K.L.N. COLLEGE OF ENGINEERING

Pottapalayam - 630612, Sivagangai District

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Estd: 1994

CURRICULAM & SYLLABUS

I to IV Semesters

REGULATIONS 2024

For Post Graduate Program

M.E. COMPUTER SCIENCE AND ENGINEERING
(With Specialization in Networks)

CHOICE BASED CREDIT SYSTEM

(For the students admitted from the academic year 2024-2025 onwards)

K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM

(An Autonomous Institution, Affiliated to Anna University, Chennai)

VISION OF THE INSTITUTION

To become a Centre of Excellence in Technical Education and Research in producing Competent and Ethical professionals to the society.

MISSION OF THE INSTITUTION

To impart Value and Need based curriculum to the students with enriched skill development in the field of Engineering, Technology, Management and Entrepreneurship and to nurture their character with social concern and to pursue their career in the areas of Research and Industry**.**

VISION OF THE DEPARTMENT

To emerge as a center of excellence through innovative technical education and research in Information Technology.

MISSION OF THE DEPARTMENT

To produce competent Information Technology professionals to face the industrial and Societal challenges by imparting quality education with ethical values.

K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM

(An Autonomous Institution, Affiliated to Anna University, Chennai)

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1 To excel in industrial or graduate work in Information Technology and multi-disciplinary Environments.

PEO2 To adapt to ever changing technologies by applying Engineering Principles.

PROGRAM OUTCOMES (POs)

Students should be able to

PO1: Critically analyze complex challenges in computer networks and apply engineering principles to support sustainable development goals.

PO2: Demonstrate the application of systems and processes to address challenges in computer networks, employing modern engineering tools and resources to meet societal needs, with a strong focus on public health, safety, and environmental

protection.

PO3: Independently carry out research /investigation and development work to solve practical problems

PO4: Write and present a substantial technical report/document

PO5: Apply ethical principles, human values adhere to national and International Laws

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1 To create better learning environment in line with technological updation and research progress.

PSO2 To give industry exposure through research and consultancy in Information and Communication Technologies.

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REGULATIONS 2024

CHOICE BASED CREDIT SYSTEM

M.E. COMPUTER SCIENCE AND ENGINEERING
(With Specialization in Networks)

CATEGORY OF COURSES

i. **FOUNDATION COURSES (FC)** may include Mathematics or other basic courses

ii. **PROFESSIONAL CORE (PC)** courses include the core courses relevant to the chosen specialization/branch.

iii. **PROFESSIONAL ELECTIVES (PE)** courses include the elective courses relevant to the chosen specialization/ branch.

iv. **EMPLOYABILITY ENHANCEMENT COURSES (EEC)** includes Term paper writing and seminar, Project work Phase – I and II.

v. **AUDIT COURSES (AC)** includes courses which develop desired attitude.

vi. **OPEN ELECTIVE COURSES (OE**) include skill development Courses.

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REGULATIONS 2024

CHOICE BASED CREDIT SYSTEM

M.E. COMPUTER SCIENCE AND ENGINEERING (With Specialization in Networks)

(FULL TIME)

CURRICULUM AND SYLLABUS I TO IV SEMESTERS

SEMESTER I

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	24MA103	Applied Probability and Statistics	FC	4	4	0	0	4
2	24NE101	Advanced Data Structures and Algorithms	PC	4	4	0	0	4
3	24NE102	Database Practices	PC	3	3	0	0	3
4	24NE103	Network Technologies	PC	3	3	0	0	3
5	24NE104	Machine Learning Techniques	PC	3	3	0	0	3
6	24RM101	Research Methodology and IPR	PC	3	3	0	0	3
7		Audit Course - I(Optional)	AC	2	2	0	0	0
PRACTICAL								
8	24NE1L1	Advanced Data Structures and Algorithms Laboratory	PC	4	0	0	4	2
9	24NE1L2	Networks Laboratory	PC	4	0	0	4	2
TOTAL				**30**	**22**	**0**	**8**	**24**

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SEMESTER II

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	24NE201	Network Design and Programming	PC	4	4	0	0	4
2	24NE202	Network Security	PC	3	3	0	0	3
3	24NE203	IOT Architecture and Programming	PC	3	3	0	0	3
4		Professional Elective –I	PE	3	3	0	0	3
5		Professional Elective –II	PE	3	3	0	0	3
6		Audit Course-II (Optional)	**AC**	2	2	0	0	0
PRACTICAL								
8	24NE2L1	Network Design and Programming Laboratory	PC	4	0	0	4	2
	24NE2L2	Network Security Laboratory	PC	4	0	0	2	2
9	24NE2L3	Term Paper Writing and Seminar	EEC	2	0	0	2	1
TOTAL				**28**	**18**	**0**	**8**	**21**

SEMESTER III

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	24NE301	Multimedia Communication Networks	PC	3	3	0	0	3
2		Professional Elective –III	PE	3	3	0	0	3
3		Professional Elective –IV	PE	3	3	0	0	3
		Open Elective	OE	3	3	0	0	3
PRACTICAL								
4	24NE3L1	Project Work Phase – I	EEC	12	0	0	12	6
TOTAL				**24**	**12**	**0**	**12**	**18**

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SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICAL								
1	20NE4L1	Project Work Phase – II	EEC	24	0	0	24	12
TOTAL				**24**	**0**	**0**	**24**	**12**

TOTAL NO. OF CREDITS: 75

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FOUNDATION COURSES (FC)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	24MA103	Applied Probability and Statistics	FC	4	4	0	0	4

PROFESSIONAL CORE (PC)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	24NE101	Advanced Data Structures and Algorithms	PC	4	4	0	0	4
2	24NE102	Database Practices	PC	3	3	0	0	3
3	24NE103	Network Technologies	PC	3	3	0	0	3
4	24NE104	Machine Learning Techniques	PC	3	3	0	0	3
5	24RM101	Research Methodology and IPR	PC	3	3	0	0	3
6	24NE1L1	Advanced Data Structures and Algorithms Laboratory	PC	4	0	0	4	2
7	24NE1L2	Networks Laboratory	PC	4	0	0	4	2
8	24NE201	Network Design and Programming	PC	4	4	0	0	4
9	24NE202	Network Security	PC	3	3	0	0	3
10	24NE203	IOT Architecture and Programming	PC	3	3	0	0	3
11	24NE2L1	Network Design and Programming Laboratory	PC	4	0	0	4	2
12	24NE2L2	Network Security Laboratory	PC	4	0	0	2	**2**
13	24NE301	Multimedia Communication Networks	PC	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	24NE2L3	Term Paper Writing and Seminar	EEC	2	0	0	2	1
2	24NE3L1	Project Work Phase - I	EEC	12	0	0	12	6
3	24NE4L1	Project Work Phase - II	EEC	24	0	0	24	12

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PROFESSIONAL ELECTIVES (PE)

Semester II

Elective I and II

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	24NE2A1	Wireless Sensor Networks and Protocols	PE	3	3	0	0	3
2	24NE2A2	Social Network Analysis	PE	3	3	0	0	3
3	24NE2A3	Mobile Application Development	PE	3	3	0	0	3
4	24NE2A4	Deep Learning	PE	3	3	0	0	3
5	24NE2A5	Advanced Software Engineering	PE	3	3	0	0	3
6	24NE2B1	Mobile and Pervasive Computing	PE	3	3	0	0	3
7	24NE2B2	High Speed Switching Architectures	PE	3	3	0	0	3
8	24NE2B3	Simulation of Computer Systems and Networks	PE	3	3	0	0	3
9	24NE2B4	Data Science and Big Data Analytics	PE	3	3	0	0	3
10	24NE2B5	Cognitive Computing	PE	3	3	0	0	3

Semester III

Elective III and IV

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	24NE3A1	Network Management	PE	3	3	0	0	3
2	24NE3A2	Network Performance Analysis	PE	3	3	0	0	3
3	24NE3A3	Next Generation Networks	PE	3	3	0	0	3
4	24NE3A4	Software Defined Networks and Network Function Virtualization (SDN and NFV)	PE	3	3	0	0	3
5	24NE3A5	Simulation of Computer Systems and Networks	PE	3	3	0	0	3
6	24NE3B1	Embedded Software Development	PE	3	3	0	0	3

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S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
7	24NE3B2	Protocols and Architectures for Wireless Sensor Networks	PE	3	3	0	0	3
8	24NE3B3	Data Storage and Information Management	PE	3	3	0	0	3
9	24NE3B4	Cloud Computing Technologies	PE	3	3	0	0	3
10	24NE3B5	Ethical Hacking	PE	3	3	0	0	3

AUDIT COURSES (AC)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	24AC101	English For Research Paper Writing	AC	2	2	0	0	0
2.	24AC102	Disaster Management	AC	2	2	0	0	0
3.	24AC104	Value Education	AC	2	2	0	0	0
4.	24AC105	Constitution of India	AC	2	2	0	0	0
5.	24AC107	Stress Management by Yoga	AC	2	2	0	0	0
6.	24AC109	Natramizh Ilakiam	AC	2	2	0	0	0

OPEN ELECTIVES (OE) (For other PG Programmes)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	24NEOE1	IoT for Smart Systems	OE	3	3	0	0	3
2	24NEOE2	Machine learning and Deep Learning	OE	3	3	0	0	3
3	24NEOE3	E- Learning	OE	3	3	0	0	3
4	24NEOE4	Digital Marketing	OE	3	3	0	0	3

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OPEN ELECTIVES (OE) - For M.E-CSE (WSN)

Offered by Other PG Programmes

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	24PSOE1	Energy Conservation and Management in Domestic Sectors	OE	3	3	0	0	3
2	24PSOE2	Electric Vehicle Technology	OE	3	3	0	0	3
3	24PSOE3	Smart Grid	OE	3	3	0	0	3
4	24PSOE4	Renewable Energy Technology	OE	3	3	0	0	3
5	24CUOE1	Satellite Communication Systems	OE	3	3	0	0	3
6	24CUOE2	Fundamentals Of Wireless Communication	OE	3	3	0	0	3
7	24CUOE3	Multicore Systems	OE	3	3	0	0	3
8	24CUOE4	Microprocessor And Embedded Systems	OE	3	3	0	0	3
9	24MCOE1	Software Project Management	OE	3	3	0	0	3
10	24MCOE2	Crypto Currency and Block Chain Technologies	OE	3	3	0	0	3
11	24MCOE3	Data Warehousing and Data Mining	OE	3	3	0	0	3
12	24MCOE4	Big Data Analytics	OE	3	3	0	0	3

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SUMMARY

S.No	Category	Credits as per Semester				Total Credits
		I	II	III	IV	
1	**FC**	4	-	-	-	4
2	**PC**	20	14	3	-	37
3	**PE**	-	6	6	-	12
4	**OE**	-	-	3	-	3
5	**EEC**	-	1	6	12	19
6	**AC**	0	0	-	-	0
Total		**24**	**21**	**18**	**12**	**75**

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24MA103	APPLIED PROBABILITY AND STATISTICS	L	T	P	C
		4	0	0	4

OBJECTIVES:

The primary objective of this course is to demonstrate various analytical skills in applied mathematics and extensive experience with the tactics of problem solving and Logical thinking applicable in Computer Science Engineering**.**

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

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OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

