DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
MANONMANIAM SUNDARANAR UNIVERSITY

Master of Engineering (Computer Science and Engineering)
Choice Based Credit System (CBCS)
[Effect from AY 2022 – 2023]

Learning Outcome based Curriculum Framework (LOCF)

Vision of the University

To provide quality education to reach the un-reached

Mission of the University

- To conduct research, teaching and outreach progrmmes to improve conditions of human living.
- To create an academic environment that honours women and men of all races, caste, creed, cultures, and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity.
- To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development.
- To provide quality / inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled.

Vision & Mission of the Department

Vision

To create industrious and research-oriented professionals in the field of Computer Science and Engineering

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Mission

To achieve academic excellence by,

providing an environment that combines Computing practice and research

giving an exposure to the area of computer Science and the underlying mathematics to impart research skills and career goals

giving an opportunity to the rural and underprivileged students to pursue Higher Education

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PREAMBLE

The Department of Computer Science and Engineering is one of the few departments functioning from the inception of the university in 1990. The Department is offering M.C.A, M.Sc, M.E., M.Phil. and Ph.D. programmes. The M.E. (CSE) programme is approved by the AICTE.

M.E.(CSE) is a Professional PG Engineering degree Programme which provides students with an opportunity to develop Professional ethics, computing skills and core competence in the field of Engineering. The Learning Outcome based Curriculum Framework (LOCF) for the program has been formulated with the Regulations, Program Specific Outcomes, Course outcomes, curriculum structure, the detailed syllabus for the Core, allied, Practical, supportive, and skill-based courses; and the guidelines for the project works / internship activities.

REGULATIONS

Eligibility for M.E (C.S.E) - 2 Years

Passed B.E / Bachelor Degree in Computer Science and Engineering or B.Tech (IT) discipline with minimum aggregate marks of 50% for the general category and (45% marks for the reserved category from a recognized institution. Candidates with AMIE degree along with two years of work experience are also eligible to apply.

Entrance Test:

Applicants seeking admission to M.E (C.S.E) are required to qualify the Tamilnadu Common Entrance Test (TANCET), conducted by Anna University, Chennai, in the respective year. Previous year TANCET score will not be considered for Admission. Those who are not in the possession of TANCET score can appear in the University Entrance Examination and they will be admitted in the unfilled vacant seats. However, priority in admission will be given to those applicants who have valid TANCET scores.

Selection:

- Selection for the M.E (C.S.E) programme will be made based on the TANCET scores.
- Vacancy if exists will be filled by the applicants who possess valid university entrance examination score.
- Reservation of seats as per Tamilnadu Government norms and Manonmaniam Sundaranar University norms.
- Seats will be filled by conducting a two day counselling in which the first day will be allotted for the TANCET Scorers and the second day will be for all others. The date and time of counselling will be communicated through the University website one week in advance. Individual communication will not be sent in this regard. Students shall furnish all the relevant supporting documents during the counselling.

PROGRAM EDUCATIONAL OBJECTIVES:

1. Prepare students to understand the foundational concepts in Computer Science and Engineering
2. Enable students to integrate theory and practice for problem solving.
3. Empower students to critically analyze current trends and future issues from a system perspective at multiple levels of detail and abstraction.
4. Prepare students to critically analyze existing literature, identify the gaps and propose innovative and research oriented solutions
5. Enable students to pursue lifelong multidisciplinary learning as professional engineers and scientists
6. Enable students to effectively communicate technical information, function effectively on teams, and apply computer engineering solutions within a global, societal, and environmental context by following ethical practices

PROGRAM OUTCOMES (POs):

PO #	Graduate Attribute	Programme Outcomes
1	Research Aptitude	An ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems.
2	Technical documentation	An ability to write and present a substantial technical report/ document.
3	Technical competence	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
4	Handle complex problems	Use research based knowledge, methods, appropriate techniques, resources and tools to solve complex engineering issues with an understanding of the limitations.
5	Environmental Sustainability and societal Ethics	Ensure development of socially relevant and eco friendly indigenous products by applying technical knowledge, ethical principles and, sound engineering practices
6	Life-long learning	Recognize the need for independent, life-long learning and engage in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES:

1. To use mathematical, algorithmic and theoretical foundations in the study of computing systems.
2. To acquire in-depth knowledge and skills in core and emerging technologies of Computer Science and Engineering.
3. To develop and apply innovative solutions to real world problems using appropriate research techniques.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
Master of Computer Science and Engineering
Scheme of Examination [Effect from 2022 – 2023]

SEMESTER: I

Sl. No.	SUB CODE	COURSE TITLE	C	L	T	P	INT	EXT
1		Advanced Mathematicsfor Scientific Computing	4	3	1	0	25	75
2		Data Structures and Algorithms (e-PGPathshala)	4	3	1	0	25	75
3		Multi Core Architectures	4	3	1	0	25	75
4		Advanced Computer Networks	4	3	1	0	25	75
5		Research Methodology and IPR	4	3	1	0	25	75
6		Advanced Operating Systems	4	3	1	0	25	75
7		Data Structures and Algorithms Laboratory	2	0	0	4	50	50
8		Advanced Network Programming Laboratory	2	0	0	4	50	50
Total Credits:			**28**					

SEMESTER: II

Sl. No.	SUB CODE	COURSE TITLE	C	L	T	P	INT	EXT
1		Advanced Database Technology	4	3	1	0	25	75
2		Wireless Sensor Networks	4	3	1	0	25	75
3		Advanced Compiler Design	4	3	1	0	25	75
4		Object Oriented System Engineering	4	3	1	0	25	75
5		Machine Learning	4	3	1	0	25	75
6		Elective - I	3	3	0	0	25	75
7		Advanced Database Laboratory	2	0	0	4	50	50
8		Machine Learning Laboratory	2	0	0	4	50	50
Total Credits:			**27**					

SEMESTER III

Sl. No.	SUB CODE	COURSE TITLE	C	L	T	P	INT	EXT
1		Software Process and Project Management	4	3	1	0	25	75
2		Digital Image Processing	4	3	1	0	25	75
3		Mobile and Pervasive Computing	4	3	1	0	25	75
4		Elective - II	3	3	0	0	25	75
5		Dissertation - I	7	0	0	14	50	50
Total Credits:			**22**					

SEMESTER IV

Sl. No.	SUB CODE	COURSE TITLE	C	L	T	P	INT	EXT
1		Dissertation - II	13	0	0	26	50	50
Total Credits:			**13**					

CREDIT SUMMARY FOR M.E (C.S.E)	
SEMESTER I	28
SEMESTER II	27
SEMESTER III	22
SEMESTER IV	13
TOTAL CREDITS	**90**

LIST OF ELECTIVE COURSES

ELECTIVE I

S.No	SUB CODE	COURSE TITLE	C	L	T	P	INT	EXT
1		Human Computer Interaction	3	3	0	0	25	75
2		Mobile Application Development	3	3	0	0	25	75
3		Block Chain Technology	3	3	0	0	25	75
4		Software Testing	3	3	0	0	25	75
5		Ethical Hacking	3	3	0	0	25	75

ELECTIVE II

S.No	SUB CODE	COURSE TITLE	C	L	T	P	INT	EXT
1		Deep Learning	3	3	0	0	25	75
2		Cryptography and Network Security	3	3	0	0	25	75
3		Embedded Systems	3	3	0	0	25	75
4		Bio Informatics	3	3	0	0	25	75
5		Evolutionary Algorithms	3	3	0	0	25	75

Model Question Pattern

PG Degree Examinations, Month Year
Name of the Degree
Course Code – Course Name

Max.Marks-75 Time-3 Hours

PART A (10 x 1=10 Marks)
Answer all questions

PART B (5 x 5=25)
Answer all by choosing either (a) or (b)

PART C (5 x 8=40)
Answer all by choosing either (a) or (b)

ADVANCED MATHEMATICS FOR SCIENTIFIC COMPUTING

a. Course Code : …….

b. Course Objectives:

C	L	T	P
4	3	1	0

- To apply mathematical linear programming techniques to solve constrained problems.
- To appreciate the use of simulation techniques.
- To enable them to estimate the value of the parameters involved in the specific distributionfrom a possible continuum of alternatives.
- To give an idea of testing the statistical hypothesis claimed based on a set of data pointsusing standard sampling distributions.
- To impart knowledge of handling random vectors which represent random variables in multidimensional space.

c. Course Prerequisite:

- Should know the basic knowledge of mathematics and computing.

d. Course Outcome (COs):

After completion of this course, students will be able to

C01: Formulate and find optimal solution in the real life optimizing /allocation /assignment problemsinvolving conditions and resource constraints.
C02: Simulate appropriate application/distribution problems.
C03: Obtain the value of the point estimators using the method of moments and method of maximum likelihood.
C04: Apply the concept of various test statistics used in hypothesis testing for mean and variances of large and small samples.
C05: Get exposure to the principal component analysis of random vectors and matrices.

e. Course Outline:

UNIT I: LINEAR PROGRAMMING 12 hours

Formulation – Graphical solution – Simplex method – Two phase method –Transportation and Assignment Problems.

UNIT II: SIMULATION 12 hours

Discrete Event Simulation – Monte – Carlo Simulation – Stochastic Simulation – Applications to real time problems.

