRIBUTEDDATABASES	9

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

UNITII	SPATIALANDTEMPORALDATABASES	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.

UNITIII	NOSQLDATABASES	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

UNITIV	XMLDATABASES	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

UNITV	INFORMATIONRETRIEVALANDWEBSEARCH	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 PHPand Python**
2. **Createspatialdatabaseof anyplaceandperformqueryoperations**
3. **CreatingDatabasesandwritingsimplequeriesusingMongoDB,DynamoDB,Vol demortKey- 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. Performsentimentanalysisforanywebdocumentusingtextpreprocessingtechniques	
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	**ADVANCEDDATASTRUCTURESANDALGORITHMS LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

COURSEOBJECTIVES:

- **Toacquiretheknowledgeofusingadvancedtreestructures**
- **Tolearntheusageofheapstructures**
- **Tounderstandtheusageofgraphstructuresandspanningtrees**
- **Tounderstandtheproblemssuchasmatrixchainmultiplication,activityselectionand Huffman coding**
- **Tounderstandthenecessarymathematicalabstractiontosolveproblems.**

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-bitOpensourceLinuxoritsderivative
SOFTWARE: : OpenSourceC++ProgrammingtoollikeG++/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**									

23MC4112	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSEOBJECTIVES:

- To acquire the knowledge of fundamental object-oriented programming concepts
- To learn the usage of key OOP principles
- To understand the creation and usage of interfaces, abstract classes, and packages
- To understand exception handling, multithreading, and file handling mechanisms
- To develop the ability to design and implement interactive applications.

PRACTICALS :

1. Write a Java program to display Names, Roll No., and grade of 3 students who have appeared in the examination. Declare the class of name, roll no., and grade. Create an array of class objects. Read and display the contents of the array.
2. Write a Java program to demonstrate constructor overloading by creating an Employee class with multiple constructors to initialize employee details in different ways and display them.
3. Develop a Java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10% of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area() that prints the area of the given shape.
5. Write a Java program using packages and sub-packages where university. Student contains a Student class and university. Faculty contains a Professor class. Create objects in the main program and display their details.
6. Wrie a Java program to create an interface Shape with the getArea() method. Create three classes Rectangle, Circle, and Triangle that implement the Shape interface. Implement the Shape interface. Implement the getArea() method for each of the three classes.
7. Write a Java program to create and use a custom exception InvalidAgeException for student registration validation.
8. Write a Java program that implements a multi-threaded application that has three threads. The first thread generates a random integer every 1 second and if the value if even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
9. Write a Java program to create an ArrayList of Employee objects (id, name, salary) and display employees with salary>50,000.
10. Write a Java program to read a text file and count the number of words and lines.
11. Write a Java program to design a login form using FlowLayout with JLabel, JTextField, and JButton.
12. Write a Java Swing program to create a form with JTextField, JTextArea, and JButton for submittin

	TOTAL: 60 PERIODS
LABORATORY REQUIREMENT:	
HARDWARE : 64-bit Open-source Linux system or its derivative **SOFTWARE: : Open-source Java Development Kit (JDK 8 or above) and Open-source Java programming tools such as Javac/Java or OpenJDK**	
COURSE OUTCOMES:	
After completion of the course, the students will be able to:	
CO1:	**Understand and apply the fundamental concepts of object-oriented programming such as classes, objects, methods, and constructors.**
CO2:	**Implement key OOP principles—encapsulation, inheritance, polymorphism, and abstraction—to develop modular and reusable applications.**
CO3:	**Design and develop Java programs using interfaces, abstract classes, and packages for improved code organization and maintainability.**
CO4:	**Apply exception handling, multithreading, and file operations to build robust and efficient Java applications.**
CO5:	**Develop graphical user interface (GUI) applications using AWT/Swing components to enhance user interaction and application usability.**
REFERENCES:	
1	**E. Balagurusamy, *"Programming with Java – A Primer"*, Tata McGraw Hill, 5th Edition.**
2	**Y. Daniel Liang, *"Introduction to Java Programming"*, Pearson Education, 10th Edition.**
3	**https://docs.oracle.com/javase/tutorial/**
4	**https://www.javatpoint.com/java-tutorial**
5	**https://www.geeksforgeeks.org/java/**

