VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY, MADURAI-625009

(Autonomous)

REGULATION - 2021

M.E. COMPUTER SCIENCE AND ENGINEERING

(WITH SPECIALIZATION IN NETWORKS)

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 *(Common to M.E. CSE and M.E CSE(Specialisation in Networks))*	FC	3	2	0	4
2.	21RM101	Research Methodology and IPR for Telecom Engineers *(Common to M.E CSE(Specialisation in Networks) and M.E Communication Systems programmes)*	RM	3	0	0	3
3.	21CP101	Advanced Data Structures and Algorithms *(Common to M.E CSE and M.E CSE(Specialisation in Networks))*	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.	21NE102	Wireless Communications	PC	3	0	0	3
6.	21AC101	Audit Course – I* *(Common to all M.E. Programmes)*	AC	2	0	0	0
THEORY CUM PRACTICAL COURSES							
7.	21CP104	Database Practices *(Common to M.E CSE and M.E CSE(Specialisation in Networks))*	PC	3	0	2	4
PRACTICAL COURSES							
8.	21CP103	Advanced Data Structures and Algorithms Laboratory *(Common to M.E CSE and M.E CSE(Specialisation in Networks))*	PC	0	0	4	2
9.	21NE103	Networks Laboratory	PC	0	0	4	2
Total Credits							**24**

SEMESTER- II

S.No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21NE104	Network Security	PC	3	0	0	3
2.	21CP107	Machine Learning *(Common to M.E.CSE, M.E CSE (with Specialization in Networks))*	PC	3	2	0	4
3.	21NEPXX	Professional Elective I	PE	3	0	0	3
4.	21NEPXX	Professional Elective II	PE	3	0	0	3
5.	21AC102	Audit Course – II* *(Common to all M.E. Programmes)*	AC	2	0	0	0
THEORY CUM PRACTICAL COURSES							
6.	21NE105	Internet of Things and Applications	PC	3	0	2	4
PRACTICAL COURSES							
7.	21NE106	Network Design and Programming Laboratory	PC	0	0	4	2
8.	21NE107	Network Security Laboratory	PC	0	0	4	1
9.	21NE108	Term Paper and Seminar *(Common to M.E.CSE, M.E CSE (with Specialization in Networks))*	EE	0	0	2	1
Total Credits							**21**

SEMESTER- III

S.No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21NE201	Multimedia Communication Networks	PC	3	0	0	3
2.	21NEXXX	Professional Elective III	PE	3	0	0	3
3.	21NEXXX	Professional Elective IV	PE	3	0	0	3
4.	21NEXXX	Professional Elective V	PE	3	0	0	3
PRACTICAL							
6.	21NE202	Project Work I	EE	0	0	12	6
Total Credits							**18**

SEMESTER- IV

S. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21NE203	Project Work II	EE	0	0	24	12
Total Credits							**12**

TOTAL NO. OF CREDITS: 75

*Audit Courses I & II is optional.

SUMMARY

Category	I	II	III	IV	Total
FC	4	-	-	-	4
PC	17	14	3	-	35
RM	3	-	-	-	2
PE	-	6	9	-	15
EE	-	1	6	12	19
Total	24	21	18	12	**75**

PROFESSIONAL ELECTIVES (PE)*

SEMESTER II, ELECTIVE I

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1.	21NEP01	Wireless Sensor Networks and Protocols	PE	3	0	0	3
2.	21NEP02	Optical Networks	PE	3	0	0	3
3.	21NEP03	Multimedia Security	PE	3	0	0	3
4.	21NEP04	Image Processing and Analysis	PE	3	0	0	3
5.	21NEP05	Agile Methodologies	PE	3	0	0	3

SEMESTER II, ELECTIVE II

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1.	21NEP06	Mobile and Pervasive Computing	PE	3	0	0	3
2.	21NEP07	Advanced Software Engineering	PE	3	0	0	3
3.	21NEP08	High Speed switching architectures	PE	3	0	0	3
4.	21NEP09	Network Management	PE	3	0	0	3

SEMESTER III, ELECTIVE III

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1.	21NEP10	Software Quality Assurance	PE	3	0	0	3
2.	21NEP11	Performance Analysis of Computer Systems *(Common to M.E.CSE, M.E CSE (with Specialization in Networks))*	PE	3	0	0	3
3.	21NEP12	Simulation of Computer Systems and Networks	PE	3	0	0	3
4.	21NEP13	Next Generation Networks	PE	3	0	0	3
5.	21NEP14	IT Audit and Control	PE	3	0	0	3

SEMESTER III, ELECTIVE IV

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1.	21NEP15	Cyber Physical Systems	PE	3	0	0	3
2.	21NEP16	Bioinformatics *(Common to M.E.CSE, M.E CSE (with Specialization in Networks))*	PE	3	0	0	3
3.	21NEP17	Deep Learning	PE	3	0	0	3
4.	21NEP18	Mobile Application Development *(Common to M.E.CSE, M.E CSE (with Specialization in Networks))*	PE	3	0	0	3
5.	21NEP19	Ethical Hacking	PE	3	0	0	3

SEMESTER III, ELECTIVE V

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1.	21NEP20	Web Engineering *(Common to M.E.CSE, M.E CSE (with Specialization in Networks))*	PE	3	0	0	3
2.	21NEP21	Security in IoT and Cloud	PE	3	0	0	3
3.	21NEP22	Software Defined Networks and Network Function Virtualization	PE	3	0	0	3
4.	21NEP23	Digital Forensics	PE	3	0	0	3
5.	21NEP24	Social Network Analysis *(Common to M.E.CSE, M.E CSE (with Specialization in Networks))*	PE	3	0	0	3

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

SL. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	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

21MA121	APPLIED PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE ENGINEERS *(Common to M.E.CSE, M.E.CSE (with Specialization in Networks))*	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: 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.

21RM101	RESEARCH METHODOLOGY AND IPR FOR TELECOM ENGINEERS *(Common to M.E. CSE(Specialisation in Networks) and M.E. Communication Systems programmes)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand research methodology, process and design.
- To know the details of sampling designs and also different methods of data collections.
- To introduce the art of interpretation and writing research reports.
- To be familiar with various forms of the intellectual property, its relevance and business impact in the changing global business environment.
- To understand the law of patent and licensing.

UNIT I	RESEARCH DESIGN	9

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

UNIT II	DATA COLLECTION AND SOURCES	9

Measurements, Measurement scales, Questionnaires and instruments, Sampling and methods. Data - Preparing, Exploring, Examining and Displaying.

UNIT III	DATA ANALYSIS AND REPORTING	9

Overview of Multivariate analysis, Hypotheses testing and Measures of association. Presenting insights and findings using written reports and oral presentation. Case studies.

UNIT IV	INTELLECTUAL PROPERTY RIGHTS	9

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

UNIT V	PATENTS	9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the technique of defining a research problem
CO2: Outline the concepts of data collections and analysis.
CO3: Interpret data and write research reports.
CO4: Explain the concepts of IPR and rules of IPR practices.
CO5: Infer the law of patent and licensing.

REFERENCES:

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

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.

UNIT I	ROLE OF ALGORITHMS IN COMPUTING	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+3

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+3

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+3

NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducibility – NP-Completeness Proofs – NP-Complete Problems.

	TOTAL: 60 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", Oxford University Press, 1st Edition, 2014.
2. Adam Drozdex, "Data Structures and algorithms in C++", Cengage Learning, 4th Edition, 2013.
3. T.H. Cormen, C.E.Leiserson, R.L. Rivest and C.Stein, "Introduction to Algorithms", Prentice Hall of India, 3rd Edition, 2012.
4. Mark Allen Weiss, "Data Structures and Algorithms in C++", Pearson Education, 3rd Edition, 2009.
5. E. Horowitz, S. Sahni and S. Rajasekaran, "Fundamentals of Computer Algorithms", University Press, 2nd Edition, 2008.
6. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.

21NE101	NETWORK TECHNOLOGIES *(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 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, 1st Edition ,2013 (UNIT 3)
4. Saad Z. Asif – “5G Mobile Communications Concepts and Technologies” CRC press , 1st Edition ,2019 (UNIT 3)
5. William Stallings –“Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud” 1st Edition, Pearson Education, 1st Edition ,2016.(Unit 4 and 5)
6. Thomas D.Nadeau and Ken Gray, “SDN – Software Defined Networks” ,O‟Reilly Publishers, 1st Edition ,2013.
7. Guy Pujolle, “Software Networks”, Second Edition, Wiley-ISTE, 2020

21NE102	WIRELESS COMMUNICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts in cellular communication.
- To learn the characteristics of wireless channels.
- To understand the impact of digital modulation techniques in fading.
- To get exposed to diversity techniques in wireless communication.
- To acquire knowledge in multicarrier systems.