- Apply various methods in Linear algebra to solve the system of linear equations. (K3)
- Calculate the basic probability axioms, rules and to find the moments of discrete and continuous random variables. (K3)
- Determine Marginal and Conditional distributions of two-dimensional random variables. (K3)
- Apply statistical tests in testing the hypotheses on data. (K3)
- Calculate descriptive statistics, testing for multivariate normality using analysis of multivariate data. (K3)

REFERENCES:

1. Dallas E Johnson, “Applied multivariate methods for data Analysis”, Thomson and Duxbury press, Singapore, 1998. (Chapters-1.5, 5.1-5.2 & 10-10.1).
2. Richard A. Johnson and Dean W. Wichern, “Applied multivariate statistical Analysis”, Pearson Education, Fifth Edition, 6th Edition, New Delhi, 2013.
3. Bronson, R.,” Matrix Operation” Schaum’s outline series, Tata McGraw Hill, New York, 2011. (Chapters- 9, 10, 20 & 21).
4. Veera Rajan. T, “Probability, Statistics and Random Process with Queueing Theory and Queueing Network, Tata McGraw Hill, 4th Edition,2017. (Chapters - 1.2-1.10-1.19, 2.1-2.26-2.4,4.2-4.22,5 & 9)
5. Johnson R. A. and Gupta C.B., “Miller and Freund’s Probability and Statistics for Engineers”, Pearson India Education, Asia, 9th Edition, New Delhi, 2017. (Chapters-3, 5 ,6, 7 & 3.4)

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24NE101 ADVANCED DATA STRUCTURES AND ALGORITHMS

L	T	P	C
4	0	0	4

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 INTRODUCTION TO ALGORITHM ANALYSIS **12**

Algorithms – Algorithms as a Technology- Insertion Sort – Analyzing Algorithms – Designing Algorithms- Growth of Functions: Asymptotic Notation – Standard Notations and Common Functions- Recurrences: The Substitution Method – The Recursion-Tree Method

UNIT II HIERARCHICAL DATA STRUCTURES **12**

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- Fibonacci Heaps: structure – Mergeable- heap operations- Decreasing a key and deleting a node-Bounding the maximum degree.

UNIT III GRAPHS **12**

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; All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd-Warshall Algorithm.

UNIT IV ALGORITHM DESIGN TECHNIQUES **12**

Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming –Longest Common Subsequence- Greedy Algorithms: An Activity-Selection Problem – Elements ofthe Greedy Strategy- Huffman Codes.

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UNIT V NP COMPLETE AND NP HARD 12

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

TOTAL: 60 PERIODS

OUTCOMES:

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

- Measure the efficiency of the algorithm by applying appropriate methodology. (K3)
- Design the various trees and apply its applications. (K3)
- Solve the geometrical application by using various graph algorithms. (K3)
- Apply suitable design strategy for problem solving. (K3)
- Design an Analyze the problems related to P & NP type of problems. (K3)

REFERENCES:

1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, Reprint 2006.
2. Robert Sedgewick and Kevin Wayne, “ALGORITHMS”, Fourth Edition, Pearson Education.
3. S.Sridhar, “Design and Analysis of Algorithms”, First Edition, Oxford University Press. 2014
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, Third Edition, Prentice-Hall, 2011.
5. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, 4th Edition, Pearson, 2014.

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24NE102	DATABASE PRACTICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- Understand query processing in a distributed database system
- Understand the basics of XML and create well-formed and valid XML documents.
- Distinguish the different types of NoSQL databases
- To understand the different models involved in database security and their applications in real time world to protect the database and information associated with them.

UNIT I RELATIONAL DATA MODEL **9**

Entity Relationship Model – Relational Data Model – Mapping Entity Relationship Model to Relational Model – Relational Algebra – Structured Query Language – Database Normalization.

UNIT II DISTRIBUTED DATABASES, ACTIVE DATABASES AND OPEN DATABASE CONNECTIVITY **9**

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.

UNIT III XML DATABASES **9**

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

UNIT IV NOSQL DATABASES AND BIG DATA STORAGE SYSTEMS **9**

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.

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UNIT V DATABASE SECURITY **9**

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

TOTAL: 45 PERIODS

OUTCOMES:

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

- Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data. (K3)
- Understand and write well-formed XML documents(K3)
- Be able to apply methods and techniques for distributed query processing. (K3)
- Design and implement secure database systems. (K3)
- Use the data control, definition, and manipulation languages of the NoSQL databases(K3)

REFERENCES:

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education 2016.
2. Henry F. Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Sixth Edition, McGraw Hill, 2019.
3. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems, EighthEdition, Pearson Education, 2006.
4. Raghu Ramakrishnan , Johannes Gehrke “Database Management Systems”, FourthEdition, McGraw Hill Education, 2015.
5. Harrison, Guy, “Next Generation Databases, NoSQL and Big Data” , First Edition, Apress publishers, 2015
6. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Sixth Edition, Pearson Education, 2015

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24NE103	NETWORK TECHNOLOGIES	L	T	P	C
		3	0	0	3

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 learn about Network Function Virtualization
- To understand the paradigm of Software defined networks

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 Modelling 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. Group Table. OpenFlow Protocol. SDN Control Plane Architecture. Control Plane Functions. Southbound Interface. Northbound Interface. Routing. ITU-T Model. Open Daylight. Open Daylight Architecture. OpenDaylight Helium. SDN Application Plane Architecture. Northbound Interface. Network Services Abstraction Layer. Network Applications. User Interface.

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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- NFVand SDN –Network virtualization – VLAN and VPN

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain basic networking concepts (K2)
- Compare different wireless networking protocols (K2)
- Describe the developments in each generation of mobile data networks (K3)
- Explain and develop SDN based applications (K3)
- Explain the concepts of network function virtualization (K3)

REFERENCES:

1. James Bernstein, “Networking made Easy”, 2018.
2. HoudaLabiod, Costantino de Santis, HossamAfifi –“Wi-Fi, Bluetooth, Zigbee and WiMax”, Springer 2007
3. Erik Dahlman, Stefan Parkvall, Johan Skold, “4G: LTE/LTE-Advanced for Mobile Broadband, Academic Press, 2013
4. Saad Z. Asif – “5G Mobile Communications Concepts and Technologies” CRC press –2019
5. William Stallings –“Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud” 1st Edition, Pearson Education, 2016.
6. Thomas D.Nadeau and Ken Gray, “SDN – Software Defined Networks” ,O"Reilly Publishers, 2013.
7. Guy Pujolle, “Software Networks”, Second Edition, Wiley-ISTE, 2020

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24NE104 MACHINE LEARNING TECHNIQUES

L	T	P	C
3	0	0	3

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 probabilities-based learning techniques.
- To understand graphical models of machine learning algorithms.

UNIT I INTRODUCTION 9

Learning – Types of Machine Learning -Uses of Machine learning- languages for 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.

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-Case Study - Building an automated category tree.

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-Case Study - Digitizing information on business cards.

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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

OUTCOMES:

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

- Distinguish between, supervised, unsupervised and semi-supervised learning(K3)
- Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem(K3)
- Design systems that uses the appropriate graph models of machine learning(K3)
- Modify existing machine learning algorithms to improve classification efficiency(K3)
- Understand graphical models of machine learning algorithms(K3)

REFERENCES:

1. Ethem Alpaydin, “Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)”, Third Edition, MIT Press, 2014
2. Jason Bell, “Machine learning – Hands on for Developers and Technical Professionals”, First Edition, Wiley, 2014
3. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, First Edition, Cambridge University Press, 2012.
4. Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, Second Edition, Chapman and Hall, CRC Machine Learning and Pattern Recognition Series, 2014.
5. Tom M Mitchell, “Machine Learning”, First Edition, McGraw Hill Education, 2013.
6. https://tryolabs.com/static/Machine-Learning-Case-Studiesv98b4e1fad373e3bc0e13f2bfca4433e9.pdf

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24RM101 RESEARCH METHODOLOGY AND IPR

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give an overview of the research methodology
- To explain the technique of defining a research problem
- To explain the functions of the literature review in research.
- To explain the art of interpretation and the art of writing research reports.
- To explain various forms of the intellectual property its relevance and business impact in the changing global business environment.

UNIT-I RESEARCH METHODOLOGY **9**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches o f investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations. Effective literature studies, approaches, analysis, Plagiarism, Research ethics.

UNIT-II EFFECTIVE TECHNICAL WRITING **9**

How to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and Assessment by a review committee

UNIT - III INTELLECTUALPROPERTYANDINTERNATIONALSCENARIO **9**

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

UNIT – IV PATENT RIGHTS **9**

Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications

UNIT – V NEW DEVELOPMENTS IN IPR **9**

Administration of Patent System, New developments in IPR,IPR of Biological Systems, Computer Software etc Traditional knowledge Case Studies, PR and IITs.

TOTAL:45 PERIODS

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OUTCOMES:

Upon Completion of the Course, the Students will be able to:

- Explain the scope and objectives of research problem (K2)
- Develop effective technical writing for research proposal (K3)
- Classify the Intellectual property in IPR (K3)
- Illustrate patent rights, indications (K3)
- Predict the new development in IPR (K3)

TEXT BOOKS:

1. Debora J. Halbert, “Resisting Intellectual Property (RIPE Series in Global Political Economy)”, Taylor Francis Ltd.,2006.
2. W.H.Mayall, “Industrial Design for Engineers”, London Iliffe Books Ltd. 1967.
3. Benjamin W. Niebel, “Product Design and Process Engineering”, McGraw-HillInc.,US,1974.
4. Morris Asimow, “An Introduction To Design”, Prentice-Hall, Inc. First Edition,1962.
5. Robert P. Merges, Peter S. Menell and Mark A. Lemley, “Intellectual Property in New Technological Age”, AspenLaw&Business,2012.
6. T.Ramappa,“Intellectual Property Rights Under WTO: Tasks Before India”, AH Wheeler PublishingCo.Ltd.,2002.

REFERENCES:

1. S. Melvilleand W. Goddard, “Research Methodology: an Introduction for Science and Engineering Students”, Juta&Co. Ltd., 1996.
2. Ranjit Kumar, “Research Methodology: A Step-by-Step Guide for Beginners”, Third Edition, SAGE Publications Ltd.,2010

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24NE1L1	ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2

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.

LIST OF EXPERIMENTS

Each student has to work individually on assigned lab exercises. Lab sessions could be scheduled as one contiguous four-hour session per week or two two-hour sessions per week. There will be about 15 exercises in a semester. It is recommended that all implementations are carried out in Java. If C or C++ has to be used, then the threads library will be required for concurrency. Exercises should be designed to cover the following topics:

EXPERIMENTS:

1. Implementation of Merge Sort and Quick Sort-Analysis
2. Implementation of Binary Search and Linear Search
3. Implementation of a Binary Search Tree
4. Implementation of Tree Traversal
5. Red-Black Tree Implementation
6. Heap Implementation
7. Fibonacci Heap Implementation
8. Graph Traversals
9. Spanning Tree Implementation
10. Implementation of Kruskal Algorithm
11. You are supposed to build a Social Cop in your smart phone. Social Cop helps people report crimes in the nearest police station in real time. Use K-d tree to search for the police station nearest to the crime location before attempting to report anything by constructing a 2 dimensional K-d tree from the location of all the police stations in your city querying the K-d tree to find the nearest police to the any given location in the city.