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	COMMUNICATIONSKILLSENHANCEMENT–I	L	T	P	C
		0	0	2	1

COURSEOBJECTIVES:

- To provide opportunities to learners to practice English and thereby make them proficient users of the language.
- Toenablelearnerstofine-tunetheirlinguisticskills(LSRW)withthehelpoftechnology.
- Toimprovetheperformanceofstudents'listening,speaking,readingandwritingskillsand 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									

SEMESTER –II

23MC4201	FULLSTACKWEBDEVELOPMENT	L	T	P	C
		3	0	0	3

COURSEOBJECTIVES:

- 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

UNITI	INTRODUCTIONTOCSSANDJAVASCRIPT	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

UNITII	SERVERSIDEPROGRAMMINGWITHNODEJS	9

IntroductiontoWeb Servers – Javascript in theDesktop 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

UNITIII	ADVANCEDNODEJSANDDATABASE	9

Introduction to NoSQL databases – MongoDB system overview - Basic querying with MongoDBshell – 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

UNITIV	ADVANCEDCLIENTSIDEPROGRAMMING	9

ReactJS:ReactDOM-JSX-Components-Properties–FetchAPI-StateandLifecycle--JS Localstorage - Events - Lifting State Up - Composition and Inheritance

UNITV	APPIMPLEMENTATIONINCLOUD	9

CloudprovidersOverview–VirtualPrivateCloud–Scaling(HorizontalandVertical)– Virtual Machines, Ethernet and Switches – Docker Container – Kubernetes

TOTAL: 45 PERIODS

SUGGESTEDACTIVITIES:

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 tothefront end. Thefrontendmust displaythe scorein aseparate neatlydesigned 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 eitherMongoDB 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. BuildasimplecalculatorappwithReact.Theusershouldbeabletoaddnumbersand 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

COURSEOBJECTIVES:

- **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.**

UNITI	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.

UNITII	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.

UNITIII	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.

UNITIV	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.

UNITV	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	CLOUDCOMPUTINGTECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSEOBJECTIVES:

- **TounderstandthebasicconceptsofDistributedsystems.**
- **TolearnaboutthecurrenttrendandbasicsofCloudcomputing.**
- **TobefamiliarwithvariousCloudconcepts.**
- **ToexposewiththeServer,Networkandstoragevirtualization.**
- **TobeawareofMicroservicesandDevOps.**

UNITI	DISTRIBUTEDSYSTEMS	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.

UNITII	BASICSOFCLOUDCOMPUTING	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.

UNITIII	CLOUDINFRASTRUCTURE	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.

UNITIV	CLOUDENABLINGTECHNOLOGIES	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.		
UNITV	**MICROSERVICESANDDEVOPS**	**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		
SUGGESTEDACTIVITIES:		
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	MOBILEAPPLICATIONDEVELOPMENT	L	T	P	C
		3	0	2	4

COURSEOBJECTIVES:

- 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.

UNITI	INTRODUCTION	15

MobileApplicationModel–Infrastructureand ManagingResources– MobileDeviceProfiles–Frameworks and Tools

- Installation of necessary components and software

UNITII	USERINTERFACE	15

GenericUIDevelopment-MultimodalandMultichannelUI–GestureBasedUI–Screen Elements and Layouts – Voice XML.

Lab Component:

i. ImplementmobileapplicationsusingUItoolkitsandframeworks.
ii. DesignanapplicationthatusesLayoutManagersandeventlisteners

UNITIII	APPLICATIONDESIGN	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. Designamobileapplicationthatisawareoftheresourceconstraintsofmobiledevices.
ii. DesignanapplicationthatusesDynamicLinking

UNITIV	MOBILEOS	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. Implementanandroidapplicationthatwritesdataintothe SDcard.

