VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY, MADURAI-625009

(Autonomous)

REGULATIONS - 2021

M.E. COMPUTER SCIENCE AND ENGINEERING (CBCS)

CURRICULUM FOR SEMESTERS I TO IV

SEMESTER - I

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1	21MA121	Applied Probability and Statistics for Computer Science Engineers	FC	3	2	0	4
2.	21RM102	Research Methodology and IPR	RM	3	0	0	3
3.	21CP101	Advanced Data Structures and Algorithms	PC	3	0	0	3
4.	21NE101	Network Technologies (Common to M.E.CSE, M.E CSE (with Specialization in Networks))	PC	3	0	0	3
5.	21CP102	Principles of Programming Languages	PC	3	0	0	3
6.	21ACXXX	Audit Course – I*	AC	2	0	0	0
THEORY CUM PRACTICAL							
7.	21CP104	Database Practices (Common to M.E.CSE, M.E CSE (with Specialization in Networks))	PC	3	0	2	4
PRACTICAL							
8.	21CP103	Advanced Data Structures and Algorithms Laboratory	PC	0	0	4	2
Total Credits							**22**

SEMESTER- II

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21CP105	Internet of Things (Common to M.E.CSE, M.E CSE (with Specialization in Networks))	PC	3	0	0	3
2.	21CP106	Security Practices	PC	3	2	0	4
3.	21CP107	Machine Learning (Common to M.E.CSE, M.E CSE (with Specialization in Networks))	PC	3	2	0	4
4.	21CP108	Big Data Analytics	PC	3	2	0	4
5.	21CP109	Advanced Computer Architecture	PC	3	0	0	3
6.	21CPPXX	Professional Elective I	PE	3	0	0	3
7.	21ACXXX	Audit Course – II*	AC	2	0	0	0
PRACTICAL							

8.	21NE112	Term Paper and Seminar (Common to M.E.CSE, M.E CSE (with Specialization in Networks))	EE	0	0	2	1
9.	21CP110	Data Analytics Laboratory	PC	0	0	4	2
10.	21CP111	Machine Learning Laboratory	PC	0	0	4	2
Total Credits							**26**

SEMESTER- III

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21CPPXX	Professional Elective II	PE	3	0	0	3
2.	21CPPXX	Professional Elective III	PE	3	0	0	3
3.	21CPPXX	Professional Elective IV	PE	3	0	0	3
PRACTICAL							
4.	21CP201	Project Work (Phase-I)	EE	0	0	12	6
Total Credits							**15**

SEMESTER- IV

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
PRACTICAL							
1	21CP202	Project Work (Phase-II)	EE	0	0	24	12
Total Credits							12

TOTAL NO. OF CREDITS: 75

PROFESSIONAL ELECTIVES - II SEMESTER - ELECTIVE I

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21CPP01	Cloud Computing Technologies	PE	3	0	0	3
2.	21CPP02	Image Processing and Analysis	PE	3	0	0	3
3.	21NEP20	Web Engineering (Common to M.E.CSE, M.E CSE (with Specialization in Networks))	PE	3	0	0	3
4.	21CPP03	Real Time Systems	PE	3	0	0	3
5.	21CPP04	Software Architectures and Design	PE	3	0	0	3

PROFESSIONAL ELECTIVES – III SEMESTER - ELECTIVE II

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21NEP11	Performance Analysis of Computer Systems	PE	3	0	0	3
2.	21CPP05	Language Technologies	PE	3	0	0	3
3.	21CPP06	Computer Vision	PE	3	0	0	3
4.	21CPP07	Software Quality Assurance and Testing	PE	3	0	0	3
5.	21NEP24	Social Network Analysis	PE	3	0	0	3

PROFESSIONAL ELECTIVES – III SEMESTER - ELECTIVE III

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21CPP08	Formal models of software Systems	PE	3	0	0	3
2.	21CPP09	Embedded Software Development	PE	3	0	0	3
3.	21CPP10	Bio-inspired Computing	PE	3	0	0	3
4.	21CPP11	Compiler Optimization Techniques	PE	3	0	0	3
5.	21CMP13	Speech Processing and Synthesis (Common to M.E. CS, M.E.CSE, M.E CSE (with Specialization in Networks))	PE	3	0	0	3

PROFESSIONAL ELECTIVES - III SEMESTER - ELECTIVE IV

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21CPP12	Data Visualization Techniques	PE	3	0	0	3
2.	21CPP13	Reconfigurable Computing	PE	3	0	0	3
3.	21NEP18	Mobile Application Development (Common to M.E.CSE, M.E CSE (with Specialization in Networks))	PE	3	0	0	3
4.	21CPP14	Bio Informatics	PE	3	0	0	3
5.	21CPP15	Information Storage Management	PE	3	0	0	3

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

S. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	21AC101	English for Research Paper Writing	2	0	0	0
2.	21AC102	Constitution of India	2	0	0	0
3.	21AC103	Disaster Management	2	0	0	0

SEMESTER-WISE CREDIT DISTRIBUTION

	I SEM	II SEM	III SEM	IV SEM	Total Credits
FC	**4**	**-**	**-**	**-**	**4**
PC	**15**	**22**	**-**	**-**	**37**
PE	**-**	**3**	**9**	**-**	**12**
EE	**-**	**1**	**6**	**12**	**19**
RM	**3**	**-**	**-**	**-**	**3**
Total	**22**	**26**	**15**	**12**	**75**

S.No	Topic
FC	Foundation Course (FC)
PC	Professional Core Courses (PC)
PE	Professional Electives : Courses relevant to chosen specialization / branch (PE)
EE	Project Work, Seminar and Internship in Industry – Employability Enhancement Courses (EE)
RM	Research Methodology (RM)

21MA121	APPLIED PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE ENGINEERS (*Common to M.E (CSE)&M.E(CSE with Network Specialization*))	L	T	P	C
		3	2	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.
- 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 – Baye's 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:

At the end of the course, learners 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 dimensional 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",vol 42, Thomson and Duxbury press, Singapore, 1998.
2. Richard A. Johnson and Dean W. Wichern, "Applied multivariate statistical Analysis", 6th Edition, Pearson Education, New Delhi, 2013.
3. Bronson, R.,"Matrix Operation", Schaum's outline series, 2nd Edition ,Tata McGraw Hill, New York, 2011.
4. Oliver C. Ibe, "Fundamentals of Applied probability and Random Processes", 2nd Edition, Academic Press, Boston, 2014.
5. Johnson R. A. and Gupta C.B., "Miller and Freund's Probability and Statistics for Engineers", 9th Edition, Pearson India Education, Asia, New Delhi, 2017.

21RM102	**RESEARCH METHODOLOGY AND IPR** *(Common to M.E (Manufacturing Engineering), M.E (Computer Science Engineering), M.E. (Power Systems))*	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To impart knowledge of collecting data for carrying out research work effectively.
- To enable the students to use optimization technique for problem solving.
- To impart decision making skills using statistical tool.
- To gain exposure to write research reports.
- To impart knowledge about the procedure for filing patents and protecting intellectual property rights.

UNIT I	**FUNDAMENTALS AND DATA COLLECTION**	**9**

Research methodology - definition, COURSE OBJECTIVES, mathematical tools for analysis, Research design. Types of research, exploratory research, conclusive research, modelling research, algorithmic research, Research process- steps. Data collection methods- Primary data – observation method, personal interview, telephonic interview, mail survey, questionnaire design.

UNIT II	**HYPOTHESES TESTING AND ANALYSIS**	**9**

Hypotheses testing – Testing of hypotheses concerning means, concerning variance – one tailed Chi-square test. Introduction to Discriminant analysis, Factor analysis, cluster analysis, multidimensional scaling, conjoint analysis.

UNIT III	**REPORT WRITING AND PRESENTATION**	**9**

Report writing- Types of report, guidelines to review report, report format, typing instructions, oral presentation, power point presentation, Data analysis using excel sheet, Proposal submission for funding agencies. Plagiarism, tools to avoid plagiarism, research ethics.

Case study: (Use software) report format, Prepare review paper, Reference formation end note, Grammar verification, Sample plagiarism report using Urkund/ Turnitin.

UNIT IV	**PATENT RIGHTS**	**9**

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc.

UNIT V	NATURE OF INTELLECTUAL PROPERTY	9

Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Understand the fundamental search concepts and data collection methods for conducting Research work.

CO2: Experiment the test hypothesis and analyze the outcome

CO3: Report the research work and write research proposals for various funding agencies.

CO4: Analyze the procedure for filing patent rights, licensing and transfer of technology.

CO5: Analyze the nature of intellectual property

REFERENCES:

1. Ranjith Kumar, "Research Methodology", 4th Edition, SAGE publication, 2018.
2. Robert Coe, Michael Waring, Larry V Hadges, James Arthur, "Research Method and Methodology in Education", 2nd Edition, SAGE Publication, 2017.
3. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age, 3rd Edition, 2016.
4. T. Ramappa, "Intellectual Property Rights Under WTO", 3rd Edition, Asia Law house, 2022.

21CP101	ADVANCED DATA STRUCTURES AND ALGORITHMS *(Common to M.E.CSE, M.E CSE (with Specialization in Networks)*	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.

TOPICS TO BE COVERED

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

COURSE OUTCOMES::

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

21NE101	NETWORK TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts of networks
- To explore various technologies in the wireless domain
- To study about 4G and 5G cellular networks
- To understand the paradigm of Software defined networks
- To learn about Network Function Virtualization

UNIT I	NETWORKING CONCEPTS	9

Peer To Peer Vs Client-Server Networks. Network Devices. Network Terminology. Network Speeds. Network throughput, delay. OSI Model. Packets, Frames, And Headers. Collision And Broadcast Domains. LAN Vs WAN. Network Adapter. Hub. Switch. Router. Firewall,

IP addressing.

UNIT II	WIRELESS NETWORKS	9

Wireless access techniques- IEEE 802.11a, 802.11g, 802.11e, 802.11n/ac/ax/ay/ba/be, QoS – Bluetooth – Protocol Stack – Security – Profiles – zigbee

UNIT III	MOBILE DATA NETWORKS	9

4G Networks and Composite Radio Environment – Protocol Boosters – Hybrid 4G Wireless Networks Protocols – Green Wireless Networks – Physical Layer and Multiple Access – Channel Modeling for 4G – Concepts of 5G – channel access –air interface -Cognitive Radio-spectrum management – C-RAN architecture - Vehicular communications-protocol – Network slicing – MIMO, mmWave, Introduction to 6G.

UNIT IV	SOFTWARE DEFINED NETWORKS	9

SDN Architecture. Characteristics of Software-Defined Networking. SDN- and NFV-Related Standards. SDN Data Plane. Data Plane Functions. Data Plane Protocols. OpenFlow Logical Network Device. Flow Table Structure. Flow Table Pipeline. The Use of Multiple Tables. GroupTable. OpenFlow Protocol. SDN Control Plane Architecture. Control Plane Functions. Southbound Interface. Northbound Interface. Routing. ITU-T Model. OpenDaylight. OpenDaylight Architecture. OpenDaylight Helium. SDN Application Plane Architecture. Northbound Interface. Network Services Abstraction Layer. Network Applications. User Interface.

UNIT V	NETWORK FUNCTIONS VIRTUALIZATION	9

Motivation-Virtual Machines –NFV benefits-requirements – architecture- NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration- NFV Use Cases- NFV and SDN –Network virtualization – VLAN and VPN

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Understand the networking concepts.

CO2: Understand various technologies in wireless domain

CO3: Classify 4G and 5G networks

CO4: Interpret the paradigm of Software defined networks.