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12. Implement Crossword puzzles as Constraint satisfaction problems
13. Develop an approximation algorithm for the problems like graph coloring, vertex color Problem, Maximal flow, shortest path problems, Minimum subsequence generation etc.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Design and apply iterative and recursive algorithms. (K3)
- Design and implement algorithms using the hill climbing and dynamic programming and recursive backtracking techniques. (K3)
- Design and implement randomized algorithms.(K3)
- Design appropriate shared objects and concurrent objects for applications.(K3)
- Implement and apply concurrent linked lists, stacks, and queues.(K3)

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24NE1L2	NETWORKS LABORATORY	L	T	P	C
		0	0	4	2

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 skill**s** 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- Tunnelling
6. Configuration of WLAN
7. Mini Project

TOTAL: 60 PERIODS

HARDWARE / SOFTWARE REQUIREMENTS

1: C/Java/Python

2: NS2/ QUALNET /NS3/ OMNET/ equivalent

OUTCOMES:

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

- Design MAC and routing protocols in Wired and Wireless Environment usingNS2/QUALNET. (K3)
- Acquire the technical competence to meet out the industry expectation on the state – ofthe art wired / wireless technologies. (K3)
- Acquire the ability to design WLAN/ LAN systems meeting out real time requirements. (K3)
- Design and configure a network. (K3)
- Design VLAN for secured communication. (K3)

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24NE201	NETWORK DESIGN AND PROGRAMMING	L	T	P	C
		4	0	0	4

OBJECTIVES:

- To understand the basic networking principles
- To explore various networking devices and protocols required for network design and management
- To study two novel networking technologies: SDN and DTN
- To learn network programming in UNIX C

UNIT I NETWORKING PRINCIPLES **12**

Advanced multiplexing – Code Division Multiplexing, DWDM and OFDM – Shared media networks – Collision detection and collision avoidance, Hidden and Exposed Terminals – Switched networks – Datagrams, Virtual circuits, Cell switching and Label switching – Wireless Networks – Infrastructure based, ad hoc and hybrid – End to end semantics – Connectionless, Connection oriented, Wireless Scenarios –Applications, Comparison of WLAN and UMTS -Quality of Service – End to end level and network level solutions.

UNIT II PHYSICAL NETWORK DESIGN **12**

LAN cabling topologies – Ethernet Switches – High speed and Gigabit and 10Gbps – Building cabling topologies and Campus cabling topologies – Routers, Firewalls and L3 switches –Remote Access Technologies and Devices – Modems and DSLs – SLIP and PPP - WAN Design and Enterprise Networks – Core networks, distribution networks and access networks-Comparison of WLAN and UMTS.

UNIT III LOGICAL DESIGN AND MANAGEMENT **12**

IPv4 and IPv6 Dynamic Addressing –Hierarchical routing – VLSM and CIDR – Transition from IPv4 to IPv6 – NAT and DHCP – Static and Dynamic routes – RIP, OSPF and BGP – VPN –RMON and SNMP

UNIT IV INNOVATIVE NETWORKS **12**

Green Wireless Networks -Software Defined Networks – Evolution of switches and control planes – Centralized and distributed data and control planes – OpenFlow and SDN Controllers – Network Function Virtualization – Needsof the Data Centres – SDN solutions for data centres - Delay Tolerant Networks – Overlay architecture – Bundle Protocol – Opportunistic routing and Epidemic routing-4G

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Networks and Composite Radio Environment-Green Wireless Networks - 4G Networks and Composite Radio Environment

UNIT V NETWORK PROGRAMMING IN UNIX C 12

Socket address structures – Byte ordering and byte manipulation functions – Elementary TCP sockets– socket, connect, bind, listen, accept and close functions – Stream socket and datagram Socket-TCP client and server – Elementary UDP sockets –recvfrom and sendto functions, connect function with UDP – Raw sockets – Client-server design alternatives – Iterative and Concurrent servers-Stream socket and datagram Socket .

TOTAL: 60 PERIODS

OUTCOMES:

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

- Apply the networking principles to design a network
- Develop various client server applications using TCP/UDP sockets
- Develop client applications for major APIs
- Develop an application that interacts with various servers like e-mail servers
- Design and implement a multiprotocol server with TCP and UDP

REFERENCES:

1. Larry Peterson and Bruce Davie, “Computer Networks: A Systems Approach”, 5th edition, Morgan Kauffman, 2011
2. Paritosh Puri, M.P.Singh, “Asurvey paper on routing in delay tolerant networks”, International Conference on Information and Computer Networks (ISCON), 2013, DOI:10.1109/ICISCON 2013.6524206
3. Paul Goransson, Chuck Black, “Software Defined Networks: A Comprehensive Approach”, Morgan Kauffman, 2014
4. W.Richard Stevens, Bill Fenner and Andrew M Rudoff, “Unix Network Programming: The Sockets Networking API: Volume 1”, 3rd Edition, Addison Wesley, 2003
5. Ying Dar Lin, Ren-Hung Hwang and Fred Baker, “Computer Networks: An Open-Source Approach”, McGraw Hill, 2011

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24NE202 **NETWORK SECURITY**

L	T	P	C
3	0	0	3

OBJECTIVES:

- 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
- To design security applications in the field of Information technology

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 authentication protocols – DSS – EIGamal – Schnorr.

UNIT IV E-MAIL, IP & WEB SECURITY **8**

E-mail Security: Pretty Good Privacy-S/MIME. IP Security: 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).

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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

OUTCOMES:

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

- Compare various Security Techniques Design Secure Applications Inject secure coding in the developed applications
- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Analyze the possible security attacks in complex real time systems and their effective countermeasures
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical derivation, modeling, and simulations

REFERENCES:

1. Behrouz A. Ferouzan, “Cryptography & Network Security”, Tata McGraw Hill, 2007.
2. Bruce Schneier and Neils Ferguson, “Practical Cryptography”, First Edition, Wiley Dream tech 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”, Second Edition, Private Communication in Public World, PHI 2002.
5. Douglas R Simson, “Cryptography – Theory and practice”, First Edition, CRC Press,1995.
6. Ulysess Black, “Internet Security Protocols”, Pearson Education Asia, 2000.
7. William Stallings, “Cryptography and Network Security”, 6th Edition, Pearson Education, March 2013.
8. Man Young Rhee, “Internet Security: Cryptographic Principles-Algorithms and Protocols”, Wiley Publications,2003.
9. http://nptel.ac.in/

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24NE203 IOT ARCHITECTURE AND PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the significance of Internet of Things and its applications
- To learn about the basics of IOT Sensors and circuits
- To build a small low cost embedded system using Raspberry Pi.
- To learn about IoT challenges in the real world scenario.

UNIT UNIT I- IOT – MOTIVATION AND APPLICATIONS 9

Importance of IoT. Motivating Applications of IoT: Smart Cities- Smart Waste Management, Smart Street Lights, Smart Street Parking, Security without Surveillance, Connected Vehicles. Healthcare- Baby Monitoring, Elderly Monitoring, Mood Enhancing, Disease Treatment and Progression Monitoring, Enhance Adherence, Challenges. Agriculture- Precision Agriculture, Connected Livestock, Food Safety. Manufacturing and Logistics- Smart Manufacturing- Smart Packaging, Smart Label. Smart Electricity Grid- Managing Supply and Demand. Home Automation.

UNIT II SENSORS AND CIRCUITS 9

Sensor – Introduction, Terminology, Behavior, Selection, Circuits – Overview and Applications, Battery Issue and Energy Management, Wireless Link, Digital and Analog – Digital Computing, Analog to Digital Interfaces

UNIT III EMBEDDED SYSTEMS, CONNECTIVITY AND NETWORKING 9

Embedded Systems – Overview, Technology Drivers, Energy, Microcontrollers, Software Connectivity and Networking – Introduction, Connectivity Challenges in IoT, Energy Harvesting Transmitters, Massive Multiple Access, Computation vs Communication.

UNIT IV ARCHITECTURE AND PROGRAMMING 9

IoT Architectures – embedded System, Gateway and Cloud (MGC) Architecture and other reference models and architectures Arduinovs Raspberry Pi vs Electric Imp – Key features and comparisons – Arduino Interfaces – Arduino IDE – Programming

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UNIT V IOT CHALLENGES **9**

Technology Challenges – Security, Connectivity, Compatibility and Longevity, Standards, Intelligent Analysis and Actions Business Challenges – Consumer IoT, Commercial IoT, Industrial IoT Society Challenges – Privacy, Regulatory Standards

TOTAL : 45 PERIODS

OUTCOMES:

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

- Understand the evolution and applications of IoT
- Analyze different options for Embedded systems, connectivity and networking protocol.
- Understand MGC Architecture and Arduino Programming.
- Analyze technological challenges of IoT and overcome the Business challenges.
- Analyze applications and develop IoT products in real time scenario.

REFERENCES:

1. Pethuru Raj and Anupama C. Raman ,"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, Taylor and Francis Group, 2017.
2. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, John Wiley & Sons Ltd., UK, 2014.
3. ArshdeepBahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press,2014.
4. David Boswarthick, Omar Elloumi and OlivierHersent, “M2M Communications: A Systems Approach”, John Wiley & Sons Ltd, UK, 2012.
5. Dieter Uckelmann, Mark Harrison and Florian Michahelles, “Architecting the Internet of Things”, Springer, NewYork, 2011.
6. Olivier Hersent, David Boswarthick and OmarElloumi, “The Internet of Things: Key Applications and Protocols”, John Wiley & Sons Ltd., UK, 2012.
7. Dieter Uckelmann, Mark Harrison and Florian Michahelles, “Architecting the Internet of Things”, Springer, NewYork, 2011

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24NE2L1	NETWORK DESIGN AND PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To practice LAN and WAN design
- To learn network programming in UNIX C and Python
- Establish a LAN with a switch/hub with 3 PCs and check the connectivity and configuration
- Establish a internetwork with 2 routers and two or more LANs using static routes and check the connectivity and configuration
- In the internetwork created in experiment number 4, analyze the performance of various TCP variants using an FTP application

NETWORK PROGRAMMING EXERCISES:

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

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OUTCOMES:

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

- Develop network-based applications in UNIX C and Python
- Develop various client server applications using TCP/UDP sockets
- Develop an application that interacts with various servers like e-mail servers
- Design and implement a multiprotocol server with TCP and UDP
- Develop an application that work with remote servers using SSH, FTP

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24NE2L2	NETWORK SECURITY LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To explore the digital signature standard.
- Learn to implement security algorithms using Wireshark
- To analyze the effectiveness of intrusion detection system
- To learn the security issues in Virtual Private Network
- To identify mechanism for secured Email communication

NETWORK PROGRAMMING EXERCISES:

1. Implement the SIGNATURE SCHEME - Digital Signature Standard
2. Implement how to capture and analyze packets using Wireshark
3. To Analysis Network using Wireshark for
   (a) Traffic Monitoring (TCP slow down and HTTP slow down)
   (b) Packet Sniffing
4. To perform man in middle attack using DNS spoofing
5. To Perform HTTP Session Hijacking through Cookie stealing
6. To Configure AAA (TACACS+) on Packet Tracer for User Authentication
7. Demonstrate intrusion detection system (ids) using any tool(snort or any other software)
8. Create a Virtual Private Network and evaluate application response time in the presence and absence of a firewall.
9. Implementation of Email incoming and outgoing authenticity controls and malware filtration and attachment security

TOTAL :60 PERIODS

OUTCOMES:

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

- Implement the digital signature scheme
- Develop the various security algorithms using Wireshark
- Use different open-source tools for network security and analysis
- Develop an Virtual Private Network with security.
- Addressing the Email secured communication

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24NE2L3 TERM PAPER WRITING AND SEMINAR

L	T	P	C
0	0	2	1

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 analyzing each paper.
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
10. Presentation and publication of final paper in reputed International Conference / Journals

Please keep a file where the work carried out by you is maintained.