UNITV	APPLICATIONDEVELOPMENT	15

CommunicationviatheWeb–NotificationandAlarms–GraphicsandMultimedia:Layer Animation, Event handling and Graphics services – Telephony – Location based services

Lab Component:

i. Developawebbasedmobileapplicationthataccessesinternetandlocationdata.
ii. Developanandroidapplicationusingtelephonytosend SMS.

	TOTAL: 75 PERIODS
SOFTWAREREQUIREMENTS **JDK,ECLIPSEIDE/equivalent,ANDROIDSTUDIO**	
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	**ZigurdMednieks, 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

COURSEOBJECTIVES:

- 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.

UNITI	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.

UNITII	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.

UNITIII	DISTRIBUTED RESOURCE MANAGEMENT	9

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

UNITIV	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.

UNITV	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	FULLSTACKWEBDEVELOPMENTLABORATORY	L	T	P	C
		0	0	4	2

COURSEOBJECTIVES:

- **Toimplementtheclientsideofthewebapplicationusingjavascript.**
- **TounderstandJavascriptonthedesktopusingNodeJS.**
- **TodevelopawebapplicationusingNodeJSandExpress.**
- **ToimplementaSPAusingReact.**
- **TodevelopafullstacksinglepageapplicationusingReact,NodeJS,andaDatabase (MongoDB or SQL).**

PRACTICALS :

1. **Createaformandvalidatethecontentsoftheformusing 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. **Createacounterusing 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. **CreateadockercontainerthatwilldeployaNodeJSpingserverusingtheNodeJSimage.**

TOTAL: 60 PERIODS

LABORATORY REQUIREMENT:

1. **NodeJS/ExpressJS,ReactJS,Docker, any IDElike NOTEPAD++/visualstudiocode/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	COMMUNICATIONSKILLSENHANCEMENT–II	L	T	P	C
		0	0	2	1

COURSEOBJECTIVES:

- **Toprovideopportunitiestolearnerstopracticetheircommunicationskillstomakethem become proficient users of English.**
- **To enable learners to fine-tune their linguistic skills (LSRW) with the help of Technology tocommunicate globally.**
- **To enhance the performance of learners at placement interviews and group discussions and other recruitment procedures**

1. **Soft Skills**
   - **Peopleskills**
   - **Interpersonalskills**
   - **Teambuildingskills**
   - **Leadershipskills**
   - **Problemsolvingskills**
2. **Presentation Skills**
   - **Preparingslideswithanimationrelatedtothetopic**
   - **Introducingoneselftotheaudience**
   - **Introducingthetopic**
   - **Presentingthevisualseffectively–5minutepresentation**
3. **Group Discussion Skills**
   - **Participatingingroupdiscussions**
   - **Brainstormingthetopic**
   - **ActivitiestoimproveGDskills.**
4. **Interview Skills**
   - **Interviewetiquette–dresscode–bodylanguage**
   - **Attendingjobinterviews**
   - **Answeringquestionsconfidently**
   - **Technicalinterview–telephone/Skypeinterview**
   - **Emotionalandculturalintelligence**
   - **StressInterview**

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 & MACHINELEARNING	L	T	P	C
		3	0	0	3

COURSEOBJECTIVES:

- To gain knowledge on foundations of AI, machine learning and apply suitable dimensionality reduction techniques for an application
- Toselecttheappropriatemodelandusefeatureengineeringtechniques
- TogainknowledgeonProbabilityandBayesianLearningtosolvethegivenproblem
- Todesignandimplementthemachinelearningtechniquesforrealworldproblems
- Toanalyze,learnandclassifycomplexdatawithoutpredefinedmodelsalso

UNITI	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.

