

ANNA UNIVERSITY, CHENNAI
NON - AUTONOMOUS COLLEGES AFFILIATED ANNA UNIVERSITY
M.E. COMPUTER SCIENCE AND ENGINEERING (WITH SPECIALIZATION IN NETWORKS)
REGULATIONS – 2021
CHOICE BASED CREDIT SYSTEM

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

- I. Acquire core competence and excel in computing and networking based industries.
- II. Analyze and understand the foundations of networking as well as advanced techniques and tools so as to build or improve current techniques to a higher standard.
- III. Possess creativity and understanding to build innovative and research-oriented systems, and provide solutions of varying complexity.
- IV. Effectively communicate technical information, function effectively on teams, and apply computer engineering solutions within a global, societal, and environmental context
- V. Provide consultancy and offer networking solutions for establishments.

2. PROGRAM SPECIFIC OUTCOMES (PSOs) :

1. To use mathematical, algorithmic and theoretical foundations in the study of computing systems
2. To adapt to emerging generations of networking technologies to design, build and dream up innovative interconnected systems.
3. To acquire in-depth knowledge and skills in core and emerging technologies of Computer Networks.
4. To understand the concepts and theories of networking and apply them to various situations for classifying networks, analyzing performance and implementing new technologies.

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CHOICE BASED CREDIT SYSTEM
I TO IV SEMESTERS CURRICULA AND SYLLABI
SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA4151	Applied Probability and Statistics for Computer Science Engineers	FC	3	1	0	4	4
2.	RM4151	Research Methodology and IPR	RMC	2	0	0	2	2
3.	CP4151	Advanced Data Structures and Algorithms	PCC	3	0	0	3	3
4.	CP4152	Database Practices	PCC	3	0	2	5	4
5.	CP4153	Network Technologies	PCC	3	0	0	3	3
6.	MP4152	Wireless Communications	PCC	3	0	0	3	3
7.		Audit Course – I*	AC	2	0	0	2	0
PRACTICALS								
8.	CP4161	Advanced Data Structures and Algorithms Laboratory	PCC	0	0	4	4	2
9.	NE4111	Networks Laboratory	PCC	0	0	4	4	2
TOTAL				19	1	10	30	23

*Audit course is optional

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CP4251	Internet of Things	PCC	3	0	2	5	4
2.	CP4252	Machine Learning	PCC	3	0	2	5	4
3.	NE4251	Network Security	PCC	3	0	0	3	3
4.		Professional Elective I	PEC	3	0	0	3	3
5.		Professional Elective II	PEC	3	0	0	3	3
6.		Audit Course – II*	AC	2	0	0	2	0
PRACTICALS								
7.	NE4211	Term Paper and seminar	EEC	0	0	2	2	1
8.	NE4212	Network Design and Programming Laboratory	PCC	0	0	4	4	2
9.	NE4261	Network Security Laboratory	PCC	0	0	2	2	1
TOTAL				17	0	12	29	21

*Audit course is optional

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MU4152	Multimedia Communication Networks	PCC	3	0	0	3	3
2.		Professional Elective III	PEC	3	0	0	3	3
3.		Professional Elective IV	PEC	3	0	2	5	4
4.		Open Elective	OEC	3	0	0	3	3
PRACTICALS								
5.	NE4311	Project Work I	EEC	0	0	12	12	6
TOTAL				12	0	14	26	19

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	NE4411	Project Work II	EEC	0	0	24	24	12
TOTAL				0	0	24	24	12

TOTAL NO. OF CREDITS: 75

PROFESSIONAL ELECTIVES**SEMESTER II, ELECTIVE I**

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	NE4072	Wireless Sensor Networks and Protocols	PEC	3	0	0	3	3
2.	EL4351	Optical Networks	PEC	3	0	0	3	3
3.	NE4071	Haptic Technology	PEC	3	0	0	3	3
4.	IF4079	Social Network Analysis	PEC	3	0	0	3	3
5.	NE4001	IoT Architecture and Protocols	PEC	3	0	0	3	3
6.	SE4071	Agile Methodologies	PEC	3	0	0	3	3

SEMESTER II, ELECTIVE II

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CP4077	Mobile and Pervasive Computing	PEC	3	0	0	3	3
2.	SE4151	Advanced Software Engineering	PEC	3	0	0	3	3
3.	MP4071	Cognitive Computing	PEC	3	0	0	3	3
4.	NE4002	High Speed Switching Architectures	PEC	3	0	0	3	3

SEMESTER III, ELECTIVE III

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CP4079	Software Quality Assurance	PEC	3	0	0	3	3
2.	CP4078	Performance Analysis of Computer Systems	PEC	3	0	0	3	3
3.	NE4003	Simulation of Computer Systems and Networks	PEC	3	0	0	3	3
4.	NE4004	Next Generation Networks	PEC	3	0	0	3	3
5.	CP4071	Autonomous Systems	PEC	3	0	0	3	3

SEMESTER III, ELECTIVE IV

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MP4251	Cyber Physical Systems	PEC	3	0	2	5	4
2.	CP4072	Bioinformatics	PEC	3	0	2	5	4
3.	IF4073	Deep Learning	PEC	3	0	2	5	4
4.	MP4252	Mobile Application Development	PEC	3	0	2	5	4
5.	BC4251	Ethical Hacking	PEC	3	0	2	5	4

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

SL. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	AX4091	English for Research Paper Writing	2	0	0	0
2.	AX4092	Disaster Management	2	0	0	0
3.	AX4093	Constitution of India	2	0	0	0
4.	AX4094	நற்றமிழ் இலக்கியம்	2	0	0	0

FOUNDATION COURSES (FC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	MA4151	Applied Probability and Statistics for Computer Science Engineers	3	1	0	4	I

PROFESSIONAL CORE COURSES (PCC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	CP4151	Advanced Data Structures and Algorithms	3	0	0	3	I
2.	CP4152	Database Practices	3	0	2	4	I
3.	CP4153	Network Technologies	3	0	0	3	I
4.	MP4152	Wireless Communications	3	0	0	3	I
5.	CP4161	Advanced Data Structures and Algorithms Laboratory	0	0	4	2	I
6.	NE4111	Networks Laboratory	0	0	4	2	I
7.	CP4251	Internet of Things	3	0	2	4	I I
8.	CP4252	Machine Learning	3	0	2	4	I I
9.	NE4251	Network Security	3	0	0	3	I I
10.	NE4212	Network Design and Programming Laboratory	0	0	4	2	I I
11.	NE4261	Network Security Laboratory	0	0	4	2	I I
12.	MU4152	Multimedia Communication Networks	3	0	0	3	I I I

RESEARCH METHODOLOGY AND IPR COURSES (RMC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	RM4151	Research Methodology and IPR	2	0	0	2	1

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	NE4211	Term Paper and seminar	0	0	2	1	III
2.	NE4311	Project Work I	0	0	12	6	III
3.	NE4411	Project Work II	0	0	24	12	IV

SUMMARY

Sl. No.	Name of the Programme: M.E.COMPUTER SCIENCE AND ENGINEERING (WITH SPECIALIZATION IN NETWORKS)					
	SUBJECT AREA	CREDITS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	
1.	FC	04	00	00	00	04
2.	PCC	17	14	03	00	34
3.	PEC	00	06	07	00	13
4.	RMC	02	00	00	00	02
5.	OEC	00	00	03	00	03
6.	EEC	00	01	06	12	19
7.	Non Credit/Audit Course	✓	✓	00	00	
8.	TOTAL CREDIT	23	21	19	12	75

MA4151 APPLIED PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE ENGINEERS

L T P C
3 1 0 4

COURSE OBJECTIVES:

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

UNIT I LINEAR ALGEBRA 12

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

UNIT II PROBABILITY AND RANDOM VARIABLES 12

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

UNIT III TWO DIMENSIONAL RANDOM VARIABLES 12

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

UNIT IV TESTING OF HYPOTHESIS 12

Sampling distributions – Type I and Type II errors – Small and Large samples – Tests based on Normal, t, Chi square and F distributions for testing of mean , variance and proportions – Tests for independence of attributes and goodness of fit.

UNIT V MULTIVARIATE ANALYSIS 12

Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components – Population principal components – Principal components from standardized variables.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

- apply the concepts of Linear Algebra to solve practical problems.
- use the ideas of probability and random variables in solving engineering problems.
- be familiar with some of the commonly encountered two dimensional random variables and be equipped for a possible extension to multivariate analysis.
- use statistical tests in testing hypotheses on data.
- develop critical thinking based on empirical evidence and the scientific approach to knowledge development.

REFERENCES:

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

RM4151

RESEARCH METHODOLOGY AND IPR

L T P C
2 0 0 2

UNIT I RESEARCH DESIGN

6

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

UNIT II DATA COLLECTION AND SOURCES

6

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

UNIT III DATA ANALYSIS AND REPORTING

6

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

UNIT IV INTELLECTUAL PROPERTY RIGHTS

6

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

UNIT V PATENTS

6

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

TOTAL : 30 PERIODS

REFERENCES

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.

4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

CP4151 ADVANCED DATA STRUCTURES AND ALGORITHMS L T P C
3 0 0 3

COURSE OBJECTIVES:

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

UNIT I ROLE OF ALGORITHMS IN COMPUTING & COMPLEXITY 9
ANALYSIS

Algorithms – Algorithms as a Technology -Time and Space complexity of algorithms- Asymptotic analysis-Average and worst-case analysis-Asymptotic notation-Importance of efficient algorithms- Program performance measurement - Recurrences: The Substitution Method – The Recursion-Tree Method- Data structures and algorithms.