Activities to be carried Out

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic	You are requested to select an area of interest, topic and state an objective	2nd week	**3 %** (Based on clarity of thought, current relevance and clarity in writing)
Stating an Objective			

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Activity	Instructions	Submission week	Evaluation
Collecting Information about your area & topic	1. List 1 Special Interest Groups or professional society 2. List 2 journals 3.List2 conferences, symposia or workshops 4.List1 thesis title 5.List 3 web presences (mailing lists, forums, news sites) 6. List 3 authors who publish regularly in your area 7. Attach a call for papers (CFP) from your area.	3rd week	**3%** (The selected information must be area specific and of international and national standard)

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Collection of Journal papers in the topic in the context of the objective – collect 20 & then filter	1. You have to provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar 2. When picking papers to read - try to: Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them, Favour papers from well-known journals and conferences. 3. Favour —first or —foundational papers in the field (as indicated in other people's survey paper), 4. Favour more recent papers, 5. Pick a recent survey of the field so you can quickly gain an overview, 6. Find relationships with respect to each	4th week	**6%** (The list of standard papers and reason for selection)

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Activity	Instructions	Submission week	Evaluation
	other and to your topic area (classification scheme/categorization) 7. Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered		

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Reading and notes for first 5 papers	Reading Paper Process For each paper form a Table answering the following questions: • What is the main topic of the article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • How does the work build on other's work, in the author's opinion? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author say were the important directions for future research? Conclude with limitations/issues not addressed by the paper (from the perspective of your survey)	5th week	**8%** (The table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)

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Activity	Instructions	Submission week	Evaluation
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)

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Introduction Background	Write an introduction and background Sections	10th week	**5%** (Clarity)

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Activity	Instructions	Submission week	Evaluation
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11th week	**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	**5%** (formatting, English, Clarity and linking) **4%** (Plagiarism Check Report)
Seminar	A brief 15 slides on your paper	14th week	**5%** (based on presentation and Viva-voce)
Presentation & Publication	Presentation and Publication of the final paper in reputed International Conference/Journal		**10%** **(Presentation** & Publication)

TOTAL : 30 PERIODS

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24NE301 MULTIMEDIA COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the multimedia communication models
- To study the multimedia transport in wireless networks
- To explore real-time multimedia network applications

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 sharing Queuing-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 Streaming Interactive and non-Interactive Multimedia-RTP/RTCP-SIP-RTSP.

UNIT VMULTIMEDIA QOS ON WIRELESS NETWORKS 9

IEEE 802.11e, IEEE 802.16, 3G networks-UMTS, 3GPP, 4G networks-LTE-IMS-5G Mobile Networks.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- To understand different multimedia communication models and it's real time applications
- To implement various algorithms to provide best effort and quality service
- To understand different IP routing protocols and it's working in multimedia network to provide QoS
- To understand the working of multimedia in transport layer
- To apply QoS on wireless networks using IEEE standards.

REFERENCES:

1. James F. Kurose and Keith W. Ross, “Computer Networking-A Top-Down Approach Featuring the Internet”, Pearson, 2012.
2. Larry L. Peterson and Bruce S. Davie, “Computer Networks- A Systems Approach”, MorganKaufmann Publishers, 2007.
3. Mario Marques da Silva, “Multimedia Communications and Networking”, CRC Press, 2012.
4. Mark Wuthnow, Jerry Shih, Matthew Stafford, “IMS: A New Model for Blending Applications”,Auerbach Publications, 2009.

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20NE2A1 WIRELESS SENSOR NETWORKS AND PROTOCOLS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn about the issues in the design of wireless ad hoc networks
- To understand the working of protocols in different layers of mobile ad hoc and sensornetworks
- To expose the students to different aspects in sensor networks
- To understand various security issues in ad hoc and sensor networks and solutions to theissues

UNIT I WIRELESS SENSOR NETWORK ARCHITECTURE 9

Introduction to wireless sensor networks- Challenges, Comparison with ad hoc network, Node architecture and Network architecture, design principles, Service interfaces, Gateway, Short range radio communication standards - Physical layer and transceiver design considerations.

UNIT II MAC & ROUTING IN WIRELESS SENSOR NETWORKS 9

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – Contention-Based protocols – Schedule-Based protocols – IEEE 802.15.4 Zig bee – Topology Control – Routing Protocols

UNIT III TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS 9

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control – In-network processing – Operating systems for wireless sensor networks – Examples

UNIT IV SECURITY IN AD HOC AND SENSOR NETWORKS 9

Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Antitamper techniques – Watermarking techniques – Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS

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UNIT V TOOLS FOR WSN 9

TinyOS – Introduction, NesC, Interfaces, modules, configuration, Programming in TinyOS using NesC, TOSSIM, Contiki – Structure, Communication Stack, Simulation environment – Cooja simulator, Programming.

TOTAL :45PERIODS

OUTCOMES:

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

- Identify different issues in wireless ad hoc and sensor networks
- To analyze protocols developed for ad hoc and sensor networks
- To identify and understand security issues in ad hoc and sensor networks
- To learn the significance of Transport layer and QoS in wireless sensor networks.
- To analyze the tools used for Wireless Sensor Networks

REFERENCES:

1. Anna Hac, Wireless Sensor Network Designǁ, John Wiley & Sons, 2003.
2. Holger Karl, Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, Inc., 2007.
3. Erdal Çayırcı , Chunming Rong, “Security in Wireless Ad Hoc and Sensor Networks”, John Wiley and Sons, 2009.
4. C.Siva Ram Murthy and B.S.Manoj, “Ad Hoc Wireless Networks – Architectures and Protocols, 1e”, Pearson Education, 2006.
5. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, “Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition)”, World Scientific Publishing, 2011.
6. Waltenegus Dargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks Theory and Practice”, John Wiley and Sons, 2010
7. Adrian Perrig, J. D. Tygar, "Secure Broadcast Communication: In Wired and Wireless Networks", Springer, 2006.

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20NE2A2	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Formalize different types of entities and relationships as nodes and edges and represent this information as relational data.
- Understand the fundamental concepts in analyzing the large-scale data that are derived from social networks
- Understand the basic concepts and principles of different theoretical models of social networks analysis.
- Transform data for analysis using graph-based and statistics-based social network measures
- Choose among social network designs based on research goals

UNIT I GRAPH THEORY AND STRUCTURE 9

Breadth First Search (BFS) Algorithm. Strongly Connected Components (SCC) Algorithm. Weakly Connected Components (WCC) Algorithm. First Set of Experiments—Degree Distributions. Second Set of Experiments—Connected Components. Third Set of Experiments—Number of Breadth First Searches. Rank Exponent R. Out-Degree Exponent O. Hop Plot Exponent H. Eigen Exponent E. Permutation Model. Random Graphs with Prescribed Degree Sequences. Switching Algorithms. Matching Algorithm. “Go with the Winners” Algorithm. HyperANF Algorithm. Iterative Fringe Upper Bound (iFUB) Algorithm. Spid. Degree Distribution. Path Length. Component Size. Clustering Coefficient and Degeneracy. Friends-of-Friends. Degree Assortativity. Login Correlation.

UNIT II SOCIAL NETWORK GRAPH ANALYSIS 9

Social network exploration/ processing and properties: Finding overlapping communities, similarity between graph nodes, counting triangles in graphs, neighborhood properties of graphs. Pregel paradigm and Apache Giraph graph processing system.

UNIT III INFORMATION DIFFUSION IN SOCIAL NETWORKS 9

Strategic network formation: game theoretic models for network creation/ user behavior in social

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networks. Information diffusion in graphs: Cascading behavior, spreading, epidemics, heterogeneous social network mining, influence maximization, outbreak detection. Opinion analysis on social networks: Contagion, opinion formation, coordination and cooperation.

UNIT IV CASCADING IN SOCIAL NETWORKS 9

Cascading in Social Networks. Decision Based Models of Cascade. Collective Action. Cascade Capacity. Co-existence of Behaviours. Cascade Capacity with Bilinguality. Probabilistic Models of Cascade. Branching Process. Basic Reproductive Number. SIR Epidemic Model. SIS Epidemic Model. SIRS Epidemic Model. Transient Contact Network. Cascading in Twitter.

UNIT V LINK ANALYSIS & COMMUNITY DETECTION 9

Search Engine. Crawling. Storage. Indexing. Ranking. Google. Data Structures. Crawling. Searching. Web Spam Pages Strength of Weak Ties. Triadic Closure. Detecting Communities in a Network. Girvan-Newman Algorithm. Modularity. Minimum Cut Trees. Tie Strengths in Mobile Communication Network. Exact Betweenness Centrality. Approximate Betweenness Centrality.

TOTAL :45PERIODS

OUTCOMES:

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

- Plan and execute network analytical computations.
- Implement mining algorithms for social networks
- Analyze and evaluate social communities.
- Use social network analysis in behavior analytics
- Perform mining on large social networks and illustrate the results.

REFERENCES:

1. Practical Social Network Analysis with Python, Krishna Raj P. M. Ankith Mohan and K. G. Srinivasa. Springer, 2018
2. Social Network Analysis: Methods and Applications, Stanley Wasserman, and Katherine F' Aust. Cambridge University Press, 2012
3. Social Network Analysis: History, Theory and Methodology by Christina Prell, SAGE Publications, 1st edition, 2011
4. Sentiment Analysis in Social Networks, Federico Alberto Pozzi, Elisabetta Fersini, Enza Messina, and Bing. LiuElsevier Inc, 1st edition, 2016
5. Social Network Analysis, John Scott. SAGE Publications, 2012

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20NE2A3 MOBILE APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

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 **5**

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 **8**

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 **8**

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 **12**

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-Develop a mobile application for a simple needs.

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UNIT V IOS **12**

Introduction to Objective C –Swift and Xcode-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 :45PERIODS

OUTCOMES:

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

- Explain the design and quality constraints of mobile application development.
- Develop and design for mobile applications for specific requirements.
- Implement the design using Android SDK for application like location identify, Database and communication with social media.
- Implement the design using Objective C and iOS for location aware applications.
- Deploy mobile application in Android and iPhone marketplace for distribution.