UNIT I	CELLULAR CONCEPTS	9

Frequency Reuse – Channel Assignment Strategies – Handoff Strategies – Interference and system capacity- Co-Channel Interference- Adjacent Channel Interference – Trunking and Grade of service – Improving coverage & capacity in cellular systems-Cell Splitting- Sectoring- Repeaters for Range Extension-Microcell Zone Concept

UNIT II	THE WIRELESS CHANNEL	9

Overview of wireless systems – Physical modeling for wireless channels – Time and Frequency coherence – Statistical channel models – Capacity of wireless Channel- Capacity of Flat Fading Channel – Channel Side Information at Receiver – Channel Side Information at Transmitter and Receiver –Capacity comparisons – Capacity of Frequency Selective Fading channels

UNIT III	PERFORMANCE OF DIGITAL MODULATION OVER WIRELESSCHANNELS	9

Performance of flat fading and frequency selective fading – Impact on digital modulation techniques –- Outage Probability– Average Probability of Error — Combined Outage and Average Error Probability – Doppler Spread – Inter symbol Interference.

UNIT IV	DIVERSITY TECHNIQUES	9

Realization of Independent Fading Paths – Receiver Diversity – Selection Combining – Threshold Combing – Maximal-Ratio Combining – Equal - Gain Combining – Capacity with Receiver diversity – Transmitter Diversity – Channel known at Transmitter – Channel unknownat Transmitter – The Alamouti Scheme– Transmit & Receive Diversity-MIMO Systems.

UNIT V	MULTICARRIER MODULATION	9

Data Transmission using Multiple Carriers – Multicarrier Modulation with Overlapping Sub channels – Mitigation of Subcarrier Fading – Discrete Implementation of Multicarrier Modulation– Peak to average Power Ratio- Frequency and Timing offset.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Design solutions for cellular communication.

CO2: Determine the capacity of wireless channels.

CO3: Understand the performance of the digital modulation techniques in fading channels.

CO4: Apply various diversity techniques in wireless communication.

CO5: Design multicarrier systems in wireless communication.

REFERENCES:

1. Theodore.S. Rappaport, “Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, India, 2010
2. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005.
3. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Wiley Publication, 2nd Edition,2005.
4. Saad Z. Asif, “5G Mobile Communications Concepts and Technologies” 3rd Edition, CRC press –2019.
5. Keith Q. T. Zhang, “Wireless Communications: Principles, Theory and Methodology” 1st edition, John Wiley & Sons, 2016.
6. Ramjee Prasad, "OFDM for Wireless Communication Systems", Artech House,2nd edition, 2004.

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 explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- 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

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 DATABASE CONNECTIVITY	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 Data Store 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

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 database and formulate SQL queries on data.

CO2: Understand and write well-formed XML documents.

CO3: 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.

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”, Tata McGraw Hill, 3rd Edition, 2014.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, Reprint 2006.

21NE103	NETWORKS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To understand the functioning of various protocols in wired and wireless environments.
- To perform real time experiments using the existing infrastructure.
- To impart programming skills using NS2/QUALNET.
- To gain knowledge in constructing LAN, WLAN, and VLAN in a real-time environment.
- To understand the security algorithms for networks.

LIST OF EXPERIMENTS:

1. AODV/DSR routing
2. Security algorithms in wired networks
3. MAC protocols wired and wireless networks
4. Configuration of LAN
5. Configuration of VLAN- Tunneling
6. Configuration of WLAN
7. Mini Project

HARDWARE/SOFTWARE REQUIREMENTS:

1: C/Java/Python

2: NS2/ QUALNET /NS3/ OMNET/ equivalent

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Design MAC and routing protocols in Wired and Wireless Environment using NS2/QUALNET.

CO2: Acquire the technical competence to meet out the industry expectation on the state – of the art wired / wireless technologies.

CO3: Acquire the ability to design WLAN/ LAN systems meeting out real time requirements.

CO4: Design and configure a network.

CO5: Design VLAN for secured communication.

21NE104	NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To understand the fundamentals of network security.
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks.

UNIT I	INTRODUCTION	10

Services, Mechanisms and attacks-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm- Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms.

UNIT II	BLOCK CIPHERS & PUBLIC KEY ENCRYPTION	10

Data Encryption Standard-Block cipher design principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key encryption: Principles of public key cryptosystems-The RSA algorithm – Key Management - Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT III	HASH FUNCTIONS AND DIGITAL SIGNATURES	9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authenticationprotocols – DSS – EI Gamal – Schnorr.

UNIT IV	E-MAIL, IP & WEB SECURITY	8

E-mail Security: Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSec - IP security policy-Encapsulation Security Payload (ESP)-Combining Security Associations-Internet Key Exchange. Web Security: Web Security Considerations-Secure Socket Layer(SSL)- Transport Layer Security(TLS)- -Secure Electronic Transaction (SET).

UNIT V	SYSTEM SECURITY	8

Authentication applications – Kerberos – X.509 Authentication services - Firewalls – Types of Firewalls- Firewall design principles- Trusted System. Intruders – Intrusion detection – Viruses and related threats – Virus Countermeasures.

	TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Compare various Security Techniques Design Secure applications Inject secure coding in the developed applications

CO2: Implement basic security algorithms required by any computing system.

CO3: Understand the vulnerabilities in any computing system and hence be able to design a security solution.

CO4: Suggest the possible security attacks in complex real time systems and their effective counter measures

CO5: Identify the security issues in the network and resolve it.

REFERENCES:

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 1st Edition 2007.
2. Bruce Schneier and Neils Ferguson,"Practical Cryptography", 1st Edition, Wiley Dreamtech India Pvt Ltd, 2003.
3. Charles Pfleeger,"Security in Computing", 4th Edition, Prentice Hall of India, 2006.
4. Charlie Kaufman and Radia Perlman, Mike Speciner,"Network Security", 2nd Edition, Private Communication in Public World, PHI 2002.
5. Douglas R Simson "Cryptography – Theory and practice", 1st Edition, CRC Press, 1995.
6. Man Young Rhee, "Internet Security: Cryptographic Principles, -Algorithms and Protocols" , Wiley Publications, 1st Edition, 2003.
7. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 1st Edition, 2000.
8. William Stallings, "Cryptography and Network Security", 6th Edition, PearsonEducation, March 2013.

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. EthemAlpaydin, ―Introduction to Machine Learning , 3rd edition (Adaptive Computation and Machine Learning Series) , 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.

21NE105	INTERNET OF THINGS AND APPLICATIONS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand the fundamentals of Internet of Things
- To learn about various IoT architecture
- 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.

UNIT I	INTRODUCTION TO IoT	12

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

Suggested Activities :

Node MCU/ESP 32 - Temperature Sensor Interfacing (LM35) - Bluetooth Interfacing (HC05)- Motor driver Interfacing (L298) -LCD Interfacing (HD44780).

UNIT II	IoT ARCHITECTURE	12

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

Suggested Activities :

Implementation of IoT using BLYNK/CAYENNE - –Installation and Activation - Blinking an LED -Reading Analog Voltage - LCD Interfacing (HD44780) –Project.

UNIT III	IoT PROTOCOLS	12

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

Suggested Activities :

Implementation of Zigbee protocol using Arduino.

UNIT IV	BUILDING IoT WITH RASPBERRY PI & ARDUINO	12

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

Suggested Activities :

Implementation of IoT using Raspberry Pi & Python Programming: - LCD Interfacing (HD44780) - Motor driver Interfacing (L298) – Camera interface.

UNIT V	CASE STUDIES AND REAL-WORLD APPLICATIONS	12

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.

Suggested Activities :

Study of various applications using IoT.

TOTAL: 60 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

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, 1st edition,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, 1st edition, 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",1st edition, Academic Press, Elsevier, 2014.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley,2nd edition, 2012.

21NE106	NETWORK DESIGN AND PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To practice LAN and WAN design
- To learn network programming in UNIX C and Python
- To establish a LAN with a switch/hub with 3 PCs and check the connectivity and configuration
- To establish a internetwork with 2 routers and two or more LANs using static routes and check the connectivity and configuration
- To establish a dynamic routing based internetwork with 2 routers and two or more LANs using RIP/OSPF and check the connectivity and configuration.

LIST OF EXPERIMENTS:

1. Develop a C program that demonstrates inter process communication
2. Develop a TCP client/server application
3. Develop a UDP client/server application
4. Develop an Iterative UDP server with 2 or 3 clients
5. Develop a concurrent TCP server with 2 or 3 clients
6. Develop a multiprotocol server with TCP and UDP and 2 clients
7. Develop simple Python programs that use frequently used syntactic constructs
8. Develop a Socket based application in Python
9. Build client applications for major APIs (Amazon S3, Twitter etc) in Python
10. Develop an application that interacts with e-mail servers in python
11. Develop applications that work with remote servers using SSH, FTP etc in Python

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Design and implement LANs and internetworks.