UNIT II HIERARCHICAL DATA STRUCTURES 9

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

UNIT III GRAPHS 9

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

UNIT IV ALGORITHM DESIGN TECHNIQUES 9

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

UNIT V NP COMPLETE AND NP HARD 9

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

TOTAL : 45 PERIODS

SUGGESTED ACTIVITIES:

1. Write an algorithm for Towers of Hanoi problem using recursion and analyze the complexity (No of disc-4)
2. Write any one real time application of hierarchical data structure
3. Write a program to implement Make_Set, Find_Set and Union functions for Disjoint Set Data Structure for a given undirected graph $G(V,E)$ using the linked list representation

- with simple implementation of Union operation
- 4. Find the minimum cost to reach last cell of the matrix from its first cell
- 5. Discuss about any NP completeness problem

COURSE OUTCOMES:

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

REFERENCES:

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

CP4152

DATABASE PRACTICES

L T P C
3 0 2 4

COURSE 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

12

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

Suggested Activities:

Data Definition Language

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

Data Manipulation Language

- Insert, Delete, Update

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

Transaction Control Language

- Commit, Rollback and Save Points

UNIT II DISTRIBUTED DATABASES, ACTIVE DATABASES AND OPEN DATABASE CONNECTIVITY 12

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

Suggested Activities:

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

UNIT III XML DATABASES 12

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

Suggested Activities:

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

UNIT IV NOSQL DATABASES AND BIG DATA STORAGE SYSTEMS 12

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

Suggested Activities:

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

UNIT V DATABASE SECURITY 12

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

SUGGESTED ACTIVITIES:

Implementing Access Control in Relational Databases

TOTAL : 75 PERIODS**COURSE OUTCOMES**

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

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

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", Seventh Edition, McGraw Hill, 2019.
3. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006
4. Raghu Ramakrishnan , Johannes Gehrke "Database Management Systems", Fourth Edition, 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

CP4153**NETWORK TECHNOLOGIES****L T P C
3 0 0 3****COURSE OBJECTIVES:**

- To understand the basic concepts of networks
- To explore various technologies in the wireless domain
- To study about 4G and 5G cellular networks
- To 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. OpenDaylight. OpenDaylight Architecture. OpenDaylight Helium. SDN Application Plane Architecture. Northbound Interface. Network Services Abstraction Layer. Network Applications. User Interface.

UNIT V NETWORK FUNCTIONS VIRTUALIZATION 9

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

TOTAL : 45 PERIODS

SUGGESTED ACTIVITIES:

- 1: Execute various network utilities such as tracert, pathping, ipconfig
- 2: Implement the Software Defined Networking using Mininet
- 3: Implement routing in Mininet
- 4: Install a virtual machine and study network virtualization
- 5: Simulate various network topologies in Network Simulator

REFERENCES:

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

MP4152

WIRELESS COMMUNICATIONS

**L T P C
3 0 0 3**

COURSE OBJECTIVES:

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

- To acquire knowledge in multicarrier systems.

UNIT I CELLULAR CONCEPTS 9

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

UNIT II THE WIRELESS CHANNEL 9

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

UNIT III PERFORMANCE OF DIGITAL MODULATION OVER WIRELESS CHANNELS 9

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

UNIT IV DIVERSITY TECHNIQUES 9

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

UNIT V MULTICARRIER MODULATION 9

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

SUGGESTED ACTIVITIES:

- 1: Survey on various features of cellular networks
- 2: Study the nature of cellular networks
- 3: A comparative study on the performance of different digital modulation techniques
- 4: Perform a review of various diversity techniques in wireless communication
- 5: Presentation on design of multicarrier systems for 5G

COURSE OUTCOMES:

- CO1:** Design solutions for cellular communication
- CO2:** Determine the capacity of wireless channels
- CO3:** Analyze the performance of the digital modulation techniques in fading channels
- CO4:** Apply various diversity techniques in wireless communication
- CO5:** Design multicarrier systems in wireless communication

TOTAL : 45 PERIODS

REFERENCES:

1. Theodore.S. Rappaport, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, India, 2010.

2. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.
3. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Wiley Series in Telecommunications, Cambridge University Press, 2005.
4. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies" CRC press – 2019.
5. Keith Q. T. Zhang, "Wireless Communications: Principles, Theory and Methodology" 1st edition, John Wiley & Sons, 2016.
6. Ramjee Prasad, "OFDM for Wireless Communication Systems", Artech House, 2004.

CP4161	ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY	L T P C 0 0 4 2
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COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS:

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

HARDWARE/SOFTWARE REQUIREMENTS

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

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

REFERENCES:

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

NE4111	NETWORKS LABORATORY	L T P C
	(Experiments using NS2/ QUALNET /NS3/ OMNET/ equivalent)	0 0 4 2

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS:

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

HARDWARE/SOFTWARE REQUIREMENTS

- 1: C/Java/Python
- 2: NS2/ QUALNET /NS3/ OMNET/ equivalent

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

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

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

CO4: Design and configure a network.

CO5: Design VLAN for secured communication.

REFERENCES:

1. Behrouz Forouzan, "Introduction to Data Communications and Networking", Tata McGraw Hill, 5th Edition, 2015.
2. Stallings, "Data and Computer Communications", PHI, 10th Edition, 2015.
3. Teerawat Issariyakul, Ekram Hossain, "Introduction to Network Simulator NS2", Springer, Second Edition, 2012.
4. ns-3 Manual
5. OMNeT++ - Simulation Manual
6. QualNet 6.1 User's Guide Qual Net User's Guide

COURSE OBJECTIVES:

- To Understand the Architectural Overview of IoT
- To Understand the IoT Reference Architecture and Real World Design Constraints
- To Understand the various IoT levels
- To understand the basics of cloud architecture
- To gain experience in Raspberry PI and experiment simple IoT application on it

UNIT I INTRODUCTION**12**

Internet of Things- Domain Specific IoTs - IoT and M2M-Sensors for IoT Applications–Structure of IoT– IoT Map Device- IoT System Management with NETCONF-YANG

UNIT II IoT ARCHITECTURE, GENERATIONS AND PROTOCOLS**12**

IETF architecture for IoT - IoT reference architecture -First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics

UNIT III IoT PROTOCOLS AND TECHNOLOGY**12**

SCADA and RFID Protocols - BACNet Protocol -Zigbee Architecture - 6LowPAN - CoAP -Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module–Sensing Module

UNIT IV CLOUD ARCHITECTURE BASICS**12**

The Cloud types; IaaS, PaaS, SaaS.- Development environments for service development; Amazon, Azure, Google Appcloud platform in industry

UNIT V IOT PROJECTS ON RASPBERRY PI**12**

Building IOT with RASPBERRY PI- Creating the sensor project - Preparing Raspberry Pi - Clayster libraries – Hardware Interacting with the hardware - Interfacing the hardware- Internal representation of sensor values - Persisting data - External representation of sensor values - Exporting sensor data

SUGGESTED ACTIVITIES:

1. Develop an application for LED Blink and Pattern using arduino or Raspberry Pi
2. Develop an application for LED Pattern with Push Button Control using arduino or Raspberry Pi
3. Develop an application for LM35 Temperature Sensor to display temperature values using arduino or Raspberry Pi
4. Develop an application for Forest fire detection end node using Raspberry Pi device and sensor
5. Develop an application for home intrusion detection web application
6. Develop an application for Smart parking application using python and Django for web application

COURSE OUTCOMES:

CO1: Understand the various concept of the IoT and their technologies

- CO2: Develop the IoT application using different hardware platforms
 CO3: Implement the various IoT Protocols
 CO4: Understand the basic principles of cloud computing
 CO5: Develop and deploy the IoT application into cloud environment

TOTAL PERIODS: 60

REFERENCES:

1. Arshdeep Bahga, Vijay Madiseti, Internet of Things: A hands-on approach, Universities Press, 2015
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles (Eds), Architecting the Internet of Things, Springer, 2011
3. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
4. Ovidiu Vermesan Peter Friess, 'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014
5. N. Ida, Sensors, Actuators and Their Interfaces: A Multidisciplinary Introduction, 2nd Edition Scitech Publishers, 202014
6. Reese, G. (2009). Cloud Application Architectures: Building Applications and Infrastructure in the Cloud. Sebastopol, CA: O'Reilly Media, Inc. (2009)

	PO					
	1	2	3	4	5	6
C01	1	1	2	1	1	3
C02	3	2	1	2	3	2
C03	1	1	2	1	3	3
C04	2	3	2	1	2	2
C05	1	2	1	2	1	1
AVG	1.60	1.80	1.60	1.40	2.00	2.20

CP4252

MACHINE LEARNING

**L T P C
3 0 2 4**

COURSE OBJECTIVES:

- To understand the concepts and mathematical foundations of machine learning and types of problems tackled by machine learning
- To explore the different supervised learning techniques including ensemble methods
- To learn different aspects of unsupervised learning and reinforcement learning
- To learn the role of probabilistic methods for machine learning
- To understand the basic concepts of neural networks and deep learning

UNIT I INTRODUCTION AND MATHEMATICAL FOUNDATIONS

9

What is Machine Learning? Need –History – Definitions – Applications - Advantages, Disadvantages & Challenges -Types of Machine Learning Problems – Mathematical Foundations - Linear Algebra & Analytical Geometry -Probability and Statistics- Bayesian Conditional Probability -Vector Calculus & Optimization - Decision Theory - Information theory

UNIT II SUPERVISED LEARNING

9

Introduction-Discriminative and Generative Models -Linear Regression - Least Squares -Under-fitting / Overfitting -Cross-Validation – Lasso Regression- Classification - Logistic Regression- Gradient

Linear Models -Support Vector Machines –Kernel Methods -Instance based Methods - K-Nearest Neighbours - Tree based Methods –Decision Trees –ID3 – CART - Ensemble Methods –Random Forest - Evaluation of Classification Algorithms

UNIT III UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING 9

Introduction - Clustering Algorithms -K – Means – Hierarchical Clustering - Cluster Validity - Dimensionality Reduction –Principal Component Analysis – Recommendation Systems - EM algorithm. Reinforcement Learning – Elements -Model based Learning – Temporal Difference Learning

UNIT IV PROBABILISTIC METHODS FOR LEARNING- 9

Introduction -Naïve Bayes Algorithm -Maximum Likelihood -Maximum Apriori -Bayesian Belief Networks -Probabilistic Modelling of Problems -Inference in Bayesian Belief Networks – Probability Density Estimation - Sequence Models – Markov Models – Hidden Markov Models

UNIT V NEURAL NETWORKS AND DEEP LEARNING 9

Neural Networks – Biological Motivation- Perceptron – Multi-layer Perceptron – Feed Forward Network – Back Propagation-Activation and Loss Functions- Limitations of Machine Learning – Deep Learning– Convolution Neural Networks – Recurrent Neural Networks – Use cases

45 PERIODS

SUGGESTED ACTIVITIES:

1. Give an example from our daily life for each type of machine learning problem
2. Study at least 3 Tools available for Machine Learning and discuss pros & cons of each
3. Take an example of a classification problem. Draw different decision trees for the example and explain the pros and cons of each decision variable at each level of the tree
4. Outline 10 machine learning applications in healthcare
5. Give 5 examples where sequential models are suitable.
6. Give at least 5 recent applications of CNN

PRACTICAL EXERCISES:

30 PERIODS

1. Implement a Linear Regression with a Real Dataset (<https://www.kaggle.com/harrywang/housing>). Experiment with different features in building a model. Tune the model's hyperparameters.
2. Implement a binary classification model. That is, answers a binary question such as "Are houses in this neighborhood above a certain price?"(use data from exercise 1). Modify the classification threshold and determine how that modification influences the model. Experiment with different classification metrics to determine your model's effectiveness.
3. Classification with Nearest Neighbours. In this question, you will use the scikit-learn's KNN classifier to classify real vs. fake news headlines. The aim of this question is for you to read the scikit-learn API and get comfortable with training/validation splits. Use California Housing Dataset
4. In this exercise, you'll experiment with validation sets and test sets using the dataset. Split a training set into a smaller training set and a validation set. Analyze deltas between training set and validation set results. Test the trained model with a test set to determine whether your trained model is overfitting. Detect and fix a common training problem.
5. Implement the k-means algorithm using <https://archive.ics.uci.edu/ml/datasets/Codon+usage> dataset
6. Implement the Naïve Bayes Classifier using <https://archive.ics.uci.edu/ml/datasets/Gait+Classification> dataset

7. Project - (in Pairs) Your project must implement one or more machine learning algorithms and apply them to some data.
- Your project may be a comparison of several existing algorithms, or it may propose a new algorithm in which case you still must compare it to at least one other approach.
 - You can either pick a project of your own design, or you can choose from the set of pre-defined projects.
 - You are free to use any third-party ideas or code that you wish as long as it is publicly available.
 - You must properly provide references to any work that is not your own in the write-up.
 - Project proposal You must turn in a brief project proposal. Your project proposal should describe the idea behind your project. You should also briefly describe software you will need to write, and papers (2-3) you plan to read.

List of Projects (datasets available)

- Sentiment Analysis of Product Reviews
- Stock Prediction
- Sales Forecasting
- Music Recommendation
- Handwriting Digit Classification
- Fake News Detection
- Sports Prediction
- Object Detection
- Disease Prediction

COURSE OUTCOMES:

CO1: Understand and outline problems for each type of machine learning

CO2: Design a Decision tree and Random forest for an application

CO3: Implement Probabilistic Discriminative and Generative algorithms for an application and analyze the results.

CO4: Use a tool to implement typical Clustering algorithms for different types of applications.

CO5: Design and implement an HMM for a Sequence Model type of application.

CO6: Identify applications suitable for different types of Machine Learning with suitable justification.

TOTAL PERIODS:75

REFERENCES

- Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Chapman & Hall/CRC, 2nd Edition, 2014.
- Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
- Ethem Alpaydin, "Introduction to Machine Learning", Third Edition, Adaptive Computation and Machine Learning Series, MIT Press, 2014
- Tom M Mitchell, "Machine Learning", McGraw Hill Education, 2013.
- Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.
- Shai Shalev-Shwartz and Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2015
- Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.
- Hal Daumé III, "A Course in Machine Learning", 2017 (freely available online)
- Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, 2009 (freely available online)

10. Aurélien Géron , Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition, o'reilly, (2017)

	PO					
	1	2	3	4	5	6
C01	1	2	1	3	1	1
C02	2	3	1	2	1	2
C03	1	1	2	1		2
C04	2	2				3
C05	3	3	1	1	1	3
AVG	1.80	2.20	1.25	1.75	1.00	2.20

NE4251

NETWORK SECURITY

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To learn the fundamentals of cryptography and its application to network security.
- To understand the mathematics behind cryptography.
- To learn about the security issues in internet protocol.
- To understand the security issues in other layers
- To study about intrusion detection and prevention system and wireless hacking.

UNIT I INTRODUCTION TO NETWORK SECURITY 9

Security Services and Mechanisms – Vulnerabilities in wireless communications –security basics – Attack and its types Security essentials on layers - Electronic signatures – PKI and electronic certificate

UNIT II SYMMETRIC AND ASYMMETRIC CIPHERS 9

Classical Techniques – Substitution Ciphers - Transposition Ciphers. Modern symmetric ciphers : Stream cipher - RC4, Block cipher - DES – AES – Uses of Modes of operation. Modern Asymmetric block ciphers - RSA, ElGamal., MAC – Cryptographic Hash Functions- Key management system- Key Distribution & Key Agreements.

UNIT III SECURITY ISSUES IN INTERNET PROTOCOL 9

Reconnaissance-Wireshark- TCPDump - Netdiscover - Shodan ,NESSUS,Hping3 NSE Scripts: Introduction - How to write and read NSE script - TCP session Hijacking - UDP session Hijacking -HTTP Session – Hijacking - Spoofing basics - IP, DNS and ARP Spoofing

UNIT IV SECURITY IN OTHER LAYERS 9

E-Mail Security and its services – PGP - S/MIME – DNS Security - VPN Concept and its configuration - AAA Concept, RADIUS, TACACS+ technologies, SSL architecture and protocol.

UNIT V INTRUSION DETECTION AND PREVENTION SYSTEM(IDPS) AND WIRELESS HACKING 9

IDPS introduction - Uses of IDPS Technologies - Key functions of IDPS Technologies , Signature Based Detection , Anomaly Based Detection - Wireless networks - WPA Handshaking - Wireless hacking tools.

COURSE OUTCOMES:

CO1: To design cryptographic algorithms and carry out their implementation.

CO2: To carry out cryptanalysis on cipher.

CO3: To be able to design and implement security based internet protocols.

CO4: To carry out system security for other layers.

CO5: To understand the importance of intrusion detection and prevention system and wireless hacking.

TOTAL PERIODS: 45

REFERENCES

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay —Cryptography & Network Security, 3rd edition, Tata McGraw Hill, 2015.
2. William Stallings "Network Security Essentials Applications and Standards", Pearson Education., 5th Edition, 2014.
3. Ryan Russell, " Hack Proofing your network ", Wiley,2nd Edition,2002.
4. David M. Durton, "Elementary Number Theory", Tata Mcgraw Hill, Sixth Edition, 2009.
5. Jonathan Katz, Yehuda Lindell, "Introduction to Modern Cryptography: Principles and Protocols (Chapman & Hall/CRC Cryptography and Network Security Series)", 1st Edition , CRC Press Taylor and Francis Group, 2008.
6. Douglas R. Stinson," Cryptography: Theory and Practice, Third Edition (Discrete Mathematics and Its Applications), Chapman & Hall/CRC, 2005.

NE4211

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 analysing 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

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	2 nd week	3 % Based on clarity of thought, current relevance and clarity in writing
Stating an Objective			
Collecting Information about your area & topic	<ol style="list-style-type: none"> 1. List 1 Special Interest Groups or professional society 2. List 2 journals 3. List 2 conferences, symposia or workshops 4. List 1 thesis title 5. List 3 web presences (mailing lists, forums, news sites) 6. List 3 authors who publish regularly in your area 7. Attach a call for papers (CFP) from your area. 	3 rd week	3% (the selected information must be area specific and of international and national standard)
Collection of Journal papers in the topic in the context of the objective – collect 20 & then filter	<ul style="list-style-type: none"> • You have to provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar • When picking papers to read - try to: <ul style="list-style-type: none"> • 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, • Favour “first” or “foundational” papers in the field (as indicated in other people’s survey paper), • Favour more recent papers, • Pick a recent survey of the field so you can quickly gain an overview, • Find relationships with respect to each other and to your topic area (classification scheme/categorization) • Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered 	4 th week	6% (the list of standard papers and reason for selection)
Reading and notes for first 5 papers	<p>Reading Paper Process</p> <ul style="list-style-type: none"> • For each paper form a Table answering the following questions: • What is the main topic of the 	5 th week	8% (the table given should indicate your understanding of the

	<p>article?</p> <ul style="list-style-type: none"> • 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? <p>Conclude with limitations/issues not addressed by the paper (from the perspective of your survey)</p>		<p>paper and the evaluation is based on your conclusions about each paper)</p>
Reading and notes for next 5 papers	Repeat Reading Paper Process	6 th 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	7 th 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	8 th 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	9 th week	6% (Clarity, purpose and conclusion) 6% Presentation & Viva Voce
Introduction	Write an introduction and background	10 th week	5%

Background	sections		(clarity)
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11 th week	10% (this component will be evaluated based on the linking and classification among the papers)
Your conclusions	Write your conclusions and future work	12 th week	5% (conclusions – clarity and your ideas)
Final Draft	Complete the final draft of your paper	13 th week	10% (formatting, English, Clarity and linking) 4% Plagiarism Check Report
Seminar	A brief 15 slides on your paper	14 th & 15 th week	10% (based on presentation and Viva-voce)

TOTAL: 30 PERIODS

NE4212

NETWORK DESIGN AND PROGRAMMING LABORATORY

L T P C
0 0 4 2

COURSE OBJECTIVES:

- To practice LAN and WAN design
- To learn network programming in UNIX C and Python
- 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
- Establish a dynamic routing based internetwork with 2 routers and two or more LANs using
- RIP/OSPF and check the connectivity and configuration

SUGGESTED ACTIVITIES:

- 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
- 5: Develop a multiprotocol server with TCP and UDP and 2 clients
- 6: Develop simple Python programs that use frequently used syntactic constructs
- 7: Develop a Socket based application in Python
- 8: Build client applications for major APIs (Amazon S3, Twitter etc) in Python
- 9: Develop an application that interacts with e-mail servers in python
- 10: Develop applications that work with remote servers using SSH, FTP etc in Python

COURSE OUTCOMES:

- CO1: Design and implement LANs and internetworks
CO2: Develop network based applications in UNIX C and Python
CO3: Develop TCP UDP servers with multiple clients
CO4: Build client applications for major API in Python
CO5: Develop applications that interact with e-mail server, remote servers

TOTAL PERIODS: 60**NE4261****NETWORK SECURITY LAB****L T P C
0 0 2 1****COURSE 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

SUGGESTED ACTIVITIES:

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 PERIODS: 60**COURSE OUTCOMES:**

- CO1: Implement the digital signature scheme
CO2: Develop the various security algorithms using wireshark
CO3: Use different open source tools for network security and analysis
CO4: Develop an Virtual Private Network with security.
CO5: Addressing the Email secured communication

COURSE OBJECTIVES:

- To recapitulate the fundamentals of networking and understand the requirements for multimedia communication.
- To learn guaranteed service model.
- To learn communication protocols that is frequently used in IoT ecosystems.
- To explore the support provided for multimedia communication in 3G and 4G networks.
- To study about VoIP and real time multimedia network applications.