REFERENCES:

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

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24NE2A4	DEEP LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To present the mathematical, statistical and computational challenges of building neural networks
- To study the concepts of deep learning
- To introduce dimensionality reduction techniques
- To enable the students to know deep learning techniques to support real-time applications
- To examine the case studies of deep learning techniques

UNIT I INTRODUCTION **9**

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT II DEEP NETWORKS **9**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Back propagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning

UNIT III DIMENTIONALITY REDUCTION **9**

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyper parameter optimization

UNIT IV OPTIMIZATION AND GENERALIZATION **9**

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

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UNIT V CASE STUDY AND APPLICATIONS 9

ImageNet- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection Bio-Informatics- Face Recognition- Scene Understanding- Gathering Image Captions

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand basics of deep learning
- Implement various deep learning models
- Realign high dimensional data using reduction techniques
- Analyze optimization and generalization in deep learning
- Explore the deep learning applications

REFERENCES:

1. Cosma Rohilla Shalizi, “Advanced Data Analysis from an Elementary Point of View”, 2015.
2. Deng & Yu, “Deep Learning: Methods and Applications”, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.
4. Michael Nielsen, “Neural Networks and Deep Learning”, Determination Press, 2015.

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24NE2A5 ADVANCED SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

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.

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 modeling using UML – Use case Model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Functional modeling – Data Flow Diagram-Sequence Diagram.

UNIT III ARCHITECTURE AND DESIGN 9

Software design – Design process – Design concepts –-Modularity- 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 – Smoke Testing-Debugging - Program analysis – Symbolic execution – Model Checking

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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

OUTCOMES:

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

- Understand project management approaches, cost and schedule estimation strategies
- Use UML diagrams for analysis and design
- Architect and design using architectural styles and design patterns
- Understand software testing approaches
- Understand the advantages of DevOps practices

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, 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.
7. Roger S. Pressman, “Software Engineering A Practitioner's Approach”, sixth Edition, McGraw Hill International Edition, 2007.

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24NE2B1	MOBILE AND PERVASIVE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the basic architecture of 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
- Apply the pervasive concepts in mobile environment

UNIT I INTRODUCTION 9

History – Wireless communications: GSM – DECT – TETRA – UMTS – IMT – 2000 – Bluetooth, 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 - 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-AURA-GAIA

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

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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 - Coordination Algorithm for Pervasive Transactions - Participant Discovery - Formal Transaction Verification - Petri Net with Selective Transition.

TOTAL : 45PERIODS

OUTCOMES:

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

- Understand the Basic architecture and concepts of till Third Generation Communication systems.
- Explain the latest 4G Telecommunication System Principles.
- Develop applications using Pervasive Computing Environments
- Implement the HCI in Pervasive environment.
- Work on the pervasive concepts in mobile environment.

REFERENCES:

1. Alan Colman, Jun Han, and Muhammad AshadKabir, “Pervasive Social Computing Socially-Aware Pervasive Systems and Mobile Applications”, Springer, 2016.
2. J.Schiller, “Mobile Communication”, Addison Wesley, 2000
3. JuhaKorhonen, “Introduction to 4G Mobile Communications” , Artech House Publishers, 2014
4. Kolomvatsos, “Kostas, Intelligent Technologies and Techniques for Pervasive Computing”, IGI Global, 2013.
5. M. Bala Krishna, Jaime LloretMauri, “Advances in Mobile Computing and Communications: Perspectives and Emerging Trends in 5G Networks”, CRC 2016
6. MinyiGuo, Jingyu Zhou, Feilong Tang, Yao Shen, “Pervasive Computing: Concepts, Technologies and Applications”, CRC Press, 2016.

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24NE2B2 HIGH SPEED SWITCHING ARCHITECTURES

L	T	P	C
3	0	0	3

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 – Pollaczek Khinchine 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

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– 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

OUTCOMES

Upon completion of this course the students should be able to:

- Apply switching concepts to build networks.
- Deploy the network with appropriate type of switching Architectures.
- Understand the different types of Packet Queues and Delay Analysis.
- Select and configure the appropriate type of IP router.
- Design and implement MPLS networks.

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, John Wiley and Sons”, 2007
4. Howard C Berkowitz, “Designing Routing and Switching Architectures for Enterprise Networks”, Sams, 1999
5. Luc De Ghein, “MPLS Fundamentals”, Cisco Press 2014.
6. Vivek Alwayn, “Advanced MPLS Design and Implementation”, 2001.
7. Itamar Elhanany and Mounir Hamdi, “High-performance Packet Switching Architectures”, Springer Kindle Edition. 2007th Edition

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24NE2B3	SIMULATION OF COMPUTER SYSTEMS AND NETWORKS	L	T	P	C
		3	0	0	3

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

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OUTCOMES:

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

- Understand the modeling and development of simulations and simulators
- Differentiate the different ways in which simulators are designed
- Analyze how computer networks are simulated
- Analyze Performance metrics in computer network simulation
- Compare the features of different simulators

REFERENCES:

1. J. B. Sinclair, “Simulation of Computer Systems and Computer Networks: A Process-Oriented Approach”, 2004.
2. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, “Discrete-event System Simulation”, Fifth Edition, Pearson, 2010.
3. Law, Averill, “Simulation Modeling and Analysis with Expert Software”, McGraw Hill, 2006.
4. Mohammad S. Obaidat, Petros Nico politidis, FaouziZarai, “Modeling and Simulation of Computer Networks and Systems – Methodologies and Applications”, Morgan Kaufmann, 2015.
5. Sheldon M. Ross, “Simulation”, Fifth Edition, Elsevier, 2013.

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24NE2B4	DATA SCIENCE AND BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of data science.
- To apply various analytical theory and methods.
- To understand and use the advanced analytics technology and tools
- To explore the Hadoop distributed file system architecture
- To apply the Map-Reduce concepts and learn Hadoop related tools.

UNIT I INTRODUCTION TO DATA SCIENCE 9

Data Science - Evolution of data – Best Practices for Big data Analytics – Big data characteristics – Validating – The Promotion of the Value of Big Data – Big Data Use Cases- Characteristics of Big Data Application-Statistics for Analytics – Data science life cycle – Analysis and reporting – Modern Data Analytics Tools

UNIT II ADVANCED ANALYTICAL THEORY AND METHODS 9

Overview of Clustering, K-means, Use Cases, Overview of the Method, Perform a K-means Analysis using RClassification, Decision Trees, Overview of a Decision Tree, Decision Tree Algorithms, Evaluating a Decision Tree - Decision Tree in R, Bayes' Theorem, Naïve Bayes Classifier, Smoothing, Naive Bayes in R

UNIT III ADVANCED ANALYTICS TECHNOLOGY AND TOOLS 9

Analytics for Unstructured Data, Use Cases, MapReduce, Apache Hadoop, The Hadoop Ecosystem, Pig, Hive, Hbase, Mahouth, NoSQL, SQL Essentials- Joins, Set Operations, Grouping Extensions, In-Database Text Analysis, Advanced SQL, Window Functions, User-defined Functions and Aggregates, Ordered Aggregates, MADlib.

UNIT IV HADOOP DISTRIBUTED FILE SYSTEM ARCHITECTURE 9

HDFS Architecture, HDFS Concepts, Blocks- NameNode, Secondary NameNode, DataNode, HDFS Federation, HDFS High Availability, Basic File System Operations- Data Flow, Anatomy of File Read, Anatomy of File Write, Anatomy of a MapReduce Job Run

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UNIT V MAPREDUCE APPLICATIONS AND HADOOP RELATED TOOLS 9

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of Map Reduce job run, classic Map-reduce, YARN: failures in classic Map-reduce and YARN job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats. Hadoop Related Tools Hbase: data model and implementations, Pig: Grunt, pig data model, Hive: data types and file format, HiveQL data definition, HiveQL data manipulation, HiveQLqueries.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course the students should be able to:

- Understand the basics of data science.
- Apply the advanced analytical theory and methods.
- Understand and use the advanced analytics technology and tools
- Understand the Hadoop distributed file system architecture
- Apply the Map-Reduce concepts and learn hadoop related tools.

REFERENCES:

1. David Dietrich, Barry Heller and Beibei Yang, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, EMC Education Services, Reprint 2015, Wiley,ISBN: 9788126556533.
2. Nathan Marz, James Warren, “Big Data-Principles and best practices of scalable real-time data systems”, Edition 2015, DreamTech Press, ISBN: 9789351198062.
3. Tom White, "Hadoop: The Definitive Guide", 4th Edition, 2015, O'Reilly, ISBN: 9789352130672
4. BirisLublinsky, Kevin T. Smith and Alexey Yakubovich, “Professional Hadoop Solutions”, Reprint 2014, Wiley, ISBN 13:9788126551071
5. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
6. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
7. Alan Gates, "Programming Pig", O'Reilley, 2011.

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24NE2B5	COGNITIVE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To familiarize Use the Innovation Canvas to justify potentially successful products.
- To learn various ways in which to develop product ideas.
- To understand how Big Data can play vital role in Cognitive Computing
- To know about the business applications of Cognitive Computing
- To get into all applications of Cognitive Computing

UNIT I FOUNDATION OF COGNITIVE COMPUTING 9

Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, cognitive systems, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation, and visualization services

UNIT II NATURAL LANGUAGE PROCESSING IN COGNITIVE SYSTEMS 9

Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations

UNIT III BIG DATA AND COGNITIVE COMPUTING 9

Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, using advanced analytics to create value, Impact of open source tools on advanced analytics

UNIT IV BUSINESS IMPLICATIONS OF COGNITIVE COMPUTING 9

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Preparing for change ,advantages of new disruptive models , knowledge meaning to business, difference with a cognitive systems approach , meshing data together differently, using business knowledge to plan for the future , answering business questions in new ways , building business specific solutions , making cognitive computing a reality , cognitive application changing the market The process of building a cognitive application: Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing

UNIT V APPLICATION OF COGNITIVE COMPUTING 9

Building a cognitive health care application: Foundations of cognitive computing for healthcare, constituents in healthcare ecosystem, learning from patterns in healthcare Data, Building on a foundation of big data analytics, cognitive applications across the health care eco system, starting with a cognitive application for healthcare, using cognitive applications to improve health and wellness, using a cognitive application to enhance the electronic medical record Using cognitive application to improve clinical teaching

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain applications in Cognitive Computing.
- Describe Natural Language Processor Role in Cognitive computing.
- Explain future directions of Cognitive Computing
- Evaluate the process of taking a product to market
- Comprehend the applications involved in this domain.

REFERENCES:

1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, “Cognitive computing and Big Data Analytics”, Wiley, 2015
2. Robert A. Wilson, Frank C. Keil, “The MIT Encyclopedia of the Cognitive Sciences”, TheMIT Press, 1999.
3. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, “Probabilistic Models of Cognition”, Second Edition, 2016, https://probmods.org/.24NE2B5 COGNITIVE COMPUTING

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24NE3A1	NETWORK MANAGEMENT	L	T	P	C
		3	0	0	3

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

UNIT I OSI NETWORK MANAGEMENT 8

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 10

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.

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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

OUTCOMES:

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

- Diagnose problems and make minor repairs to computer networks using appropriate diagnostics software
- Demonstrate how to correctly maintain LAN computer systems
- Maintain the network by performing routine maintenance tasks
- Apply network 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, Second edition, 2010.
3. Mani Subramanian, "Network Management Principles and Practice", Addison Wesley, Second edition, 2010.
4. Mark Burges, "Principles of Network System Administration", Wiley, 2000.
5. Salah Aiidarons and Thomas Plevayk, "Telecommunications Network Technologies and Implementationsl, Eastern Economy Edition IEEE press, New Delhi, 1998.
6. Stephen Morris, "Network Management, MIBs and MPLS - Principles, Design and Implementation", Pearson Education, 2003.