UNIT III: ESTIMATION THEORY 12 hours

Estimators: Unbiasedness, Consistency, Efficiency and Sufficiency – Maximum Likelihood Estimation — Method of moments.

UNIT IV: TESTING OF HYPOTHESIS 12 hours

Sampling distributions — Estimation of parameters — Statistical hypothesis — Tests based on Normal, t, Chi-square and F distributions for mean, variance and proportion, Tests for independence of attributes and goodness of fit.

UNIT V: MULTIVARIATE ANALYSIS **12 hours**

Random vectors and Matrices – Mean vectors and Covariance matrices – Multivariate Normal density and its properties – Principal components: Population principal components – Principalcomponents from standardized variables.

TOTAL: 60 hours

f. Mapping of COs to POs and PSOs:

Course Outcome	PO Addressed PO1 to PO6		Correlation Level L/M/H		PSO Addressed PSO1 to PSO3		Correlation Level L/ M/ H		Cognitive Level K_1 to K_6
CO1	PO1		H		PSO3		H		K_4
CO2	PO1		H		PSO3		M		K_3
CO3	PO1		H		PSO1		H		K_2
CO4	PO4		M		PSO2		H		K_4
CO5	PO2	PO6	M	H	PSO2	PSO3	M	H	K_3

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create**)**

g. Reference books:

1. Jay L.Devore, "Probability and Statistics for Engineering and the Sciences" Cengage Learning, 9th Edition, Boston, 2016.
2. Johnson, R.A, Irwin Miller and John Freund., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, 9th Edition, New York, 2016.
3. Johnson, R.A., and Wichern, D.W., "Applied Multivariate Statistical Analysis", Pearson Education, Sixth Edition, New Delhi, 2013.
4. Ross. S.M., "Probability Models for Computer Science", Academic Press, San Diego,2002.
5. Taha H.A.,, "Operations Research: An Introduction", Prentice Hall of India Pvt. Ltd. 10th Edition, New Delhi, 2017.
6. Winston, W.L., "Operations Research", Thomson – Brooks/Cole, Fourth Edition, Belmont,200

DATA STRUCTURES AND ALGORITHMS (e-PGPathshala)

a. Course Code : …….

C	L	T	P
4	3	1	0

b. Course Objectives:

- To extend the student's knowledge of algorithms and data structures.
- To enhance their expertise in algorithmic analysis and algorithm design techniques.
- To understand various types of search and heap structures.
- To study various types of geometric, randomized and approximation algorithms.
- To extrapolate from them in order to apply those algorithms and techniques to solve problems.

c. Course Prerequisite:

Should know the basic knowledge of Algorithms and mathematics.

d. Course Outcome (COs):

After completion of this course, students will be able to

CO1: Analyze algorithms.
CO2: Determine algorithm correctness.
CO3: Choose appropriate data structures for the problems to be solved.
CO4: Design algorithms for problems from different domains.
CO5: Identify various research strategies on algorithmic design.

e. Course Outline:

UNIT I: FUNDAMENTALS **12 hours**

Properties of Big-oh Notation –Conditional Asymptotic Notation – Algorithm Analysis – AmortizedAnalysis – Introduction to NP-Completeness/NP-Hard – Recurrence Equations – Solving Recurrence Equations – Time-Space Tradeoff.

UNIT II: SEARCH STRUCTURES **12 hours**

Binary Search Trees – AVL Trees – Red-Black trees – Multi-way Search Trees –B-Trees – SplayTrees — Tries.

UNIT III: HEAP STRUCTURES **12 hours**

Min/Max heaps – Deaps – Leftist Heaps – Binomial Heaps – Fibonacci Heaps – Skew Heaps –Lazy Binomial Heaps

UNIT IV: GEOMETRIC ALGORITHMS **12 hours**

Segment Trees – 1-Dimensional Range Searching – k-d Trees – Line Segment Intersection – Computing the Overlay of Two Subdivisions – Range Trees – Voronoi Diagram

UNIT V: ADDITIONAL TOPICS **12 hours**

Approximation Algorithms: Vertex Cover & Euclidean Travelling Salesperson Problem — Randomized Algorithms: Closest Pair Problem & Minimum Spanning Trees — Online Algorithm:Euclidean Spanning Tree.

TOTAL: 60 hours

f. Mapping of COs to POs and PSOs:

Course Outcome	**PO Addressed PO1 to PO6**	**Correlation Level L/M/H**	**PSO Addressed PSO1 to PSO3**		**Correlation Level L/ M/ H**		**Cognitive Level K_1 to K_6**
CO1	PO1	H	PSO1		H		K_1
CO2	PO1	M	PSO1		M		K_2
CO3	PO2	H	PSO2		M		K_3
CO4	PO4	H	PSO3		H		K_4
CO5	PO6	M	PSO2	PSO3	M	H	K_5

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create**)**

g. Reference books:

1. Web Link:
   https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQKJvP3a/8Vd3L08tQ==
   (e-PGPathshala (inflibnet.ac.in)

2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C",Second Edition, University Press, 2008.
3. Gilles Brassard, Paul Bratley, "Algorithmics: Theory and Practice", Prentice Hall, 1988.
4. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, "Computational Geometry Algorithms and Applications", Third Edition, Springer, 2008.
5. R.C.T Lee, S.S Tseng, R.C Chang and Y.T Tsai, "Introduction to the Design and Analysisof Algorithms", Tata McGraw-Hill Edition, 2012.

Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, 2009.

MULTICORE ARCHITECTURES

a. Course Code : …….

C	L	T	P
4	3	1	0

b. Course Objectives:

- To introduce the students to the recent trends in the field of Computer Architectureand identify performance related parameters.
- To understand the different multiprocessor issues.
- To expose the different types of multicore architectures.
- To understand the design of the memory hierarchy.
- To understand how the various forms of parallelism are exploited by the architecture.

c. Course Prerequisite:

- Should know the basic knowledge of computer architecture and organization.

d. Course Outcome (COs):

After completion of this course, students will be able to

CO1: Identify the limitations of ILP and the need for multicore architectures.
CO2: Discuss the issues related to multiprocessing and suggest solutions.
CO3: Point out the salient features of different multicore architectures and how they exploit parallelism.
CO4: Point out the various optimizations that can be performed to improve the memory hierarchydesign.
CO5: Point out the salient features of vector, GPU and domain specific architectures.

e. Course Outline:

UNIT I: FUNDAMENTALS OF COMPUTER DESIGN & ILP 12 hours

Fundamentals of Computer Design – Measuring and Reporting Performance – Instruction Level Parallelism and its Exploitation – Concepts and Challenges – Limitations of ILP – Multithreading –SMT and CMP Architectures – The Multicore era.

UNIT II: MEMORY HIERARCHY DESIGN 12 hours

Introduction – Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines – Design of Memory Hierarchies – Case Studies.

UNIT III: MULTIPROCESSOR ISSUES 12 hours

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

UNIT IV: MULTICORE ARCHITECTURES **12 hours**

Homogeneous and Heterogeneous Multi-core Architectures – Intel Multicore Architectures – SUN CMP architecture – IBM Cell Architecture. Introduction to Warehouse-Scale computers, Cloud Computing – Architectures and Issues – Case Studies.

UNIT V: VECTOR, SIMD AND GPU ARCHITECTURES **12 hours**

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

TOTAL: 60 hours

f. Mapping of COs to POs and PSOs:

Course Outcome	PO Addressed PO1 to PO6	Correlation Level L/ M/ H	PSO Addressed PSO1 to PSO3	Correlation Level L/ M/ H	Cognitive Level K_1 to K_6
CO1	PO1	H	PSO1, PSO3	L	K_1
CO2	PO1	H	PSO1	M	K_2
CO3	PO1, PO4, PO5	M	PSO2, PSO3	M	K_3
CO4	PO4, PO5	M	PSO2	H	K_4,K_5
CO5	PO3, PO5	M	PSO2, PSO3	H	K_6

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

g. Reference books:

1. John L. Hennessey and David A. Patterson, "Computer Architecture — A QuantitativeApproach", Morgan Kaufmann / Elsevier, 5th edition, 2012.
2. Darryl Gove, "Multicore Application Programming: For Windows, Linux, and Oracle Solaris",Pearson, 2011.
3. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors", Morgan Kauffman, 2010.
4. Wen–mei W.Hwu,"GPU Computing Gems", Morgan Kaufmann / Elsevier, 2011.

ADVANCED COMPUTER NETWORKS

a. Course code: ……

C	L	T	P
4	3	1	0

b. Course Objectives:

- Have a basic knowledge on the concept of networks
- Know the idea on protocols, OSI layers and its functions.
- Get the knowledge on protocols used in different layers

c. Course Prerequisites:

1. Basic knowledge on mathematics
2. Exposure to fundamental concepts of topology
3. Knowledge on switching and telephone networks.

d. Course outcomes (COs):

After completion of this course, students will be able to

CO1: Understand fundamental underlying principles of computer networking
CO2: Understand details and functionality of layered network architecture.
CO3: Apply mathematical foundations to solve computational problems in computer networking.
CO4: Analyze performance of various communication protocols.
CO5: Compare routing algorithms
CO6: Practice packet /file transmission between nodes.

e. Course Outline:

Unit I Introduction **12 Hours**

Introduction- data communications – networks – The internet – Protocols and standards – OSI model – layers in OSI model – TCP/IP protocol suite – addressing – guided media – Unguided media

Unit II Data link layer **12 Hours**

Switching – Circuit switched networks – datagram networks – virtual circuit networks – Framing – Flow and error control Multiple access – random access – wired Lan – wireless Lan – Cellular telephony – satellite networks–Emulating the techniques using emulator kits.