UNITII	MODELEVALUATIONANDFEATUREENGINEERING	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

UNITIII	BAYESIANLEARNING	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.		
UNITIV	PARAMETRICMACHINELEARNING	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		
UNITV	NONPARAMETRICMACHINELEARNING	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:45PERIODS		

SUGGESTEDACTIVITIES:

1. ExplorethesignificantstepsinvolvedindatapreprocessinginMachineLearning
2. ChooseamodelandtrainamodelinmachinelearningExplaintheapplicationofBayesTheoremandhowit'susefultopredictthefuture
3. MakethedifferencebetweensupervisedLearningandunsupervisedLearningTechniques
4. DifferentiatePerceptron,NeuralNetwork,ConvolutionalNeuralNetworkandDeep 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	EthemAlpaydin, "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 KumarDas, "Machine Learning",1stEdition, 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	INTERNETOFTHINGS	L	T	P	C
		3	0	0	3

COURSEOBJECTIVES:

- **TounderstandtheconceptsofIoTanditsworkingmodels**
- **ToknowthevariousIoT protocols**
- **TounderstandaboutvariousIoTPhysicaldevicesandEndpoints**
- **ToknowthesecurityandprivacyissuesconnectedwithIoT**
- **ToapplytheconceptofInternetofThingsinarealworldscenario.**

UNITI	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 – WirelessSensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

UNITII	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

UNITIII	IOTPHYSICALDEVICESANDENDPOINTS	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.

UNITIV	INTERNETOFTHINGSPRIVACY,SECURITYANDGOVERNANCE	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

UNITV	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:45PERIODS
SUGGESTEDACTIVITIES: 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, ArshdeepBahga 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									

23MC4303	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSEOBJECTIVES:

- 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

UNITI	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.

UNITII	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.

UNITIII	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.

UNITIV	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.

UNITV	SECURITY PRACTICE AND SYSTEM SECURITY	9

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

TOTAL:45PERIODS

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	**AtulKahate. "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 & MACHINELEARNINGLABORATORY	L	T	P	C
		0	0	4	2

COURSEOBJECTIVES:

- **Tounderstandaboutdatacleaninganddatapreprocessing**
- **TofamiliarizewiththeSupervisedLearningalgorithmsandimplementthemi npractical situations.**
- **TofamiliarizewithunsupervisedLearningalgorithmsandcarryontheimplementationpa rt.**
- **ToinvolvethestudentstopracticeMLalgorithmsandtechniques.**
- **Learntousealgorithmsforrealtimedatasets.**

LISTOFEXPERIMENTS:

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:

PythonoranyMLtoolslikeR

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	INTERNETOFTHINGS LABORATORY	L	T	P	C
		0	0	4	2

COURSEOBJECTIVES:

- Todesignapplicationstointeractwithsensors
- TodesignanddevelopIoTapplicationArduino/Raspberrypiforrealworldscenario.
- ToenablecommunicationbetweenIoTandcloudplatforms
- TodevelopapplicationsusingDjangoFramework

LISTOFEXPERIMENTS:

1. TostudyvariousIoTprotocols–6LowPAN,IPv4/IPv6,Wifi,Bluetooth,MQTT.
2. IoTApplicationDevelopmentUsingsensorsandactuators(temperaturesensor,lightsensor, infrared sensor)
3. TostudyRaspberryPidevelopmentboardandtoimplementLEDblinkingapplications.
4. TodevelopanapplicationtosendandreceivedatawithArduinousingHTTPrequest
5. To develop an application that measures the room temperature and posts the temperature value on the cloud platform.
6. Todevelopanapplicationthat measuresthemoisture of soilandpost thesenseddataover Google Firebase cloud platform.
7. Todevelopanapplicationformeasuringthedistanceusingultrasonicsensorandpost distance value on Google Cloud IoT platform
8. Developasimpleapplicationbasedonsensors.
9. DevelopIoTapplicationsusingDjangoFrameworkandFirebase/Bluemixplatform.
10. DevelopacommercialIoTapplication.

TOTAL: 60 PERIODS

LABORATORY REQUIREMENT:

1. Theuniversalmicrocontrollerdevelopmentboard
2. 8051DaughterBoard
3. RaspberryPi3B+Original
4. ArduinoDaughterBoard
5. Humidity+IRSensorInterface
6. UltrasonicSensors
7. OpensourcesoftwaresDjangoFramework
8. OpencloudarchitectureslikeBluemix,DevelopmentplatformslikeFirebase

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									