CO2: Develop network based applications in UNIX C and Python.

CO3: Establish a LAN with a switch/hub.

CO4: Design a LANs using static routes.

CO5: Suggest the various critical parameters in deploying a WSN.

21NE107	NETWORK SECURITY LABORATORY	L	T	P	C
		0	0	4	1

COURSE OBJECTIVES:

- To learn about security protocols
- To implement security algorithms
- To learn and implement third party tools for security analysis.
- To implement security testing.
- To implement SQL Injection Technique.

LIST OF EXPERIMENTS:

1. Implementation of Known Plain text attack in Hill Cipher
2. Implementation of Data Encryption Standard
3. Implementation of Advanced Encryption Standard
4. Implementation of RSA
5. Implementation of Least Significant Bit method in Image Steganography
6. Security Analysis of Cryptographic algorithms using OPEN SSL
7. Analysis of Secure Socket Layer and IPSec protocol using wireshark
8. Simulation of SQL injection using DVWA
9. Simulation of Cross site Scripting using DVWA
10. Port Scanning using Nmap and Buffer overflow
11. Forensic Analysis using OSSEC
12. Email log Reports using Pflogsum

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand and implement various security protocols.

CO2: Compare the performances of various security protocols.

CO3: Understand about various third party tools used for security analysis.

CO4: Analyse those tools used for security testing.

CO5: Understand about SQL injection technique.

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 obtain information 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 ofarea 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 clarityin 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 theobjective – 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	5th week	8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)

	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 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)

21NE201	MULTIMEDIA COMMUNICATION NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the multimedia communication models
- To study the multimedia transport in wireless networks
- To explore real-time multimedia network applications.
- To formulate real-time multimedia network applications.
- To analyse the various qualities of Wireless Networks.

UNIT I	MULTIMEDIA COMMUNICATION MODELS	9

Common Multimedia applications - VoIP- Video Conferencing- Military Surveillance- Interactive TV- Video on Demand- Smart Phone - Requirements and Design challenges of multimedia communications-Architecture of Internet Multimedia Communication- Protocol Stack-H.323.

UNIT II	BEST EFFORT AND GUARANTEED SERVICE MODEL	9

Best effort service model and its limitations-Resource allocation-Metrics-Max and Min fair sharingQueuing-FIFO-Priority queue-Fair queue- Waited fair queue-Traffic policing-Token bucket- leaky bucket-Admission control-Packet classification and scheduling.

UNIT III	MULTIMEDIA ON IP NETWORKS	9

QoS aware routing-RSVP-Integrated and Differentiated services-MPLS-Multicasting-IGMP-PIMDVMRP

UNIT IV	TRANSPORT LAYER SUPPORT FOR MULTIMEDIA	9

Multimedia over TCP-Significance of UDP- Multimedia Streaming- Audio and Video StreamingInteractive and non Interactive Multimedia-RTP/RTCP-SIP-RTSP.

UNIT V	MULTIMEDIA QOS ON WIRELESS NETWORKS	9

IEEE 802.11e, IEEE 802.16, 3G networks-UMTS, 3GPP, 4G networks-LTE-IMS

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: To select suitable multimedia communication model for the required application.

CO2: Deploy the right Multimedia Communication models.

CO3: Apply QoS to multimedia network applications with efficient routing techniques.

CO4: Develop the real-time multimedia network applications.

CO5: Compare the various qualities of Wireless Networks.

REFERENCES:

1. James F. Kurose and Keith W. Ross, ―Computer Networking-A Top-Down Approach Featuring the Internet, Pearson, 2nd edition,2012.
2. Larry L. Peterson and Bruce S. Davie, ―Computer Networks- A Systems Approach, Morgan Kaufmann Publishers,2nd edition, 2007.
3. Mario Marques da Silva, ―Multimedia Communications and Networking, CRC Press, 3rd edition, 2012.

21NEP01	WIRELESS SENSOR NETWORKS AND PROTOCOLS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of wireless sensor networks and its application to critical real time scenarios.
- To study the various protocols at various layers and its differences with traditional protocols.
- To understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network.
- To analyse the issues associated with routing protocols.
- To understand the issues and challenges in providing QoS and Energy Management.

UNIT I	INTRODUCTION	9

Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.

UNIT II	INTRODUCTION TO ADHOC/SENSOR NETWORKS	9

Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering.

UNIT III	MAC PROTOCOLS	9

Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4.

UNIT IV	ROUTING PROTOCOLS	9

Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.

UNIT V	QOS AND ENERGY MANAGEMENT	9

Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Technically know how to build a WSN network.

CO2: Explain the working principle and applications of sensor networks.

CO3: Describe about MAC protocols.

CO4: Demonstrate the characteristics of routing protocols.

CO5: Analysis of various critical parameters in deploying a WSN.

TEXT BOOKS:

1. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless networks ", Pearson Education - 2008.

REFERENCES:

1. Feng Zhao and Leonides Guibas, "Wireless sensor networks ", Elsevier publication - 2004.
2. Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition, 2003.
3. William Stallings, "Wireless Communications and Networks ", Pearson Education 2nded, 2004.

21NEP02	OPTICAL NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To be well-versed in functionalities of various optical components and networking architectures like SONET /SDH used in Optical Networking.
- To be prepared for cost effective laying Access Networks like Fiber to the Home in India.
- To design and develop Optical Network Routing Algorithms.
- To apply basic Networking knowledge in optical domain.
- To analyze the optical networks in its configuration, fault and performance.

UNIT I	OPTICAL SYSTEM COMPONENTS	9

Light propagation in optical fibers – Loss & bandwidth, Dispersion effects, Non-Linear effects; Solitons-Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches,Wavelength Converters.

UNIT II	OPTICAL NETWORK ARCHITECTURES	9

Introduction to Optical Networks: SONET / SDH standards, Metropoliton Area Networks, Layered Architecture-Broadcast and Select Networks– Topologies for Broadcast Networks, Media Access Control Protocols, Test beds for WDM; Outline of Wavelength Routing Architecture.

UNIT III	WAVELENGTH ROUTING NETWORKS	9

Optical layer, Node Designs, Routing and Wavelength Assignment, Virtual topology design problem, Regular virtual topology design- Predetermined Virtual topology and Light path routes-Architectural variations.

UNIT IV	PACKET SWITCHING AND ACCESS NETWORKS	9

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronisation, Broadcast OTDM networks, Switch-based networks- Access Networks – Network Architecture overview, OTDM networks- Optical Access Network Architectures- Future Access Networks, FTTH Scenario in India and Foreign Countries.

UNIT V	NETWORK DESIGN AND MANAGEMENT	9

Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion- Wavelength stabilization ; Overall design considerations- Control and Management– Network management functions, Configuration management, Performance management, Fault management, Optical safety. Simple simulations using OPTSIM software.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply knowledge ofbasic optical components for realizing any optical function.

CO2: Identify and formulate different networking Topologies.

CO3: Design Optical Network Routing Algorithms.

CO4: Apply the basic Networking knowledge to realize any sort of end to end communication and analyze the Time division multiplexing in optical domain.

CO5: Manage the optical networks in its configuration, fault and performance.

REFERENCES:

1. Rajiv Ramaswami, Kumar N. Sivarajan and Galen H. Sasaki "Optical Networks : A Practical Perspective", 3rd Edition ,Harcourt Asia Pvt. Ltd., 2010.
2. Mohammad Ilyas, Hussein T. Mouftah, "Handbook of Optical Communication Networks", 1st edition , Taylor and Francis, 2007.
3. C.Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks :Concept, Design and Algorithms",Prentice Hall of India, First Edition, 2002.
4. Biswanath Mukherjee, "Optical Communication Networks", McGrawHill Revised Edition 2006.
5. P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ, 1993. 6. Rajiv Ramaswami and Kumar N. Sivarajan,"Optical Networks : A Practical Perspective", Harcourt Asia Pvt. Ltd., First Edition 1997.
6. Rajiv Ramaswami, Kumar N. Sivarajan and Galen H. Sasaki "Optical Networks : A Practical Perspective",Harcourt Asia Pvt. Ltd., First Edition 2005

21NEP03	MULTIMEDIA SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamental concepts of forensic science.
- To understand the application of forensic science principles to digital evidence examinations.
- To articulate the steps of the forensic process as applied to digital evidence.
- To draft a Standard Operating Procedure.
- To Conduct rudimentary digital forensic examinations

UNIT I	INTRODUCTION TO MULTIMEDIA	9

Image, Video and Audio Formats and Standards, and Digital Rights Management Mathematical Preliminaries - Discrete Fourier Transform, Discrete Cosine Transform, Discrete Wavelet Transform ,Random Sequence Generation, The Chaotic Maps , Error Correction Codes.