Unit III Network layer **12 Hours**

Frame relay – ATM – Network layer – IP V4 addressing – IPV6 addressing – ICMP – IGMP – Network layer delivery – forwarding – unicast and multicast routing protocols.

Unit IV Transport layer **12 Hours**

Transport layer – Process to process delivery – UDP -TCP -Congestion – congestion control – QOS – Techniques to improve QOS – simulation of transport layer protocols using network simulation tools.

Unit V – Application layer and Network security **12 Hours**

Domain name system – name space – domain name space – distribution of name space – DNS in the internet – remote logging - email – file transfer -Network management system – SNMP Protocol – cryptography – symmetric key cryptography – asymmetric key cryptography – security services – message confidentiality – message integrity – message authentication – digital signature – entity authentication

Total: 60 hours

f. Mapping of COs to POs and PSOs :

Course Outcome	PO Addressed PO1 to PO6	Correlation Level L/M/H	PSO Addressed PSO1 to PSO3	Correlation Level L/ M/ H	Cognitive Level K_1 to K_6
CO1	PO1	H	PSO1 PSO3	H	K_1
CO2	PO1	H	PSO1	M	K_2
CO3	PO2 PO4 PO5	M	PSO2 PSO3	M	K_3
CO4	PO4 PO5	M	PSO2	H	K_4,K_5
CO5	PO3 PO5	M	PSO2 PSO3	M	K_6
CO6	PO6 PO6	M	PSO2 PSO3	M	K_6

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create**)**

g. Reference books:

1. Data communications and networking – Behrouz A Forouzan McGraw Hill 4th Edition 2015 reprint
2. Computer Networks – Tanenbaum -Pearson -2013
3. Computer networking –Kurose James F, Ross Keith W -Pearson – 2017
4. Data and computer communications – William Stallings – Pearson 2017

RESEARCH METHODOLOGY AND IPR

a. Course Code : …….

C	L	T	P
4	3	1	0

b. Course Objectives:

To impart knowledge and skills required for research and IPR:

- Problem formulation, analysis and solutions.
- Technical paper writing / presentation without violating professional ethics
- Patent drafting and filing patents.

c. Course Prerequisite:

Should know the basic Research knowledge of research and property rights.

d. Course Outcome (COs):

After completion of this course, students will be able to

CO1: Ability to formulate research problem
CO2: Ability to carry out research analysis
CO3: Ability to follow research ethics
CO4: Ability to understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
CO5: Ability to understand about IPR and filing patents in R & D.

e. Course Outline:

UNIT I: RESEARCH PROBLEM FORMULATION 12 hours

Meaning of research problem- Sources of research problem - criteria characteristics of a good research problem - errors in selecting a research problem - scope and objectives of research problem. Approaches of investigation of solutions for research problem - data collection – analysis – interpretation - necessary instrumentations.

UNIT II: LITERATURE REVIEW 12 hours

Effective literature studies approaches – analysis - plagiarism - and research ethics.

UNIT III: TECHNICALWRITING /PRESENTATION 12 hours

Effective technical writing - how to write report - paper, developing a research proposal - format of research proposal - a presentation and assessment by a review committee.

UNIT IV:INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR) 12 hours

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

UNIT V: INTELLECTUAL PROPERTY RIGHTS (IPR) 12 hours

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

Traditional knowledge Case Studies, IPR and IITs.

TOTAL: 60 hours

f. Mapping of COs to POs and PSOs:

Course Outcome	PO Addressed PO1 to PO6	Correlation Level L/M/H	PSO Addressed PSO1 to PSO3		Correlation Level L/ M/ H		Cognitive Level K_1 to K_6
CO1	PO1	H	PSO1		M		K_2
CO2	PO5	H	PSO1		H		K_4
CO3	PO1	H	PSO2		M		K_4
CO4	PO2	H	PSO1		H		K_3
CO5	PO1	H	PSO1	PSO3	H	M	K_2

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create**)**

g. Reference books:

1. Asimov, "Introduction to Design", Prentice Hall, 1962.
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
3. Mayall, "Industrial Design", McGraw Hill, 1992.
4. Niebel, "Product Design", McGraw Hill, 1974.
5. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"2010

ADVANCED OPERATING SYSTEMS

a. Course Code: ……..

C	L	T	P
4	3	1	0

b. Course Objectives:

1. To make the students to realize the importance of the operating system in the computing domain.
2. Emphasis would be to provide the knowledge of communication, synchronization, resource management and security aspect in distributed operating system
3. Explicitly define and intuitively describe why operating systems virtualize hardware and how the operating system makes it possible for many applications to share resources and to make programming easier for user space applications
4. Configure a Linux-based operating system and work from the shell
5. Understand the procedures to manage files and directories in the Linux operating system
6. Develop and debug systems software

c. Course Prerequisites:

Knowledge of computer systems organization

d. Course Outcomes (COs):

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

CO1: Gain knowledge about the history of the Linux operating system, its unique licensing model and the major distributions that are available to use.

CO2: Start and stop services from running in the Linux operating systems.

CO3: Implement process scheduling algorithms.

CO4: Learn to manage files and directories in the Linux operating system.

CO5: To use the Linux environment for problem solving.

e. Course Outline:

Unit I **10 Hours**

Operating system: objectives and functions - major achievements. **Processes and threads**: process description - process control block - process states – thread control block – RPC using threads – multithreading example on a uniprocessor – types of threads - process structure in UNIX and Solaris. Consumable and reusable resources.

Unit II **9 Hours**

Concurrency issues: mutual exclusion, deadlock and starvation - definition. **Synchronization mechanisms**: semaphore: binary and counting semaphores – producer-consumer problem: solution using semaphores. Dead locks: prevention - detection - avoidance. Message Passing – RPC.

Unit III **13 Hours**

.**Memory Management**: main memory partitioning schemes: fixed, dynamic, paging and segmentation - page table, logical address, logical to physical address translation. **Virtual memory**: thrashing – principle of locality - memory management formats – TLB: role, operation. Address translation in virtual memory: paging, segmentation, paging/segmentation systems.

Unit IV **14 Hours**

Process Scheduling: criteria - types of scheduling – characteristics – process scheduling policies: FCFS – round robin – SPN – SRT.

Linux OS: History of Linux - Linux Licensing Model – comparison of GPL and BSD Licenses - Linux Distributions: Red Hat Enterprise Linux - Fedora Linux – SUSE – Ubuntu - Linux Command Line: the shell prompt – basic commands to view, create, copy, move, and remove files/directories. Deamon –procedure to check the type of the webserver on a website. **Connection establishment**: Instructions to Install MySQL on linux - Connecting to the MySQL Server with the mysql Client - Basic Operations with MySQL: show, create, describe, add, delete operations. Managing Services - core components and libraries - Ancillary components - Configuration of system.

Unit V **14Hours**

I/O management: categories of I/O devices - Disk Performance Parameters - Disk Scheduling Policies: FIFO, LIFO, PRI, SCAN – SSTF. RAID: level 0 to level 6.

Handle Files and Directories: Files and Directory Links: hard link, soft link. Reading Files: Linux Text Files – commands to read complete and parts of files from the Linux command line: cat, pr, grep, head, tail, pager - commands to find and Compare Files: diff, which, locate, find. Commands to Filter Text Files: cut, grep, wc. BREs – EREs – redirections – redirecting Standard Input, redirecting Standard Output, redirecting Standard Error - here documents – file descriptor operations - Common Redirection Operators – pipes and filters: create your own filter - create advanced automations. text editor to modify a file: Nano, Vim. Stream editors: sed, gawk.

f. Mapping of COs to POs and PSOs

Course Outcome	PO Addressed PO1 to PO6	Correlation Level L/M/H	PSO Addressed PSO1 to PSO3		Correlation Level L/ M/ H		Cognitive Level K_1 to K_6
CO1	PO1	H	PSO1		H		K_1
CO2	PO1	M	PSO1		M		K_2
CO3	PO2	H	PSO2	PSO3	H	M	K_3
CO4	PO4	H	PSO3		H		K_4
CO5	PO6	M	PSO2	PSO3	H	M	K_5

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create**)**

g: Reference books:

1. William Stallings - Operating Systems: Internals and Design Principles, Pearson Education.
2 . Richard Petersen, Linux - The Complete Reference, McGraw Hill Education.
3. Andrew S.Tanenbaum - Modern Operating Systems, pages, Prentice-Hall international editions
4. Achyut S Godbole- Operating Systems, Tata McGraw-Hill Education
5. Silberschatz, Abraham, Peter B. Galvin, and Greg Gagne. Operating System Concepts. John Wiley & Sons.