CO5: Understand about Network Function Virtualization.

REFERENCES:

1. James Bernstein, "Networking made Easy", 2018. (UNIT I)
2. HoudaLabiod, Costantino de Santis, HossamAfifi –"Wi-Fi, Bluetooth, Zigbee and WiMax", Springer 2007. (UNIT 2)
3. Erik Dahlman, Stefan Parkvall, Johan Skold, ―4G: LTE/LTE-Advanced for Mobile Broadband, Academic Press, 2013. (UNIT 3)
4. Saad Z. Asif – "5G Mobile Communications Concepts and Technologies" CRC press – 2019 (UNIT 3)
5. William Stallings –"Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud" 1st Edition, Pearson Education, 2016.(Unit 4 and 5)
6. Thomas D.Nadeau and Ken Gray, "SDN – Software Defined Networks",O"Reilly Publishers,

2013.
7. Guy Pujolle, "Software Networks", 2nd Edition, Wiley-ISTE, 2020.

21CP102	PRINCIPLES OF PROGRAMMING LANGUAGES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand and describe syntax and semantics of programming languages
- To understand data, data types, and basic statements
- To understand call-return architecture and ways of implementing them
- To understand object-orientation, concurrency, and event handling in programming languages
- To understand functional and logic programming languages

TOPICS TO BE COVERED

UNIT I	**SYNTAX AND SEMANTICS**	**9**
Evolution of programming languages – describing syntax – context – free grammars –attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom- up parsing		
UNIT II	**DATA, DATA TYPES, AND BASIC STATEMENTS**	**9**
Names – variables – binding – type checking – scope – scope rules – lifetime and garbage collection –primitive data types–strings–array types– associative arrays–record types– union types – pointers and references – Arithmetic expressions – overloaded operators – type conversions – relational and Boolean expressions – assignment statements – mixed- mode assignments – control structures – selection – iterations – branching – guarded statements		
UNIT III	**SUBPROGRAMS AND IMPLEMENTATIONS**	**9**
Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions – semantics of call and return – implementing simple subprograms – stack and dynamic local variables – nested subprograms – blocks – dynamic scoping		
UNIT IV	**OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING**	**9**
Object-orientation – design issues for OOP languages – implementation of object-oriented constructs – concurrency – semaphores – monitors – message passing – threads – statement level concurrency – exception handling – event handling		
UNIT V	**FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES**	**9**
Introduction to lambda calculus – fundamentals of functional programming languages – Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming with Prolog – multi-paradigm languages		
		TOTAL: 45 PERIODS

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Describe syntax and semantics of programming languages

CO2: Explain data, data types, and basic statements of programming languages

CO3: Design and implement subprogram constructs

CO4: Apply object-oriented, concurrency, and event handling programming constructs

CO5: Develop programs in Scheme, ML, and Prolog

REFERENCES:

R1. Robert W. Sebesta, "Concepts of Programming Languages", 11th Edition, Addison Wesley 2012.

R2.W. F. Clocksin and C. S. Mellish, "Programming in Prolog: Using the ISO Standard", 5th Edition, Springer, 2003.
R3. Michael L.Scott, "Programming Language Pragmatics", 4th Edition, Morgan Kaufmann, 2009.
R4. R.Kent Dy bvig," The Scheme programming language", 4th Edition, MITPress, 2009.

21CP103	ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY *(Common to M.E.CSE, M.E CSE (with Specialization in Networks))*	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

LIST OF EXPERIMENTS:

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

HARDWARE/SOFTWARE REQUIREMENTS

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

TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners 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", 3rd Edition, Tata McGraw Hill, 2014.

2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", 3rd Edition, Pearson Education, Reprint 2006.

21CP104	DATABASE PRACTICES *(Common to M.E.CSE, M.E CSE (with Specialization in Networks)*	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To describe the fundamental elements of relational database management systems
- To understand query processing in a distributed database system
- To understand the basics of XML and create well-formed and valid XML documents.
- To distinguish the different types of NoSQL databases
- To understand the different models involved in database security and their applications in real time world to protect the database and information associated with them.

TOPICS TO BE COVERED

UNIT I	RELATIONAL DATA MODEL	12

Entity Relationship Model – Relational Data Model – Mapping Entity Relationship Model To Relational Model – Relational Algebra – Structured Query Language – Database normalization

Suggested Activities:

Data Definition Language

- Create, Alter and Drop
- Enforce Primary Key, Foreign Key, Check, Unique and Not Null Constraints
- Creating Views

Data Manipulation Language

- Insert, Delete, Update
- Cartesian Product, Equi Join, Left Outer Join, Right Outer Join and Full Outer Join
- Aggregate Functions
- Set Operations
- Nested Queries

Transaction Control Language

Commit, Rollback and Save Points

UNIT II	DISTRIBUTED DATABASES, ACTIVE DATABASES AND OPEN DATABASECONNECTIVITY	12

Distributed Database Architecture – Distributed Data Storage – Distributed Transactions – Distributed Query Processing – Distributed Transaction Management – Event Condition Action Model – Design and Implementation Issues for Active Databases – Open Database Connectivity.

Suggested Activities:

- Distributed Database Design and Implementation
- Row Level and Statement Level Triggers
- Accessing a Relational Database using PHP, Python and R

UNIT III	XML DATABASES	12

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

Suggested Activities:

- Creating XML Documents, Document Type Definition and XML Schema
- Using a Relational Database to store the XML documents as text
- Using a Relational Database to store the XML documents as data elements
- Creating or publishing customized XML documents from pre-existing relational databases
- Extracting XML Documents from Relational Databases XML Querying

UNIT IV	**NOSQL DATABASES AND BIG DATA STORAGE SYSTEMS**	**12**

NoSQL – Categories of NoSQL Systems – CAP Theorem – Document-Based NoSQL Systems and MongoDB – MongoDB Data Model – MongoDB Distributed Systems Characteristics – NoSQL Key-Value Stores – DynamoDB Overview – Voldemort Key-Value Distributed Data Store – Wide Column NoSQL Systems – Hbase Data Model – Hbase Crud Operations – Hbase Storage and Distributed System Concepts – NoSQL Graph Databases and Neo4j – Cypher Query Language of Neo4j – Big Data – MapReduce – Hadoop – YARN

Suggested Activities:

- Creating Databases using MongoDB, DynamoDB, Voldemort Key-Value Distributed DataStore Hbase and Neo4j.
- Writing simple queries to access databases created using MongoDB, DynamoDB,Voldemort Key-Value Distributed Data Store Hbase and Neo4j.

UNIT V	**DATABASE SECURITY**	**12**

Database Security Issues – Discretionary Access Control Based on Granting and Revoking Privileges – Mandatory Access Control and Role-Based Access Control for Multilevel Security – SQL Injection – Statistical Database Security – Flow Control – Encryption and Public Key Infrastructures – Preserving Data Privacy – Challenges to Maintaining Database Security – Database Survivability – Oracle Label-Based Security

Suggested Activities:

Implementing Access Control in Relational Databases

TOTAL:60 PERIODS

COURSE OUTCOMES

At the end of the course, learners will be able to

CO1: Convert the ER-model to relational tables, populate relational databases and formulate SQL queries on data.

CO2: Understand and write well-formed XML documents

CO3: Be able to apply methods and techniques for distributed query processing.

CO4: Design and Implement secure database systems.

CO5: Use the data control, definition, and manipulation languages of the NoSQL databases

REFERENCES:

1. R.Elmasri, S.B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2016.
2. Henry F. Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", 7th Edition, McGraw Hill, 2019.
3. C.J. Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems, 8th Edition, Pearson Education, 2006.
4. Raghu Ramakrishnan, Johannes Gehrke "Database Management Systems", 4th Edition, McGraw Hill Education, 2015.
5. Harrison, Guy, "Next Generation Databases, NoSQL and Big Data", 1st Edition,

Apress publishers, 2015.
6. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design,Implementation and Management", 6th Edition, Pearson Education, 2015.

21CP105	INTERNET OF THINGS *(Common to M.E.CSE, M.E CSE (with Specialization in Networks))*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of Internet of Things
- To understand the different architecture of IoT
- To learn about the basics of IOT protocols
- To build a small low-cost embedded system using Raspberry Pi.
- To apply the concept of Internet of Things in the real-world scenario.

TOPICS TO BE COVERED

UNIT I	**INTRODUCTION TO IoT**	**9**

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

UNIT II	**IoT ARCHITECTURE**	**9**

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

UNIT III	**IoT PROTOCOLS**	**9**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP - Security

UNIT IV	**BUILDING IoT WITH RASPBERRY PI & ARDUINO**	**9**

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

UNIT V	**CASE STUDIES AND REAL-WORLD APPLICATIONS**	**9**

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

TOTAL:45 PERIODS

COURSE OUTCOMES::

At the end of the course, learners will be able to
CO1: Analyze various protocols for IoT
CO2: Develop web services to access/control IoT devices.
CO3: Design a portable IoT using Rasperry Pi and Arduino.
CO4: Deploy an IoT application and connect to the cloud.
CO5: Analyze applications of IoT in real time scenario.

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach,

Universities Press, 2015.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), Architecting the Internet of Things, Springer, 2011.
3. Honbo Zhou, ―The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2012.
4. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things - Key applications and Protocols‖, Wiley, 2012.

21CP106	SECURITY PRACTICES	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

- To learn the core fundamentals of system and web security concepts
- To have through understanding in the security concepts related to networks
- To deploy the security essentials in IT Sector
- To be exposed to the concepts of Cyber Security and encryption Concepts
- To perform a detailed study of Privacy and Storage security and related Issues.

TOPICS TO BE COVERED

UNIT I	**SYSTEM SECURITY**	**9**

Building a secure organization- A Cryptography primer- detecting system Intrusion Preventing system Intrusion- Fault tolerance and Resilience in cloud computing environments- Security web applications, services and servers.

UNIT II	**NETWORK SECURITY**	**9**

Internet Security - Botnet Problem- Intranet security- Local Area Network Security - Wireless Network Security - Wireless Sensor Network Security- Cellular Network Security Optical Network Security- Optical wireless Security

UNIT III	**SECURITY MANEGEMENT**	**9**

Information security essentials for IT Managers- Security Management System - Policy Driven System Management- IT Security - Online Identity and User Management System - Intrusion and Detection and Prevention System

UNIT IV	**CYBER SECURITY AND CRYPTOGRAPHY**	**9**

Cyber Forensics- Cyber Forensics and Incidence Response - Security e-Discovery - Network Forensics - Data Encryption- Satellite Encryption - Password based authenticated Key establishment Protocols.

UNIT V	**PRIVACY AND STORAGE SECURITY**	**9**

Privacy on the Internet - Privacy Enhancing Technologies - Personal privacy Policies - Detection of Conflicts in security policies- privacy and security in environment monitoring systems. Storage Area Network Security - Storage Area Network Security Devices - Risk management - Physical Security Essentials.

TOTAL: 45 PERIODS

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Understand the core fundamentals of system security
CO2: Apply the security concepts related to networks in wired and wireless scenario
CO3: Implement and Manage the security essentials in IT Sector
CO4: Able to explain the concepts of Cyber Security and encryption Concepts

CO5: Able to attain a thorough knowledge in the area of Privacy and Storage security and related Issues.
REFERENCES: 1. John R.Vacca, Computer and Information Security Handbook, 2nd Edition, Elsevier 2013. 2. Michael E. Whitman, Herbert J. Mattord, Principal of Information Security, 4th Edition, Cengage Learning, 2012. 3. Richard E.Smith, Elementary Information Security, 2nd Edition, Jones and Bartlett Learning, 2016.