UNIT II	MULTIMEDIA ENCRYPTION	9

Requirements and Applications Approaches – Full Encryption, Selective Encryption, Joint Compression and Encryption, Syntax-Compliant Encryption,Scalable Encryption and Multi-Access Encryption. Attacks – Traditional Attacks, Statistical Attack, Error concealment attack.

UNIT III	DIGITAL WATER MARKING	9

Requirements and Applications, Watermarking Algorithms-Spatial-Domain Watermarking - Substitution and Additive Watermarking. Frequency-Domain Watermarking - Substitution and Multiplicative Watermarking, Watermarking Based on Vector Quantization, Fragile Watermarking - Block-Based and Hierarchical Block-Based watermarking.

UNIT IV	WATER MARKING PROTOCOLS	9

A Buyer-Seller Watermarking Protocol,Extensions of Watermarking Protocols, Protocols for Secure Computation Attacks -Filtering, Remodulation, JPEG Coding Distortion and JPEG 2000 Compression, Geometric Transformation -Image Scaling, Rotation, Image Clipping, Linear Transformation, Bending,
Warping and Perspective Projection, Cryptographic attacks and Protocol attacks, Watermarking Tools

UNIT V	LAWS AND ACTS	9

Requirements and Applications, Types– Text, Audio, Video, Linguisticand Network steganography Algorithms – Least Significant Method, GIFshuffle, EzStego,Jsteg, Steganographic Tools Steganalysis - Statistical Properties of Images, The Visual Steganalytic System, IQM-Based Steganalytic System, Learning Strategies- Support Vector Machine, Neural Networks, Principle Component Analysis, Frequency-Domain Steganalytic System

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand an idea regarding the fundamental concepts of forensic science.
CO2: Apply the concepts and will be able to collect digital evidence.
CO3: Implement the forensic concepts in open platform.
CO4: Apply the Standard Operating Procedure.
CO5: Understand the forensic evidence in terms of Legal procedure.

REFERENCES:

1. Cox, Miller, Bloom, Fridrich, and Kalker, ” Digital Watermarking and Steganography”,2nd Edition, 2008
2. Wenjun Zeng, Heather Yu, Ching-Yung Lin, ”Multimedia Security Technologies for Digital Rights Management”, Elsevier, 2008
3. Borko Furht, Darko Kirovski “Multimedia Security Handbook”, CRC Press,2nd edition, 2004

21NEP04	IMAGE PROCESSING AND ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the image processing concepts and analysis
- 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 analyze the concept of image registration and visualization

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 OperationsDistance 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: Critically analyze different approaches to image processing applications.

CO4: Explore the possibility of applying Image processing concepts in various applications.

CO5: Understand the concept of image registration and visualization.

REFERENCES:

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

21NEP05	AGILE METHODOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I	FUNDAMENTALS OF AGILE	9

The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools

UNIT II	AGILE SCRUM FRAMEWORK	9

Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management.

UNIT III	AGILE TESTING	9

The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester.

UNIT IV	AGILE SOFTWARE DESIGN AND DEVELOPMENT	9

Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control.

UNIT V	INDUSTRY TRENDS	9

Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Experiment the Agile development practice.

CO2: Perform development with unit tests using Test Driven Development.

CO3: Apply design principles and refactoring to achieve Agility.

CO4: Deploy and justify automated build tools, version control and continuous integration

CO5: Build testing activities within an Agile project.

REFERENCES:

1. Ken Schawber, Mike Beedle," Agile Software Development with Scrum", Pearson publication,2nd edition,2010.
2. Lisa Crispin, Janet Gregory, "Agile Testing: A Practical Guide for Testers and Agile Teams", Publisher: Addison Wesley, 2nd edition,2009.
3. Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", Publisher: Prentice Hall,3rd edition,2002.
4. Alistair Cockburn ,"Agile Software Development: The Cooperative Game", Publisher: Addison Wesley, 2nd edition, 2008.

21NEP06	MOBILE AND PERVASIVE COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the basic architecture and concepts till Third Generation Communication systems..
- To understand the latest 4G Telecommunication System Principles.
- To introduce the broad perspective of pervasive concepts and management.
- To Explore the HCI in Pervasive environment.
- To explore the pervasive concepts in mobile environment

UNIT I	INTRODUCTION	9

History – Wireless communications: GSM – DECT – TETRA – UMTS – IMT – 2000 – Blue tooth, WiFi, WiMAX, 3G ,WATM.- Mobile IP protocols -WAP push architecture-Wml scripts and applications. Data networks – SMS – GPRS – EDGE – Hybrid Wireless100 Networks – ATM – Wireless ATM.

UNIT II	OVERVIEW OF A MODERN 4G TELECOMMUNICATIONS SYSTEM	9

Introduction. LTE-A System Architecture. LTE RAN. OFDM Air Interface. Evolved Packet Core. LTE Requirements. LTE-Advanced. LTE-A in Release. OFDMA – Introduction. OFDM Principles. LTE Uplink—SC-FDMA. Summary of OFDMA..

UNIT III	PERVASIVE CONCEPTS AND ELEMENTS	9

Technology Trend Overview - Pervasive Computing: Concepts - Challenges - Middleware - Context Awareness - Resource Management - Human–Computer Interaction - Pervasive Transaction Processing - Infrastructure and Devices - Wireless Networks - Middleware for Pervasive Computing Systems - Resource Management - User Tracking- Context Management -Service Management - Data Management - Security Management - Pervasive Computing Environments - Smart Car Space - Intelligent Campus

UNIT IV	HCI IN PERVASIVE COMPUTING	9

Prototype for Application Migration - Prototype for Multimodalities - Human–Computer Interface in Pervasive Environments - HCI Service and Interaction Migration - Context-Driven HCI Service Selection - Interaction Service Selection Overview - User Devices - Service-Oriented Middleware Support - User History and Preference - Context Manager - Local Service Matching - Global Combination - Effective Region - User Active Scope - Service Combination Selection Algorithm

UNIT V	PERVASIVE MOBILE TRANSACTIONS	9

Pervasive Mobile Transactions - Introduction to Pervasive Transactions – Mobile Transaction Framework - Unavailable Transaction Service - Pervasive Transaction Processing Framework - Context-Aware Pervasive Transaction Model - Context Model for Pervasive Transaction Processing - Context-Aware Pervasive Transaction Model - A Case of Pervasive Transactions - Dynamic Transaction Management - Context-Aware Transaction Coordination Mechanism - Coordination Algorithm for Pervasive Transactions - Participant Discovery - Formal Transaction Verification - Petri Net with Selective Transition.

	TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Obtain a thorough understanding of Basic architecture and concepts of till Third Generation Communication systems.
CO2: Explain the latest 4G Telecommunication System Principles.
CO3: Incorporate the pervasive concepts.
CO4: Implement the HCI in Pervasive environment
CO5: Work on the pervasive concepts in mobile environment

REFERENCES:

1. Alan Colman, Jun Han, and Muhammad Ashad Kabir, "Pervasive Social Computing Socially-Aware Pervasive Systems and Mobile Applications", Springer, 2016.
2. J.Schiller, "Mobile Communication", Addison Wesley,1st edition, 2000
3. Juha Korhonen, "Introduction to 4G Mobile Communications" , Artech HousePublishers, 2nd edition,2014
4. Kolomvatsos, Kostas, "Intelligent Technologies and Techniques for Pervasive Computing", IGI Global,2nd edition, 2013.
5. M. Bala Krishna, Jaime Lloret Mauri, "Advances in Mobile Computing and Communications: Perspectives and Emerging Trends in 5G Networks", First edition,CRC press, 2016
6. Minyi Guo, Jingyu Zhou, Feilong Tang, Yao Shen,"Pervasive Computing: Concepts,Technologies and Applications ",First edition,CRC Press, 2016.

21NEP07	ADVANCED SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand Software Engineering Lifecycle Models..
- To do project management and cost estimation
- To gain knowledge of the System Analysis and Design concepts.
- To understand software testing approaches
- To be familiar with DevOps practices

UNIT I	INTRODUCTION	9

Software engineering concepts – Development activities – Software lifecycle models - Classical waterfall - Iterative waterfall – Prototyping – Evolutionary - Spiral – Software project management – Project planning – Estimation – Scheduling – Risk management – Software configuration management.