Reference Link:

https://web.njit.edu/~alexg/courses/cs332/OLD/S2020/s20hand3/Linux- Tutorial.pdf

DATA STRUCTURES AND ALGORITHMS LABORATORY

a. Course Code : …….

b. Course Objectives:

C	L	T	P
2	0	0	4

- To familiarize various data structure implementations.
- To implement heap and various tree structures like AVL, Red-black, B-Tree and segmenttrees.
- To understand efficient implementation of line segment intersection.
- To understand various search structures.
- To get understanding of problem to program mapping.

c. Course Prerequisite:

Should know the basic of data structure concepts and mathematical Knowledge.

d. Course Outcome (COs):

After completion of this course, students will be able to

CO1: Achieve programming skill to convert a problem to a programming logic.
CO2: Apply suitable data structure for the problem in hand.
CO3: Implement heap and various tree structures like AVL, Red- black, B-Tree and segmenttrees.
CO4: Understand the usage of data structures for geometric problems.
CO5: Understand the importance of height balancing in search structures.

e. Course Outline:

LIST OF EXPERIMENTS:

1. Binary Search Trees
2. Min/Max Heaps
3. Leftist Heaps
4. AVL Trees
5. Red-Black Trees
6. B-Trees
7. Segment Trees
8. Line segment intersection

f. Mapping of COs to POs and PSOs:

Course Outcome	PO Addressed PO1 to PO6		Correlation Level L/M/H		PSO Addressed PSO1 to PSO3		Correlation Level L/ M/ H		Cognitive Level K_1 to K_6
CO1	PO3		M		PSO1	PSO3	M		K_2
CO2	PO3	PO6	M	M	PSO2	PSO3	M	H	K_3
CO3	PO3	PO6	M	M	PSO1	PSO3	H	M	K_6
CO4	PO2	PO3	M	H	PSO3		H		K_5
CO5	PO3	PO4	H	H	PSO2	PSO3	M	M	K_3

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create**)**

g. Reference books:

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C",Second Edition, University Press, 2008.
2. Gilles Brassard, Paul Bratley, "Algorithmics: Theory and Practice", Prentice Hall, 1988.
3. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, "Computational Geometry Algorithms and Applications", Third Edition, Springer, 2008.
4. R.C.T Lee, S.S Tseng, R.C Chang and Y.T Tsai, "Introduction to the Design and Analysis of Algorithms", Tata McGraw-Hill Edition, 2012.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction toAlgorithms", MIT Press, 2009.

ADVANCED NETWORK PROGRAMMING LABORATORY

a. Course Code : …….

C	L	T	P
2	0	0	4

b. Course Objectives:

- Demonstrate the operation of wireless networks.
- Simulate and analyze the performance of GSM, CDMA, LTE and SDN.
- To gain knowledge and work on various protocol layers.
- To explore network simulators.
- Identify the different features of integrated and differentiated services.

c. Course Prerequisite:

Should know the basic knowledge of Computer Network Technology.

d. Course Outcome (COs):

After completion of this course, students will be able to

CO1: Judge the emerging wireless technology standards.
CO2: Configure functionalities of router and switches.
CO3: Assess the importance of wireless adhoc networks.
CO4: Compare and contrast various wireless technologies.
CO5: Explain and design the considerations for deploying wireless network infrastructure.

e. Course Outline:

LIST OF EXPERIMENTS:

1) Configure networks using:
   a) Distance Vector Routing protocol
   b) Link State Vector Routing protocol
2) Implement the congestion control using Leaky bucket algorithm.
3) Installation of NS3 and execution of TCL commands / scripts.
4) Implementation Point to Point network using duplex links between the nodes. Analyze thepacket transfer by varying the queue size and bandwidth. (using simulator)
5) Implement the dynamic routing protocol by varying the CBR traffic for each node and use aflow monitor( ) to monitor losses at nodes. (using simulator)
6) Create a wireless mobile ad-hoc network environment and implement the OLSR routingprotocol. (using simulator)
7) Implement CDMA by assigning orthogonal code sequence for 5 stations, generate the CDMA code sequence and communicate between the stations using the generated code.
8) Create a GSM environment and implement inter and intra handover mechanisms. (usingsimulator)
9) In LTE environment implement Round Robin and Token Bank Fair Queue scheduler inMAC layer.
10) Write python script to create topology in Mininet and configure OpenFlow switches withPOX controller to communicate between nodes.

f. Mapping of COs to POs and PSOs:

Course Outcome	PO Addressed PO1 to PO6		Correlation Level L/M/H		PSO Addressed PSO1 to PSO3		Correlation Level L/ M/ H		Cognitive Level K_1 to K_6
CO1	PO3		M		PSO1	PSO3	M		K_2
CO2	PO3	PO6	M	M	PSO2	PSO3	M	H	K_3
CO3	PO3	PO6	M	M	PSO1	PSO3	H	M	K_6
CO4	PO2	PO3	M	H	PSO3		H		K_5
CO5	PO3	PO4	H	H	PSO2	PSO3	M	M	K_3

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create**)**

g. Reference books:

1. William Stallings, "High Speed Networks and Internets: Performance and Quality ofService", Prentice Hall, Second Edition, 2002.
2. Martin Sauter, "From GSM to LTE, An Introduction to Mobile Networks and MobileBroadband", Wiley, 2014.
3. Savo G Glisic, "Advanced Wireless Networks — 4G Technologies", John Wiley & Sons,2007.
4. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", Wiley, 2015.
5. Martin Sauter, "Beyond 3G – Bringing Networks, Terminals and the Web Together: LTE,
6. WiMAX, IMS, 4G Devices and the Mobile Web 2.0", Wiley, 2009.
7. Naveen Chilamkurti, SheraliZeadally, HakimaChaouchi, "Next-Generation Wireless Technologies", Springer, 2013.
8. Erik Dahlman, Stefan Parkvall, Johan Skold, "4G: LTE/LTE-Advanced for MobileBroadband", Academic Press, 2013.

ADVANCED DATABASE TECHNOLOGY

a. Course Code: ---------

C	L	T	P
4	3	1	0

b. Course Objectives:

1. Acquire Knowledge on Database Models, Applications and Emerging Trends
2. Compare and distinguish various database architectures
3. Select the databases and design database solutions
4. Handle the data using MongoDB commands.
5. Write several queries such as XML Query, NoSQL, SQL, PL/SQL

c. Course Prerequisites:

1. Knowledge on the database management system
2. Knowledge on the computer architecture
3. Knowledge on the OOP

d. Course Outcomes (COs):

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

CO1: Recognize the importance of Various Data models and Architecture
CO2: Analyze and Design the normalized database schema
CO3: Decide the database for his problem
CO4: Develop database solutions
CO5: Write database queries in SQL, PL SQL and NoSQL

e. Course Outline:

Unit I: 12 Hours

Relational and parallel Database Design: Basics, Entity Types, Relationship Types, ER Model, ER-to-Relational Mapping algorithm. Normalization: Functional Dependency, 1NF, 2NF, 3NF, BCNF,4NF and 5NF. Architecture, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism, Interoperation Parallelism.

Unit II 14 Hours

Distributed and Object based Databases: Architecture, Distributed data storage, Distributed transactions, Commit protocols, Concurrency control, Query Processing. Complex Data Types, Structured Types and Inheritance, Table Inheritance, array and Multiset, Object Identity and Reference Types, Object Oriented versus Object Relational.

Unit III: 12 Hours

Spatial and Logic Database: Spatial Database Characteristics, Spatial Data Model, Spatial Database Queries, Techniques of Spatial Database Query, Structured and unstructured data, NoSQL databases, NoSQL data modelling, Benefits of NoSQL databases, Introduction to MongoDB Shell, Running MongoDB Shell, MongoDB client, Basic operations with MongoDB shell, Data Types, Arrays, Embedded documents, Querying with MongoDB.

Unit IV: 10 Hours

XML Databases: XML Hierarchical data model, XML Documents,DTD, XML Schema, XML Querying, XHTML, Illustrative Experiments.

Unit V: 12 Hours

Temporal Databases: Introduction, Intervals, Packing and Unpacking Relations, Generalizing the Relational Operators, Database Design, Integrity Constraints, Multimedia Databases: Multimedia Sources, Multimedia Database Queries, Multimedia Database Applications.

f. Mapping of COs to POs and PSOs:

Course Outcome	**PO Addressed** PO1 to PO6	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO3	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1	M	K_2
CO2	PO5	H	PSO1	H	K_4
CO3	PO1	H	PSO2	M	K_4
CO4	PO2	H	PSO1	H	K_3
CO5	PO1	H	PSO1 PSO3	H M	K_2

(L – Low, M – Medium, H – High); K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create

g. Reference Books

1. Abraham Silberschatz, Henry F Korth , S Sudarshan, "Database System Comcepts", 6th edition , McGraw-Hill International Edition ,2011
2. C.J.Date, A.Kannan, S.Swamynathan, "An IntroductiontoDatabase Systems", 8thEdition, Pearson Education Reprint2016.
3. RamezElmasri, Shamkant B Navathe, "Fundamental of Database Systems", Pearson, 7th edition 2016.
4.Thomas Connolly, Carolyn Begg., "Database Systems a practical approach to Design, Implementation and Management ", Pearson Education, 2014.

h. Web Resources:

1. https:// docs.mongodb.com/manual/tut

WIRELESS SENSOR NETWORKS

a) Course code:

C	L	T	P
4	3	1	0

b) Course Objectives:

1. Learn and understand the fundamental concepts behind the Sensor Networks
2. Know the idea clustering, location identification and energy conservation mechanisms.
3. Apply the knowledge gathered as applications in the practical life.

c) Course Prerequisites:

1. Basic knowledge on functionalities of sensors and basic electronics
2. Exposure to fundamental concepts of node radio transmission
3. Knowledge on computer networks and wireless communication.

d) Course outcomes (COs):

After completion of this course, students will be able to
CO1: Have knowledge on the fundamental characteristics of WSN.
CO2: Understand the effect of routing, broadcasting and multicasting in WSN.
CO3: Identify the techniques used in data transmission.
CO4: Analyze the power efficiency in data transmission
CO5: Identify the applications of WSN.
CO6: Able to design and develop WSN based on the need.

e) Course Outline:

Unit IINTRODUCTION 12 Hours

Introduction to WSN - overview of WSN - Technological background - Network architecture for WSN - Classification of WSN - Protocol stack for WSN - Fundamental MAC Protocols – MAC design for WSN.