UNIT I INTRODUCTION**9**

Switched Networks and Shared media Networks – Circuit Switching, Packet Switching and Virtual Circuits – Flow Control and Congestion Control – TCP/IP reference model – Network Externalities – Service Integration – Elastic and Inelastic Traffic – Playback Applications – Additional Requirements For Inelastic Traffic – Core Networks And Access/Edge Networks.

Suggested Activities:

- Flipped classroom on network externalities and Economies of scale.
- External learning – Inter-continental backbone network and Autonomous Systems model of the Internet.
- Assignments on computing the playout time of packets.

Suggested Evaluation Methods:

- Quiz and discussion on network externalities and economies of scale.
- Assignments on proprietary protocols used in IoT and M2M.
- Assignments on problems related to playout time of multimedia applications.

UNIT II GUARANTEED SERVICE MODEL**9**

Best Effort Service Model and Its Limitations – Qos Metrics – Diffserv and Intserv Networks – Queuing Techniques – WFQ and Its Variants – RED – Qos Aware Routing – Call Admission Control – RSVP – Policing and Traffic Shaping Algorithms – Multicast Routing – IGMP, Protocol Independent Multicast – PIM SM and PIM DM Variants.

Suggested Activities:

- Flipped classroom on IntServ and DiffServ networks.
- External learning – Exploring the ways of using DSCP in IP header.
- Assignments on finish time problems related to WFQ and its variants.

Suggested Evaluation Methods:

- Quiz and discussion on IntServ and DiffServ networks.
- Assignments on configuring a router in such a way that DSCP fielder is exploited to provide QoS.
- Assignments on problems related to the virtual finish and actual finish of packets in WFQ and its variants.

UNIT III MULTIMEDIA TRANSPORT

9

End To End Solutions – Laissez Faire Approach – Multimedia over TCP – Significance of UDP – Multimedia Streaming – Audio and Video Streaming – Accessing Audio And Video from a Web Server And Media Server – Removing Jitter at the Receiver – Recovering from Packet Loss – Forward Error Correction and Interleaving – Interactive And Non-Interactive Multimedia – Transcoding – RTSP – RTP/RTCP.

Suggested Activities:

- External learning – Exploring various media players available and the ways to customize them.
- Exploring the ways to configure RTP.
- Flipped classroom on RTP and RTCP.

Suggested Evaluation Methods:

- Assignments on media players available and configuring them.
- Configuring RTP and RTSP.
- Quiz and discussion on RTP and RTCP.

UNIT IV MULTIMEDIA OVER WIRELESS NETWORKS

9

Architecture of IP Multimedia Subsystem in 3G Networks – Application, Control and Data Planes in IMS Networks – Session Control, AAA, Real Time Data Transfer and Policy Control Protocols of IMS Networks – Relay Node and Multiple Radio Access Technologies in LTE – Voice Over IP Basics – IMS Volte Architecture – IP Multimedia Service Identity Module, Private Identity, Public Identity (ISIM, IMPI And IMPU) – SIP User Agent (SIP UAC And SIP UAE) – Real Time Polling Service and Extended Real Time Polling Service in IEEE 802.16/Wimax Networks.

Suggested Activities:

- Flipped classroom on IMSVoLTE architecture.
- External learning – Multimedia support in 5G networks.
- Analyzing the protocols of IP media subsystem.

Suggested Evaluation Methods:

- Quiz and discussion on IMSVoLTE architecture.
- Assignments on multimedia support in 5G networks.
- Assignments on analyzing the headers of IP multimedia subsystem.

UNIT V MULTIMEDIA NETWORKED APPLICATIONS

9

H.322 Standard – Protocol Stack And Call Setup – Session Initiation Protocol – Components, Messages And Operation – Supporting Protocols For SIP – Media Gateway Access Protocol, Resource Reservation Protocol, Session Description Protocol – Case Study – Video Conferencing – Military Surveillance – Interactive TV – Video On Demand – Smart Phone.

Suggested Activities:

- Flipped classroom on SCIBus and S.100.
- External learning – Multimedia access networks and edge networks.
- Exploring the ways to configure SIP.

Suggested Evaluation Methods:

- Quiz and discussion on SCIBus and S.100.
- Assignments on multimedia access networks and edge networks.
- Configuring SIP using suitable commands.

TOTAL: 45 PERIODS**COURSE OUTCOMES:****On completion of the course, the students will be able to:**

CO1:Deploy the right multimedia communication models.

CO2:Apply QoS to multimedia network applications at the network level with efficient scheduling and routing techniques.

CO3:Apply QoS to multimedia network applications at the end system level with efficient scheduling and routing techniques.

CO4:Understand IP multimedia subsystem and IP initiatives in cellular networks to support multimedia traffic.

CO5:Design and implement VoIP based solutions for multimedia transport.

CO6:Develop the real-time multimedia network applications.

REFERENCES:

1. Mario Marques da Silva, "Multimedia Communications and Networking", CRC Press, 2012
2. K. R. Rao, Zoran S. Bojkovic, Bojan M. Bakmaz, "Wireless Multimedia Communication Systems: Design, Analysis and Implementation", CRC Press, 2017
3. Jim Kurose, Keith Ross, "Computer Networking: A Top Down Approach", Pearson Education, 2017
4. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Introduction to Multimedia Communications Applications, Middleware, Networking", John Wiley and Sons, 2009

NE4072**WIRELESS SENSOR NETWORKS AND PROTOCOLS****L T P C****3 0 0 3****COURSE 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 sensor networks
- To expose the students to different aspects in sensor networks
- To understand various security issues in ad hoc and sensor networks and solutions to the issues

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

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.

COURSE OUTCOMES:

- CO1: Identify different issues in wireless ad hoc and sensor networks
 CO2: To analyze protocols developed for ad hoc and sensor networks
 CO3: To identify and understand security issues in ad hoc and sensor networks
 CO4: To learn the significance of Transport layer and QoS in wireless sensor networks.

TOTAL PERIODS: 45

REFERENCES

1. Anna Hac, Wireless Sensor Network DesignII, John Wiley & Sons, 2003.
2. Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Inc., 2007.
3. Erdal Çayırıcı , 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 Moraes 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.

COURSE OBJECTIVES:

- Understand the concepts of optical components and networks.
- To gain an understanding of various issues in designing a high speed, and huge bandwidth optical network.
- To acquire knowledge of architecture and standards of optical networks.
- Thorough knowledge about the routing and access mechanism in optical networks.
- Thorough understanding of the scientific and engineering principles underlying the photonics technology.

UNIT I OPTICAL SYSTEM COMPONENTS 9

Light propagation in optical fibers-Loss & Bandwidth, System limitations, Non-Linear effect, Solitons, Optical Network Components- Couplers, Isolators & Circulators, Multiplexers & Filters Optical Amplifiers, Switches, Wavelength Converters.

UNIT II OPTICAL NETWORK ARCHITECTURES 9

Introduction to Optical Networks; WDM networks , SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks- Topologies for Broadcast Networks, Media-Access Control Protocols, Wavelength Routing Architecture. WOBAN and OTDM networks. Introduction to ASON.

UNIT III WAVELENGTH ROUTING NETWORKS 9

The Optical layer, Node Designs, Optical layer cost tradeoff, Routing and Wavelength Assignment algorithms, Virtual Topology design, Architectural variations

UNIT IV PACKET SWITCHING AND ACCESS NETWORKS 9

Photonic Packet Switching – OTDM , Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch based networks; Access Networks- Network Architecture overview , Future Access Networks, Optical Access Network Architectures.

UNIT V NETWORK DESIGN AND MANAGEMENT 9

Transmission system Engineering-system model, Power penalty-transmitter, receiver, Optical amplifiers, crosstalk, dispersion, wavelength stabilization; overall design consideration; Control and Management-Network management functions, Configuration management, Performance management, Fault management. Optical safety, Service interface.

COURSE OUTCOMES:

On completion of the course the student will be

CO1:able to design state-of-the-art optical networks.

CO2: able to implement optical network protocols.

CO3: able to design high speed networks using optical fibers

CO4: able to simulate access network

CO5: able to design the optical network infrastructure and network management methods.

TOTAL: 45 PERIODS

REFERENCES

1. Rajiv Ramaswami and Kumar N.Sivarajan, "Optical Networks: A Practical Perspective", Harcourt Asia Pvt Ltd., Second Edition 2004.
2. C.Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks: Concept, Design and Algorithms", PHI, 1st Edition, 2002.
3. P.E.Green, jr., "Fiber Optical Networks", Prentice Hall, New Jersey, 1993.
4. Optical Networks: Third Generation Transport Systems, Prentice Hall, 2002.
5. Martin Maier, "Optical Switching Networks", Cambridge India, 2014.

NE4071

HAPTIC TECHNOLOGY

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To provide an overview of Haptic technology
- To learn the concepts of Haptic rendering system.
- To analyze the effectiveness of multimedia haptic in real time applications.
- To enable the student to create applications in a collaborative environment.

UNIT I INTRODUCTION 9

Human Senses-Haptic Exploration-Concepts and Terminology-Roadmap to Multimedia Haptics - Haptic Multimedia Audio and Visual System-Haptic Evolution-Haptics for Medical Application-Tele Robotics and Tele operation-Media-Mobile Haptics-Virtual reality-Learning and Education-Haptic Security

UNIT II HUMAN HAPTIC PERCEPTION AND MACHINE HAPTICS 9

Touch and Cognition-Human Haptic System-Concept of Illusion-Human Perceptual parameters for Interface Development-Haptic Interfaces-HAVE Sensors- HAVE Actuators-Performance Specifications-State-of-Art Haptic interfaces

UNIT III COMPUTER HAPTICS 9

Haptic Rendering Subsystem-Polygon based Representation and Scene Graph-Collision Detection Techniques and Bounding Volumes-Penetration Depth and Collision Response-Haptic Rendering of Surface Properties-Haptic Rendering of other Representation methods- Haptic Rendering of more than 3-DOF-Control Methods for Haptic systems-Benchmarking Haptic Rendering systems-Haptic Software Frameworks

UNIT IV MULTIMEDIA HAPTICS 9

Haptic as a new media-HAVE Content Creation- Content Representation-Haptic Media Transmission-Architecture for C-HAVE-Communication Framework for C-HAVE systems-Quality of Experience in Multimedia Haptics - Haptics Watermarking.

UNIT V TOUCHING THE FUTURE: CHALLENGES AND TRENDS 9

The Golden Age of Haptics-Human Haptics-Machine Haptics-Computer Haptics-Multimedia Haptics Haptic Technology In Surgical Simulation and Medical Training- Haptic Devices- Haptic Rendering- Applications of Haptic technology.