21CP107	**MACHINE LEARNING** *(Common to M.E.CSE, M.E CSE (with Specialization in Networks))*	**L**	**T**	**P**	**C**
		3	**2**	**0**	**4**

COURSE OBJECTIVES:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques
- To study the various probability-based learning techniques
- To understand dimensionality reduction and evolutionary models
- To understand graphical models of machine learning algorithms

TOPICS TO BE COVERED

UNIT I	**INTRODUCTION**	**9**

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression

UNIT II	**LINEAR MODELS**	**9**

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

UNIT III	**TREE AND PROBABILISTIC MODELS**	**9**

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map

UNIT IV	**DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS**	**9**

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process

UNIT V	**GRAPHICAL MODELS**	**9**

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov

Models – Tracking Methods

TOTAL: 45 PERIODS

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Distinguish between supervised, unsupervised and semi-supervised learning.

CO2: Apply the appropriate machine learning strategy for any given problem.

CO3: Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem.

CO4: Design a system that uses the appropriate graph models of machine learning.

CO5: Modify existing machine learning algorithms to improve classification efficiency

REFERENCES:

1. Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series) 3rd Edition, MIT Press, 2014 .
2. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals‖, 1st Edition, Wiley, 2014 .
3. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data, 1st Edition, Cambridge University Press, 2012.
4. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective, 2nd Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
5. Tom M Mitchell, ―Machine Learning‖, 1st Edition, McGraw Hill Education, 2013.

21CP108	BIG DATA ANALYTICS	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

- To understand the competitive advantages of big data analytics
- To understand the big data frameworks
- To learn data analysis methods
- To learn stream computing
- To gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytic

TOPICS TO BE COVERED

UNIT I	INTRODUCTION TO BIG DATA	12

Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools.

UNIT II	HADOOP FRAMEWORK	12

Distributed File Systems - Large-Scale FileSystem Organization – HDFS concepts - MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN

UNIT III	DATA ANALYSIS	12

Statistical Methods: Regression modelling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics – Data analysis using R.

UNIT IV	MINING DATA STREAMS	12

Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time-series data - Real Time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

UNIT V	BIG DATA FRAMEWORKS	12

Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples. Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data Types and File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries

TOTAL: 60 PERIODS

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Understand how to leverage the insights from big data analytics
CO2: Understand the basics of Hadoop Framework
CO3: Analyze data by utilizing various statistical and data mining approaches
CO4: Perform analytics on real-time streaming data
CO5: Understand the various NoSql alternative database models

REFERENCES:

1. Bill Franks, ―Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics‖, Wiley and SAS Business Series, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
3. Michael Berthold, David J. Hand, ―Intelligent Data Analysis‖, 2nd Edition, Springer, 2007.
4. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
6. Richard Cotton, "Learning R – A Step-by-step Function Guide to Data Analysis, , O'Reilly Media, 2013.

21CP109	ADVANCED COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the students to the recent trends in the field of Computer Architecture and identify performance related parameters.
- To understand the memory hierarchy design
- To learn the different multiprocessor issues.
- To expose the different types of multicore architectures.
- To understand the design of the memory hierarchy.

TOPICS TO BE COVERED

UNIT I	FUNDAMENTALS OF COMPUTER DESIGN AND ILP	9

Fundamentals of Computer Design – Measuring and Reporting Performance – Instruction Level Parallelism and its Exploitation – Concepts and Challenges –Exposing ILP - Advanced Branch Prediction - Dynamic Scheduling - Hardware-Based Speculation - Exploiting ILP - Instruction Delivery and Speculation - Limitations of ILP – Multithreading

UNIT II	MEMORY HIERARCHY DESIGN	9

Introduction – Optimizations of Cache Performance – Memory Technology and Optimizations

– Protection: Virtual Memory and Virtual Machines – Design of Memory Hierarchies – Case Studies.

UNIT III	MULTIPROCESSOR ISSUES	9

Introduction- Centralized, Symmetric and Distributed Shared Memory Architectures –Cache Coherence Issues – Performance Issues – Synchronization – Models of Memory Consistency – Case Study-Interconnection Networks – Buses, Crossbar and Multi-stage Interconnection Networks.

UNIT IV	MULTICORE ARCHITECTURES	9

Homogeneous and Heterogeneous Multi-core Architectures – Intel Multicore Architectures – SUN CMP architecture – IBM Cell Architecture. Introduction to Warehouse-scale computers-Architectures- Physical Infrastructure and Costs- Cloud Computing –Case Study- Google Warehouse-Scale Computer

UNIT V	VECTOR, SIMD AND GPU ARCHITECTURES	9

Introduction-Vector Architecture – SIMD Extensions for Multimedia – Graphics Processing Units – Case Studies – GPGPU Computing – Detecting and Enhancing Loop Level Parallelism-Case Studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Identify the limitations of ILP.

CO2: Discuss the issues related to multiprocessing and suggest solutions

CO3: Point out the salient features of different multicore architectures and how they exploit parallelism.

CO4: Discuss the various techniques used for optimizing the cache performance

CO5: Point out how data level parallelism is exploited in architectures

REFERENCES:

1. Darryl Gove, ―Multicore Application Programming: For Windows, Linux, and Oracle Solaris‖, Pearson, 2011.
2. David B. Kirk, Wen-mei W. Hwu, ―Programming Massively Parallel Processors‖, Morgan Kauffman, 2013.
3. David E. Culler, Jaswinder Pal Singh, ―Parallel computing architecture: A hardware/software approach, Morgan Kaufmann /Elsevier Publishers, 1999.
4. John L. Hennessey and David A. Patterson, ―Computer Architecture – A Quantitative Approach‖, Morgan Kaufmann / Elsevier, 5th edition, 2012.
5. Kai Hwang and Zhi.WeiXu, ―Scalable Parallel Computing‖, Tata McGraw Hill, New Delhi, 2003.

21NE108	TERM PAPER AND SEMINAR *(Common to M.E.CSE, M.E.CSE (with Specialization in Networks))*	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

In this course, students will develop their scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtaininformation from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic
2. Stating an objective.
3. Collecting the relevant bibliography (atleast 15 journal papers)
4. Preparing a working outline.
5. Studying the papers and understanding the authors contributions and critically analysing eachpaper.

6. Preparing a working outline
7. Linking the papers and preparing a draft of the paper.
8. Preparing conclusions based on the reading of all the papers.
9. Writing the Final Paper and giving final Presentation

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic Stating an Objective	You are requested to select an area ofinterest, topic and state an objective	2nd week	**3 %** Based on clarity of thought, current relevance and clarity in writing
Collecting Information about your area & topic	1. List 1 Special Interest Groups or professional society 2. List 2 journals 3. List 2 conferences, symposia or workshops 4. List 1 thesis title 5. List 3 web presences (mailing lists,forums, news sites) 6. List 3 authors who publish regularly inyour area 7. Attach a call for papers (CFP) from your area.	3rd week	**3%** (the selected information must bearea specific and of international and national standard)
Collection of Journal papers in the topic in the context of the objective – collect 20 & then filter	• You have to provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar • When picking papers to read - try to: • Pick papers that are related to eachother in some ways and/or that are in the same field so that you can write a meaningful survey out of them,	4th week	**6%** (the list of standard papers and reason forselection)

	• Favour papers from well-known journals and conferences, • Favour ―first or ―foundational‖ papers in the field (as indicated in other people's survey paper), • Favour more recent papers, • Pick a recent survey of the field so you can quickly gain an overview, • Find relationships with respect to each other and to your topic area (classification scheme/categorization) • Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered		
Reading and notes for first 5 papers	Reading Paper Process • For each paper form a Table answering the following questions: • What is the main topic of the article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • How does the work build on other's work, in the author's opinion? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author	5th week	8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)

	say were the important directions for future research? Conclude with limitations/issues not addressed by the paper (from the perspective of your survey)		
Reading and notes for next5 papers	Repeat Reading Paper Process	6th week	8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
Reading and notes for final 5 papers	Repeat Reading Paper Process	7th week	8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
Draft outline 1 and Linking papers	Prepare a draft Outline, your survey goals, along with a classification / categorization diagram	8th week	8% (this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstract and give a presentation	9th week	6% (Clarity, purpose and conclusion) 6% Presentation & Viva Voce
Introduction Background	Write an introduction and background sections	10th week	5% (clarity)
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11thweek	10% (this component will be evaluated based on the linking and classification among the papers)
Your conclusions	Write your conclusions and future work	12th week	5% (conclusions – clarity and your ideas)
Final Draft	Complete the final draft of your paper	13th week	10% (formatting, English, Clarity and linking) 4% Plagiarism Check Report
Seminar	A brief 15 slides on your paper	14th & 15th week	10% (based on presentation and Viva- voce**)**

21CP110	DATA ANALYTICS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES::

- To implement Map Reduce programs for processing big data
- To realize storage of big data using H base, Mongo DB
- To analyse big data using linear models
- To analyse big data using machine learning techniques such as SVM / Decision tree classification and clustering
- To implement clustering techniques

LIST OF EXPERIMENTS

Hadoop

1. Install, configure and run Hadoop and HDFS
2. Implement word count / frequency programs using MapReduce
3. Implement an MR program that processes a weather dataset

R

4. Implement Linear and logistic Regression
5. Implement SVM / Decision tree classification techniques
6. Implement clustering techniques
7. Visualize data using any plotting framework
8. Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R.

TOTAL: 60 PERIODS

COURSE OUTCOMES::

At the end of the course, learners will be able to
CO1: Process big data using Hadoop framework
CO2: Build and apply linear and logistic regression models
CO3: Perform data analysis with machine learning methods
CO4: Build and apply clustering techniques
CO5: Perform graphical data analysis

LIST OF SOFTWARE FOR A BATCH OF 30 STUDENTS:

Hadoop/YARN/R Package/ Hbase /MongoDB

21CP111	MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES::

- To enable the students to use optimization technique for problem solving.
- To impart decision making skills using statistical tool.
- To apply back propagation algorithm
- To implement clustering algorithm.
- To apply reinforcement learning for developing a game

LIST OF EXPERIMENTS

1. 1. Study and usage of python and R tool.
2. Study of Python Libraries for ML application such as Statistics, Math, Numpy, Scipy,Pandas and Matplotlib.
3. Write a Python program to implement Simple Linear Regression.
4. Implementation of Multiple Linear Regression for House Price Prediction using sklearn.
5. Implementation of Decision tree using sklearn and its parameter tuning.
6. Implementation of KNN using sklearn.
7. Implementation of Logistic Regression using sklearn.
8. Write a program to construct a Bayesian network considering medical data.Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
9. Implement the FIND-S algorithm. Verify that it successfully produces the trace in for the Enjoy sport example.
10. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate datasets.
11. Implementation of K-Means Clustering.
12. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Mean‟s algorithm. Compare the results of these two algorithms and comment on the quality of clustering.
13. Write a program to implement Reinforcement Learning and Model-Based Reinforcement Learning.

NOTE :

Datasets for the above exercises available in Kaggle and UCI repository mentioned below

i. https://www.kaggle.com

ii. ii. http://archive.ics.uci.edu/ml/datasets.html

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Apply various classification techniques for problems using tools like R and Python.

CO2Apply various clustering techniques for problems using tools like R and Python.

CO3: Implement solutions for various prediction problems using tools.