Unit II ROUTING, BROADCASTING AND MULTICASTING 12 Hours

Routing and Data Dissemination - Fundamentals and challenges - Taxonomy - Location aided protocols - Layered and In-Network processing protocols - Data centric protocols – Broadcasting multicasting and geocasting: Concepts and major challenges - Broadcasting mechanisms - Multicasting and geocasting mechanisms

Unit III CLUSTERING AND DATA AGGREGATION 12 Hours

Node clustering: Introduction - Cluster head election algorithms - Node clustering algorithms for WSN - Query processing and data aggregation

Unit IV LOCALIZATION 12 Hours

Node localization: Concepts and challenges - TOA based ranging - Wireless sensor node localization - Energy efficiency and power control: Need - Physical layer power conservation mechanisms - MAC layer mechanisms

Unit V STANDARDS AND APPLICATIONS 12 Hours

Transport protocols for WSN - Sensor network Standards - IEEE 802.15.4 - ZigBee – Wireless multimedia network - Wireless sensor and actor networks - Sensor network application in Challenging environments - Cross layer design for WSN.

f. Mapping of COs, POs and PSOs:

Course Outcome	**PO Addressed** PO1 to PO6	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO3	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1	H	K_1
CO2	PO1	M	PSO1	M	K_2
CO3	PO3 PO4 PO5	H M M	PSO2 PSO3	M H	K_3, K_5
CO4	PO4 PO5	M	PSO2 PSO3	M H	K_4, K_5
CO5	PO5 PO6	M M M	PSO3	M H	K_5
CO6	PO2 PO5 PO6	H H M M	PSO3	M M	K_6

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5– Evaluate, K_6 – Create**)**

g. References:

1. Wireless Sensor Networks - A networking Perspective - Jun Zheng, Abbas Jamalipour - Wiley 2014
2. Wireless Sensor networks : Feng Zhao,LeonidasGuibas –Morgan Kaufmann Publications – 2012
3. Wireless Sensor Networks: Technology, Protocols and Applications - TaiebZnati Kazem Sohraby, Daniel Minoli - Wiley India 2010
4. Protocols and Architectures for Wireless Sensor Networks- Holger Karl wiley 2011

ADVANCED COMPILER DESIGN

a. Course Code:

C	L	T	P
4	3	1	0

b. Course Objectives:

- To learn the various phases of compiler
- To learn the parsing techniques
- To understand intermediate code generator and runtime environment
- To learn to implement front end of the compiler
- To learn the implement code generator

c. Course Prerequisite:

Knowledge of mathematics, data structure

d. Course Outcome

- C01: Understand the different phases of compiler.
- C02: Design a lexical analyzer for a sample language.
- C03: Apply different parsing algorithms to develop the parsers for a given grammar.
- C04: Understand syntax-directed translation and run-time environment.
- C05: Learn to implement code optimization techniques and a simple code generator.
- C06: Design and implement a scanner and a parser using LEX and YACC tools.

e. Course Outline:

UNIT I: Lexical Analysis **10 Hours**

Lexical Analysis – Language Processors, The Structure of a Compiler, Parameter passing mechanism – Symbol table– The role of the lexical analyzer – Input buffering – Specification of tokens – Recognition of tokens – CompilerConstruction Tools.

UNIT II: Syntax Analysis **15 Hours**

Syntax Analysis – Finite automata – Regular expression to automata - The role of the parser – Context-free grammars – Writing a grammar – Top down Parsing – Recursive descent parsing, Predictive parsing - Bottom-upParsing – LR parsers – LALR parsers.

UNIT III: Semantic Analysis **12 Hours**

Semantic Analysis – Inherited and Synthesized attributes– Dependency graphs – Ordering the evaluation of attributes – S – attributed definitions – L – attributed definitions – Applications of Syntax Directed translations– Syntax Directed translations schemes – Storage organization – Stack allocation of space.

UNIT IV: Intermediate Code Generation **13 Hours**

Intermediate Code Generation – Syntax Directed Definition – Variants of Syntax trees – Three Address code – Types and Declarations – Translation of Expressions – Type checking – Control flow – Back patching – Switch Statements – Procedure calls.

UNIT V: Code Generation & Code Optimization **10 Hours**

Code Generation and Code Optimization – Issues in the design of a code generator – The target language – Address in the Target Code – Basic Block and Flow graphs –Optimization of Basic Blocks – A simple code generator –Peephole Optimization, Machine Independent Optimization.

f. Mapping of COs to POs and PSOs:

Course Outcome	**PO Addressed** PO1 to PO6		**Correlation Level** L/M/H		**PSO Addressed** PSO1 to PSO3		**Correlation Level** L/ M/ H		**Cognitive Level** K_1 to K_6
CO1	PO1		M		PSO1		L		K_1
CO2	PO1	PO2	L	M	PSO1	PSO2	M	H	K_2
CO3	PO5	PO1	H	M	PSO1	PSO2	H	H	K_3
CO4	PO2	PO4	H	M	PSO1		M		K_4
CO5	PO4		H		PSO2		H		K_5
CO6	PO5	PO6	H	H	PSO3		H		K_6

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5– Evaluate, K_6 – Create**)**

g. Reference books:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman, "Compilers – Priciples, Techniques and Tools", Second Edition, Pearson Education Asia, 2009.
2. A. V Aho, Ravi Sethi, J.D Ullman, Compilers –Principles, Techniques and Tools, Addison – Wesley,2003.
3. Fischer Leblanc, Crafting Construction, Benjamin Cummings, Menlo Park, 1988.
4. Kennath C. Louden, Compiler Construction Principles and Practice, Vikas publishing House, 2004.
5. AllenI.Holub, Compiler Design in C, PrenticeHall of India, 2001.
   S. Godfrey Winster, S. Aruna Devi, R. Sujatha, "Compiler Design", yesdee Publishers, Third Reprint 2019.

OBJECT ORIENTED SYSTEM ENGINEERING

a. Course Code:

C	L	T	P
4	3	1	0

b. Course Objectives:

- To learn the oops concept.
- To learn the basic concept of C++.
- To understand the modelling concepts.
- To understand the object oriented approach to implement real world problem.

c. Course Prerequisite:

Knowledge of C++, oops.

d. Course Outcome:

CO 1 Understand the application development and analyze the insights of object oriented programming to implement application

CO 2 Analyze and apply the role of overall modeling concepts (i.e. System, structural)

CO 3 Analyze and apply oops concepts (i.e. abstraction, inheritance)

CO 4 Understand the basic concepts of C++ to implement the object oriented concepts.

CO 5 To understand the object oriented approach to implement real world problem.

e. Course Outline:

UNIT I: **12 Hours**

Introduction: The meaning of Object Orientation, object identity, Encapsulation, information hiding, polymorphism, generosity, importance of modelling, principles of modelling, object oriented modelling, Introduction to UML, conceptual model of the UML, Architecture.

UNIT II: **12 Hours**

Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Class &Object Diagrams: Terms, concepts, modelling techniques for Class & Object Diagrams. Collaboration Diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration Diagrams, iterated messages, use of self in messages. Sequence Diagrams: Terms, concepts, depicting asynchronous messages with/without priority, call-back mechanism, broadcast messages. Basic Behavioural Modeling: Use cases, Use case Diagrams, Activity Diagrams, State Machine , Process and thread, Event and signals, Time diagram, interaction diagram, Package diagram. Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.

UNIT III: **12 Hours**

Object Oriented Analysis: Object oriented design, Object design, Combining three models, Designing algorithms, design optimization, Implementation of control, Adjustment of inheritance, Object representation, Physical packaging, Documenting design considerations. Structured analysis and structured design (SA/SD), Jackson Structured Development

(JSD).Mapping object oriented concepts using non-object oriented language, Translating classes into data structures, Passing arguments to methods, Implementing inheritance, associations encapsulation.Object oriented programming style: reusability, extensibility, robustness, programming in the large. Procedural v/s OOP, Object oriented language features. Abstraction and Encapsulation.

UNIT IV: **12 Hours**

C++ Basics : Overview, Program structure, namespace, identifiers, variables, constants, enum, operators typecasting, control structures C++ Functions : Simple functions, Call and Return by reference, Inline functions, MacroVs. Inline functions, Overloading of functions, default arguments, friend functions, virtual functions.