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24NE3A2 NETWORK PERFORMANCE ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the mathematical basis for analyzing the performance of networks.
- To understand queuing theory and queuing models.
- To analytically model traffic control protocols, and error control protocols using these concepts.
- To model performance of wired and wireless MAC such as 802.3, 802.11 and 802.16.
- To model network traffic and study the performance of different packet scheduling algorithms.

UNIT I MARKOV CHAINS BASICS 9

Overview of Random Processes, Markov Chains – Markov matrices, State transition matrix, Markov chains at equilibrium – steady state distribution vector.

UNIT II REDUCIBLE AND PERIODIC MARKOV CHAINS 9

Reducible Markov chain – Transition matrix, Reducible Composite Markov chain, Transient analysis, Steady state, Periodic Markov chain – Transition matrix, canonical form, Strongly and weakly periodic Markov chains, Queuing Analysis –M/M/1 queues, M/M/1/B queues, D/M/1/B queues, performance, communicating Markov chains

UNIT III TRAFFIC CONTROL, ERROR CONTROL AND MAC MODELING 9

Modeling traffic control protocols – Modeling leaky bucket and token bucket algorithms, Modeling Error control protocols - Stop and wait and GBN ARQ performance, Modeling media access control protocols – 802.1p, ALOHA, 802.3.

UNIT IV WIFI AND WIMAX PERFORMANCE 9

Modeling 802.11 protocol – Basic DCF modeling, RTS/CTS modeling, Modeling 802.11e, Performance, 802.11e HCCA Performance. Modeling 802.16 protocol – system and user performance.

UNIT V NETWORK TRAFFIC AND SCHEDULING 9

Modeling network traffic – Flow traffic models – Continuous time modeling, Discrete time modeling,

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Pareto traffic distribution, Destination traffic. Scheduling algorithms – Analysis.

TOTAL :45 PERIODS

OUTCOMES :

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

- Identify the mathematical performance of network systems.
- Apply Markov chain models and analyze the behavior of network systems.
- Perform queuing theory-based analysis of various L2 layer functions, such as flow control, error control, and MAC.
- Build network traffic models.
- Analyze QoS functions such as scheduling and traffic control.

REFERENCES:

1. Anurag Kumar, D. Manjunath, Joy Kuri, “Communication Networking: An analytical Approach”, Elsevier, 2004.
2. Bertsekas D and Gallager R, “Data Networks”, 2nd Edition, Prentice-Hall, 1992.
3. Fayez Gebali, “Analysis of computer networks”, 2nd Edition, Springer, 2015.
4. Harrison P G and Patel N M, “Performance Modelling of Communication Networks and Computer Architectures”, Addison-Wesley, 1993.
5. Robertazzi T G, “Computer Networks and Systems: Queuing Theory and Performance Evaluation”, 2nd, Edition, Springer-Verlag, 1994.

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24NE3A3	NEXT GENERATION NETWORKS	L	T	P	C
		3	0	0	3

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.

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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

OUTCOMES:

- Identify the importance of wireless IP networks
- To be able to understand the issues and challenges of wireless domain in future generation network design.
- To be able to explore the LTE concepts and technologies.
- To be able to understand the integration of SDN with LTE.
- To be able to understand the NGN management and standardizations.

REFERENCES:

1. Jingming Li Salina, Pascal Salina "Next Generation Networks-perspectives and potentials" Wiley, January 2008.
2. Madhu Sanga Liyanage, Andrei Gurtov, Mika Ylianttila, "Software Defined Mobile Networks beyond LTE Network Architecture", 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, 2010.

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24NE3A4	SOFTWARE DEFINED NETWORKS AND NETWORK FUNCTION VIRTUALIZATION (SDN AND NFV)	L	T	P	C
		3	0	0	3

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

UNIT I SOFTWARE DEFINED NETWORK (SDN) 9

Introduction – Centralized and Distributed Control and Data Planes – Open Flow – SDN Architecture-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-Fog Computing Concepts

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

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OUTCOMES:

Upon successful completion of this course, a student will be able to:

- To identify/design software defined network for the required application/platform
- To able to understand the basics of virtualization.
- To deploy network virtualization tool & design
- To equip in various network security measures and tackle

REFERENCES:

1. Jim Doherty,"SDN and NFV Simplified", Addison Wesley, 2016
2. SiamakAzodoimolky, "Software Defined Networking with OpenFlow", Packt Publishing Limited, 2013
3. Thomas D.Nadeau and Ken Gray, “SDN – Software Defined Networks”, O"Reilly Publishers,2013

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24NE3A5	SYSTEMS SIMULATION OF COMPUTER AND NETWORKS	L	T	P	C
		3	0	0	3

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

OUTCOMES:

- Understand the modeling and development of simulations and simulators
- Differentiate the different ways in which simulators are designed
- Analyse how computer networks are simulated
- Use simulators like ns-3
- Compare the features of different simulators

REFERENCES:

1. J. B. Sinclair, —Simulation of Computer Systems and Computer Networks: A Process-Oriented

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

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24NE3B1 EMBEDDED SOFTWARE DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

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

UNIT I EMBEDDED PROCESSORS 9

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

UNIT II EMBEDDED COMPUTING PLATFORM 9

CPU Bus Configuration - Memory Devices and Interfacing – Input / Output Devices and Interfacing - System Design - Development and Debugging – Emulator – Simulator - JTAG Design Example – Alarm Clock - Analysis and Optimization of Performance - Power and Program Size.

UNIT III EMBEDDED NETWORK ENIVIRONMENT 9

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

UNIT IV REAL-TIME CHARACTERISTICS 9

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

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UNIT V SYSTEM DESIGN TECHNIQUES **9**

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

TOTAL: 45 PERIODS

OUTCOME:

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

- Understand different architectures of embedded processor, microcontroller and peripheral devices.
- Interface memory and peripherals with embedded systems.
- Work with embedded network environment.
- Understand challenges in Real time operating systems.
- Design and analyze applications on embedded systems.

REFERENCES:

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

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24NE3B2	PROTOCOLS AND ARCHITECTURES FOR WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of wireless sensor networks
- To understand the protocols for WSN
- To get exposure on WSN environment with TinyOS and like
- To understand the layered approach in sensor networks
- To design WSN and analyze performance

UNIT I WIRELESS SENSOR NETWORK ARCHITECTURE 9

Introduction to wireless sensor networks- Challenges, Comparison with ad hoc network, Node architecture and Network architecture, design principles, Service interfaces, Gateway, Short range radio communication standards-IEEE 802.15.4, Zigbee and Bluetooth. Physical layer and transceiver design considerations.

UNIT II DATA LINK LAYER 9

MAC protocols – fundamentals, low duty cycle protocols and wakeup concepts, contention-based protocols, Schedule-based protocols - SMAC, BMAC, TRAMA, Link Layer protocols – fundamentals task and requirements, error control, framing, link management, Naming and addressing – address assignment, unique, Content-based and geographical addressing.

UNIT III NETWORK LAYER 9

Routing protocols – Requirements, Taxonomy - Data-centric routing – SPIN, Directed Diffusion, Energy aware routing, Gradient-based routing – COUGAR, ACQUIRE, Hierarchical Routing – LEACH, PEGASIS, Location Based Routing – GAF, GEAR, Data aggregation – Various aggregation techniques, Localization and positioning – Properties, Approaches, Mathematical basics for single hop and multi-hop environment.

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UNIT IV TRANSPORT LAYER **9**

Transport Protocol, Coverage and deployments - Sensing models, Coverage measures, Random deployments: Poisson model, Boolean sensing model, general sensing model, Coverage determination, grid deployment, Reliable data transport, Single packet delivery, Block delivery, Congestion control and rate control, Time synchronization – Issues and protocol – Sender/Receiver, Security – protocols and Key Distribution Techniques.

UNIT V TOOLS FOR WSN **9**

TinyOS – Introduction, NesC, Interfaces, modules, configuration, Programming in TinyOS using NesC, TOSSIM, Contiki – Structure, Communication Stack, Simulation environment – Cooja simulator, Programming.

TOTAL : 45 PERIODS

OUTCOMES:

Upon successful completion of this course, a student will be able to:

- Understand the concept of WSN and its service types
- Explain the protocols in TinyOS and Contiki.
- Classify different routing mechanism.
- Explain transport layer mechanisms and principles of operation.
- Ability to operate the tools for WSN

REFERENCES:

1. Anna Hac, "Wireless Sensor Network Design", John Wiley & Sons, 2003.
2. C.S.Raghavendra Krishna, M.Sivalingam and Taribznati, "Wireless Sensor Networks", Springer Publication, 2004
3. HolgerKarl , Andreas willig, "Protocol and Architecture for Wireless Sensor Networks", John Wiley Publication, 2006.
4. KazemSohraby, Daniel Minoli and TaiebZnati, "Wireless Sensor Networks Technology Protocols and Applications", John Wiley & Sons, 2007.
5. Paolo Santi, "Topology Control in Wireless Adhoc and Sensor Networks", John Wiley & Sons, 2005.
6. Philip Levis, David Gay,"Tiny OS Programming", Cambridge University Press, 2009 Contiki - Open Source Operating System for IOT - http://www.contiki-os.org/

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24NE3B3 DATA STORAGE AND INFORMATION MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To gain knowledge about information storage system, data protection and intelligent storage system
- To learn various storage networking technologies
- To discuss the various virtualization techniques
- To study the backup and recovery, local and remote replications
- To understand the storage security and management

UNIT I INTRODUCTION TO INFORMATION STORAGE SYSTEM 9

Introduction to information storage and management: Information storage – Evolution of storage technology and architecture – Data center infrastructure – Key challenges in managing information – Information lifecycle. Storage system environment: Components of a storage system environment – Disk drive components – Disk drive performance – Data protection: RAID - Implementation of RAID, RAID array components – RAID levels – RAID comparison – RAID impact on disk performance – Applications - Intelligent storage system: Components of an Intelligent Storage System – Intelligent Storage Array.

UNIT II STORAGE NETWORKING TECHNOLOGIES 9

Direct-Attached Storage and Introduction to SCSI: Types of DAS – DAS Benefits and Limitations – Disk Drive Interfaces – Introduction to Parallel SCSI – SCSI Command Model – Storage Area Networks: Fibre Channel – SAN Evolution – Components of SAN – FC Connectivity – Fibre Channel Ports – Fibre Channel Architecture – Zoning – Fibre Channel Login Types – FC Topologies - Network-Attached Storage: Benefits – NAS File I/O – Components of NAS – NAS Implementations – NAS File-Sharing Protocols.

UNIT III NETWORKING TECHNOLOGIES AND VIRTUALIZATION 9

IPSAN: iSCSI – FCIP – Content-Addressed Storage: Fixed Content and Archives – Types – Features – Benefits – CAS Architecture - Storage Virtualization: Forms of Virtualization –

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SNIA Storage Virtualization Taxonomy – Storage Virtualization Configurations – Storage Virtualization Challenges – Types of Storage Virtualization.