CO4:Design and development of programs using reinforcement learning

CO5: Design and development of programs using Model-Based reinforcement Learning.

PROFESSIONAL ELECTIVE-I

21CPP01	CLOUD COMPUTING TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of virtualization and virtual machines
- To gain expertise in server, network and storage virtualization.
- To understand and deploy practical virtualization solutions and enterprise solutions
- To gain knowledge on the concept of virtualization that is fundamental to cloud computing
- To understand the various issues in cloud computing

TOPICS TO BE COVERED

UNIT I	VIRTUALIZATION	9

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines – Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management Virtualization — Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization

UNIT II	VIRTUALIZATION INFRASTRUCTURE	9

Comprehensive Analysis – Resource Pool – Testing Environment –Server Virtualization – Virtual Workloads – Provision Virtual Machines – Desktop Virtualization – Application Virtualization -Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation

UNIT III	CLOUD PLATFORM ARCHITECTURE	9

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design, Layered cloud, Architectural Development- Virtualization Support and Disaster Recovery- Architectural Design Challenges - Public Cloud Platforms: GAE, AWS – Inter-cloud Resource Management

UNIT IV	PROGRAMMING MODEL	9

Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus

UNIT V	CLOUD SECURITY	9

Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud – Cloud Security and Trust Management

TOTAL:45 PERIODS

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Employ the concepts of storage virtualization, network virtualization and its management

CO2: Apply the concept of virtualization in the cloud computing

CO3: Identify the architecture, infrastructure and delivery models of cloud computing

CO4: Develop services using Cloud computing

CO5: Apply the security models in the cloud environment

REFERENCES

1.Danielle Ruest, Nelson Ruest, ―Virtualization: A Beginner‟s Guide‖, McGraw-Hill

Osborne Media, 2009.
2. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
3. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
4. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
5. Tim Mather, Subra Kumaraswamy, and Shahed Latif ,"Cloud Security and Privacy", O'Reilly Media, Inc.,2009.
6. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
7. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.

21CPP02	IMAGE PROCESSING AND ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the image processing concepts
- To understand the image processing techniques
- To familiarize the image processing environment and their applications,
- To appreciate the use of image processing in various applications
- To Understand Image analysis and classification.

TOPICS TO BE COVERED

UNIT I	IMAGE PROCESSING FUNDAMENTALS	9

Introduction – Elements of visual perception, Steps in Image Processing Systems – Digital Imaging System - Image Acquisition – Sampling and Quantization – Pixel Relationships – File Formats – colour images and models - Image Operations – Arithmetic, logical, statistical and spatial operations

UNIT II	IMAGE ENHANCEMENT AND RESTORATION	9

Image Transforms -Discrete and Fast Fourier Transform and Discrete Cosine Transform ,Spatial Domain - Gray level Transformations Histogram Processing Spatial Filtering – Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain – Smoothing and Sharpening filters – Homomorphic Filtering., Noise models, Constrained and Unconstrained restoration models.

UNIT III	IMAGE SEGMENTATION AND MORPHOLOGY	9

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Motion Segmentation, Image Morphology: Binary and Gray level morphology operations - Erosion, Dilation, Opening and Closing Operations Distance Transforms- Basic morphological Algorithms. Features – Textures - Boundary representations and Descriptions- Component Labeling – Regional descriptors and Feature Selection Techniques.

UNIT IV	IMAGE ANALYSIS AND CLASSIFICATION	9

Image segmentation- pixel based, edge based, region-based segmentation. Active contour models and Level sets for medical image segmentation, Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and statistical image classification.

UNIT V	IMAGE REGISTRATION AND VISUALIZATION	9

Rigid body visualization, Principal axis registration, Interactive principal axis registration, Feature based registration, Elastic deformation based registration, Image visualization – 2D display methods, 3D display methods, virtual reality based interactive visualization

TOTAL:45 PERIODS

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Design and implement algorithms for image processing applications that incorporates different concepts of medical Image Processing

CO2: Familiar with the use of MATLAB and its equivalent open-source tools

CO3: Discuss image segmentation and morphology

CO4: Critically analyze different approaches to image processing applications

CO5: Explore the possibility of applying Image processing concepts in various Applications

REFERENCES:

1. Alasdair McAndrew, ―Introduction to Digital Image Processing with Matlab, Cengage Learning, India 2011.
2. Anil J Jain, ―Fundamentals of Digital Image Processing‖, PHI, 2006.
3. Kavyan Najarian and Robert Splerstor,‖ Biomedical signals and Image processing‖,CRC – Taylor and Francis, New York, 2006.
4. Rafael C.Gonzalez and Richard E.Woods, ―Digital Image Processing‖, Third Edition, Pearson Education, New Delhi,2008.
5. S.Sridhar, ―Digital Image Processing‖, Oxford University Press, 2011.

21NEP20	WEB ENGINEERING *(Common to M.E.CSE, M.E.CSE (with Specialization in Networks))*	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand the characteristics of web applications
- Learn to Model web applications
- Be aware of Systematic design methods
- Be familiar with the testing techniques for web applications

UNIT I	INTRODUCTION TO WEB ENGINEERING	9

Motivation, Categories of Web Applications, Characteristics of Web Applications. Requirements of Engineering in Web Applications- Web Engineering-Components of Web Engineering-Web Engineering Process-Communication-Planning.

UNIT II	WEB APPLICATION ARCHITECTURES & MODELLING WEB APPLICATIONS	9

Introduction- Categorizing Architectures- Specifics of Web Application Architectures, Components of a Generic Web Application Architecture- Layered Architectures, 2-Layer Architectures, N-Layer Architectures-Data-aspect Architectures, Database-centric Architectures- Architectures for Web Document Management- Architectures for Multimedia Data- Modeling Specifics in Web Engineering, Levels, Aspects, Phases Customization, Modeling Requirements, Hypertext Modeling, Hypertext Structure Modeling Concepts, Access Modeling Concepts, Relation to Content Modeling, Presentation Modeling, Relation to Hypertext Modeling, Customization Modeling, Modelling Framework-Modeling languages Analysis Modeling for Web Apps-The Content Model-The Interaction Model-Configuration Model.

UNIT III	WEB APPLICATION DESIGN	9

Design for WebApps- Goals-Design Process-Interactive Design- Principles and Guidelines Workflow-Preliminaries-Design Steps- Usability- Issues- Information Design- Information Architecture- structuring- Accessing Information-Navigation Design- Functional Design WepApp Functionality- Design Process- Functional Architecture- Detailed Functional Design.

UNIT IV	TESTING WEB APPLICATIONS	9

Introduction-Fundamentals-Test Specifics in Web Engineering-Test ApproachesConventional Approaches, Agile Approaches- Testing concepts- Testing Process -Test Scheme- Test Methods and Techniques- Link Testing- Browser Testing-Usability TestingLoad, Stress, and Continuous Testing, Testing Security, Test-driven Development, -Content Testing-User Interface testing-Usability Testing-Compatibility Testing-Component Level Testing-Navigation Testing-Configuration testing-Security and Performance Testing- Test Automation.		
UNIT V	**PROMOTING WEB APPLICATIONS AND WEB PROJECT MANAGEMENT**	**9**
Introduction-challenges in launching the web Application-Promoting Web ApplicationContent Management-Usage Analysis-Web Project Management-Challenges in Web Project Management-Managing Web Team- Managing the Development Process of a Web Application-Risk, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project. Introduction to node JS - web sockets.		
	TOTAL : 45 PERIODS	

Course Outcomes:

At the end of the course, learners will be able to

CO1: Explain the characteristics of web applications.

CO2: Model web applications.

CO3: Design web applications.

CO4: Test web applications.

CO5: Promote the Web Applications

REFERENCES:

1. Chris Bates, "Web Programming: Building Internet Applications", 3rd Edition, Wiley India Edition, 2007.
2. Gerti Kappel, Birgit Proll, "Web Engineering", John Wiley and Sons Ltd, 2006.
3. Guy W. Lecky-Thompson, -Web Programming‖, Cengage Learning, 2008.
4. John Paul Mueller, ―Web Development with Microsoft Visual Studio 2005, Wiley Dream tech, 2006. 5. Roger S. Pressman, David Lowe, ―Web Engineering, Tata McGraw Hill Publication, 2007.

21CPP03	**REAL TIME SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To learn real time operating system concepts, the associated issues & Techniques.
- To understand design and synchronization problems in Real Time System.
- To explore the concepts of real time databases.
- To understand the evaluation techniques, present in Real Time System
- To understand the Real time system and Scheduling

TOPICS TO BE COVERED

UNIT I	**REAL TIME SYSTEM AND SCHEDULING**	**9**

Introduction– Structure of a Real Time System –Task classes – Performance Measures for Real Time Systems – Estimating Program Run Times – Issues in Real Time Computing – Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms –Fault Tolerant Scheduling.

UNIT II	**SOFTWARE REQUIREMENTS ENGINEERING**	**9**

Requirements engineering process – types of requirements – requirements specification for real time systems – Formal methods in software specification – structured Analysis and Design – object oriented analysis and design and unified modelling language – organizing the requirements document – organizing and writing documents – requirements validation and revision

UNIT III	INTERTASK COMMUNICATION AND MEMORY MANAGEMEN 9

Buffering data – Time relative Buffering- Ring Buffers – Mailboxes – Queues – Critical regions – Semaphores – other Synchronization mechanisms – deadlock – priority inversion – process stack management – run time ring buffer – maximum stack size – multiple stack arrangement – memory management in task control block - swapping – overlays – Block page management – replacement algorithms – memory locking – working sets – real time garbage collection – contiguous file systems.

UNIT IV	REAL TIME DATABASES 9

Real time Databases – Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two– phase Approach to improve Predictability – Maintaining Serialization Consistency – Databases for Hard Real Time Systems.

UNIT V	EVALUATION TECHNIQUES AND CLOCK SYNCHRONIZATION 9

Reliability Evaluation Techniques – Obtaining parameter values, Reliability models for Hardware Redundancy–Software error models. Clock Synchronization–Clock, A Nonfault–Tolerant Synchronization Algorithm – Impact of faults – Fault Tolerant Synchronization in Hardware – Fault Tolerant Synchronization in software.

Total: 45 Periods

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Apply principles of real time system design techniques to develop real time Applications.
CO2: Make use of database in real time applications.
CO3: Make use of architectures and behavior of real time operating systems.
CO4: Apply evaluation techniques in application.
CO5: Understand the Intertask Communication and Memory Management

REFERENCES:

1. C.M. Krishna, Kang G. Shin, ―Real-Time Systems, McGraw-Hill International Editions, 1997.
2. Philip.A.Laplante, ―Real Time System Design and Analysis, 3rd Edition Prentice Hall of India, 2004.
3. Rajib Mall, ―Real-time systems: theory and practice, Pearson Education, 2009.
4. R.J.A Buhur, D.L Bailey, ―An Introduction to Real-Time Systems‖, Prentice Hall International, 1999.
5. Stuart Bennett, ―Real Time Computer Control-An Introduction‖, Prentice Hall of India,1998.
6. Allen Burns, Andy Wellings, ―Real Time Systems and Programming Languages, Pearson Education, 2003.

21CPP04	SOFTWARE ARCHITECTURES AND DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the need, design approaches for software architecture to bridge the dynamic requirements and implementation.
- To learn the design principles and to apply for large scale systems
- To design architectures for distributed heterogeneous systems ,environment through brokerage interaction
- To build design knowledge on service oriented and model driven architectures and the aspect oriented architecture.
- To develop appropriate architectures for various Case studies like semantic web

services, supply chain cloud services

TOPICS TO BE COVERED

UNIT I	**INTRODUCTION**	**10**

Introduction to Software Architecture-Bridging Requirements and Implementation, Design Guidelines, Software Quality attributes. Software Architecture Design Space. Agile Approach to Software Architecture Design, Models for Software Architecture Description Languages (ADL).