COURSE OUTCOMES:

- CO1: Demonstrate knowledge in human perception, Machine and Multimedia Haptics.
CO2: Create integrated and collaborative haptic systems
CO3: Analyze and characterize Human , Multimedia Haptics
CO4: Demonstrate Simulation in Medical fields

TOTAL PERIODS: 45

REFERENCES

1. Abdulmotaleb El Saddik, Mauricio Orozco, Mohamad Eid, Jongeun Cha “Haptics Technologies: Bringing Touch to Multimedia” (Springer Series on Touch and Haptic Systems), 2013
2. <http://haptic.mech.nwu.edu>
3. <http://www.webopedia.com/TERM/H/haptic.html>
4. <http://www.stanford.edu/dept/news/report/news/2003/april2/haptics-42.html>
5. <http://www.caip.rutgers.edu/~bouzit/lrp/glove.html>
6. <http://www.utoronto.ca/atrc/rd/vrml/haptics.html>

IF4079

SOCIAL NETWORK ANALYSIS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- Formalise 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

10

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

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 8

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.

SUGGESTED ACTIVITIES:

- 1: Twitter Intelligence project performs tracking and analysis of the Twitter
- 2: Large-Scale Network Embedding as Sparse Matrix Factorization
- 3: Implement how Information Propagation on Twitter
- 4: Social Network Analysis and Visualization software application.
- 5: Implement the Structure of Links in Networks

COURSE OUTCOMES:

- CO1: Plan and execute network analytical computations.
- CO2: Implement mining algorithms for social networks
- CO3: Analyze and evaluate social communities.
- CO4: Use social network analysis in behavior analytics
- CO5: Perform mining on large social networks and illustrate the results.

TOTAL PERIODS: 45 PERIODS

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

COURSE OBJECTIVES:

- To learn about the basics of IoT
- To study the architecture of IoT with its reference model
- To discuss the various IoT network layer protocols.
- To identify the various IoT application layer protocols with its features
- To develop various IoT-based real time applications.

UNIT I BASICS OF IoT**9**

Introduction to IoT - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates- Domain Specific IoTs - IoT and M2M - Applications of IoT, Use cases of IoT

UNIT II IoT ARCHITECTURE**9**

The IoT Architectural Reference Model as Enabler - M2M high-level ETSI architecture - IoT in Practice: IoT in Logistics and Health - IoT Reference Model: Domain, information, functional and communication models - SOA based Architecture - API-based Architecture - OPENIoT Architecture for IoT/Cloud Convergence

UNIT III IoT NETWORK LAYER PROTOCOL**9**

Introduction – RPL – CORPL – CARP – 6LoWPAN: Properties-Security measure-Comparative analysis- Security challenges

UNIT IV IOT APPLICATION LAYER PROTOCOLS**9**

Protocol Standardization for IoT – Constrained Application Protocol(CoAP)- Message Queue Telemetry Transport(MQTT) - Extensible Message and Presence Protocol(XMPP)- Advanced Message Queuing Protocol(AMQP) - Representational State Transfer(REST) – Comparative Analysis

UNIT V APPLICATIONS AND CASE STUDY**9**

Real world design constraints – Applications: Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - Case study : Cloud-Based Smart-Facilities Management, Healthcare, Environment Monitoring System.

COURSE OUTCOMES:

- CO1: Comprehend the essentials of IoT and its applications
 CO2: Understand the concepts of IoT Architecture Reference model and IoT reference architecture
 CO3: Use of IoT network layer protocols with security challenges.
 CO4: Analyze various IoT Application layer Protocols
 CO5: Design IoT-based systems for real-world problems

TOTAL PERIODS: 45**REFERENCES**

1. Bassi, Alessandro, et al, “Enabling things to talk”, Springer-Verlag Berlin An, 2016.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the

Internet of Things”, CISCO Press, 2017

3. Hersent, Olivier, David Boswarthick, and Omar Elloumi. The internet of things: Key applications and protocols. John Wiley & Sons, 2011.
4. Buyya, Rajkumar, and Amir Vahid Dastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.

SE4071

AGILE TECHNOLOGIES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To learn the fundamental principles and practices associated with each of the agile development methods
- To apply the principles and practices of agile software development on a project of interest and relevance to the student.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of Agile development and testing techniques.
- To understand Agile development and testing.

UNIT I AGILE SOFTWARE DEVELOPMENT 9

Basics and Fundamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, Challenges . Lean Approach: Waste Management, Kaizen and Kanban, add process and products add value. Roles related to the lifecycle, differences between Agile and traditional plans, differences between Agile plans at different lifecycle phases. Testing plan links between testing, roles and key techniques, principles, understand as a means of assessing the initial status of a project/ How Agile helps to build quality

UNIT II AGILE AND SCRUM PRINCIPLES 9

Agile Manifesto, Twelve Practices of XP, Scrum Practices, Applying Scrum. Need of scrum, working of scrum, advanced Scrum Applications, Scrum and the Organization, scrum values

UNIT III AGILE PRODUCT MANAGEMENT 9

Communication, Planning, Estimation Managing the Agile approach Monitoring progress, Targeting and motivating the team, Managing business involvement, Escalating issue. Quality, Risk, Metrics and Measurements, Managing the Agile approach Monitoring progress, Targeting and motivating the team, Managing business involvement and Escalating issue

UNIT IV AGILE REQUIREMENTS AND AGILE TESTING 9

User Stories, Backlog Management. Agile Architecture: Feature Driven Development. Agile Risk Management: Risk and Quality Assurance, Agile Tools. Agile Testing Techniques, Test-Driven Development, User Acceptance Test

UNIT V AGILE REVIEW AND SCALING AGILE FOR LARGE PROJECTS**9**

Agile Metrics and Measurements, The Agile approach to estimating and project variables, Agile Measurement, Agile Control: the 7 control parameters. Agile approach to Risk, The Agile approach to Configuration Management, The Atern Principles, Atern Philosophy, The rationale for using Atern, Refactoring, Continuous integration, Automated Build Tools. Scrum of Scrums, Team collaborations, Scrum, Estimate a Scrum Project, Track Scrum Projects, Communication in Scrum Projects, Best Practices to Manage Scrum.

COURSE OUTCOMES:

CO1: Analyze existing problems with the team, development process and wider organization

CO2: Apply a thorough understanding of Agile principles and specific practices

CO3: Select the most appropriate way to improve results for a specific circumstance or need

CO4: Judge and craft appropriate adaptations to existing practices or processes depending upon analysis of typical problems

CO5: Evaluate likely successes and formulate plans to manage likely risks or problems

TOTAL PERIODS: 45**REFERENCES**

1. Robert C. Martin ,Agile Software Development, Principles, Patterns, and Practices Alan Apt Series (2011)
2. Succeeding with Agile : Software Development Using Scrum, Pearson (2010)
3. David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
4. Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.
5. Craig Larman, "Agile and Iterative Development: A Managers Guide, Addison-Wesley, 2004.
6. Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.

	PO					
	1	2	3	4	5	6
CO1	2	-	3	2	-	2
CO2	2	-	3	2	-	-
CO3	2	-	3	2	-	2
CO4	-	-	3	2	2	2
CO5	1	-	3	-	2	2
Avg	1.4	-	3	1.6	0.8	1.6

COURSE OBJECTIVES:

- To understand the basics of Mobile Computing and Personal Computing
- To learn the role of cellular networks in Mobile and Pervasive Computing
- To expose to the concept of sensor and mesh networks
- To expose to the context aware and wearable computing
- To learn to develop applications in mobile and pervasive computing environment

UNIT I INTRODUCTION 9

Differences between Mobile Communication and Mobile Computing – Contexts and Names – Functions – Applications and Services – New Applications – Making Legacy Applications Mobile Enabled – Design Considerations – Integration of Wireless and Wired Networks – Standards Bodies – Pervasive Computing – Basics and Vision – Principles of Pervasive Computing – Categories of Pervasive Devices

UNIT II 3G AND 4G CELLULAR NETWORKS 9

Migration to 3G Networks – IMT 2000 and UMTS – UMTS Architecture – User Equipment – Radio Network Subsystem – UTRAN – Node B – RNC functions – USIM – Protocol Stack – CS and PS Domains – IMS Architecture – Handover – 3.5G and 3.9G a brief discussion – 4G LAN and Cellular Networks – LTE – Control Plane – NAS and RRC – User Plane – PDCP, RLC and MAC – WiMax IEEE 802.16d/e – WiMax Internetworking with 3GPP

UNIT III SENSOR AND MESH NETWORKS 9

Sensor Networks – Role in Pervasive Computing – In Network Processing and Data Dissemination – Sensor Databases – Data Management in Wireless Mobile Environments – Wireless Mesh Networks – Architecture – Mesh Routers – Mesh Clients – Routing – Cross Layer Approach – Security Aspects of Various Layers in WMN – Applications of Sensor and Mesh networks

UNIT IV CONTEXT AWARE COMPUTING & WEARABLE COMPUTING 9

Adaptability – Mechanisms for Adaptation - Functionality and Data – Transcoding – Location Aware Computing – Location Representation – Localization Techniques – Triangulation and Scene Analysis – Delaunay Triangulation and Voronoi graphs – Types of Context – Role of Mobile Middleware – Adaptation and Agents – Service Discovery Middleware Health BAN- Medical and Technological Requirements-Wearable Sensors-Intra-BAN communications

UNIT V APPLICATION DEVELOPMENT 9

Three tier architecture - Model View Controller Architecture - Memory Management – Information Access Devices – PDAs and Smart Phones – Smart Cards and Embedded Controls – J2ME – Programming for CLDC – GUI in MIDP – Application Development ON Android and iPhone

COURSE OUTCOMES:

CO1: Design a basic architecture for a pervasive computing environment

CO2: Design and allocate the resources on the 3G-4G wireless networks

CO3: Analyze the role of sensors in Wireless networks

CO4: Work out the routing in mesh network

CO5: Deploy the location and context information for application development

CO6: Develop mobile computing applications based on the paradigm of context aware computing and wearable computing