UNIT II	SOFTWARE REQUIREMENT SPECIFICATION	9

Requirement analysis and specification – Requirements gathering and analysis – Software Requirement Specification – Formal system specification – Finite State Machines – Petrinets – Object modelling using UML – Use case Model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Functional modelling – Data Flow Diagram

UNIT III	ARCHITECTURE AND DESIGN	9

Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model-view-controller – Publish-subscribe – Adapter – Command – Strategy – Observer – Proxy – Facade – Architectural styles – Layered - Client-server - Tiered - Pipe and filter.- User interface design

UNIT IV	TESTING	9

Testing – Unit testing – Black box testing– White box testing – Integration and System testing– Regression testing – Debugging - Program analysis – Symbolic execution – Model Checking

UNIT V	DEVOPS	9

DevOps:Motivation-Cloud as a platform-Operations- Deployment Pipeline:Overall Architecture-Building and Testing-Deployment- Case study: Migrating to Microservices

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the advantages of various Software Development Lifecycle Models.

CO2: Gain knowledge on project management approaches as well as cost and schedule estimation strategies.

CO3: Perform formal analysis on specifications.

CO4: Use UML diagrams for analysis and design

CO5: Architect and design using architectural styles and design patterns

REFERENCES:

1. Bernd Bruegge, Alan H Dutoit, "Object-Oriented Software Engineering", 2nd edition, Pearson Education, 2004.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, "Fundamentals of Software Engineering", 2nd edition, PHI Learning Pvt. Ltd., 2010.

3. Craig Larman, “Applying UML and Patterns”, 3rd edition, Pearson Education, 2005.
4. Len Bass, Ingo Weber and Liming Zhu, “DevOps: A Software Architect’s Perspective”, Pearson Education,2nd edition, 2016.
5. Rajib Mall, “Fundamentals of Software Engineering”, 3rd edition, PHI Learning Pvt. Ltd., 2009.
6. Stephen Schach,” Software Engineering”, 7th edition, McGraw-Hill, 2007

21NEP08	HIGH SPEED SWITCHING ARCHITECTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the basics of switching
- To explore the various space division switches
- To evaluate the performance of various switching architectures
- To study the architecture of IP routers
- To study about MPLS switches

UNIT I	SWITCHING BASICS	9

Circuit switching, Message switching and Packet switching – Datagrams and Virtual circuits – Cell switching – Label switching – L2 switching Vs L3 switching – VLANs – Switching and Bridging – Loop resolution, Spanning tree algorithms – Cut through and Store and forward switches – Head of line blocking – Back pressure – Switch design goals.

UNIT II	SWITCHING ARCHITECTURES	9

Shared medium switches – Shared memory switches – Space division switches – Cross bar based switching architecture – Input queued, Output queued and Combined input-output queued switches – Non blocking and blocking cross bar switches – Banyan networks – Batcher Banyan networks – Optical switches – Unbuffered and buffered switches – Buffering strategies – Optical packet switches and Optical burst switches – MEMS optical switches.

UNIT III	PACKET QUEUES AND DELAY ANALYSIS	9

Littles theorem – Birth and death processes – Queuing disciplines – Markovian FIFO queuing – Non Markovian – PollaczekKhinchine formula –M/M/1, M/G/1 and M/D/1 models – Self similar models and Batch arrivals models – Network of queues – Burkes theorem and Jackson theorem.

UNIT IV	P ROUTER ARCHITECTURE	9

Bus based router architecture with single processor and multiple processors – Architecture with multiple parallel forwarding engines – Switch based router architecture with multiple processors – Switch based router architecture with multiple processors – Switch based architecture with fully distributed processors – Critical and non critical data path processing – fast and slow path.

UNIT V	MPLS ROUTERS	9

MPLS – Layer 2.5 - Labels – Switching and Distribution –Label Switched Path – Label Forwarding Instance Base – Label Stacking - IP Lookup vs Label lookup – Label Distribution Protocol – MPLS based VPNs– Label switching – Label switched path – Comparison with ATM technology.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply switching concepts to build networks.

CO2: Deploy the network with appropriate type of switches

CO3: Select and configure the appropriate type of IP router.

CO4: Design and implement MPLS networks

CO5: Architect and design using architectural styles and design patterns

REFERENCES:

1. Damitri P Bertsekas and Gallager, “Data Networks”, 2nd edition, PHI, 1992
2. Elhanany, Itamar, Hamdi and Mounir, “High Performance Packet Switching Architectures”,

Springer 2007
3. H.Jonathan Chao and Bin Liu, "High Performance Switches and Routers",2nd edition, John Wiley and Sons, 2007.
4. Howard C Berkowitz, "Designing Routing and Switching Architectures for Enterprise Networks",1st edition, Sams, 1999.

21NEP09	NETWORK MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To appreciate the need for interoperable network management as a typical distributed application
- To familiarize concepts and terminology associated with SNMP
- To be aware of current trends in network management technologies.
- To apply network management tools
- To analyze the web based management tools.

UNIT I	OSI NETWORK MANAGEMENT	9

OSI Network management model - Organizational model - Information model, Communication model. Abstract Syntax Notation - Encoding Structure, Macros Functional Model CMIP/CMIS.

UNIT II	BROADBAND NETWORK MANAGEMENT	9

Broadband networks and services, ATM Technology - VP, VC, ATM Packet, Integrated service, ATM LAN emulation, Virtual LAN, ATM Network Management - ATM Network reference model, Integrated local Management Interface. ATM Management Information base, Role of SNMP and ILMI in ATM Management, M1, M2, M3, M4 interface. ATM Digital Exchange Interface Management.

UNIT III	SIMPLE NETWORK MANAGEMENT PROTOCOL	9

SNMPv1 Network Management: Communication and Functional Models. The SNMP Communication Model, Functional model. SNMP Management SNMPv2: Major Changes in SNMPv2, SNMPv2 System Architecture, SNMPv2 Structure of Management Information, The SNMPv2 Management Information Base,SNMPv2 Protocol, Compatibility With SNMPv1.Configuration management, Fault management, Performance management, Event Correlation Techniques 168 security management, Accounting management, Report Management, Policy Based Management, Services Level Management.

UNIT IV	NETWORK MANAGEMENT SYSTEMS	9

Network Management Tools, Network Statistics Measurement Systems, History of Enterprise Management, Commercial Network management Systems, System Management and Enterprise Management Solutions.

UNIT V	WEB-BASED MANAGEMENT	9

NMS with Web Interface and Web-Based Management, Web Interface to SNMP Management, Embedded Web-Based Management, Desktop management Interface, Web-Based Enterprise Management, WBEM: Windows Management Instrumentation, Java management Extensions, Management of a Storage Area Network.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Diagnose problems and make minor repairs to computer networks using appropriate diagnostics software

CO2: Demonstrate how to correctly maintain LAN computer systems

CO3: Maintain the network by performing routine maintenance tasks

CO4:Apply network management tools

CO5: Analyze the web based management tools.

REFERENCES:

1. Lakshmi G Raman, "Fundamentals of Telecommunication Network Management", Eastern Economy Edition IEEE Press, New Delhi, 1999.
2. Mani Subramanian, "Network Management - Principles and Practice", Pearson Education, 2nd edition, 2010.
3. Mark Burges, "Principles of Network System Administration", Wiley,2nd edition, 2000.
4. Salah Aiidarons and Thomas Plevayk, "Telecommunications Network Technologies and Implementations", Eastern Economy Edition IEEE press, New Delhi, 1998.
5. Stephen Morris, "Network Management, MIBs and MPLS - Principles, Design and Implementation", Pearson Education,2nd edition, 2003.

21NEP10	SOFTWARE QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand the basic tenets of software quality and quality factors.
- Be exposed to the Software Quality Assurance (SQA) architecture and the details of SQA components.
- Understand of how the SQA components can be integrated into the project life cycle.
- Be familiar with the software quality infrastructure.
- Be exposed to the management components of software quality.

UNIT I	INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE	9

Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall?s quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans.

UNIT II	SQA COMPONENTS AND PROJECT LIFE CYCLE	9

Software Development methodologies – Quality assurance activities in the development process- Verification & Validation – Reviews – Software Testing – Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components – Quality assurance tools – CASE tools for software quality – Software maintenance quality – Project Management.

UNIT III	SOFTWARE QUALITY INFRASTRUCTURE	9

Procedures and work instructions - Templates - Checklists – 3S developmenting - Staff training and certification Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control – Storage and retrieval.

UNIT IV	SOFTWARE QUALITY MANAGEMENT & METRICS	9

Project process control – Computerized tools - Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model.

UNIT V	STANDARDS, CERTIFICATIONS & ASSESSMENTS	9

Quality manangement standards – ISO 9001 and ISO 9000-3 – capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards – IEEE st 1012 & 1028 – Organization of Quality Assurance – Department management responsibilities – Project management responsibilities – SQA units and other actors in SQA systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES: At the end of the course, learners will be able to

CO1: Utilize the concepts in software development life cycle.

CO2: Demonstrate their capability to adopt quality standards.

CO3: Assess the quality of software product.