UNIT II	**OBJECT-ORIENTED PARADIGM**	**8**

Object-Oriented Paradigm -Design Principles. Data-Centered Software Architecture: Repository Architecture, Blackboard Architecture. Hierarchical Architecture Main-Subroutine, Master-Slave, Layered, Virtual Machine. Interaction-Oriented Software Architectures: Model-View-Controller (MVC), Presentation-Abstraction-Control (PAC).

UNIT III	**DISTRIBUTED ARCHITECTURE**	**9**

Distributed Architecture: Client-Server, Middleware, Multi-tiers, Broker Architecture – MOM,CORBA Message Broker Architecture- Service-Oriented Architecture (SOA), SOAP, UDDI, SOA Implementation in Web Services, Grid/cloud Service Computing. Heterogeneous Architecture- Methodology of Architecture Decision, Quality Attributes.

UNIT IV	**USER INTERFACES**	**9**

Architecture of User Interfaces containers, case study-web service. Product Line Architectures - methodologies, processes and tools. Software Reuse and Product Lines -Product Line Analysis, Design and implementation, configuration Models. Model Driven Architectures (MDA) –why MDA-Model transformation and software architecture, SOA and MDA. Eclipse modeling framework.

UNIT V	**ASPECT ORIENTED ARCHITECTURES**	**9**

Aspect Oriented Architectures- AOP in UML,AOP tools, Architectural aspects and middleware Selection of Architectures, Evaluation of Architecture Designs, Case Study: Online Computer Vendor, order processing, manufacture &shipping –inventory, supply chain cloud service Management, semantic web services

TOTAL:45 PERIODS

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Understand the need of software architecture for sustainable dynamic systems.

CO2: Have a sound knowledge on design principles and to apply for large scale systems

CO3: Design architectures for distributed heterogeneous systems

CO4: Have good knowledge on service oriented and model driven architectures and the aspect-oriented architecture.

CO5: Have a working knowledge to develop appropriate architectures through various case studies.

REFERENCES:

1.Essentials of software Architecture , Ion Gorton, 2nd Edition, Springer-verlag, 2011.

2.Software Architecture Design Illuminated, Kai Qian Jones and Bartlett Publishers Canada, 2010.

PROFESSIONAL ELECTIVE-II

21NEP11	PERFORMANCE ANALYSIS OF COMPUTER SYSTEMS *(Common to M.E.CSE, M.E.CSE (with Specialization in Networks))*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the mathematical foundations needed for performance evaluation of computer systems
- To understand the metrics used for performance evaluation
- To understand the analytical modeling of computer systems
- To enable the students to develop new queuing analysis for both simple and complex systems
- To appreciate the use of smart scheduling and introduce the students to analytical techniques for evaluating scheduling policies

UNIT I	OVERVIEW OF PERFORMANCE EVALUATION	9

Need for Performance Evaluation in Computer Systems – Overview of Performance Evaluation Methods – Introduction to Queuing – Probability Review – Generating Random Variables for Simulation – Sample Paths, Convergence and Averages – Little‘s Law and other Operational Laws – Modification for Closed Systems

UNIT II	MARKOV CHAINS AND SIMPLE QUEUES	9

Discrete-Time Markov Chains – Ergodicity Theory – Real World Examples – Google, Aloha – Transition to Continuous-Time Markov Chain – M/M/1.

UNIT III	MULTI-SERVER AND MULTI-QUEUE SYSTEMS	9

Server Farms: M/M/k and M/M/k/k – Capacity Provisioning for Server Farms – Time Reversibility and Burke‘s Theorem – Networks of Queues and Jackson Product Form – Classed and Closed Networks of Queues

UNIT IV	REAL-WORLD WORKLOADS	9

Case Study of Real-world Workloads – Phase-Type Distributions and Matrix-Alalytic Methods – Networks with Time-Sharing Servers – M/G/1 Queue and the Inspection Paradox – Task Assignment Policies for Server Farms.

UNIT V	SMART SCHEDULING IN THE M/G/1	9

Performance Metrics – Scheduling Non-Preemptive and Preemptive Non-Size-Based Policies - . Scheduling Non-Preemptive and Preemptive Size-Based Policies – Scheduling - SRPT and Fairness

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Identify the need for performance evaluation and the metrics used for it

CO2: Distinguish between open and closed queuing networks

CO3: Apply the operational laws to open and closed systems

CO4: Use discrete-time and continuous-time Markov chains to model real world systems

CO5: Develop analytical techniques for evaluating scheduling policies

REFERENCES:

1. K. S. Trivedi, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2001.

2. Krishna Kant, "Introduction to Computer System Performance Evaluation", McGraw-Hill, 1992.

3. Lieven Eeckhout, "Computer Architecture Performance Evaluation Methods", Morgan and Claypool Publishers, 2010.

4. Mor Harchol - Balter, "Performance Modeling and Design of Computer Systems – Queueing Theory in Action", Cambridge University Press, 2013.

5. Paul J. Fortier and Howard E. Michel, "Computer Systems Performance Evaluation and Prediction", Elsevier, 2003.

6. Raj Jain, "The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation and Modeling", Wiley-Interscience, 1991

21CPP05	LANGUAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the fundamentals of natural language processing
- To appreciate the use of CFG and PCFG in NLP
- To understand the role of semantics and pragmatics
- To understand the Computational Phonology
- To Understand Machine Translation

TOPICS TO BE COVERED

UNIT I	**INTRODUCTION**	**9**
Words - Regular Expressions and Automata - Words and Transducers - N-grams - Part-of-Speech – Tagging - Hidden Markov and Maximum Entropy Models.		
UNIT II	**SPEECH**	**9**
Speech – Phonetics - Speech Synthesis - Automatic Speech Recognition - Speech Recognition: - Advanced Topics - Computational Phonology.		
UNIT III	**SYNTAX**	**9**
Formal Grammars of English - Syntactic Parsing - Statistical Parsing - Features and Unification - Language and Complexity.		
UNIT IV	**SEMANTICS AND PRAGMATICS**	**9**
The Representation of Meaning - Computational Semantics - Lexical Semantics - Computational Lexical Semantics-Computational Discourse		
UNIT V	**APPLICATIONS**	**9**
Information Extraction - Question Answering and Summarization - Dialogue and Conversational Agents - Machine Translation		
		Total Periods:45

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: To tag a given text with basic Language features

CO2: To design an innovative application using NLP components

CO3: To implement a rule-based system to tackle morphology/syntax of a language

CO4: To design a tag set to be used for statistical processing for real-time applications

CO5 :To compare and contrast use of different statistical approaches for different types

of NLP applications

REFERENCES:

1. Breck Baldwin, "Language Processing with Java and LingPipe Cookbook", Atlantic Publisher, 2015.
2. Daniel Jurafsky, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2014.
3. Nitin Indurkhya and Fred J. Damerau, "Handbook of Natural Language Processing", 2nd Edition, Chapman and Hall/CRC Press, 2010.
4. Richard M Reese, "Natural Language Processing with Java", O_Reilly Media, 2015.
5. Steven Bird, Ewan Klein and Edward Loper, -"Natural Language Processing with Python,1st Edition, O_Reilly Media, 2009.

21CPP06	COMPUTER VISION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To review image processing techniques for computer vision.
- To understand shape and region analysis.
- To understand Hough Transform and its applications to detect lines, circles, ellipses.
- To understand three-dimensional image analysis techniques.
- To understand motion analysis.

TOPICS TO BE COVERED

UNIT I	**IMAGE PROCESSING FOUNDATIONS**	**9**

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

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UNIT II	**SHAPES AND REGIONS**	**9**

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

.

UNIT III	**HOUGH TRANSFORM**	**9**

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection

UNIT IV	**3 D VISION AND MOTION**	**9**

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

UNIT V	**APPLICATIONS**	**9**

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

TOTAL:45 PERIODS

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Implement fundamental image processing techniques required for computer vision.

CO2: Perform shape analysis and Implement boundary tracking techniques.

CO3: Apply Hough Transform for line, circle, and ellipse detections.

CO4: Apply 3D vision techniques.

CO5: Develop applications using computer vision techniques.

REFERENCES:

1.D. L. Baggio et al., ―Mastering OpenCV with Practical Computer Vision Projects‖, Packt Publishing, 2012.

2. E. R. Davies, ―Computer & Machine Vision, 4th Edition, Academic Press, 2012.

3.Jan Erik Solem, ―Programming Computer Vision with Python: Tools and algorithms for analyzing images‖, O'Reilly Media, 2012.

4.Mark Nixon and Alberto S. Aquado, ―Feature Extraction & Image Processing for Computer Vision, 3rd Edition, Academic Press, 2012.

5. R. Szeliski, ―Computer Vision: Algorithms and Applications‖, Springer 2011.

6. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.

21CPP07	SOFTWARE QUALITY ASSURANCE AND TESTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of testing, test planning &design and test team organization
- To study the various types of test in the life cycle of the software product.
- To build design concepts for system testing and execution
- To learn the software quality assurance ,metrics, defect prevention techniques
- To learn the techniques for quality assurance and applying for applications.

TOPICS TO BE COVERED

UNIT I	SOFTWARE TESTING - CONCEPTS, ISSUES, AND TECHNIQUES	9

Quality Revolution, Verification and Validation, Failure, Error, Fault, and Defect, Objectives of Testing, Testing Activities, Test Case Selection White-Box and Black ,test Planning and design, Test Tools and Automation, . Power of Test. Test Team Organizatic and Management-Test Groups, Software Quality Assurance Group ,System Test Team Hierarchy, Team Building.

UNIT II	SYSTEM TESTING	9

System Testing - System Integration Techniques-Incremental, Top Down Bottom Up Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration. Built-in Testing. functional testing - Testing a Function in Context. Boundary Value Analysis, Decision Tables. acceptance testing - Selection of Acceptance Criteria, Acceptance Test Plan, Test Execution Test. software reliability - Fault and Failure, Factors Influencing Software, Reliability Models

UNIT III	SYSTEM TEST CATEGORIES	9

System test categories Taxonomy of System Tests, Interface Tests Functionality Tests.GUI Tests, Security Tests Feature Tests, Robustness Tests, Boundary Value Tests Power Cycling Tests Interoperability Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Regulatory Tests. Test Generation from FSM models- State-Oriented Model. Finite-State Machine Transition Tour Method, Testing with State Verification. Test Architectures-Local, distributed,Coordinated, Remote. system test design- Test Design Factors Requirement Identification, modeling a Test Design Process Test Design Preparedness, Metrics, Test Case Design Effectiveness. system test execution- Modeling Defects, Metrics for Monitoring Test Execution .Defect Reports, Defect Causal Analysis, Beta testing, measuring Test Effectiveness.

UNIT IV	SOFTWARE QUALITY	9

Software quality - People‘s Quality Expectations, Frameworks and ISO-9126, McCall‘s Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Maturity models- Test Process Improvement ,Testing Maturity Model

UNIT V	SOFTWARE QUALITY ASSURANCE	9

Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement. Case Study: FSM-Based Testing of Web-Based Applications.

Total:45 Periods

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Perform functional and nonfunctional tests in the life cycle of the software product.

CO2: Understand system testing and test execution process.