UNIT IV BACKUP AND RECOVERY, LOCAL AND REMOTE REPLICATION 9

Information availability and Business Continuity -terminologies - Business Continuity Planning – Solutions - Clustering and Multipathing architecture - Single Points of Failure - Backup and Recovery - Methods, targets and topologies - Data Deduplication and backup in virtualized environment - Fixed Content and Data Archive – Replication - Local Replication - Remote Replication - Three-Site Remote Replication - Continuous Data Protection

UNIT V STORAGE SECURITY AND MANAGEMENT 9

Securing the Storage Infrastructure: Framework – Risk Triad – Storage Security Domains – Security Implementations in Storage Networking – Managing the Storage Infrastructure: Monitoring the Storage Infrastructure – Storage Management Activities – Storage Infrastructure Management Challenges – Developing an Ideal Solution.

TOTAL : 45PERIODS

OUTCOMES:

Upon successful completion of this course, a student will be able to:

- Analyze the information and intelligent storage system
- Work with various storage networking technologies
- Choose the right networking technology and virtualization method
- Devise the backup and recovery procedure and do local and remote replication
- Propose a solution using storage security and management

REFERENCES:

1. G. Somasundaram, Alok Shrivastava, “Information Storage and Management: Storing, Managing and Protecting Digital Information”, EMC Corporation, Wiley Publication, 2009.

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2. Gerald J. Kowalski, Mark T. Maybury, “Information Storage and Retrieval Systems”, Kluwer Academic Publishers, 2002.

3.C. Manning, P. Raghavan and H.Schutze, “Information Retrieval”, Cambridge University Press, 2008.

4.Ricardo Baeza, Yates and Berthier Ribeiro Neto, “Modern Information Retrieval: The concepts and technology behind search”, Second Edition, ACM Press Books, 2011.

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24NE3B4	CLOUD COMPUTING TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of virtualization and virtual machines
- To understand and deploy practical virtualization solutions and enterprise solutions
- To gain knowledge on the concept of virtualization that is fundamental to cloud computing
- To understand the various issues in cloud computing and to be able to set up a private cloud
- To understand the security issues in the grid and the cloud environment

UNIT I VIRTUALIZATION 9

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

UNIT II VIRTUALIZATION INFRASTRUCTURE 9

The anatomy of cloud infrastructures – distributed Management of Virtual Infrastructures – Testing Environment –Server Virtualization – Virtual Workloads – Provision Virtual Machines – Desktop Virtualization – Application Virtualization - Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation.

UNIT III CLOUD PLATFORM ARCHITECTURE 9

Cloud deployment models: public, private, hybrid, community – Aneka Cloud Platform- Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design –Workflow Engine for clouds- Layered cloudArchitectural Development – Virtualization Support and Disaster Recovery –Architectural Design Challenges - Public Cloud Platforms :

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GAE,AWS – Inter-cloud Resource Management

UNIT IV PROGRAMMING MODEL **9**

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

UNIT V CLOUD SECURITY **9**

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

TOTAL : 45 PERIODS

OUTCOMES:

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

- Understand the concepts of virtualization and virtual machines.
- Employ the concepts of storage virtualization, network virtualization and its management.
- Identify the architecture, infrastructure and delivery models of cloud computing.
- Develop services using Cloud computing.
- Apply security models in the cloud environment.

REFERENCES:

1. Danielle Ruest, Nelson Ruest, “Virtualization: A Beginner’s Guide”, McGraw-Hill Osborne Media, 2009.
2. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005
3. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
4. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers,

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2012.

5. Tim Mather, SubraKumaraswamy, and ShahedLatif ,"Cloud Security and Privacy", O'Reilly Media, Inc.,2009.
6. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
7. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.
8. Thomas Erl, "Cloud Computing : Concepts, Technology and Architecture", 1e, Pearson publication, Second Edition,2014.

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24NE3B5	ETHICAL HACKING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand and analyze security threats & countermeasures related to ethical hacking.
- To learn the different levels of vulnerabilities at a system level.
- To gain knowledge on the different hacking methods for web services and session hijacking.
- To understand the hacking mechanisms on how a wireless network is hacked.

UNIT I ETHICAL HACKING OVERVIEW & VULNERABILITIES 9

Understanding the importance of security, Concept of ethical hacking and essential Terminologies- Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking

UNIT II FOOTPRINTING & PORT SCANNING 9

Footprinting - Introduction to foot printing, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase, Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting Enumeration-Introduction, Enumerating windows OS & Linux OS

UNIT III SYSTEM HACKING 9

Aspect of remote password guessing, Role of eavesdropping ,Various methods of password cracking, Keystroke Loggers, Understanding Sniffers ,Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

UNIT IV HACKING WEB SERVICES & SESSION HIJACKING 9

Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases, cross-site scripting, cross-site request forging, authentication bypass, web services and related flaws, protective http headers. Understanding Session Hijacking, Phases involved in Session Hijacking, Types of Session Hijacking, Session Hijacking

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Tools

UNIT V HACKING WIRELESS NETWORKS 9

Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks,WLANScanners, WLANSniffers,HackingTools,Securing Wireless Network

TOTAL :45 PERIODS

OUTCOMES:

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

- Understand vulnerabilities, mechanisms to identify vulnerabilities/threats/attacks
- Use tools to identify vulnerable entry points
- Identify vulnerabilities using sniffers at different layers
- Handle web application vulnerabilities
- Identify attacks in wireless networks

REFERENCES:

1. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2010
2. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology,2010
3. RajatKhare, "Network Security and Ethical Hacking", Luniver Press, 2006
4. Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner's Guide (3rd ed.).
Packt Publishing, 2011
5. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003
6. Matthew Hickey, Jennifer Arcuri, "Hands on Hacking: Become an Expert at Next GenPenetration Testing and Purple Teaming", 1st Edition, Wiley, 2020.
7. Jon Ericson, Hacking: The Art of Exploitation, 2nd Edition, NoStarch Press, 2008.

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24AC101	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
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OBJECTIVES:

This course is intended to provide an integrated framework for the students can able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title
- Ensure the good quality of paper at very first-time submission

UNIT – I **4**

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

UNIT – II **4**

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

UNIT – III **4**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT – IV **4**

Key skills are needed when writing a Title, Key skills are needed when writing an Abstract, Key skills are needed when writing an Introduction, Skills needed when writing a Review of the Literature.

UNIT - V **4**

Skills are needed when writing the Methods, Skills needed when writing the Results, Skills are needed when writing the Discussion, Skills are needed when writing the Conclusions.

UNIT - VI **4**

Useful phrases, How to ensure paper is as good as it could possibly be the first-time submission.

TOTAL: 24 PERIODS

REFERENCES:

1. Robert Gold bort, “Writing for Science”, Yale University Press, 2006.
2. Robert A Day and Barbara Gastel, “How to Write and Publish a Scientific Paper”, Seventh Edition, Green wood Press, 2011.
3. Nicholas J Higham, “Handbook of Writing for the Mathematical Sciences”, Society for Industrial and Applied Mathematics, 1998.
4. Adrian Wall work, “English for Writing Research Papers”, Springer, 2011.

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24AC102	DISASTER MANAGEMENT	L	T	P	C
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OBJECTIVES:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

UNIT – I INTRODUCTION 4

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

Repercussions of Disasters and Hazards: 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, Out breaks of Disease and Epidemics, War and Conflicts.

UNIT – III DISASTER PRONE AREAS IN INDIA 4

Disaster Prone are as in India: 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 4

Disaster Preparedness and Management 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

Risk Assessment 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: 24 PERIODS

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REFERENCES:

1. Nishith Rai and A.K. Singh, “Disaster Management in India: Perspectives, Issues and Strategies”, New Royal Book Company, 2007.
2. Pardeep Sahni, Alka Dhameja and Uma Medury, “Disaster Mitigation: Experiences and Reflections”, Prentice Hall India Learning Private Limited, 2001.
3. S.L.Goel,“Disaster Administration and Management: Text and Case Studies”,Deep & Deep Publication Pvt.Ltd., 2007

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24AC104	VALUE EDUCATION	L	T	P	C
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OBJECTIVES:

This course is intended to provide an integrated framework for the students can able to:

- Understand the value of education and self-development.
- Imbibe good values in students and Know about the importance of character.
- Learn the importance of Human values and developing the overall personality.

UNIT – I **6**

Values and self – development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non-moral Valuation, Standards and Principles, Value judgments.

UNIT – II **6**

Importance of cultivation of values. Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National Unity. Patriotism, Love for nature, Discipline.

UNIT – III **6**

Personality and Behavior Development – Soul and Scientific attitude, Positive Thinking, Integrity and Discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of Labour, Universal brotherhood and religious tolerance, True Friendship, Happiness vs. Suffering, Love for Truth, Aware of Self-Destructive habits, Association and Cooperation, Doing best for saving nature.

UNIT – IV **6**

Character and Competence – Holy books vs. Blind faith, Self – Management and Good health, Science of reincarnation, Equality, Non-violence, Humility, Role of Women, All religions and same message, Mind your Mind, Self - control, Honesty, Studying effectively.

TOTAL: 24 PERIODS

REFERENCES:

1. S.K. Chakra borty, “Values of Ethics for Organization: Theory and Practice”, Oxford University Press, 1999.

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24AC105	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

OBJECTIVES:

This course is intended to provide an integrated framework for the students can able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- 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.

UNIT – I HISTORY OF MAKING OF THE INDIAN CONSTITUTION 4

History, Drafting Committee (Composition and Working)

UNIT – II PHILOSOPHY OF THE INDIAN CONSTITUTION 4

Preamble, Salient Features

UNIT – III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES 4

- 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 – IV ORGANS OF GOVERNANCE 4

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

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UNIT-V LOCAL ADMINISTRATION **4**

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

UNIT-VI ELECTION COMMISSION: **4**

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

TOTAL:24 PERIODS

REFERENCES:

1. The Constitution of India, January 1950(Bare Act), Gazette of **India**.
2. S.N. Busi, "Dr.B.R. Ambedkar Framing of Indian Constitution", Vol.1 to 6, First Edition, 2016.
3. M.P.Jain, Justice Jasti Chelameswar and Justice Dama Seshadri Naidu, "Indian Constitution Law", Lexis Nexis, 2018.
4. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2011.

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24AC107	STRESS MANAGEMENT BY YOGA	L	T	P	C
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OBJECTIVES:

This course is intended to provide an integrated framework for the students can able to:

- Achieve overall health of body and mind
- Overcome stress
- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

UNIT-I ASHTANGA **8**

Definitions of Eight parts of yoga.

UNIT-II YAMANDNIYAM **8**

Do and Not Do in life

- Ahinsa, Satya, Astheya, Bramhacharya and Aparigraha
- Shaucha, Santosh, Tapa, Swadhyay, Ishwarpranidhan

UNIT-III ASANANDPRANAYAM **8**

- Various yoga poses and their benefits for mind and body
- Regularization of breathing techniques and its effects- Types of Pranayam

TOTAL: 24 PERIODS

REFERENCES:

1. "Yogic Asanas for Group Training - Part-I", Janardan Swami Yogabhyasi Mandal, Nagpur.
2. Swami Vivekananda, "Raja-Yoga or Conquering the Internal Nature", Vedanta Press,1998.

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24NEOE1 **IoT FOR SMART SYSTEMS**

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COURSE OBJECTIVES:

- To study about Internet of Things technologies and its role in real time applications.
- To introduce the infrastructure required for IoT
- To familiarize the accessories and communication techniques for IoT.
- To provide insight about the embedded processor and sensors required for IoT
- To familiarize the different platforms and Attributes for IoT

UNIT I **INTRODUCTION TO INTERNET OF THINGS** **9**

Overview, Hardware and software requirements for IOT, Sensor and actuators, Technology drivers, Business drivers, Typical IoT applications, Trends and implications.