TOTAL:45 PERIODS

REFERENCES

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, “Mobile Computing: Technology, Applications and Service Creation”, 2nd ed, Tata McGraw Hill, 2017.
2. Reto Meier, “Professional Android 2 Application Development”, Wrox Wiley,2010.
3. Pei Zheng and Lionel M Li, ‘Smart Phone & Next Generation Mobile Computing’, Morgan Kaufmann Publishers, 2006.
4. Frank Adelstein, ‘Fundamentals of Mobile and Pervasive Computing’, TMH, 2005
5. Jochen Burthardt et al, ‘Pervasive Computing: Technology and Architecture of Mobile Internet Applications’, Pearson Education, 2003
6. Feng Zhao and Leonidas Guibas, ‘Wireless Sensor Networks’, Morgan Kaufmann Publishers, 2004
7. Uwe Hansmaan et al, ‘Principles of Mobile Computing’, Springer, 2nd edition,2006
8. Reto Meier, “Professional Android 2 Application Development”, Wrox Wiley,2010.
9. Mohammad s. Obaidat et al, “Pervasive Computing and Networking” ,John wiley, 2011
10. Stefan Poslad, “Ubiquitous Computing: Smart Devices, Environments and Interactions”, Wiley, 2009
11. Frank Adelstein Sandeep K. S. Gupta Golden G. Richard III Loren Schwiebert “Fundamentals of Mobile and Pervasive Computing, “, McGraw-Hill, 2005

	PO					
	1	2	3	4	5	6
C01	3	3	1	3	1	3
C02	2	2	2	2	2	2
C03	1	3	1	1	2	2
C04	1	2	2	2	1	1
C05	2		2	1	2	2
AVG	1.80	2.50	1.60	1.80	1.60	2.00

SE4151

ADVANCED SOFTWARE ENGINEERING

L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the rationale for software development process models
- To understand why the architectural design of software is important;
- To understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.
- To understand the basic notions of a web service, web service standards, and service-oriented architecture;
- To understand the different stages of testing from testing during development of a software system

UNIT I SOFTWARE PROCESS &MODELING

9

Prescriptive Process Models – Agility and Process – Scrum – XP – Kanban – DevOps – Prototype Construction – Prototype Evaluation – Prototype Evolution – Modeling – Principles – Requirements Engineering – Scenario-based Modeling – Class-based Modeling – Functional Modeling – Behavioral Modeling.

UNIT II SOFTWARE DESIGN 9

Design Concepts – Design Model – Software Architecture – Architectural Styles – Architectural Design – Component-Level Design – User Experience Design – Design for Mobility – Pattern-Based Design.

UNIT III SYSTEM DEPENDABILITY AND SECURITY 9

Dependable Systems – Dependability Properties – Sociotechnical Systems – Redundancy and Diversity – Dependable Processes – Formal Methods and Dependability – Reliability Engineering – Availability and Reliability – Reliability Requirements – Fault-tolerant Architectures – Programming for Reliability – Reliability Measurement – Safety Engineering – Safety-critical Systems – Safety Requirements – Safety Engineering Processes – Safety Cases – Security Engineering – Security and Dependability – Safety and Organizations – Security Requirements – Secure System Design – Security Testing and Assurance – Resilience Engineering – Cybersecurity – Sociotechnical Resilience – Resilient Systems Design.

UNIT IV SERVICE-ORIENTED SOFTWARE ENGINEERING, SYSTEMS ENGINEERING AND REAL-TIME SOFTWARE ENGINEERING 9

Service-oriented Architecture – RESTful Services – Service Engineering – Service Composition – Systems Engineering – Sociotechnical Systems – Conceptual Design – System Procurement – System Development – System Operation and Evolution – Real-time Software Engineering – Embedded System Design – Architectural Patterns for Real-time Software – Timing Analysis – Real-time Operating Systems.

UNIT V SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT 9

Software Testing Strategy – Unit Testing – Integration Testing – Validation Testing – System Testing – Debugging – White-Box Testing – Basis Path Testing – Control Structure Testing – Black-Box Testing – Software Configuration Management (SCM) – SCM Repository – SCM Process – Configuration Management for Web and Mobile Apps.

SUGGESTED ACTIVITIES

1. Comparatively analyzing different Agile methodologies.
2. Describing the scenarios where 'Scrum' and 'Kanban' are used.
3. Mapping the data flow into suitable software architecture.
4. Developing behavioural representations for a class or component.
5. Implementing simple applications as RESTful service.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The Students will be able to

CO1:Identify appropriate process models based on the Project requirements

CO2:Understand the importance of having a good Software Architecture.

CO3:Understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.

CO4:Understand the basic notions of a web service, web service standards, and service-oriented architecture;

CO5:Be familiar with various levels of Software testing

REFERENCES:

1. Software Engineering: A Practitioner's Approach, 9th Edition. Roger Pressman and Bruce Maxim, McGraw-Hill 2019.

2. Software Engineering, 10th Edition, Ian Somerville, Pearson Education Asia 2016.
3. Software Architecture In Practice, 3rd Edition, Len Bass, Paul Clements and Rick Kazman, Pearson India 2018
4. An integrated approach to Software Engineering, 3rd Edition, Pankaj Jalote, Narosa Publishing House, 2018
5. Fundamentals of Software Engineering, 5th Edition, Rajib Mall, PHI Learning Private Ltd, 2018

MP4071

COGNITIVE COMPUTING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To familiarize Use the Innovation Canvas to justify potentially successful products.
- To learn various ways in which to develop a product idea.
- To understand about 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, system cognitive, 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

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

COURSE OUTCOMES:

- CO1: Explain applications in Cognitive Computing.
- CO2: Describe Natural language processor role in Cognitive computing.
- CO3: Explain future directions of Cognitive Computing
- CO4: Evaluate the process of taking a product to market
- CO5: Comprehend the applications involved in this domain.

TOTAL PERIODS:45

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", The MIT Press, 1999.
3. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Models of Cognition", Second Edition, 2016, <https://probmods.org/>.

NE4002

HIGH SPEED SWITCHING ARCHITECTURES

**L T P C
3 0 0 3**

COURSE OBJECTIVES:

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

UNIT I SWITCHING BASICS 9

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

UNIT II SWITCHING ARCHITECTURES 9

Shared medium switches – Shared memory switches – Space division switches – Crossbar based switching architecture – Input queued, Output queued and Combined input-output queued switches – Non blocking and blocking crossbar 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

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

UNIT IV P ROUTER ARCHITECTURE 9

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

UNIT V MPLS ROUTERS 9

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

COURSE OUTCOMES:

- CO1: Apply switching concepts to build networks.
- CO2: Deploy the network with appropriate type of switches.
- CO3: Select and configure the appropriate type of IP router.
- CO4: Design and implement MPLS networks.

TOTAL PERIODS: 45

REFERENCES

1. Damitri P Bertsekas and Gallager, Data NetworksII, 2nd edition, PHI, 1992
2. Elhanany, Itamar, Hamdi and Mounir, High Performance Packet Switching ArchitecturesII, Springer 2007
3. H.Jonathan Chao and Bin Liu, High Performance Switches and RoutersII, John Wiley and Sons, 2007
4. Howard C Berkowitz, Designing Routing and Switching Architectures for Enterprise NetworksII, Sams, 1999
5. Luc De Ghein, MPLS FundamentalsII, Cisco Press 2014

CP4079

SOFTWARE QUALITY ASSURANCE

**L T P C
3 0 0 3**

COURSE OBJECTIVES:

- Be exposed to the software quality factors, Quality Assurance (SQA) architecture and SQA components.
- Understand the integration of SQA components into the project life cycle.

- Be familiar with the software quality infrastructure.
- Be exposed to the management components of software quality.
- Be familiar with the Quality standards, certifications and assessments

UNIT I INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE 9

Need for Software quality – Software quality assurance (SQA) – Software quality factors- McCall's quality model – SQA system components – Pre project quality components – Development and quality plans.

UNIT II SQA COMPONENTS AND PROJECT LIFE CYCLE 9

Integrating quality activities in the project life cycle – Reviews – Software Testing – Quality of software maintenance components – Quality assurance for external participants contribution – CASE tools for software quality Management.

UNIT III SOFTWARE QUALITY INFRASTRUCTURE 9

Procedures and work instructions – Supporting quality devices - Staff training and certification - Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control.

UNIT IV SOFTWARE QUALITY MANAGEMENT & METRICS 9

Project process control – Software quality metrics – Cost of software quality – Classical quality cost model – Extended model – Application and Problems in application of Cost model

UNIT V STANDARDS, CERTIFICATIONS & ASSESSMENTS 9

Quality management standards – ISO 9001 and ISO 9000-3 –Capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards – Organization of Quality Assurance – Role of management in SQA – SQA units and other actors in SQA systems.

COURSE OUTCOMES:

CO1: Utilize the concepts of SQA in software development life cycle

CO2: Demonstrate their capability to adopt quality standards.

CO3: Assess the quality of software products.

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

CO5: Ensure whether the product meets company's quality standards and client's expectations and demands

TOTAL PERIODS: 45

REFERENCES

1. Daniel Galin, "Software Quality Assurance", Pearson Publication, 2009.
2. Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 2011.
3. Kshirasagar Naim and Priyadarshi Tripathy," Software Testing and Quality Assurance Theory and Practice", John Wiley & Sons Inc., 2008
4. Mordechai Ben-Menachem "Software Quality: Producing Practical Consistent Software", International Thompson Computer Press, 2014

	PO					
	1	2	3	4	5	6
C01	3	3	3	3	2	3
C02	2	2	2	3	2	3
C03	3	1	1	2	1	3
C04	2	2	2	3	2	1
C05	1	1	1	3	1	2
AVG	2.20	1.80	1.80	2.80	1.60	2.40

CP4078

PERFORMANCE ANALYSIS OF COMPUTER SYSTEMS

L T P C

3 0 0 3

COURSE OBJECTIVES:

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

UNIT I OVERVIEW OF PERFORMANCE EVALUATION

9

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

UNIT II MARKOV CHAINS AND SIMPLE QUEUES

9

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

UNIT III MULTI-SERVER AND MULTI-QUEUE SYSTEMS

9

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

UNIT IV REAL-WORLD WORKLOADS

9

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

UNIT V SMART SCHEDULING IN THE M/G/1

9

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

TOTAL : 45 PERIODS

COURSE OUTCOMES :

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

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

CO2:Distinguish between open and closed queuing networks

CO3:Apply Little'e law and other operational laws to open and closed systems

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

CO5:Develop analytical techniques for evaluating scheduling policies

REFERENCES:

1. K. S. Trivedi, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2001.
2. Krishna Kant, "Introduction to Computer System Performance Evaluation", McGraw-Hill, 1992.
3. Lieven Eeckhout, "Computer Architecture Performance Evaluation Methods", Morgan and Claypool Publishers, 2010.
4. Mor Harchol - Balter, "Performance Modeling and Design of Computer Systems – Queueing Theory in Action", Cambridge University Press, 2013.
5. Paul J. Fortier and Howard E. Michel, "Computer Systems Performance Evaluation and Prediction", Elsevier, 2003.
6. Raj Jain, "The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation and Modeling", Wiley-Interscience, 1991.
7. Raj Jain, "Art of Computer Systems Performance Analysis: Techniques For Experimental Design Measurements Simulation and Modeling", 2nd edition, Wiley, 2015