CO3: Identify defect prevention techniques

CO4: Understand the different software quality assurance metrics

CO5: Apply techniques of quality assurance for typical applications.

REFERENCES:

1. Kshirasagar Nak Priyadarshi Tripathy ,Software Testing And Quality Assurance-Theory and Practice, John Wiley & Sons Inc,2008.
2. Jeff Tian , Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, John Wiley & Sons, Inc., Hoboken, New Jersey. 2005.
3. Daniel Galin, Software Quality Assurance - From Theory to Implementation, Pearson Education Ltd UK, 2004.
4. Milind Limaye, Software Quality Assurance, TMH ,New Delhi, 2011.

21NEP24	SOCIAL NETWORK ANALYSIS *(Common to M.E.CSE, M.E.CSE (with Specialization in Networks))*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the components of the social network.
- To model and visualize the social network.
- To mine the users in the social network
- To understand the evolution of the social network
- To know the applications in real time systems

UNIT I	INTRODUCTION	9

Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.

UNIT II	MODELING AND VISUALIZATION	9

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix-Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling andaggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

UNIT III	MINING COMMUNITIES	9

Aggregating and reasoning with social network data, Advanced Representations –Extracting evolution of Web Community from a Series of Web Archive – Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks..

UNIT IV	EVOLUTION	9

Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks -Feature based Link Prediction – Bayesian Probabilistic Models - Probabilistic Relational Models

UNIT V	APPLICATIONS	9

A Learning Based Approach for Real Time Emotion Classification of Tweets, - A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, - Explaining Scientific and Technical - Emergence Forecasting, Social Network Analysis - for Biometric Template Protection.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Work on the internals components of the social network

CO2: Model and visualize the social network

CO3: Mine the behavior of the users in the social network

CO4: Predict the possible next outcome of the social network

CO5: Apply social network in real time applications

REFERENCES:

1. Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, "Computational Social Network Analysis: Trends, Tools and Research Advances", Springer, 2012
2. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1st edition, 2011
3. Charu C. Aggarwal, "Social Network Data Analytics", Springer; 2014

4. Giles, Mark Smith, John Yen, "Advances in Social Network Mining and Analysis", Springer, 2010.
5. Guandong Xu , Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer, 1st edition, 2012
6. Peter Mika, "Social Networks and the Semantic Web", Springer, 1st edition, 2007.
7. Przemyslaw Kazienko, Nitesh Chawla,"Applications of Social Media and Social Network Analysis", Springer,2015

PROFESSIONAL ELECTIVE –III

21CPP08		L	T	P	C
	FORMAL MODELS OF SOFTWARE SYSTEMS	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To understand the goals, complexity of software systems, the role of Specification activities and qualities to control complexity.
- To understand the fundamentals of abstraction and formal systems
- To learn fundamentals of logic reasoning- Propositional Logic, temporal logic and apply to models systems
- To understand formal specification models based on set theory, calculus and algebra and apply to a case study
- To learn Z, Object Z and B Specification languages with case studies.

TOPICS TO BE COVERED

UNIT I	SPECIFICATION FUNDAMENTALS	10

Role of Specification- Software Complexity - Size, Structural, Environmental, Application, domain, Communication Complexity, How to Control Complexity. Software specification, Specification Activities-Integrating Formal Methods into the Software Life-Cycle. Specification Qualities- Process Quality Attributes of Formal Specification Languages, Model of Process Quality, Product Quality and Utility, Conformance to Stated Goals Quality Dimensions and Quality Model.

UNIT II	FORMAL METHODS	8

Abstraction- Fundamental Abstractions in Computing. Abstractions for Software Construction.Formalism Fundamentals - Formal Systems, Formalization Process in Software Engineering Components of a Formal System- Syntax, Semantics, and Inference Mechanism. Properties of Formal Systems - Consistency.Automata-Deterministic Finite Accepters, State Machine Modeling Nondeterministic Finite Accepters, Finite State Transducers Extended Finite State Machine. Case Study—Elevator Control. Classification of C Methods-Property-Oriented Specification Methods, Model-Based Specification Techniques

UNIT III	LOGIC	9

Propositional Logic - Reasoning Based on Adopting a Premise, Inference Based on Natural Deduction. Predicate Logic - Syntax and Semantics, Policy Language Specification, knowledge Representation Axiomatic Specification. Temporal Logic -.Temporal Logic for Specification and Verification, Temporal Abstraction Propositional Temporal Logic (PTL), First Order Temporal Logic (FOTL).Formal Verification, Verification of Simple FOTL, Model Checking, Program Graphs, Transition Systems.

UNIT IV	SPECIFICATION MODELS	9

Mathematical Abstractions for Model-Based Specifications-Formal Specification Based on Set Theory, Relations and Functions. Property-Oriented Specifications- Algebraic Specification, Properties of Algebraic Specifications, Reasoning, Structured Specifications. Case Study—A Multiple Window Environment: requirements, Modeling Formal Specifications. Calculus of Communicating Systems: Specific Calculus for Concurrency. Operational Semantics of Agents, Simulation and Equivalence, Derivation Trees, Labeled Transition Systems.

UNIT V	FORMAL LANGUAGES	9

The Z Notation, abstractions in Z, Representational Abstraction, Types, Relations and Functions, Sequences, Bags. Free Types-Schemas, Operational Abstraction -Operations Schema Decorators, Generic Functions, Proving Properties from Z specifications, Consistency of Operations. Additional Features in Z. Case Study: An Automated Billing System. The Object-Z Specification Language- Basic Structure of an Object-Z, Specification. Parameterized Class, Object-Orientation, composition of Operations-Parallel Communication Operator, Nondeterministic Choice Operator, and Environment Enrichment. The B-Method - Abstract Machine Notation (AMN), Structure of a B Specification, arrays, statements. Structured Specifications, Case Study- A Ticketing System in a Parking.

Total Periods:45

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Understand the complexity of software systems, the need for formal Specifications activities and qualities to control complexity.

CO2: Gain knowledge on fundamentals of abstraction and formal systems

CO3: Learn the fundamentals of logic reasoning- Propositional Logic, temporal logic and apply to models systems

CO4: Develop formal specification models based on set theory, calculus and algebra and apply to a typical case study

CO5:Have working knowledge on Z, Object Z and B Specification languages with case studies.

REFERENCES:

1. M.Ben-Ari, Mathematical Logic for computer science ,2nd edition, Springer,2003.
2. Logic in Computer Science- modeling and reasoning about systems, 2nd Edition, Cambridge University Press, 2004.
3. V.S. Alagar, K. Periyasamy, David Grises and Fred B Schneider, Specification of Software Systems, Springer –Verlag London, 2011
4. Jonathan Jacky, The ways Z: Practical programming with formal methods, Cambridge University Press,1996.
5. Using Z-Specification Refinement and Proof,Jim Woodcock and Jim Devies Prentice Hall, 1996
6. Antoi Diller, Wiley, Z: An introduction to formal methods, 2nd Edition, 1994.

21CPP09	EMBEDDED SOFTWARE DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the architecture of embedded processor, microcontroller and peripheral devices.
- To interface memory and peripherals with embedded systems.
- To study the embedded network environment.
- To understand challenges in Real time operating systems.
- To study, analyze and design applications on embedded systems.

TOPICS TO BE COVERED

UNIT I	EMBEDDEDROCESSORS	9

Embedded Computers - Characteristics of Embedded Computing Applications - Challenges in Embedded Computing System Design - Embedded System Design Process- Formalism for System Design - Structural Description - Behavioral Description - ARM Processor - Intel ATOM Processor

UNIT II	EMBEDDED COMPUTING PLATFORM	9

CPU Bus Configuration - Memory Devices and Interfacing - Input/Output Devices and

Interfacing - System Design - Development and Debugging – Emulator – Simulator - JTAG Design Example – Alarm Clock - Analysis and Optimization of Performance - Power and Program Size.

UNIT III	EMBEDDED NETWORK ENIVIRONMENT	9

Distributed Embedded Architecture - Hardware And Software Architectures - Networks for Embedded Systems - I2C - CAN Bus - SHARC Link Supports – Ethernet – Myrinet – Internet - Network-based Design - Communication Analysis - System Performance Analysis - Hardware Platform Design - Allocation and Scheduling - Design Example - Elevator Controller.

UNIT IV	REAL-TIME CHARACTERISTICS	9

Clock Driven Approach - Weighted Round Robin Approach - Priority Driven Approach - Dynamic versus Static Systems - Effective Release Times and Deadlines - Optimality of the Earliest Deadline First (EDF) Algorithm - Challenges in Validating Timing Constraints in Priority Driven Systems - Off-Line versus On-Line Scheduling.

UNIT V	SYSTEM DESIGN TECHNIQUES	9

Design Methodologies - Requirement Analysis – Specification - System Analysis and Architecture Design - Quality Assurance - Design Examples - Telephone PBX - Ink jet printer - Personal Digital Assistants - Set-Top Boxes.

Total Periods:45

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Understand different architectures of embedded processor, microcontroller and peripheral devices. Interface memory and peripherals with embedded systems.
CO2: Work with the Embedded Computing Platform
CO3: Work with embedded network environment.
CO4: Understand challenges in Real time operating systems.
CO5: Design and analyze applications on embedded systems.

REFERENCES:

1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things" Wiley Publication 1st edition, 2013.
2. Andrew NSloss, D. Symes, C. Wright, Arm system developers guide‖, Morgan Kauffman/Elsevier, 2006.
3. ArshdeepBahga, Vijay Madisetti, " Internet of Things: A Hands-on-Approach" VPT 1st Edition, 2014.
4. C. M. Krishna and K. G. Shin, ―Real-Time Systems , McGraw-Hill, 1997.
5. Frank Vahid and Tony Givargis, ―Embedded System Design: A Unified Hardware/Software Introduction, John Wiley & Sons.
6. Jane.W.S. Liu, ―Real-Time systems, Pearson Education Asia, 2015.
7. Michael J. Pont, ―Embedded C, Pearson Education ,2007.
8. Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, "The AVR Microcontroller and Embedded Systems: Using Assembly and C" 1st edition ,Pearson Education, 2014.
9. Steve Heath, ―Embedded System Design , Elsevier, 2005.
10. Wayne Wolf, ―Computers as Components: Principles of Embedded Computer System Design‖, Elsevier, 2006.

21CPP10	BIO-INSPIRED COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Learn bio-inspired theorem and algorithms
- To Understand random walk and simulated annealing

- To Learn genetic algorithm and differential evolution
- To Learn swarm optimization and ant colony for feature selection
- To understand bio-inspired application in image processing

TOPICS TO BE COVERED

UNIT I	**INTRODUCTION**	**9**

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

UNIT II	**RANDOM WALK AND ANEALING**	**9**

Random variables - Isotropic random walks - Levy distribution and flights - Markov chains - step sizes and search efficiency - Modality and intermittent search strategy - importance of randomization- Eagle strategy-Annealing and Boltzmann Distribution - parameters -SA algorithm - Stochastic Tunneling.