UNIT V: **12 Hours**

Objects and Classes : Basics of object and class in C++, Private and public members, static data and function members, constructors and their types, destructors, operator overloading, type conversion. Inheritance: Concept of Inheritance, types of inheritance: single, multiple, multilevel, hierarchical, hybrid, protected members, overriding, virtual base class Polymorphism : Pointers in C++, Pointes and Objects, this pointer, virtual and pure virtual functions, Implementing polymorphism.

f. Mapping of COs to POs and PSOs:

Course Outcome	PO Addressed PO1 to PO6	Correlation Level L/ M/ H	PSO Addressed PSO1 to PSO3	Correlation Level L/ M/ H	Cognitive Level K_1 to K_6
CO1	PO1	H	PSO1 PSO3	L	K_1
CO2	PO2	H	PSO3	M	K_2
CO3	PO1 PO3 PO5	M	PSO2 PSO3	M	K_3
CO4	PO4 PO5	M	PSO2	H	K_4,K_5
CO5	PO3 PO5	H	PSO2 PSO3	H	K_6

g. References Books:

1. James Rumbaugh et. al, "Object Oriented Modeling and Design", Pearson Education
2. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide",PearsonEducation
3. Object Oriented Programming With C++, E Balagurusamy, McGraw Hill.
4. C++ Programming, Black Book, Steven Holzner, dreamtech
5. Object Oriented Programming in Turbo C++, Robert Lafore, Galgotia
6. Object Oriented Programming with ANSI and Turbo C++, Ashok Kamthane, Pearson
7. The Compete Reference C++, Herbert Schlitz, McGraw Hill.

MACHINE LEARNING

a. Course Code: ---------

C	L	T	P
4	3	1	0

b. Course Objectives:

1. To Learn about Machine Intelligence and Machine Learning applications.
2. To implement and apply machine learning algorithms to real- world applications.
3. To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems.
4. To understand how to perform evaluation of learning algorithms and model selection.
5. Write own Machine Learning programs from the scratch.

c. Course Prerequisites:

1. Basic Level understanding of Mathematics.
2. Basic level knowledge in Python2/Python3 or any computer programming language.

d. Course Outcomes (COs):

After the completion of this course, student will be able to -

CO1 : Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.

CO2 : Have an understanding of the strengths and weaknesses of many popular machine learning approaches.

C03 : Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

C04 : Have an understanding of the strengths and weaknesses of many popular machine learning approaches.

C05 : Be able to design and implement various machine learning algorithms in a range of real-world applications.

e. Course Outline:

UNIT-1 INTRODUCTION **9 Hours**

Learning -Types of Machine Learning Supervised Learning - The Brain and the Neuron Linear Discriminants- Perceptron - Linear Separability - Linear Regression.

UNIT-2 LINEAR MODELS **11 Hours**

Multi-layer Perceptron - Going Forwards Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice Examples of using the MLP - Overview - Deriving Back Propagation - Radial Basis Functions (RBF) and Splines - Concepts - RBF Network - Curse of Dimensionality - Interpolation and Basis Functions – Linear Discriminant Analysis(LDA) - Principal Component Analysis(PCA) -Support Vector Machines(SVM)

UNIT-3 TREES, ENSEMBLE AND PROBABILISTIC MODELS 14 Hours

Learning with Trees Decision Trees - Constructing Decision Trees Classification and Regression Trees (CART) - Ensemble Learning – Boosting – Bagging – Random Forests - Different ways to Combine Classifiers – Naïve Bayes Classifier - K- Nearest Neighbor Methods - Unsupervised Learning – Vector Quantization - K means Algorithms – Self Organizing Feature Map (SOM).

UNIT-4 SEARCHING AND EVOLUTIONARY ALGORITHMS 14 Hours

Three basic search approaches: Exhaustive Search – Greedy Search – Hill Climbing – Genetic Algorithms (GA) - Generating Offspring: Genetic Operators – Using Genetic Algorithms.

UNIT-5 DIMENSIONALITY REDUCTION AND EVALUATION STRATEGIES

12 Hours

Dimensionality Reduction Linear Discriminant Analysis - Principal Component Analysis - Factor Analysis - Independent Component Analysis - Locally Linear Embedding Isomap - Curse of Dimensionality - Overfitting – Underfitting – Training/ Testing and Validation Sets – Cross Validation – Percentage Splits - Chi-Square - The Confusion Matrix – Accuracy Metric – The Receiver Operating Characteristic(ROC) Curve - Root Mean Square Error.

f. Mapping of COs, POs and PSOs*:*

Course Outcome	**PO Addressed** PO1 to PO6	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO3	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1	H	K_1
CO2	PO2	M	PSO1, PSO2	H	K_2
CO3	PO3	H	PSO2, PSO3	H	K_3
CO4	PO3, PO4, PO6,	M	PSO3	H	K_4
CO5	PO4, PO5, PO6	H	PSO3	M	K_5, K_6

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

g. References:

1. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Mastering Machine Learning with Python in Six Steps - Mastering Machine Learning with Python in Six Steps, ManoharSwamynatha, Apress.
3. Python Data Analytics – Data Analysis and Science using Pandas, Matplotlib and the Python Programming Langauge, Fabio Nelli, Apress.
4. Python Cookbook 3rd Edition – Recepies for Mastering Python 3, David Beazley and Brian K. Jones, O'Reilly.

ADVANCED DATABASE TECHNOLOGY LAB

a. Course Code: ---------

C	L	T	P
2	0	0	4

b. Course Objectives:

1.Write various kinds of SQL, NoSQL and XML Queries for creating and updating the databases.
2.Develop PL SQL programming
3.Design and Develop programs using MongoDB

c. Course Prerequisites:

1. Knowledge on the fundamentals of database management system
2. Knowledge on the computer architecture
3. Knowledge on the OOP

d. Course Outcomes (COs):

At the end of the course, the student will be able to
CO1: Design and Develop database solutions to the societal problem
CO2: Install and configure several database systems
CO3: Write queries to manipulate the data
CO4: Write PL SQL Procedures to solve the database problems

e. Course Outline:

LAB EXCERCISES 60 Hours

1. Implementing Locking Protocols
2. Install and configure MongoDB/ My SQL/ Oracle/ SQL Server
3. Database creation using XML attributes and elements
4. Nested queries using XML
5. XQuery implementation using FLOWER expression and joining
6. SQL Sub queries
7. PL/SQL Programming
8. SQL Queries using type inheritance and table inheritance
9. SQL Queries using object identity and reference types
10. Design and develop MongoDB Queries using basis operations
11. Aggregation queries using MongoDB

f. Mapping of COs to POs and PSOs:

Course Outcome	**PO Addressed** PO1 to PO6			**Correlation Level** L/M/H			**PSO Addressed** PSO1 to PSO3			**Correlation Level** L/ M/ H			**Cognitive Level** K_1 to K_6
CO1	PO1	PO2	PO3	H	H	M	PSO1	PSO2	PSO4	H	H	M	K_2
CO2	PO1			H			PSO2			H			K_4
CO3	PO2			H			PSO1			M			K_4
CO4	PO2			H			PSO2			H			K_3

(L – Low, M – Medium, H – High, K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

g. Reference Books:

1. Abraham Silberschatz, Henry F Korth , S Sudarshan, “Database System Comcepts”, 6th edition , McGraw-Hill International Edition ,2011
2. C.J.Date, A.Kannan, S.Swamynathan, “An IntroductiontoDatabase Systems”, 8thEdition, Pearson Education Reprint2016.

MACHINE LEARNING LAB

C	L	T	P
2	0	0	4

a. Course Code: ---------

b. Course Objectives :

1. To Learn about Machine Intelligence and Machine Learning applications.
2. To implement and apply machine learning algorithms to real- world applications.
3. To identify and apply the appropriate machine learning technique to classification, patternrecognition, optimization and decision problems.
4. To understand how to perform evaluation of learning algorithms and model selection.
5. Write own Machine Learning programs from the scratch.

c. Course Prerequisites:

1. Basic Level understanding of Mathematics.
2. Basic level knowledge in Python2/Python3 or any computer programming language.

d. Course Outcomes (COs):

After the completion of this course, student will be able to -

CO1: Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.

CO2: Have an understanding of the strengths and weaknesses of many popular machine learning approaches.

C03: Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

C04: Have an understanding of the strengths and weaknesses of many popular machine learning approaches.