	PO					
	1	2	3	4	5	6
C01	1	1	1	1	1	1
C02	2	2	3	2	2	1
C03	2	2	2		2	
C04	1		3		3	1
C05	2	2	2	1	2	
AVG	1.60	1.75	2.20	1.33	2.00	1.00

NE4003

SIMULATION OF COMPUTER SYSTEMS AND NETWORKS

L T P C

3 0 0 3

COURSE OBJECTIVES:

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

UNIT I	STATISTICAL AND QUEUING MODELS	9
Statistical models – Discrete, continuous and empirical distributions – Characteristics of Queuing systems – Measures of performance of queuing systems – Markovian models.		
UNIT II	RANDOM NUMBER AND RANDOM VARIATE GENERATION	9
Properties of random numbers – Generating uniform random numbers – Generating non-uniform random numbers - Tests for random numbers – Random-variate generation		
UNIT III	ANALYSIS OF SIMULATION DATA	9
Input modeling – Identifying the distribution – Parameter estimation – Goodness-of-fit tests – Multivariate and time-series input models – Verification and validation of simulation models		
UNIT IV	SIMULATION OF COMPUTER NETWORKS	9
Introduction – Performance modeling – Modeling Techniques – Protocol modeling – Workload modeling – Network Topology modeling – Performance metrics in computer network simulation – Validation and verification – Discrete event simulation – GPU-based simulations – Multi-agent-based simulations –Network simulators		
UNIT V	CASE STUDIES OF NETWORK SIMULATORS	9
NS-3 based Simulative Platform - Evolved packet system – Differentiated services domain – ns-3 simulator – Simulation techniques for next generation wireless heterogeneous networks - Features of common network simulators - OpNet, mininet.		

COURSE OUTCOMES:

- CO1: Understand the modeling and development of simulations and simulators
- CO2: Differentiate the different ways in which simulators are designed
- CO3: Analyze how computer networks are simulated
- CO4: Use simulators like ns-3
- CO5: Compare the features of different simulators

TOTAL PERIODS: 45

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, 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.

REFERENCES

1. Jingming Li Salina, Pascal Salina "Next Generation Networks-perspectives and potentials Wiley, January 2008.
2. Madhusanga 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, Second edition-2013.
4. Savo G Glisic, "Advanced Wireless Networks- Technology and Business models", Wiley, 3rd edition- 2016.
5. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", Wiley, 2015
6. Thomas Playvyk, "Next generation Telecommunication Networks, Services and Management", Wiley & IEEE Press Publications, 2010.
7. Athanasios G. Kanatas, Konstantina S. Nikita, Panagiotis Takis Mathiopoulos, "New Directions in Wireless Communications Systems: From Mobile to 5G", CRC Press, 2017.

CP4071

AUTONOMOUS SYSTEMS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge on the functional architecture of autonomous vehicles
- To impart knowledge on Localization and mapping fundamentals
- To impart knowledge on process end effectors and robotic controls
- To learn Robot cell design, Robot Transformation and Sensors
- To learn Micro/Nano Robotic Systems

UNIT I INTRODUCTION AND FUNCTIONAL ARCHITECTURE

9

Functional architecture - Major functions in an autonomous vehicle system, Motion Modeling - Coordinate frames and transforms, point mass model, Vehicle modeling (kinematic and dynamic bicycle model - two-track models), Sensor Modeling - encoders, inertial sensors, GPS.

UNIT II PERCEPTION FOR AUTONOMOUS SYSTEMS

9

SLAM - Localization and mapping fundamentals, LIDAR and visual SLAM, Navigation – Global path planning, Local path planning, Vehicle control - Control structures, PID control, Linear quadratic regulator, Sample controllers.

UNIT III ROBOTICS INTRODUCTION, END EFFECTORS AND CONTROL

9

Robot anatomy-Definition, law of robotics, Simple problems Specifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems, Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robotControl system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDTMotion Interpolations-Adaptive control.

UNIT IV ROBOT TRANSFORMATIONS, SENSORS AND ROBOT CELL 9
DESIGN

Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation- Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors-Tactile, Robot work cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software.

UNIT V MICRO/NANO ROBOTICS SYSTEM 9

Micro/Nano robotics system overview-Scaling effect-Top down and bottom up approach Actuators of Micro/Nano robotics system-Nano robot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nano robot in targeted drug delivery system.

COURSE OUTCOMES:

- CO1: Understand architecture and modeling of autonomous systems.
- CO2: Employ localization mapping techniques for autonomous systems
- CO3: Design solutions for autonomous systems control.
- CO4: Analyze Robot Transformations, Sensors and Cell Design
- CO5: Explain the working principles of Micro/Nano Robotic system

TOTAL PERIODS: 45

REFERENCES

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education.,2009
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.
3. Karsten Berns, Ewald Puttkamer, Springer, Autonomous Land Vehicles: Steps towards Service Robots, 2009
4. Sebastian Thrun, Wolfram Burgard, Dieter Fox., Probabilistic robotics. MIT Press, 2005
5. Steven M. LaValle., Planning algorithms, Cambridge University Press, 2006
6. Daniel Watzenig and Martin Horn (Eds.), Automated Driving: Safer and More Efficient Future Driving, Springer, 2017
7. Markus Maurer, Autonomous driving: technical, legal and social aspects. Springer, 2016
8. Jha, Theory, Design and Applications of Unmanned Aerial Vehicles, CRC Press, 2016

	PO					
	1	2	3	4	5	6
C01	1	2	3	2	3	3
C02	2	1	2	3	2	2
C03	1	2	2		1	1
C04	2	1	2	2	2	
C05	3			1		2
AVG	1.80	1.50	2.25	2.00	2.00	2.00

COURSE OBJECTIVES:

- Exposed to the need for Bioinformatics technologies
- Be familiar with the modeling techniques
- Learn microarray analysis
- Exposed to Pattern Matching and Visualization
- To know about Microarray Analysis

UNIT I INTRODUCTION**9**

Need for Bioinformatics technologies – Overview of Bioinformatics technologies
Structural bioinformatics – Data format and processing – Secondary resources and applications –
Role of Structural bioinformatics – Biological Data Integration System.

UNIT II DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS**9**

Bioinformatics data – Data warehousing architecture – data quality – Biomedical data analysis –
DNA data analysis – Protein data analysis – Machine learning – Neural network architecture
and applications in bioinformatics.

UNIT III MODELING FOR BIOINFORMATICS**9**

Hidden Markov modeling for biological data analysis – Sequence identification –
Sequence classification – multiple alignment generation – Comparative modeling –Protein
modeling – genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks –
Molecular modeling – Computer programs for molecular modeling.

UNIT IV PATTERN MATCHING AND VISUALIZATION**9**

Gene regulation – motif recognition – motif detection – strategies for motif detection – Visualization
– Fractal analysis – DNA walk models – one dimension – two dimension – higher dimension –
Game representation of biological sequences – DNA, Protein, Amino acid sequences.

UNIT V MICROARRAY ANALYSIS**9**

Microarray technology for genome expression study – image analysis for data extraction –
preprocessing – segmentation – gridding – spot extraction – normalization, filtering – cluster
analysis – gene network analysis – Compared Evaluation of Scientific Data Management Systems
– Cost Matrix – Evaluation model – Benchmark – Tradeoffs.

LIST OF EXPERIMENTS:

1. Manipulating DNA strings
2. Use Protein Data Bank to visualize and Analyze the Proteins from protein database
3. Explore the Human Genome with the SciPy Stack
4. Hidden Markov Model for Biological Sequence
5. Molecular Modeling using MMTK package
6. Sequence Alignment using Biopython, Pairwise and multiple sequence alignment using ClustalW and BLAST
7. Simple generation and manipulation of genome graphs
8. DNA data handling using Biopython
9. Chaos Game Representation of a genetic sequence
10. Visualize the microarray data using Heatmap

COURSE OUTCOMES:

CO1: Understand the different Data formats

CO2: Develop machine learning algorithms.

CO3: Develop models for biological data.

CO4: Apply pattern matching techniques to bioinformatics data – protein data genomic data.

CO5: Apply micro array technology for genomic expression study.

TOTAL: 45 PERIODS**REFERENCES**

1. Yi-Ping Phoebe Chen (Ed), "Bioinformatics Technologies", First Indian Reprint, Springer Verlag, 2007.
2. Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education, 2015.
3. Arthur M Lesk, "Introduction to Bioinformatics", Second Edition, Oxford University Press, 2019

	PO					
	1	2	3	4	5	6
C01	1	1				3
C02	1	1	2	2	1	2
C03	1	2	1	1	3	3
C04	1	2	2	2	2	2
C05	1	2	1		2	3
AVG	1.00	1.60	1.50	1.67	2.00	2.60

IF4073**DEEP LEARNING****L T P C****3 0 2 4****COURSE OBJECTIVES:**

- Develop and Train Deep Neural Networks.
- Develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection and recognition
- Build and train RNNs, work with NLP and Word Embeddings
- The internal structure of LSTM and GRU and the differences between them
- The Auto Encoders for Image Processing

UNIT I DEEP LEARNING CONCEPTS**6**

Fundamentals about Deep Learning. Perception Learning Algorithms. Probabilistic modelling. Early Neural Networks. How Deep Learning different from Machine Learning. Scalars. Vectors. Matrixes, Higher Dimensional Tensors. Manipulating Tensors. Vector Data. Time Series Data. Image Data. Video Data.

UNIT II NEURAL NETWORKS**9**

About Neural Network. Building Blocks of Neural Network. Optimizers. Activation Functions. Loss

Functions. Data Pre-processing for neural networks, Feature Engineering. Overfitting and Underfitting. Hyperparameters.