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UNIT II IOT ARCHITECTURE **9**

IoT reference model and architecture -Node Structure - Sensing, Processing, Communication, Powering, Networking - Topologies, Layer/Stack architecture**,** IoT standards, Cloud computing for IoT, Bluetooth, Bluetooth Low Energy beacons.

UNIT III PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT PROTOCOLS **9**

NFC, SCADA and RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe GSM, CDMA, LTE, GPRS, small cell. **Wireless technologies for IoT:** WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary systems-Recent trends.

UNIT IV IOT PROCESSORS **9**

Services/Attributes: Big-Data Analytics for IOT, Dependability, Interoperability, Security, Maintainability. **Embedded processors for IOT** :Introduction to Python programming -Building IOT with RASPERRY PI and Arduino.

UNIT V CASE STUDIES **9**

Industrial IoT, Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Defense

TOTAL: 45 PERIODS

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COURSE OUTCOMES:

At the end of this course, the students will have the ability to

- Analyze the concepts of IoT and its present developments.
- Compare and contrast different platforms and infrastructures available for IoT
- Explain different protocols and communication technologies used in IoT
- Analyze the big data analytic and programming of IoT
- Implement IoT solutions for smart applications

REFERENCE:

1. ArshdeepBahga and VijaiMadisetti : A Hands-on Approach “Internet of Things”, Universities Press 2015.
2. Oliver Hersent , David Boswarthick and Omar Elloumi “ The Internet of Things”, Wiley,2016.
3. Samuel Greengard, “ The Internet of Things”, The MIT press, 2015.
4. Adrian McEwen and Hakim Cassimally“Designing the Internet of Things “Wiley,2014.
5. Jean- Philippe Vasseur, Adam Dunkels, “Interconnecting Smart Objects with IP: The Next Internet” Morgan Kuffmann Publishers, 2010.
6. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, John Wiley and sons, 2014.
7. Lingyang Song/DusitNiyato/ Zhu Han/ Ekram Hossain,” Wireless Device-to-Device Communications and Networks, CAMBRIDGE UNIVERSITY PRESS,2015.
8. OvidiuVermesan and Peter Friess (Editors), “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers Series in Communication, 2013.
9. Vijay Madisetti , ArshdeepBahga, “Internet of Things (A Hands on-Approach)”, 2014.
10. Zach Shelby, Carsten Bormann, “6LoWPAN: The Wireless Embedded Internet”, John Wiley and sons, 2009.Lars T.Berger and Krzysztof Iniewski, “Smart Grid applications, communications and security”, Wiley, 2015.
11. JanakaEkanayake, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama and Nick Jenkins, “ Smart Grid Technology and Applications”, Wiley, 2015.
12. UpenaDalal,”Wireless Communications & Networks,Oxford,2015.

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24NEOE2	MACHINE LEARNING AND DEEP LEARNING	L	T	P	C
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COURSE OBJECTIVES:

The course is aimed at

- Understanding about the learning problem and algorithms
- Providing insight about neural networks
- Introducing the machine learning fundamentals and significance
- Enabling the students to acquire knowledge about pattern recognition.
- Motivating the students to apply deep learning algorithms for solving real life problems.

UNIT I LEARNING PROBLEMS AND ALGORITHMS 9

Various paradigms of learning problems, Supervised, Semi-supervised and Unsupervised algorithms

UNIT II NEURAL NETWORKS 9

Differences between Biological and Artificial Neural Networks - Typical Architecture, Common Activation Functions, Multi-layer neural network, Linear Separability, Hebb Net, Perceptron, Adaline, Standard Back propagation Training Algorithms for Pattern Association - Hebb rule and Delta rule, Hetero associative, Auto associative, Kohonen Self Organizing Maps, Examples of Feature Maps, Learning Vector Quantization, Gradient descent, Boltzmann Machine Learning.

UNIT III MACHINE LEARNING – FUNDAMENTALS & FEATURE SELECTIONS & CLASSIFICATIONS 9

Classifying Samples: The confusion matrix, Accuracy, Precision, Recall, F1- Score, the curse of dimensionality, training, testing, validation, cross validation, overfitting, under-fitting the data, early stopping, regularization, bias and variance. Feature Selection, normalization, dimensionality reduction, Classifiers: KNN, SVM, Decision trees, Naïve Bayes, Binary classification, multi class classification, clustering.

UNIT IV DEEP LEARNING: CONVOLUTIONAL NEURAL NETWORKS 9

Feed forward networks, Activation functions, back propagation in CNN, optimizers, batch normalization, convolution layers, pooling layers, fully connected layers, dropout, Examples of CNNs.

UNIT V DEEP LEARNING: RNNS, AUTOENCODERS AND GANS 9

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State, Structure of RNN Cell, LSTM and GRU, Time distributed layers, Generating Text, Autoencoders: Convolutional Autoencoders, Denoising autoencoders, Variational autoencoders, GANs: The discriminator, generator, DCGANs

TOTAL : 45 PERIODS

COURSE OUTCOMES (CO):

At the end of the course the student will be able to

- Illustrate the categorization of machine learning algorithms.
- Compare the types of neural network architectures, activation functions
- Acquainted with the pattern association using neural networks
- Elaborate various terminologies related with pattern recognition and architectures of convolutional neural networks
- Construct different feature selection and classification techniques

REFERENCES:

1. J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro Fuzzy and Soft Computing - A Computational Approach to Learning and Machine Intelligence, 2012, PHI learning
2. Deep Learning, Ian Good fellow, YoshuaBengio and Aaron Courville, MIT Press, ISBN: 9780262035613, 2016.
3. The Elements of Statistical Learning. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Second Edition. 2009.
4. Pattern Recognition and Machine Learning. Christopher Bishop. Springer. 2006.
5. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017.

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24NEOE3	E-LEARNING	L	T	P	C
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COURSEOBJECTIVES:

- To learn the various E-learning approaches and Components.
- To explore Design Thinking.
- To understand the types of design models of E-learning.
- To learn about E-learning Authoring tools.
- To know about evaluation and management of E-learningsolutions

UNITI INTRODUCTION 9

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

UNITII DESIGNINGE-LEARNINGCOURSECONTENT 9

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

UNITIII CREATINGINTERACTIVECONTENT 9

Preparing Content: Tips for Content Development and Language Style – Creating Storyboards: Structure of an Interactive E-Lesson – Techniques for Presenting Content – Adding Examples – Integrating Multimedia Elements – Adding Examples – Developing Practice and Assessment Tests–Adding Additional Resources – Courseware Development Authoring Tools – Types of Authoring Tools–Selecting an Authoring Tool.

UNITV LEARNINGPLATFORMS 9

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

UNITV COURSEDELIVERYANDEVALUATION 9

Components of an Instructor-Led or Facilitated Course – Planning and Documenting Activities –Facilitating Learners Activities–E- LearningMethodsandDeliveryFormats– UsingCommunicationToolsforE-Learning – Course Evaluation

TOTAL:45PERIODS

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SUGGESTEDACTIVITIES:

1. Prepare the E-Learning Components and how will you measure the quality of the contents. Also, analyze synchronous and Asynchronous Modes of Learning, and discuss the advantages and disadvantages of both.
2. Explain how the course instructor design and create effective E-Learning content
3. List the types of authoring tools and discuss which tool is best according to you.
4. Explain about different types of Learning Platforms
5. Discuss about the Evaluation process of E-Learning courses in detail.

COURSEOUTCOMES:

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

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

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1. Clark, R.C.,Mayer,R.E.,"E-Learning and the Science of Instruction". Third Edition, Wiley Publisher, 2016.
2. Crews,T.B.,Sheth, S.N.,Horne,T.M.,"Understanding the Learning Personalities of Successful Online Students",1st Edition, EducauseReview,2014.
3. JohnnySchneider,"Understanding Design Thinking ,Lean and Agile",1st Edition, O'Reilly Media, 2017.
4. MadhuriDubey,"Effective E–learning Design, Development and Delivery",1st Edition, University Press, 2011.
5. VladimirL. Uskov, RobertJ. Howlett, Lakhmi C.Jain ,Smart Education and E-Learning,1st Edition, SpringerSingapore,2019.
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24NEOE4 DIGITALMARKETING L T P C

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COURSEOBJECTIVES:

- To understand the difference between Traditional Marketing and digital Marketing
- To understand and analyze the searching in functions
- To develop a deep knowledge about the Digital marketing platforms and the theoretical aspects of creating a website
- To analyze inbuilt tools for digital Marketing

UNIT I INTRODUCTION TO DIGITAL MARKETING 9

What is Digital Marketing- Need of Digital Marketing-Digital Marketing Platforms – Understanding digital marketing process- Difference between Traditional Marketing and digital Marketing-tools of Digital marketing- Advantage of Digital Marketing- Digital Marketing Manager Role and functions-How we use both Digital & Traditional Marketing

UNIT II WEBSITE & SEARCH ENGINE 9

Website –Hosting and Domain– Different platforms for website creation- Introduction to SERP-What are search engines- How search engines work- Major functions of a search engine- What are keywords- Different types of keywords-Google keyword planner tool.

UNIT III MISCTOOLS-GOOGLEWEBMASTERTOOLS 9

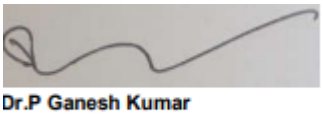
Site Map Creators-Browser-based analysis tools-Page Rank tools-pinging & indexing tools-Deadlinksidentificationtools-OpensiteexplorerDomaininformation/whois tools-Quick sprout

UNITIV LEADMANAGEMENT&DIGITALMARKETING 9

Web to lead forms- Web to case forms- Lead generation techniques- Leads are everywhere- Social media and lead gen Inbuilt tools for Digital Marketing-Ip Tracker-CPC reduction (incase of paid ads) Group posting on Social Media platforms

UNIT V TRENDINGDIGITALMARKETING SKILLS 9

Search Engine Optimization (SEO)-Search Engine Marketing (SEM).-Social Media Marketing / Optimization-Email Marketing. Website: Product Marketing-Content Writing. Marketing the created content online Copywriting- Blogging- Local Marketing. Google Ad Words - Campaign Management-PPC Advertising- Affiliate Marketing. Mobile and SMS



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Marketing- Marketing Automation-Web Analytics-Growth Hacking

COURSEOUTCOMES:

- To gain insight on the concept of digital marketing and the role of a digital manager.
- To understand and administer the website and the search engines.
- To understand how to use MISC and Google Web master tools.
- To understand the concepts of lead management and digital marketing.
- To gain knowledge on the latest digital marketing trends

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1. Chaffey, D., & Ellis-Chadwick, F. Digital Marketing: Strategy and Implementation. Pearson Education-2019
2. Kaufman,I.,&Horton,C. Digital marketing: Integrating strategy and tactics with values, a guide book For executives, managers, and students- Routledge; 1st edition -2014.
3. Royle, J., & Laing, A. , The Digital Marketing Skills Gap: Developing a Digital Marketer Model for the Communication Industries. *International Journal of Information Management, 34,* 65-73, 2014.
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