C05: Be able to design and implement various machine learning algorithms in a range of real-world applications.

e. Course Outline:

List of Experiments:

1. Implement a program for Linear Discriminant Analysis.
2. Using Linear Regression, separate the actual and the predicted values
3. Classification using Neural Network using Tensorflow for Titanic Survivors
4. Multi-Layer Perceptron using Tensorflow for MNIST Digit Recognition
5. Recognizing hand-written digits using Support Vector Machine
6. Root Node Attribute Selection using Information Gain
7. Decision Tree Classification using Gini coefficient
8. Data Classification using K-Means Algorithm
9. Text Classification using K-Means Algorithm

10. Find the optimal Solution using Genetic Algorithm for OneMax Problem
11. Data Clustering using Gaussian Mixture Model
12. Text Clustering using Gaussian Mixture Model
13. Bagging in Classification
14. Bagging Application using Regression
15. Boosting Application using Regression
16. Dimensionality Reduction using PCA in Image Processing applications
17. Application of CRF in Natural Language Processing

f. Mapping of COs, POs and PSOs:

Course Outcome	**PO Addressed** PO1 to PO6	**CorrelationLevel** L/M/H	**PSO Addressed** PSO1 to PSO3	**CorrelationLevel** L/ M/ H	**CognitiveLevel** K_1 to K_6
CO1	PO1	H	PSO1	H	K_1, K_2
CO2	PO2	H	PSO1, PSO2	H	K_2, K_3
CO3	PO3	H	PSO2, PSO3	H	K_2, K_3, K_6
CO4	PO3, PO4, PO6,	H	PSO3	H	K_4, K_5
CO5	PO4, PO5, PO6	L	PSO3	M	K_5, K_6

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

ELECTIVE I

HUMAN COMPUTER INTERACTION

C	L	T	P
3	3	0	0

a. Course Code: ---------

b. Course Objectives:

- To learn the foundations of Human Computer Interaction.
- To learn Basics of Interactive Design – HCI and Design Rules.
- To study about Evaluation techniques, Universal Design Principles and Cognitive Models.
- To know about the Mobile Ecosystem, Types of Mobile Applications & Mobile Information Architecture.
- To learn about Mobile Design, Mobile 2.0 and Design Web Interfaces.

c. Course Prerequisites:

1. Exposure to programming skill in some practical programming languages such as Java, C#, HTML for Processing.
2. Basic Concepts of Mobile Computing and Software Engineering.
3. Some Basic Mathematicsand knowledge in designing strategies.
4. Critical thinking and Creativity.

d. Course Outcomes (COs):

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

CO1: Design effective dialog for HCI

CO2: Design effective HCI for individuals and persons with disabilities.

CO3: Choose an Evaluation Method; explain Universal Design Principles & Cognitive Models

CO4: Explain Types of Mobile Applications and Mobile Information Architecture.

CO5: Develop Mobile Design & Design Web Interfaces.

e. Course Outline:

UNIT 1 **12 Hours**

The Human: I/O channels – Human Memory – Thinking: Reasoning and Problem Solving; **The Computer**: Text Entry Devices – Positioning, Pointing & Drawing – Display Devices – Devices for Virtual Reality & 3D Interaction – Physical controls, Sensors and Special Devices – Memory - Processing and networks.

I**nteraction**: Models of Interaction – Frameworks& HCI - Ergonomics –Interaction Styles – Elements of WIMP interface – Interactivity.

UNIT 2 12 **Hours**

Interactive Design Basics: Introduction – What is Design? – The process of design – User focus - Scenarios – Navigation design – Screen design and layout – Iteration and prototyping. **HCI in the software process**: Introduction – The Software life cycle – Usability engineering – Iterative design and prototyping – Design rationale.

Design rules: Introduction – Principles to support usability – Standards – Guideline – Golden rules and heuristics HCI patterns.

UNIT III 12 Hours

Evaluation Techniques: What is evaluation? – Goals of evaluation – Evaluation through expert analysis – Evaluation through user participation – Choosing an evaluation method.
Universal Design:Introduction – Universal Design Principles – Multi-modal Interaction.
Cognitive Models: Introduction – Goal and task hierarchies – Linguistic Models – Physical and Device Models – Cognitive architectures.

UNIT IV 12 Hours

Mobile Ecosystem: Platforms, Application frameworks.
Types of Mobile Applications: Mobile Application Medium Types: Mobile Widgets, Mobile Web Widgets – Mobile Web Applications – Games.

Mobile Information Architecture: What is Information Architecture, Mobile Information Architecture.

UNIT V 12 Hours

Mobile Design: The Elements of Mobile Design – Mobile Design Tools.
Mobile 2.0: What is Mobile 2.0?
Designing Web Interfaces: Drag & Drop – Direct Selection – Contextual Tools – Overlays – Inlays – Visual Pages – Process Flow.

f. Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO6	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO3	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO3	H	PSO1	H	K_1
CO2	PO3, PO6	H, M	PSO2, PSO3	H, M	K_2
CO3	PO1, PO2, PO5	H, M, M	PSO2	M	K_3
CO4	PO1, PO5	H, M	PSO2	H	K_4
CO5	PO3, PO4	H, M	PSO2, PSO3	H, M	K_5,K_6

(L – Low, M – Medium, H – High; K_1 –Remember, K_2 - Understand, K_3 –Apply, K_4– Analyze, K_5–Evaluate, K_6 – Create**)**

g. Reference Books:

1. Alan Dix, Janet Finlay, Gregory D.Abowd, Russell Beale – "Human Computer Interaction", Third Edition, Pearson Education, 2016
2. Brian Fling – "Mobile Design and Development", First Edition, O 'Reilly Media Inc., 2015
3. Bill Scott and Theresa Neil – "Designing Web Interfaces", First Edition, O 'Reilly, 2016

MOBILE APPLICATION DEVELOPMENT

a. Course code: .....

C	L	T	P
3	3	0	0

b. Course Objectives:

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

c. Course Outcome:

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

CO1: Describe the requirements for mobile applications
CO2: Explain the challenges in mobile application design and development
CO3: Develop design for mobile applications for specific requirements
CO4: Implement the design using Android SDK
CO5: Implement the design using Objective C and iOS
CO6: Deploy mobile applications in Android and iPhone market place for distribution

d. Course Prerequisite:

Should have knowledge of Android Application, and wireless networks

e. Course Outline:

UNIT I: 12 Hours

Introduction: Introduction to Mobile Computing – Introduction to – Android Development Environment -Factors in Developing Mobile Applications: Mobile Software Engineering – Frameworks and Tools – Generic UI Development – Android User.

UNIT II 12 Hours

More on UIs: VUIs and Mobile Apps – Text-to-Speech Techniques – Designing the Right UI – Multichannel and Multimodial UIs – Intents and Services: Android Intents and Services – Characteristics of Mobile Applications –Successful Mobile Development.

UNIT III 12 Hours

Storing and Retrieving Data: Synchronization and Replication of Mobile Data – Getting the Model Right –Android Storing and Retrieving Data – Working with a Content Provider – Communications Via Network and the Web: State Machine – Correct Communications Model – Android Networking and Web.

UNIT IV 12 Hours

Telephony: Deciding Scope of an App – Wireless Connectivity and Mobile Apps – Android Telephony – Notifications and Alarms: Performance – Performance and Memory Management – Android Notifications and Alarms.

UNIT V **12 Hours**

Graphics: Performance and Multithreading –Graphics and UI Performance – Android Graphics and - Multimedia: Mobile Agents and Peer-to-Peer Architecture – Android Multimedia – Location:Mobility and Location Based Services.

f. Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO6		**Correlation Level** L/M/H		**PSO Addressed** PSO1 to PSO3		**Correlation Level** L/ M/ H		**Cognitive Level** K_1 to K_6
CO1	PO1		H		PSO1		L		K_1
CO2	PO2	PO3	M	M	PSO1	PSO2	M	H	K_2
CO3	PO2	PO4	H	M	PSO1	PSO2	H	H	K_3
CO4	PO1	PO5	H	M	PSO1		H		K_4
CO5	PO4		H		PSO3		M		K_5
CO6	PO5	PO6	H	H	PSO3		H		K_6

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create**)**

g. Reference books

1. G. Luger, W. A. Stubblefield, “Artificial Intelligence”, Third Edition, Addison – Wesley Longman, 1998.
2. N. J Nilsson, “Principles of Artificial Intelligence”.Narosa Publishing House, 1980.

BLOCK CHAIN TECHNOLOGY

a) Course code:

C	L	T	P
3	3	0	0

b) Course Objectives:

1. Have a basic knowledge on the concept of block chain
2. Know the idea on crypto currency
3. Get the concept of smart contracts, ICO and security aspects in crypto currencies.

c) Course Prerequisites:

1. Basic knowledge on banking
2. Exposure to fundamental concepts of security
3. Knowledge on computer networks.

d) Course outcomes (COs):

After completion of this course, students will be able to

CO1: Explain the fundamental characteristics of block chain
CO2: Understand the requirements of the basic design of block chain
CO3: Identify the need of block chains to find the solution to the real-world problems
CO4: Recognize the underlying technology of transactions, blocks, proof-of-work, and consensus building
CO5: Perform a transaction in crypto currencies
CO6: Develop smart contracts

e) Course Outline:

Unit I Introduction 10 Hours

Fundamentals of Block chain – Introduction-origin of block chain-block chain solution-components of block chain – block in a block chain – technology and future- Block chain types and consensus mechanism – Decentralization and distribution-types of block chain-consensus protocol

Unit II Crypto currency 12 Hours

Crypto currency – Bit coin and the crypto currency- crypto currency basics -types of Crypto currency -crypto currency usage-Public block chain system – Public block chain – popular public block chains – Discussion on popular public crypto currencies.