UNIT III CONVOLUTIONAL NEURAL NETWORK 10

About CNN. Linear Time Invariant. Image Processing Filtering. Building a convolutional neural network. Input Layers, Convolution Layers. Pooling Layers. Dense Layers. Backpropagation Through the Convolutional Layer. Filters and Feature Maps. Backpropagation Through the Pooling Layers. Dropout Layers and Regularization. Batch Normalization. Various Activation Functions. Various Optimizers. LeNet, AlexNet, VGG16, ResNet. Transfer Learning with Image Data. Transfer Learning using Inception Oxford VGG Model, Google Inception Model, Microsoft ResNet Model. R-CNN, Fast R-CNN, Faster R-CNN, Mask-RCNN, YOLO

UNIT IV NATURAL LANGUAGE PROCESSING USING RNN 10

About NLP & its Toolkits. Language Modeling . Vector Space Model (VSM). Continuous Bag of Words (CBOW). Skip-Gram Model for Word Embedding. Part of Speech (PoS) Global Co-occurrence Statistics-based Word Vectors. Transfer Learning. Word2Vec. Global Vectors for Word Representation GloVe. Backpropagation Through Time. Bidirectional RNNs (BRNN) . Long Short Term Memory (LSTM). Bi-directional LSTM. Sequence-to-Sequence Models (Seq2Seq). Gated recurrent unit GRU.

UNIT V DEEP REINFORCEMENT & UNSUPERVISED LEARNING 10

About Deep Reinforcement Learning. Q-Learning. Deep Q-Network (DQN). Policy Gradient Methods. Actor-Critic Algorithm. About Autoencoding. Convolutional Auto Encoding. Variational Auto Encoding. Generative Adversarial Networks. Autoencoders for Feature Extraction. Auto Encoders for Classification. Denoising Autoencoders. Sparse Autoencoders

LIST OF EXPERIMENTS: 30

- 1: Feature Selection from Video and Image Data
- 2: Image and video recognition
- 3: Image Colorization
- 4: Aspect Oriented Topic Detection & Sentiment Analysis
- 5: Object Detection using Autoencoder

COURSE OUTCOMES:

- CO1: Feature Extraction from Image and Video Data
- CO2: Implement Image Segmentation and Instance Segmentation in Images
- CO3: Implement image recognition and image classification using a pretrained network (Transfer Learning)
- CO4: Traffic Information analysis using Twitter Data
- CO5: Autoencoder for Classification & Feature Extraction

TOTAL PERIODS: 45+30 PERIODS

REFERENCES

1. Deep Learning A Practitioner's Approach Josh Patterson and Adam Gibson O'Reilly Media, Inc.2017
2. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
3. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020

4. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017
5. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017

MP4252

MOBILE APPLICATION DEVELOPMENT

L T P C
3 0 2 4

COURSE OBJECTIVES:

- To facilitate students to understand android SDK
- To help students to gain basic understanding of Android application development
- To understand how to work with various mobile application development frameworks
- To inculcate working knowledge of Android Studio development tool
- To learn the basic and important design concepts and issues of development of mobile applications

UNIT I MOBILE PLATFORM AND APPLICATIONS

9

Mobile Device Operating Systems — Special Constraints & Requirements — Commercial Mobile Operating Systems — Software Development Kit: iOS, Android, BlackBerry, Windows Phone — MCommerce — Structure — Pros & Cons — Mobile Payment System — Security Issues

UNIT II INTRODUCTION TO ANDROID

9

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

UNIT III ANDROID APPLICATION DESIGN ESSENTIALS

9

Anatomy of Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

UNIT IV ANDROID USER INTERFACE DESIGN & MULTIMEDIA

9

User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures

UNIT V ANDROID APIs

9

Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

LIST OF EXPERIMENTS:

(30)

- 1: Develop an application that uses GUI components, Font, Layout Managers and event listeners.
- 2: Develop an application that makes use of databases
- 3: Develop a native application that uses GPS location information
- 4: Implement an application that creates an alert upon receiving a message

- 5: Develop an application that makes use of RSS Feed.
- 6: Create an application using Sensor Manager
- 7: Create an android application that converts the user input text to voice.
- 8: Develop a Mobile application for simple and day to day needs (Mini Project)

COURSE OUTCOMES:

- CO1:** Identify various concepts of mobile programming that make it unique from programming for other platforms
- CO2:** Create, test and debug Android application by setting up Android development
- CO3:** Demonstrate methods in storing, sharing and retrieving data in Android applications
- CO4:** Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces
- CO5:** Create interactive applications in android using databases with multiple activities including audio, video and notifications and deploy them in marketplace

TOTAL PERIODS: 75

REFERENCES

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)
2. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017.
3. Prasanth Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt.Ltd, New Delhi-2012
4. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd, 2010
5. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd, 2009
6. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015. ISBN-13: 978-9352131341
7. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014. ISBN-13: 978-8126547197.
8. Bill Phillips, Chris Stewart and Kristin Marsicano, "Android Programming: The Big Nerd Ranch Guide", 4th Edition, Big Nerd Ranch Guides, 2019. ISBN-13: 978-0134706054

BC4251

ETHICAL HACKING

L T P C
3 0 2 4

COURSE 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

12

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 12

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 12

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 12

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 Tools

UNIT V HACKING WIRELESS NETWORKS 12

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

LIST OF EXPERIMENTS:

- 1: Study of Guessing username and passwords using Hydra
- 2: Experiment on Recovering password Hashes
- 3: Implementation to crack Linux passwords
- 4: Experiments on SQL injections
- 5: Analysis of WEP flaws
- 6: Experiments on Wireless DoS Attacks
- 7: Implementation of Buffer Overflow Prevention
- 8: Prevention against Cross Site Scripting Attacks
- 9: Experiments on Metasploit Framework
- 10: Implementation to identify web vulnerabilities
11. Wireshark: Experiment to monitor live network capturing packets and analyzing over the live network
12. LOIC: DoS attack using LOIC
13. FTK: Bit level forensic analysis of evidential image and reporting the same.
14. Darkcomet : Develop a malware using Remote Access Tool Darkcomet to take a remote access over network
15. HTTrack: Website mirroring using Htrack and hosting on a local network.
16. XSS: Inject a client side script to a web application
17. Emailtrackerpro: Email analysis involving header check, tracing the route. Also perform a check on a spam mail and non-spam mail

COURSE OUTCOMES:

- CO1: Understand vulnerabilities, mechanisms to identify vulnerabilities/threats/attacks
- CO2: Use tools to identify vulnerable entry points
- CO3: Identify vulnerabilities using sniffers at different layers

CO4: Handle web application vulnerabilities

CO5: Identify attacks in wireless networks

TOTAL PERIODS:75

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 Gen Penetration Testing and Purple Teaming", 1st Edition, Wiley, 2020.
7. Jon Ericson, Hacking: The Art of Exploitation, 2nd Edition, NoStarch Press, 2008.

AUDIT COURSES

AX4091

ENGLISH FOR RESEARCH PAPER WRITING

L T P C

2 0 0 0

COURSE OBJECTIVES:

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING

6

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

UNIT II PRESENTATION SKILLS

6

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

UNIT III TITLE WRITING SKILLS

6

Key skills 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, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS

6

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 V VERIFICATION SKILLS**6**

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission

TOTAL: 30 PERIODS**COURSE OUTCOMES:**

- CO1 –Understand that how to improve your writing skills and level of readability
- CO2 – Learn about what to write in each section
- CO3 – Understand the skills needed when writing a Title
- CO4 – Understand the skills needed when writing the Conclusion
- CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES:

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

AX4092**DISASTER MANAGEMENT****L T P C
2 0 0 0****COURSE OBJECTIVES:**

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION**6**

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS**6**

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

UNIT III DISASTER PRONE AREAS IN INDIA**6**

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

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT 6

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

UNIT V RISK ASSESSMENT 6

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

TOTAL : 30 PERIODS

COURSE OUTCOMES:

- CO1: Ability to summarize basics of disaster
- CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- CO5: Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCES:

1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.
2. Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "NewRoyal book Company, 2007.
3. Sahni, Pradeep Et.Al. , " Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001.

AX4093

CONSTITUTION OF INDIA

L T P C

2 0 0 0

COURSE OBJECTIVES:

Students will be able to:

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

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION

History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION

Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

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

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

UNIT V LOCAL ADMINISTRATION

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Panchayat. 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

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

TOTAL: 30 PERIODS

COURSE OUTCOMES:

- Students will be able to:
- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING

1. The Constitution of India,1950(Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edn., LexisNexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, LexisNexis, 2015.

AX4094

நற்றமிழ் இலக்கியம்

L T P C

2 0 0 0

UNIT I

சங்க இலக்கியம்

6

1. தமிழின் துவக்க நூல் தொல்காப்பியம்
- எழுத்து, சொல், பொருள்
2. அகநானூறு (82)
- இயற்கை இன்னிசை அரங்கம்

3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி
4. புறநானூறு (95,195)
- போரை நிறுத்திய ஔவையார்

UNIT II

அறநெறித் தமிழ்

6

1. அறநெறி வகுத்த திருவள்ளுவர்
- அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புறவு அறிதல், ஈகை, புகழ்
2. பிற அறநூல்கள் - இலக்கிய மருந்து
- ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)

UNIT III

இரட்டைக் காப்பியங்கள்

6

1. கண்ணகியின் புரட்சி
- சிலப்பதிகார வழக்குரை காதை
2. சமூகசேவை இலக்கியம் மணிமேகலை
- சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை

UNIT IV

அருள்நெறித் தமிழ்

6

1. சிறுபாணாற்றுப்படை
- பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஔவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள்
2. நற்றிணை
- அன்னைக்குரிய புன்னை சிறப்பு
3. திருமந்திரம் (617, 618)
- இயமம் நியமம் விதிகள்
4. தர்மச்சாலையை நிறுவிய வள்ளலார்
5. புறநானூறு
- சிறுவனே வள்ளலானான்
6. அகநானூறு (4) - வண்டு
நற்றிணை (11) - நண்டு
கலித்தொகை (11) - யானை, புறா
ஐந்திணை 50 (27) - மான்
ஆகியவை பற்றிய செய்திகள்

UNIT V

நவீன தமிழ் இலக்கியம்

6

1. உரைநடைத் தமிழ்,
- தமிழின் முதல் புதினம்,
- தமிழின் முதல் சிறுகதை,
- கட்டுரை இலக்கியம்,
- பயண இலக்கியம்,

- நாடகம்,
- 2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும்,
- 3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,
- 4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,
- 5. அறிவியல் தமிழ்,
- 6. இணையத்தில் தமிழ்,
- 7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

TOTAL: 30 PERIODS

தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University)
- www.tamilvu.org
2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)
- <https://ta.wikipedia.org>
3. தர்மபுர ஆதீன வெளியீடு
4. வாழ்வியல் களஞ்சியம்
- தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக் களஞ்சியம்
- தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)
6. அறிவியல் களஞ்சியம்
- தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்