CO4: Apply the concepts in preparing the quality plan & documents

CO5: Assess the SQA Project Process Standards.
REFERENCES: 1. Alan C. Gillies, “Software Quality: Theory and Management”, International Thomson Computer Press,First edition, 1997. 2. Mordechai Ben-Menachem “Software Quality: Producing Practical Consistent Software”,International Thompson Computer Press,2nd edition, 1997.

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, 2nd edition,2001.
2. Krishna Kant, "Introduction to Computer System Performance Evaluation", McGraw-Hill,2nd edition, 1992.
3. Lieven Eeckhout, "Computer Architecture Performance Evaluation Methods", Morgan and Claypool Publishers,2nd edition, 2010.
4. Mor Harchol - Balter, "Performance Modeling and Design of Computer Systems – Queueing Theory in Action", Cambridge University Press,3rd edition, 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

21NEP12	SIMULATION OF COMPUTER SYSTEMS AND NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand how simulators are built
- To understand the statistical models used in simulations
- To learn different ways of generating random numbers
- To learn modeling of the data given as input to simulators
- To understand how computer networks are simulated using case studies.

UNIT I	STATISTICAL AND QUEUING MODELS	9

Statistical models – Discrete, continuous and empirical distributions – Characteristics of Queuing systems – Measures of performance of queuing systems – Markovian models.

UNIT II	RANDOM NUMBER AND RANDOM VARIATE GENERATION	9

Properties of random numbers – Generating uniform random numbers – Generating non-uniform random numbers - Tests for random numbers – Random-variate generation

UNIT III	ANALYSIS OF SIMULATION DATA	9

Input modeling – Identifying the distribution – Parameter estimation – Goodness-of-fit tests – Multivariate and time-series input models – Verification and validation of simulation models

UNIT IV	SIMULATION OF COMPUTER NETWORKS	9

Introduction – Performance modeling – Modeling Techniques – Protocol modeling – Workload modeling – Network Topology modeling – Performance metrics in computer network simulation – Validation and verification – Discrete event simulation – GPU-based simulations – Multi-agent-based simulations –Network simulators

UNIT V	CASE STUDIES OF NETWORK SIMULATORS	9

NS-3 based Simulative Platform - Evolved packet system – Differentiated services domain – ns-3 simulator – Simulation techniques for next generation wireless heterogeneous networks – Features of common network simulators - OpNet, mininet.

TOTAL: 45 PERIODS

COURSE OUTCOMES: At the end of the course, learners will be able to

CO1: Understand different queuing systems.

CO2: Understand the modeling and development of simulations and simulators.

CO3: Differentiate the different ways in which simulators are designed

CO4: Analyse how computer networks are simulated.

CO5: Compare the features of different simulators

REFERENCES:

1. J. B. Sinclair, “Simulation of Computer Systems and Computer Networks: A

Process-Oriented Approach",2nd edition, 2004.
2. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, "Discrete-event System Simulation", 5th Edition, Pearson, 2010.
3. Law, Averill, "Simulation Modeling and Analysis with Expert Software", Mc Graw Hill, 4th edition, 2006.
4. Mohammad S. Obaidat, Petros Nicopolitidis, Faouzi Zarai, "Modeling and Simulation of Computer Networks and Systems – Methodologies and Applications", Morgan Kaufmann, 3rd edition,2015.
5. Sheldon M. Ross, "Simulation", 5th Edition, Elsevier, 2013.

21NEP13	NEXT GENERATION NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the technical, economic and service advantages of next generation networks
- To learn the evolution of technologies of 4G and beyond
- To learn Software defined Mobile Network issues and integrating challenges with LTE
- To explore the NGN framework catering the services of end user with QoS provisioning
- To learn about the NGM management and standards.

UNIT I	INTRODUCTION	9

Evolution of public mobile services -motivations for IP based services, Wireless IP network architecture –3GPP packet data network architecture. Introduction to next generation networks - Changes, Opportunities and Challenges, Technologies, Networks, and Services, Next Generation Society, future Trends..

UNIT II	4G and BEYOND	9

Introduction to LTE-A –Requirements and Challenges, network architectures –EPC, E-UTRAN architecture-mobility management, resource management, services, channel -logical and transport channel mapping, downlink/uplink data transfer, MAC control element, PDU packet formats, scheduling services, random access procedure.

UNIT III	SDMN-LTE INTEGRATION	9

SDN paradigm and applications, SDN for wireless-challenges, Leveraging SDN for 5G networks-ubiquitous connectivity-mobile cloud-cooperative cellular network-restructuring mobile networks to SDN-SDN/LTE integration benefits.

UNIT IV	NGN ARCHITECTURE	9

Evolution towards NGN-Technology requirements, NGN functional architecture- Transport stratum, service stratum, service/ content layer and customer terminal equipment function. NGN entities, Network and Service evolution -fixed, mobile, cable and internet evolution towards NGN

UNIT V	NGN MANAGEMENT AND STANDARDIZATION	9

NGN requirements on Management-Customer, third party, Configuration, Accounting, performance, device and information management. Service and control management- End-to-End QoS and security. ITU and GSI-NGN releases, ETSI-NGN concept and releases, NGMN alliance and NGMN.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the issues and challenges of wireless domain in future generation network design.

CO2: Explore the LTE concepts and technologies.
CO3: Understand the integration of SDN with LTE.
CO4: Understand the NGN Architecture
CO5: Understand the NGN management and standardizations

REFERENCES:

1.Jingming Li Salina, Pascal Salina "Next Generation Networks-perspectives and potentials" Wiley, 2nd edition,January 2008.

2. Madhusanga Liyanage, Andrei Gurtov, Mika Ylianttila, "Software Defined Mobile Networks beyond LTE Network Architecture", 2nd edition,Wiley, June 2015.

3. Martin Sauter,"3G,4G and Beyond bringing networks, devices and web together", Wiley, 2nd edition, 2013.

4. Savo G Glisic," Advanced Wireless Networks- Technology and Business models", Wiley, 3rd edition, 2016.

5. Thomas Plavyk, ”Next generation Telecommunication Networks, Services and Management”, Wiley & IEEE Press Publications, 2013.

21NEP14	IT AUDIT AND CONTROL	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Establish an understanding of the IT environment and the role of the IT auditor
- Understand about auditing Networks.
- Develop an understanding of the IT audit process in SDLC
- Understand about the database environments
- Understand about ERP Systems.

UNIT I	AUDITING AND INTERNAL CONTROL	9

Overview of Auditing, Role of the audit committee ,Audit Risk ,The IT Audit, Internal Control, Internal Control Objectives, Principles, and Models.

UNIT II	AUDITING OPERATING SYSTEMS AND NETWORKS	9

Auditing Operating Systems, Auditing Networks, Auditing Electronic Data Interchange (EDI),Auditing PC-Based Accounting Systems.

UNIT III	SDLC RISKS AND CONTROLS	9

Participants in Systems Development, the Systems Development Life Cycle, Controlling and Auditing the SDLC.

UNIT IV	AUDITING DATABASE SYSTEMS	9

Data Management Approaches, Key Elements of the Database Environment, Databases in a Distributed Environment, Controlling and Auditing Data Management Systems, Access Controls

UNIT V	ENTERPRISE RESOURCE PLANNING SYSTEMS	9

ERP, ERP System Configurations, Risks Associated with ERP Implementation, Implications for Internal Control and Auditing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Establish an understanding of the IT environment and the role of the IT auditor

CO2: Understand about auditing Networks.

CO3: Develop an understanding of the IT audit process in SDLC

CO4: Understand about the database environments

CO5: Understand about ERP Systems.

REFERENCES:

1. James A. Hall, “Information Technology Auditing and Assurance”, South-Western cengage learning ,3rd edition, 2011.
2. Chris Davis and Mike Schiller, “IT Auditing: Using Controls to protect Information Assets”, Mc-Graw Hill, 2nd Edition, 2011.

21NEP15	CYBER PHYSICAL SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the concepts of cyber physical systems.
- To discuss various CPS platform components.
- To discuss various coordination protocols.
- To explore various security methods for CPS.
- To discuss various application scenarios of implementing CPS.

UNIT I	INTRODUCTION	9

Cyber-Physical System, Key Features of CPS, Application Domains of CPS, Basic principles of design and validation of CPS, Challenges in CPS.

UNIT II	CPS PLATFORM COMPONENTS	9

CPS HW platforms, Processors, Sensors and Actuators, CPS Network - Wireless, CAN, Automotive Ethernet, Scheduling Real Time CPS tasks, Synchronous Model and Asynchronous Model.

UNIT III	SYNCHRONOUS AND ASYNCHRONOUS MODEL	9

Reactive Components, Components Properties, Components Composing, Synchronous Designs and Circuits, Asynchronous Processes and operations, Design Primitives in Asynchronous Process, Coordination Protocols in Asynchronous Process, Leader Election, Reliable Transmission.