Unit III Smart Contracts 12 Hours

Smart contracts – Smart contracts example – Characteristics and types – Private block chain system – key characteristics – need -Private block chain example – Private block chain and open source – E- commerce site examples – smart contract in private environment –State machine – PAXOS Algorithm-RAFT Consensus algorithm

Unit IV ICO 12 Hours

Initial coin offering – Block chain fund raising methods -launching an ICO – Investing in an ICO -Pros and cons of ICO -Successful ICO- Evolution of ICO-ICO Platforms

Unit V Block chain and security 12 Hours

Security in Block chain- Security aspects in bit coin -security and privacy challenges of block chain -Performance and scalability -Identity management and authentication -Regulatory compliance and assurance – Applications of Block chain in Banking and finance – Education – Energy- Healthcare- Real estate – Supply chain – Block chain and IoT – Limitations and challenges of Block chain

f) Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO6	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO3	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1 PSO3	M H	K_1
CO2	PO1	M	PSO1	M	K_2
CO3	PO1 PO4	H L	PSO2	M	K_3
CO4	PO4 PO5 PO6	M M L	PSO2	H	K_4, K_5
CO5	PO3	M	PSO2 PSO3	M H	K_6
CO6	PO2 PO6	M L	PSO3	M	K_6

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create**)**

g. References:

1. Blockchain Technology: Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan, Universities Press 2021.
2. The Blockchain developer – EladElrom – A Press – 2020
3. Mastering Blockchain – Imran Bashir – Packt – 2020
4. Blockchain basics – Daniel Drescher – Apress– 2017

SOFTWARE TESTING

a. Course Code:---------

C	L	T	P
3	3	0	0

b. Course Objectives:

1. To understand Standard Software Testing Principles.
2. To learn the Functionality of Automated testing tools.
3. To find any defects or bugs that may have been created when the software was being developed
4. To increase confidence in the quality of the software
5. To prevent defects in the final product and to provide customers with a quality product and increase their confidence in the company

c. Course Prerequisites:

- Basic Knowledge in Software Engineering

d. Course Outcomes (COs):

CO1: Ability to understand various software testing techniques.
CO2: Ability to incorporate specialize testing responsibilities
CO3: Methods of test generation from requirements
CO4: Various test processes and continuous quality improvement
CO5: Ability to understand the software testing and quality metrics

e. Course Outline (COs)

Unit I **12 Hours**

Testing Environment and Test Processes: World - Class Software Testing Model – Building a Software Testing Environment – The Seven Step Testing process: Overview of Software Testing Process – Organizing for Testing – Developing the Test Plan – Verification Testing – Analyzing and Reporting Test Results – Acceptance Testing – Operational Testing – Post Implementation Analysis.

Unit II **12 Hours**

Testing Techniques and Levels of Testing: Using White Box Approach to Test design – Static Testing Vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs – Using Black Box Approaches to Test Case Design – Random Testing – Requirements based testing –Decision tables –State-based testing – Cause-effect graphing – Error guessing – Compatibility testing – Levels of Testing - Unit Testing - Integration Testing - Defect Bash Elimination. System Testing - Usability and Accessibility Testing – Configuration Testing - Compatibility Testing - Case study for White box testing and Black box testing techniques.

Unit III **12 Hours**

Incorporating Specialized Testing Responsibilities: Testing Client/Server Systems – Rapid Application Development Testing – Testing in a Multiplatform Environment – Testing Software System Security - Testing Object-Oriented Software – Object Oriented Testing – Testing Web based systems – Web based system – Web Technology Evolution – Traditional Software and Web based Software – Challenges in Testing for Web-based Software –Testing Data Warehouse - Case Study for Web Application Testing.

Unit IV **12 Hours**

Test Automation: Selecting and Installing Software Testing Tools - Software Test Automation – Skills needed for Automation – Scope of Automation – Design and

Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Tracking the Bug – Debugging – Case study using Bug Tracking Tool.

Unit V **12 Hours**

Software Testing and Quality Metrics: Testing Software System Security - Six-Sigma – TQM - Complexity Metrics and Models – Quality Management Metrics - Availability Metrics – Defect Removal Effectiveness - FMEA - Quality Function Deployment – Taguchi Quality Loss Function- Cost of Quality. Case Study for Complexity and Object- Oriented Metrics.

f. Mapping of COs to POs and PSOs

Course Outcome	PO Addressed PO1 to PO6	Correlation Level L/M/H	PSO Addressed PSO1 to PSO3	Correlation Level L/ M/ H	Cognitive Level K_1 to K_6
CO1	PO1	H	PSO1	H	K_1
CO2	PO2	M	PSO1	M	K_2
CO3	PO3 PO4	M M	PSO2	H	K_3
CO4	PO4	H	PSO2	H	K_4
CO5	PSO5 PSO6	M M	PSO3	M	K_5

g. Reference Book(s):

1. William Perry, Effective Methods of Software Testing, Third Edition, Wiley Publishing 2007
2. Srinivasan Desikan and Gopalaswamy Ramesh, Software Testing – Principles and Practices, Pearson Education, 2007.
3. Naresh Chauhan, Software Testing Principles and Practices, Oxford University Press, New Delhi, 2010.
4. Dale H. Besterfiled et al., Total Quality Management, Pearson Education Asia, Third Edition, 2006.
5. Stephen Kan, Metrics and Models in Software Quality, Addison – Wesley, Second Edition, 2004
6. Llene Burnstein, Practical Software Testing, Springer International Edition, Chennai, 2003.
7. Renu Rajani, Pradeep Oak, Software Testing – Effective Methods, Tools and Techniques, Tata McGraw Hill, 2004.
8. Edward Kit, Software Testing in the Real World – Improving the Process, Pearson Education, 1995.
9. Boris Beizer, Software Testing Techniques – 2nd Edition, Van Nostr and Reinhold, New York, 1990.

ETHICAL HACKING

a. Course Code:---------

C	L	T	P
3	3	0	0

b. Course Objectives:

- Introduces the concepts of Ethical Hacking.
- To understand the set Process.
- To get familiarized with Tools and Techniques of Ethical Hacking.
- Gives the students the opportunity to learn about different tools and techniques in Ethical hacking and security.
- Practically apply Ethical hacking tools to perform various activities.

c. Course Prerequisites:

- Basic Understanding of Network Security & Threat Mechanisms.

d. Course Outcomes (COs):

CO1: Ability to understand the processes involved in ethical hacking.
CO2 : Acquiring skills to analyze malware threats and developing solutions.
CO3 : Understand ethics behind hacking and vulnerability disclosure.
CO4 : Appreciate the impact of hacking
CO5: Exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies.

e. Course Outline:

Unit I **12 Hours**

Introduction to Ethical Hacking: Information security overview – skills of an ethical hacker – Hacking concepts and phases Types of attacks – Information Security threats, attack vectors, and controls – Information Assurance (IA) – Information Security Laws and Standards – Security Policies types, HR/legal implications – Physical Security – Threat Modeling – Enterprise Information Security Architecture (EISA) – Network Security Zoning.

Unit II **12 Hours**

Foot Printing & Reconnaissance: Foot printing concepts, threats, attack vectors and controls, Foot printing through Search Engines, Foot Printing through Social Networking sites, Website Foot printing, Competitive Intelligence, WHOIS Foot printing, Foot Printing tools. Scanning Networks: Scanning Methodology, techniques, and countermeasures - Techniques for IDS evasion, scanning, HTTP tunneling, and IP spoofing - Drawing network diagrams—latest network discovery and mapping tools, network discovery tools for mobile - Proxy chaining— latest proxy tools, proxy tools for mobile Enumeration: Protocols: NetBIOS, SNMP, LDAP, NTP, SMTP, DNS – Countermeasures – Techniques.

Unit III **12 Hours**

System Hacking: Cracking passwords, escalating privileges, executing applications, hiding files and covering tracks – Steganography application and classification, tools, methods/attacks on Steganography, Steganography detection tools. Practical: Foot Printing & Reconnaissance, Scanning Networks, Enumeration, System Hacking.

Unit IV **12 Hours**

Malware Threats: Introduction to malware – Trojans attacks, how to infect a system, crypters, how to deploy, latest types, analysis, countermeasures - Viruses—stages, types, latest virus maker, analysis, countermeasures - Worms— types, makers, analysis, countermeasures – Malware analysis - Antivirus tools - Penetration testing.

Unit V **12 Hours**

Sniffing: Attacks: MAC, DHCP, and spoofing - Poisoning: ARP and DNS – Tools Social Engineering: Concepts, techniques, impersonation, identity theft, and Counter measures - Phases of an attack - Common targets of an attack - Impersonation scenario - Computer based, mobile based, social networking based Denial of Service: Concepts, case study, tools, attack techniques, and Countermeasures Botnet - Scanning methods for vulnerable machines - Detection Techniques and tools. Session Hijacking: Concepts, case study, tools, attack techniques, and Countermeasures - Five stages of a web malware attack - Application level session hijacking - Network level session hijacking - TCP/IP Hijacking. Practical: Trojans and Backdoors, Viruses and Worms, Sniffers, Social Engineering, Denial of Service, Session Hijacking

f. Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed PO1 to PO6**	**Correlation Level L/M/H**	**PSO Addressed PSO1 to PSO3**	**Correlation Level L/ M/ H**	**Cognitive Level K_1 to K_6**
CO1	PO1	H	PSO1	H	K_1
CO2	PO1 PO2	M H	PSO2	M	K_2
CO3	PO3	M	PSO2 PSO3	M H	K_3
CO4	PO4	H	PSO3	H	K_4
CO5	PO5	M	PSO3	H	K_5

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

g. Reference Book(s):

1. Kimberly Graves, CEH: Certified Ethical Hacker Study Guide, Wiley; 2010.