UNIT III	**GENETIC ALOGORITHMS AND DIFFERENTIAL EVOLUTION**	**9**

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

UNIT IV	**SWARM OPTIMIZATION AND FIREFLY ALGORITHM**	**9**

Swarm intelligence - PSO algorithm - accelerated PSO - implementation - convergence analysis - binary PSO - The Firefly algorithm - algorithm analysis - implementation - varients- Ant colony optimization toward feature selection

UNIT V	**APPLICATIONS IN IMAGE PROCESSING**	**9**

Bio-Inspired Computation and its Applications in Image Processing: An Overview - Fine-Tuning Enhanced Probabilistic Neural Networks Using Meta-heuristic-driven Optimization - Fine-Tuning Deep Belief Networks using Cuckoo Search - Improved Weighted Thresholded Histogram Equalization Algorithm for Digital Image Contrast Enhancement Using Bat Algorithm - Ground Glass Opacity Nodules Detection and Segmentation using Snake Model - Mobile Object Tracking Using Cuckoo Search

Total : 45 Periods

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Implement and apply bio-inspired algorithms
CO2: Explain random walk and simulated annealing
CO3: Implement and apply genetic algorithms
CO4: Explain swarm intelligence and ant colony for feature selection
CO5: Apply bio-inspired techniques in image processing

REFERENCES:

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

21CPP11	**COMPILER OPTIMIZATION TECHNIQUES**	**L**	**T**	**P**	**C**

		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To be aware of different forms of intermediate languages and analyzing programs.
- To understand optimizations techniques for simple program blocks.
- To apply optimizations on procedures, control flow and parallelism.
- To learn the interprocedural analysis and optimizations.
- To explore the knowledge about resource utilization.

TOPICS TO BE COVERED

UNIT I	**INTERMEDIATE REPRESENTATIONS AND ANALYSIS**	**9**

Review of Compiler Structure- Structure of an Optimizing Compiler – Intermediate Languages - LIR, MIR, HIR – Control Flow Analysis – Iterative Data Flow Analysis – Static Single Assignment – Dependence Relations - Dependences in Loops and Testing-Basic Block Dependence DAGs – Alias Analysis.

UNIT II	**EARLY AND LOOP OPTIMIZATIONS**	**9**

Importance of Code Optimization Early Optimizations: Constant-Expression Evaluation - Scalar Replacement of Aggregates - Algebraic Simplifications and Re-association - Value Numbering - Copy Propagation - Sparse Conditional Constant Propagation. Redundancy Elimination: Common - Subexpression Elimination - Loop-Invariant Code Motion - Partial-Redundancy Elimination - Redundancy Elimination and Reassociation - Code Hoisting. Loop Optimizations: Induction Variable Optimizations - Unnecessary Bounds Checking Elimination.

UNIT III	**PROCEDURE OPTIMIZATION AND SCHEDULING**	**9**

Procedure Optimizations: Tail-Call Optimization and Tail-Recursion Elimination - Procedure Integration - In-Line Expansion - Leaf-Routine Optimization and Shrink Wrapping. Code Scheduling: Instruction Scheduling - Speculative Loads and Boosting - Speculative Scheduling - Software Pipelining - Trace Scheduling - Percolation Scheduling. Control-Flow and Low-Level Optimizations: Unreachable-Code Elimination - Straightening - If Simplifications - Loop Simplifications -Loop Inversion – Un-switching - Branch Optimizations Tail Merging or Cross Jumping - Conditional Moves - Dead-Code Elimination - Branch Prediction - Machine Idioms and Instruction Combining.

UNIT IV	**INTER PROCEDURAL OPTIMIZATION**	**9**

Symbol table – Runtime Support - Interprocedural Analysis and Optimization: Interprocedural Control Flow Analysis - The Call Graph - Interprocedural Data-Flow Analysis Interprocedural Constant Propagation - Interprocedural Alias Analysis - Interprocedural Optimizations - Interprocedural Register Allocation - Aggregation of Global References

UNIT V	**REGISTER ALLOCATION AND OPTIMIZING FOR MEMORY**	**9**

Register Allocation: Register Allocation and Assignment - Local Methods - Graph Coloring – Priority Based Graph Coloring - Other Approaches to Register Allocation. Optimization for the Memory Hierarchy: Impact of Data and Instruction Caches - Instruction-Cache Optimization - Scalar Replacement of Array Elements - Data-Cache Optimization - Scalar vs. Memory-Oriented Optimizations.

Total:45 Periods

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Understand intermediate representations and analysis
CO2:Identify the different optimization techniques for simple program blocks.
CO3:Design performance enhancing optimization techniques.
CO4:Perform the optimization on procedures.
CO5:Ensure better utilization of resources

REFERENCES:
1.Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques, and Tools", Addison Wesley, 2nd Edition, 2007.
2.Andrew W. Appel, Jens Palsberg, "Modern Compiler Implementation in Java", Cambridge University Press, 2nd Edition, 2002.
3.Keith Cooper, Linda Torczon, "Engineering a Compiler", Morgan Kaufmann, 2nd Edition, 2011.
4.. Randy Allen and Ken Kennedy, ―Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufman, 2001.
5.Robert Morgan ,‖Building an Optimizing Compiler‖, Digital Press, 1998.
6.Steven Muchnick, ―Advanced Compiler Design and Implementation‖, Morgan Kaufman Publishers, 1997.

21CMP13	SPEECH PROCESSING AND SYNTHESIS *(Common to M.E CS, M.E. CSE,&M.E(CSE with Network Specialization))*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce speech production and related parameters of speech.
- To illustrate the concepts of speech signal representations and coding.
- To understand different speech modeling procedures such Markov and their implementation issues.
- To gain knowledge about text analysis and speech synthesis.

UNIT I	FUNDAMENTALS OF SPEECH PROCESSING	9

Introduction – Spoken Language Structure – Phonetics and Phonology – Syllables and Words – Syntax and Semantics – Probability, Statistics and Information Theory – Probability Theory – Estimation Theory – Significance Testing – Information Theory.

UNIT II	SPEECH SIGNAL REPRESENTATIONS AND CODING	9

Overview of Digital Signal Processing – Speech Signal Representations – Short time Fourier Analysis– Acoustic Model of Speech Production – Linear Predictive Coding – Cepstral Processing – Formant Frequencies – The Role of Pitch – Speech Coding – LPC Coder, CELP, Vocoders.

UNIT III	SPEECH RECOGNITION	9

Hidden Markov Models – Definition – Continuous and Discontinuous HMMs – Practical Issues – Limitations. Acoustic Modeling – Variability in the Speech Signal – Extracting Features – Phonetic Modeling – Adaptive Techniques – Confidence Measures – Other Techniques.

UNIT IV	TEXT ANALYSIS	9

Lexicon – Document Structure Detection – Text Normalization – Linguistic Analysis – Homograph Disambiguation – Morphological Analysis – Letter-to-sound Conversion – Prosody – Generation schematic – Speaking Style – Symbolic Prosody – Duration Assignment – Pitch Generation

UNIT V	SPEECH SYNTHESIS	9

Attributes – Formant Speech Synthesis – Concatenative Speech Synthesis – Prosodic Modification of Speech – Source-filter Models for Prosody Modification – Evaluation of TTS Systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Model speech production system and describe the fundamentals of speech.
CO2: Extract and compare different speech parameters.
CO3: Choose an appropriate statistical speech model for a given application.
CO4: Design a speech recognition system.

CO5: Use different text analysis and speech synthesis techniques.
REFERENCES:
1. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing, Processing and Perception of Speech and Music", Wiley- India Edition, 2006 2. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999. 3. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2002. 4. Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997. 5. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003. 6. Steven W. Smith, "The Scientist and Engineer"s Guide to Digital Signal Processing", California Technical Publishing, 1997. 7. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education, 2004.

PROFESSIONAL ELECTIVE –IV

21CPP12	DATA VISUALIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To develop skills to both design and critique visualizations.
- To introduce visual perception and core skills for visual analysis.
- To understand visualization for time-series analysis.
- To understand visualization for ranking analysis.
- To understand visualization for deviation analysis.

TOPICS TO BE COVERED

UNIT I	CORE SKILLS FOR VISUAL ANALYSIS	9

Information visualization – effective data analysis – traits of meaningful data – visual perception –making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples.

UNIT II	TIME-SERIES, RANKING, AND DEVIATION ANALYSIS	9

Time-series analysis – time-series patterns – time-series displays – time-series best practices – part-to-whole and ranking patterns – part-to-whole and ranking displays – best practices – deviation analysis – deviation analysis displays – deviation analysis best practices.

UNIT III	DISTRIBUTION, CORRELATION, AND MULTIVARIATE ANALYSIS	9

Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations – correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays – multivariate analysis techniques and best practices.

UNIT IV	INFORMATION DASHBOARD DESIGN	9

Information dashboard – Introduction– dashboard design issues and assessment of needs – Considerations for designing dashboard-visual perception – Achieving eloquence.

UNIT V	GRAPHICS	9

Advantages of Graphics _Library of Graphs – Designing Bullet Graphs – Designing Sparklines – Dashboard Display Media –Critical Design Practices – Putting it all together- Unveiling the dashboard.

TOTAL: 45 PERIODS

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1:Explain principles of visual perception

CO2:Apply core skills for visual analysis

CO3:Apply visualization techniques for various data analysis tasks

CO4: Design information dashboard.

CO5: Apply core skills for graphics

REFERENCES:

1.Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.

2. Edward R. Tufte, "The visual display of quantitative information", 2nd Edition, Graphics Press, 2001.

3.Evan Stubbs, "The value of business analytics: Identifying the path to profitability", Wiley, 2011.

4.Gert H. N. Laursen and JesperThorlund, "Business Analytics for Managers: Taking business intelligence beyond reporting", Wiley, 2010.

5.Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.

6.Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", 2nd edition, Analytics Press, 2013.

7.Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis", Analytics Press, 2009.

8.Tamara Munzner, Visualization Analysis and Design, AK Peters Visualization Series, CRC Press, Nov 2014.

21CPP13	RECONFIGURABLE COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the need for reconfigurable computing
- To expose the students to various device architectures
- To examine the various reconfigurable computing systems
- To understand the different types of compute models for programming reconfigurable architectures
- To expose the students to HDL programming and familiarize with the development environment
- To expose the students to the various placement and routing protocols
- To develop applications with FPGAs .

TOPICS TO BE COVERED

UNIT I	**DEVICE ARCHITECTURE**	**9**

General Purpose Computing Vs Reconfigurable Computing – Simple Programmable Logic Devices – Complex Programmable Logic Devices – FPGAs – Device Architecture - Case Studies.

UNIT II	**RECONFIGURABLE COMPUTING ARCHITECTURES AND SYSTEMS**	**9**

Reconfigurable Processing Fabric Architectures – RPF Integration into Traditional Computing Systems – Reconfigurable Computing Systems – Case Studies – Reconfiguration Management.

UNIT III	PROGRAMMING RECONFIGURABLE SYSTEMS	9
Compute Models - Programming FPGA Applications in HDL – Compiling C for Spatial Computing – Operating System Support for Reconfigurable Computing.		
UNIT IV	**MAPPING DESIGNS TO RECONFIGURABLE PLATFORMS**	**9**
The Design Flow - Technology Mapping – FPGA Placement and Routing – Configuration Bitstream Generation – Case Studies with Appropriate Tools.		
UNIT V	**APPLICATION DEVELOPMENT WITH FPGAS**	**9**
Case Studies of FPGA Applications – System on a Programmable Chip (SoPC) Designs.		
		Total Periods:45

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Identify the need for reconfigurable architectures.

CO2: Discuss the architecture of FPGAs.

CO3: Point out the salient features of different reconfigurable architectures.

CO4: Develop applications using any HDL and appropriate tools.

CO5: Design and build an SoPC for a particular application

REFERENCES:

1.Christophe Bobda, ―Introduction to Reconfigurable Computing – Architectures, Algorithms and Applications‖, Springer, 2010.

2.Maya B. Gokhale and Paul S. Graham, ―Reconfigurable Computing: Accelerating Computation with Field-Programmable Gate Arrays‖, Springer, 2005.