UNIT IV	SECURITY OF CYBER-PHYSICAL SYSTEMS	9

Introduction to CPS Securities, Basic Techniques in CPSSecurities, Cyber Security Requirements, Attack Model and Countermeasures, advanced Techniques in CPS Securities.

UNIT V	CPS APPLICATION	9

Health care and Medical Cyber-Physical Systems, Smart grid and Energy Cyber-Physical Systems, WSN based Cyber-Physical Systems, Smart Cities

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Listen and comprehend key features of CPS.

CO2: Learn about various CPS platform components.

CO3: Learn about various coordination protocols.

CO4: Explore about security measures for CPS.

CO5: Explore various application implemented with CPS.

REFERENCES :

1. E. A. Lee and S. A. Seshia, "Introduction to Embedded Systems: A Cyber -Physical Systems Approach", 1st edition, 2011.
2. R. Alur, "Principles of Cyber-Physical Systems," MIT Press, 2015.
3. Raj Rajkumar, Dionisio de Niz and Mark Klein, "Cyber-Physical Systems", Addison-Wesley, 2nd Edition, 2017.
4. Fei Hu, "Cyber-Physical Systems", CRC Press , 2nd Edition,2013.

21NEP16	BIO INFORMATICS *(Common to M.E.CSE, M.E.CSE (with Specialization in Networks))*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To get exposed to the fundamentals of bioinformatics.
- To analyze DNA sequencing data and detection of genomic variants.
- To learn and understand open problems, issues in replication, assemble genome, various clustering and multiple pattern matching.
- To study bio informatics pattern matching and clustering techniques.
- To study and be exposed to the domain of animal genomics.

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 Retrieval Systems – Genome Browsers - Biomedical Data –Their Acquisition, Storage and Use, Electronic Health Records (EHR), Information Retrieval From Digital Libraries.

UNIT II	GENOMICS AND EPIGENOMICS	9

Genomic Variants Detection and Genotyping - Computational approaches for Finding Long Insertions and Deletions with NGS Data- Computational Approaches in Next-Generation Sequencing Data Analysis for Genome-Wide DNA Methylation Studies- Bisulfite-Conversion-Based Methods for DNA Methylation Sequencing Data Analysis.

UNIT III	DNA REPLICATION AND ASSEMBLE GENOME	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-Assemble Genome-String Reconstruction Problem-Assembling Genomes from Read Pairs.

UNIT IV	BIOINFORMATICS CLUSTERING AND PATTERN MATCHING	9

Introduction to Clustering- Good Clustering Principle-K-Means ClusteringLloyd Algorithm-Making Soft Decisions in Coin Flipping-Clustering Tumor Samples-Introduction to Multiple Pattern Matching-Burrows-Wheeler Transform-Pattern Matching with the Burrows-Wheeler Transform-Epilogue: Mismatch-Tolerant Read Mapping.

UNIT V	ANIMAL GENOME	9

Human and Mouse Genomes-Random Breakage Model of Chromosome Evolution – Sorting by Reversals – Greedy Heuristic Approach – Break Points Graphs-Neighbor-Joining Algorithm-Character Based Tree Reconstruction.

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 distinguish Epigenomics and Genomics

CO3: Deploy the replication and molecular clocks in Bioinformatics

CO4: Implement various Clustering and Pattern Matching techniques
CO5: Use the Breakpoint Graphs for Genome Expression

REFERENCES

1. Philip Compeau and Pavel Pevzner, "Bioinformatics Algorithms: An Active Learning Approach" 2nd Edition Volume I , Coursera, 2015.
2. Supratim Choudhuri, "Bioinformatics For Beginners", Elsevier, 2014.
3. Shortliffe EH, Ciminio JJ ,"Biomedical Informatics: Computer applications in Health care and Biomedicine", 3rd edition, 2000, New York Springer-Verlag, ISBN 0-387-28986-0.
4. Ion Mandoiu and Alexander Zelikovsky , "Computational Methods for Next Generation Sequencing Data Analysis " Wiley series, 2nd edition,2016.
5. Robert F.Coughlin, Istvan Miklos,Renyi Institute, "Introduction to algorithms in Bioinformatics",Springer 2016

21NEP17	DEEP LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic ideas and principles of neural networks.
- To understand the basic concepts of deep learning
- To familiarize with image processing facilities like TensorFlow and Keras.
- To appreciate the use of deep learning applications.
- To understand and implement deep learning architectures

UNIT I	BASICS OF NEURAL NETWORKS	9

Basic Concept of Neurons – Perceptron Algorithm – Feed Forward - Multilayer Perceptron, Gradient Descent ,Back propagation Networks, Empirical Risk Minimization, regularization, autoencoders.

UNIT II	INTRODUCTION TO DEEP LEARNING	9

Deep Feed-Forward Neural Networks – Gradient Descent – Back-Propagation and Other Differentiation Algorithms – Vanishing Gradient Problem – Mitigation – Rectified Linear Unit (ReLU) – Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Nestors Accelerated Gradient Descent – Regularization for Deep Learning – Dropout – Adversial Training – Optimization for Training Deep Models.

UNIT III	CONVOLUTIONAL NEURAL NETWORK	9

CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning – Recurrent and Recursive Nets – Recurrent Neural Networks – Deep Recurrent Networks – Recursive Neural Networks – Applications.

UNIT IV	ADDITIONAL DEEP LEARNING ARCHITECTURES	9

Long Short Term Memory (LSTM) Networks – Sequence Prediction – Gated Recurrent – Encoder/Decoder Architectures – Autoencoders – Standard – Sparse – Denoising – Contractive – Variational Autoencoders – Applications of Autoencoders – Representation Learning – Deep generative Models – Deep Belief Networks – Deep Generative Networks – Generative Schemes – Evaluating Generative Models.

UNIT V	APPLICATIONS OF DEEP LEARNING	9

Images segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative adversarial networks – Video to Text with LSTM models – Attention models for Computer Vision – Case Study: Named Entity Recognition – Opinion Mining using Recurrent Neural Networks – Parsing and Sentiment Analysis using Recursive Neural Networks – Sentence Classification using Convolutional Neural Networks – Dialogue Generation with LSTMs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the role of deep learning in machine learning applications.

CO2: Get familiar with the use of TensorFlow and Keras in deep learning applications.

CO3: Design and implement deep learning applications.
CO4: Design and implement convolutional neural networks.
CO5: Know about applications of deep learning in NLP and image processing. architectural styles and design.

REFERENCES

1. Phil Kim, "Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence", Apress, 2nd Edition,2017.
2. Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 1st Edition 2018.
3. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 1st Edition,2018.
4. Joshua F. Wiley, "R Deep Learning Essentials", Packt Publications, 2nd Edition 2016.

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, 2nd edition,2013.

3. James Dovey and Ash Furrow, “Beginning Objective C”, Apress,2nd edition, 2012.

4. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox,1st edition, 2012.

5. Reto Meier, “Professional android Development”, Wiley-India Edition, 2012.

21NEP19	ETHICAL HACKING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand and analyse Information security threats & couter measures
- To perform security auditing & testing
- To understand issues relating to ethical hacking
- To study &employ network defense measures
- To understand penetration and security testing issues

UNIT I	ETHICAL HACKING OVERVIEW	9

Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hacktivism – Vulnerability Research – Introduction to Footprinting – Information Gathering Methodology – Footprinting Tools – WHOIS Tools – DNS Information Tools – Locating the Network Range – Meta Search Engines

UNIT II	SCANNING AND ENUMERATION	9

Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools

UNIT III	SYSTEM HACKING	9

Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools

UNIT IV	PROGRAMMING FOR SECURITY PROFESSIONALS	9

Programming Fundamentals – C language – HTML – Perl – Windows OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures – Linux OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures.

UNIT V	PENETRATION TESTING	9

Introduction – Security Assessments – Types of Penetration Testing- Phases of Penetration Testing – Tools – Choosing Different Types of Pen-Test Tools – Penetration Testing Tools

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand vulnerabilities, mechanisms to identify vulnerabilities/threats/attacks.

CO2: Learn about enumeration techniques.

CO3: Understand various system hacking methods.

CO4: Learn about security vulnerabilities in OS.

CO5: Perform penetration & security testing.

REFERENCES

1. EC-Council, “Ethical Hacking and Countermeasures: Attack Phases”, Delmar Cengage Learning , 2nd Edition, 2009.

2. Jon Erickson, “Hacking: The Art of Exploitation”, No Starch Press, 2nd Edition, 2008.

3. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 1st Edition,2010

4. Patrick Engebretson, “ The Basics of Hacking and Penetration Testing – Ethical Hacking and Penetration Testing Made Easy”, Syngress Media, 2nd Revised Edition, 2013.