3. Nicole Hemsoth, Timothy Prickett Morgan FPGA Frontiers: New Applications in Reconfigurable Computing, Next Platform2017.

4.Reconfigurable Computing: From FPGAs to Hardware/Software Codesign Edition by Joao Cardoso (Editor), Michael Hübne, Springer, 2011.

5.Scott Hauck and Andre Dehon (Eds.), ―Reconfigurable Computing – The Theory and Practice of FPGA-Based Computation‖, Elsevier / Morgan Kaufmann, 2008.

21NEP18	MOBILE APPLICATION DEVELOPMENT *(Common to M.E.CSE, M.E.CSE (with Specialization in Networks))*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand system requirements for mobile applications.
- Generate suitable design using specific mobile development frameworks.
- Generate mobile application design.
- Implement the design using specific mobile development frameworks.
- Deploy the mobile applications in marketplace for distribution.

UNIT I	INTRODUCTION	9
Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications.		
UNIT II	**BASIC DESIGN**	9
Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality		

constraints – performance, usability, security, availability and modifiability.		
UNIT III	**ADVANCED DESIGN**	9
Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.		
UNIT IV	**ANDROID**	**9**
Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.		
UNIT V	**IOS**	**9**
Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Describe the requirements for mobile applications.

CO2: Explain the challenges in mobile application design and development.

CO3: Develop design for mobile applications for specific requirements.

CO4: Implement the design using Android SDK.

CO5: Implement the design using Objective C and iOS.

REFERENCES

1. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 1st Edition,2012.
2. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013.
3. James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012.
4. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox,2012.
5. 5.Reto Meier, “Professional android Development”, Wiley-India Edition, 2012.

21CPP14	**BIO INFORMATICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To get exposed to the fundamentals of bioinformatics.
- To learn bio-informatics algorithm and phylogenetic concept.
- To understand open problems and issues in replication and molecular clocks.
- To learn assemble genomes and corresponding theorem.
- To study and exposed to the domain of human genomics.

TOPICS TO BE COVERED

UNIT I	**INTRODUCTION AND FUNDAMENTALS**	**9**
Fundamentals of genes , genomics , molecular evolution – genomic technologies – beginning of bioinformatics - genetic data –sequence data formats – secondary database – examples – data		

retrival systems – genome browsers.

UNIT II	BIOINFORMATICS ALGORITHM AND ANALYSIS	9

Sequence alignment and similarity searching in genomic databases: BLAST and FASTA – additional bioinformatics analysis involving nucleic acid sequences-additional bioinformatics analysis involving protein sequences – Phylogenetic Analysis.

UNIT III	DNA REPLICATION AND MOLECULAR CLOCKS	9

Beginning of DNA replication – open problems – multiple replication and finding replication – computing probabilities of patterns in a string-the frequency array-converting patterns- solving problems- finding frequents words-Big-O notation –case study-The Tower of Hanoi problem.

UNIT IV	ASSEMBLE GENOMES AND SEQUENCES	12

Methods of assemble genomes – string reconstruction – De Bruijn graph – Euler‘s theorem – assembling genomes –DNA sequencing technologies – sequence antibiotics – Brute Force Algorithm – Branch and Bound algorithm – open problems – comparing biological sequences-Case Study –Manhattan tourist Problem.

UNIT V	HUMAN GENOME	12

Human and mouse genomes-random breakage model of chromosome evolution – sorting by reversals – greedy heuristic approach – break points- rearrangements in tumor and break point genomes-break point graps- synteny block construction -open problems and technologies.

Total: 45 Periods

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1:Deploy the genomics technologies in Bioinformatics.

CO2:Able to distinct efficient algorithm and issues.

CO3:Deploy the replication and molecular clocks in bioinformatics.

CO4:Work on assemble genomes and sequences.

CO5:Use the Microarray technologies for genome expression.

REFERENCES:

1.Ion Mandoiu and Alexander Zelikovsky , “Computational Methods for Next Generation Sequencing Data Analysis ― Wiley series 2016.

2.Istvan Miklos “Introduction to algorithms in bioinformatics, Springer, 2016.

Philip Compeau and Pavel pevzner, ―Bioinformatics Algorithms: An Active Learning Approach Second edition volume I , Cousera, 2015.

3.SupratimChoudhuri, ―Bioinformatics For Beginners‖, Elsevier, 2014.

21CPP15	INFORMATION STORAGE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the storage architecture and available technologies.
- To learn to establish & manage datacenter.

- To learn security aspects of storage & data center.
- To understand information availability, monitoring & managing datacenters
- To learn about securing storage and storage virtualization

TOPICS TO BE COVERED

UNIT I	**STORAGE TECHNOLOGY**	**9**

Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

UNIT II	**STORAGE SYSTEMS ARCHITECTURE**	**9**

Hardware and software components of the host environment, Key protocols and concepts used by each component ,Physical and logical components of a connectivity environment ,Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications, Concept of RAID and its components, Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Compare and contrast integrated and modular storage systems ,Iligh-level architecture and working of an intelligent storage system.

UNIT III	**INTRODUCTION TO NETWORKED STORAGE**	**9**

Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, understand the need for long-term archiving solutions and describe how CAS full fill the need, understand the appropriateness of the different networked storage options for different application environments

UNIT IV	**INFORMATION AVAILABILITY, MONITORING & MANAGING DATACENTERS**	**9**

List reasons for planned/unplanned outages and the impact of downtime, Impact of downtime - Business continuity (BC) and disaster recovery (DR) ,RTO and RPO, Identifysingle points of failure in a storage infrastructure and list solutions to mitigate these failures, architecture of backup/recovery and the different backup/ recovery topologies, replication technologies and their role in ensuring information availability and business continuity, Remote replication technologies and their role in providing disaster recovery and business continuity capabilities. Identify key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor for different components in a storage infrastructure, Key management tasks in a data center

UNIT V	**SECURING STORAGE AND STORAGE VIRTUALIZATION**	**12**

Information security, Critical security attributes for information systems, Storage security domains, List and analyzes the common threats in each domain, Virtualization technologies, block-level and file-level virtualization technologies and processes.

Total Periods:45

COURSE OUTCOMES::

At the end of the course, learners will be able to

CO1: Select from various storage technologies to suit for required application.

CO2: Apply security measures to safeguard storage & farm.

CO3: Analyse QoS on Storage

CO4: Understand information availability, monitoring & managing datacenters

CO5: Understand how securing storage and storage virtualizationO

REFERENCES:

1.EMC Corporation, "Information Storage and Management: Storing, Managing, and Protecting Digital Information", Wiley, India, 2010.

2. R.Marc Farley, ―Building Storage Networks‖, Tata McGraw Hill ,Osborne, 2001.
3.Robert Spalding, ―Storage Networks: The Complete Reference―, Tata McGraw Hill Osborne, 2003.

AUDIT COURSES

21AC101	ENGLISH FOR RESEARCH PAPER WRITING *Common to M.E. (Communication Systems)& M.E. (Computer Science Engineering), M.E. (Computer Science and Engineering with specialization in Networks), M.E. (Manufacturing Engineering) and M.E. (Power Systems)*	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- To explain writing skills and level of readability
- To outline content writing in each section
- To summarize the skills needed for framing a title
- To demonstrate the skills needed for writing the conclusion
- To compare the quality of paper with plagiarism report

UNIT I	INTRODUCTION TO RESEARCH PAPER WRITING	6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II	PRESENTATION SKILLS	6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III	TITLE WRITING SKILLS	6

Key skills –Title, Abstract, Introduction, Review of the Literature, Methods, Results, Discussion and Conclusions.

UNIT IV	RESULT WRITING SKILLS	6

Skills -Methods, Results, Discussion and Conclusions.

UNIT V	VERIFICATION SKILLS	6

Useful phrases, checking Plagiarism, ensuring quality paper submission.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1:Explain the writing skills and level of readability

CO2: Outline the contents of research paper in each section

CO3:Classify the skills needed for writing a title

CO4: Summarize the content for presenting research conclusion note.

CO5: Illustrate the quality of paper by checking plagiarism.

TEXT BOOKS:

1. Adrian Wallwork , "English for Writing Research Papers", Springer New York Dordrecht Heidelberg London, 2011
2. Day R ,"How to Write and Publish a Scientific Paper", Cambridge University Press 2006.
3. Goldbort R , "Writing for Science", Yale University Press ,2006
4. Highman N, "Handbook of Writing for the Mathematical Sciences", SIAM. Highman's book 1998.

REFERENCES

1. Stephen Howe, Kristina Henriksson, "Phrase Book for Writing Papers and Research in English", 4th Edition, Create Space Independent Publishing Platform, 2007.
2. Adrian Wallwork ,"English for Research: Usage, Style, and Grammar", Springer,2012.
3. John Flowerdew, PejmanHabibie, "Introducing English for Research Publication Purposes", 1st Edition, Routledge, ,2021.
4. Wendy Laura Belcher, Writing Your Journal Article in Twelve Weeks: A Guide to Academic Publishing Success, 1st Edition, SAGE Publications, Inc, , 2009

21AC102	CONSTITUTION OF INDIA *Common to all PG Programmes*	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- To understand the premises informing the twin themes of liberty and freedom from a civil rights perspective
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional Role and entitlement to civil and economic rights as well as the emergence nationhood in the early years of Indian nationalism
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.
- To understand the importance of local body administration
- To know the role and function of election commission

UNIT I	HISTORY AND PHILOSOPHY OF THE INDIAN CONSTITUTION	6

History - Drafting Committee - (Composition & Working)- Philosophy - Preamble, Salient Features

UNIT II	CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES	6

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT III	ORGANS OF GOVERNANCE	6

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT IV	LOCAL ADMINISTRATION	6

District's Administration head: Role and Importance Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Panchayati raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT V	ELECTION COMMISSION	6

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

CO3: Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

CO4: Discuss the passage of the Hindu Code Bill of 1956.

CO5: Familiarize with basic Structure and functions of Election Commission.

REFERENCES:

1. Dr. S. N. Busi, "Dr. B. R. Ambedkar, Framing of Indian Constitution", 1st Edition, Ava Publishers, 2016.
2. M.P. Jain, "Indian Constitution Law", 7th Edition, Lexis Nexis, 2014.
3. D.D. Basu, "Introduction to the Constitution of India", 26th Edition, Lexis Nexis, 2022.

21AC103	DISASTER MANAGEMENT *Common to all PG Programmes*	L	T	P	C
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COURSE OBJECTIVES:

- To summarize the basics of disaster
- To explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- To illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- To describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- To develop the strengths and weaknesses of disaster management approaches

UNIT I	INTRODUCTION	6

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Man-made Disasters: Difference, Nature, Types and Magnitude

UNIT II	REPERCUSSIONS OF DISASTERS AND HAZARDS	6

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts

UNIT III	DISASTER PRONE AREAS IN INDIA	6

Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

UNIT IV	DISASTER PREPAREDNESS AND MANAGEMENT	6

Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V	RISK ASSESSMENT	6

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Summarize basics of disaster.

CO2: Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.

CO3: Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

CO4: Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

CO5: Develop the strengths and weaknesses of disaster management approaches.

REFERENCES:

1. Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies" 1st Edition, New Royal book Company, 2007.
2. Sahni, Pardeep, "Disaster Mitigation Experiences and Reflections", 4th Edition, Prentice Hall Of India, New Delhi, 2011.
3. Goel S. L., "Disaster Administration and Management Text and Case Studies", 3rd Edition, Deep & Deep Publication Pvt. Ltd., 2009.