5. RajatKhare, "Network Seuciry and Ethical Hacking", Luniver Press, 4th Edition,2006.

6. Ramachandran V,BackTrack ," Wireless Penetration Testing Beginner's Guide", 3rd edition, Packt Publishing, 2011.
7. Thomas Mathew, "Ethical Hacking", OSB publishers, 1st Edition,2003.

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.
- Analyze the concept of promoting web applications and web project management.

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,2nd edition, 2006.
3. Guy W. Lecky-Thompson, "Web Programming", Cengage Learning,3rd edition, 2008.
4. John Paul Mueller, "Web Development with Microsoft Visual Studio" 2005, Wiley Dream tech, 2nd edition , 2006.
5. Roger S. Pressman, David Lowe, "Web Engineering", Tata McGraw Hill Publication, 2nd edition, 2007.

21NEP21	SECURITY IN IOT AND CLOUD	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the Security requirements in IoT
- To understand the cryptographic fundamentals for IoT
- To understand the authentication credentials and access control
- To understand the various types Of Trust models and Cloud Security
- To have a basic idea about IOT cloud security.

UNIT I	INTRODUCTION	9

Securing The Internet Of Things: IoT- Industry collaboration – Uses – IoT in the Enterprise – IoT Future and Need of Security – Vulnerabilities, Attacks and Countermeasures – Security Engineering for IoT Development – Security Life cycle.

UNIT II	CRYPTOGRAPHIC FUNDAMENTALS FOR IOT	9

Cryptographic primitives and its role in IoT – Encryption and Decryption – Hashes – Digital Signatures – Random number generation – Cipher suites – key management fundamentals – cryptographic controls built into IoT messaging and communication protocols – IoT Node Authentication.

UNIT III	IDENTITY & ACCESS MANAGEMENT SOLUTIONS FOR IOT	9

Identity lifecycle – Authentication credentials – IoT IAM infrastructure – Authorization with Publish / Subscribe schemes – access control.

UNIT IV	PRIVACY PRESERVATION AND TRUST MODELS FOR IOT	9

Privacy Challenges – IoT PIA – PbD principles – Privacy Engineering recommendation.

UNIT V	CLOUD SECURITY FOR IOT	9

Cloud services and IoT – offerings related to IoT from cloud service providers – Cloud IoT security controls – An enterpriseIoT cloud security architecture – New directions in cloud enabled IoT computing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the security requirements in IoT.

CO2: Choose and implement efficient security algorithms in IoT.

CO3: Understand about the different access management solutions in IoT.

CO4: Understand about different trust models for IoT.

CO5: Understand about cloud security for IoT.

REFERENCES:

1. Brian Russell, Drew Van Duren, "Practical Internet of Things Security (Kindle Edition)", 2016.

2. Fei Hu, "Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations", 1st edition,2016.

3. Ben Halpert , Auditing Cloud Computing: A Security and Privacy Guide: , John Wiley Sons,3rd edition, 2011.

4. Ianlim, E.Coleen Coolidge, Paul Hourani, Securing Cloud and Mobility: A Practitioners Guide, Auerbach Publications,2nd edition, Feb 2013.

21NEP22	SOFTWARE DEFINED NETWORKS AND NETWORK FUNCTION VIRTUALIZATION	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the concepts of software defined networks
- To learn the interface between networking devices and the software controlling them
- To learn network virtualization and tools
- To explore modern approaches like vmware, openflow, openstack.
- To explore security and visibility approaches in virtual networks.

UNIT I	SOFTWARE DEFINED NETWORK	9

Introduction – Centralized and Distributed Control and Data Planes – Open Flow – SDN Controllers – General Concepts – VLANs – NVGRE – Open Flow – Network Overlays – Types – Virtualization – Data Plane – I/O – Design of SDN Framework

UNIT II	VIRTUALIZATION BASICS	9

Primer on Virtualization, Benefits of virtual machines, Hypervisors, Managing Virtual resources, Virtualized cloud/data center .

UNIT III	NETWORK FUNCTIONS VIRTUALIZED	9

Virtualize a Network, virtualizing appliances, virtualizing core networking functions, scalability and performance.

UNIT IV	MODERN NETWORKING APPROACHES	9

Openflow, VMware NSX, OpenDayLight project-ODL architecture & controller platform, control network, Business case for SDN

UNIT V	SECURITY & VISIBILITY	9

Security-Preventing Data leakage, Logging and auditing, Encryption in Virtual Networks Visibility-Overlay networks, Network management tools, Monitoring Traffic

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify/design software defined network for the required application/platform

CO2: Deploy network virtualization tool & design

CO3: Equip in various network security measures and tackle

CO4: Analyze networking functions in virtualization.

CO5: Use modern networking approaches.

REFERENCES:

1. Jim Doherty,"SDN and NFV Simplified", Addison Wesley,2nd edition, 2016.
2. SiamakAzodoimolky, "Software Defined Networking with OpenFlow", Packt Publishing Limited, 2nd edition 2013.
3. Thomas D.Nadeau and Ken Gray, “SDN – Software Defined Networks”, O‟Reilly Publishers, 2nd edition, 2013.
4. William Stallings, ”Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud" 2nd edition,Pearson,2015
5. Oswald Coker, Siamak Azodolmolky. Software-Defined Networking with OpenFlow - Second Edition, Packt Publishing, 2017.

21NEP23	DIGITAL FORENSICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn about the fundamental concepts of forensic science.
- To understand about the application of forensic science principles to digital evidence examinations.
- To articulate the steps of the forensic process as applied to digital evidence.
- To draft a Standard Operating Procedure.
- To conduct rudimentary digital forensic examinations

UNIT I	INTRODUCTION	9

Introduction - Digital Forensics - Digital Evidence - Increasing Awareness of Digital Evidence - Digital Forensics: Past, Present, and Future – Principles - Challenging Aspects of Digital Evidence – Cyber trail - Language of Computer Crime Investigation - Role of Computers in Crime

UNIT II	EVIDENCE AND INVESTIGATIONS	9

Evidence in the Courtroom - Duty of Experts – Admissibility - Levels of Certainty in Digital Forensics - Direct versus circumstantial evidence - Scientific Evidence - Presenting Digital Evidence - Conducting Digital Investigations - Digital Investigation Process Models - Scaffolding for Digital Investigations - Applying the Scientific Method in Digital Investigations - Investigative Scenario: Security Breach

UNIT III	OPEN SOURCE EXAMINATION PLATFORM	9

Open Source Examination Platform - Using Linux and Windows as the Host, Disk and File System Analysis, Media Analysis Concepts , Sleuth Kit, Partitioning and Disk Layouts, Special Containers, Hashing.

UNIT IV	DISK AND FILE SYSTEM ANALYSIS	9

Imaging, Internet Artifacts, Browser & Mail Artifacts, File Analysis, Image, Audio, Video, Archives, Documents, Graphical Investigation Environments, PyFLAG, Fiwalk, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition.

UNIT V	LAWS AND ACTS	9

Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamental concepts of forensic science.

CO2: Apply the concepts and will be able to collect digital evidence.

CO3: Implement the forensic concepts in open platform.

CO4: Apply the Standard Operating Procedure.

CO5: Identify the forensic evidence in terms of Legal procedure.

REFERENCES:

1. Cory Altheide and Harlan Carvey, “Digital Forensics with Open Source Tools” Elsevier publication, 3rd Edition, April 2011
2. Eoghan Casey , “Digital Evidence and Computer Crime", Forensic Science, Computers, and the Internet, Elsevier, 3rd Edition, 2011
3. Kevin Mandia, Chris Prosise, Matt Pepe, “Incident Response and Computer Forensics “,

TataMcGraw -Hill, New Delhi, 2nd edition ,2006
4. Nelson Phillips and Enfinger Steuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2nd edition, 2009.
5. Robert M Slade,”Software Forensics”, Tata McGraw - Hill, New Delhi, 2nd edition, 2005

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: Understand about the internal components of the social network

CO2: Summarise about Modelling and visualization of social network

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

CO4: Identify 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, 2nd edition 2012
2. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1st edition, 2011
3. Charu C. Aggarwal, "Social Network Data Analytics", Springer; 1st edition, 2014
4. Giles, Mark Smith, John Yen, "Advances in Social Network Mining and Analysis", Springer, 1st edition, 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, 1st edition ,2015

21AC101	ENGLISH FOR RESEARCH PAPER WRITING *(Common to all M.E. Programmes)*	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, CreateSpace 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, 1stEdition, SAGE Publications, Inc, , 2009

21AC102	CONSTITUTION OF INDIA *(Common to all M.E. 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 M.E. Programmes)*	L	T	P	C
		2	0	0	0

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 Manmade 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.