DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
MANONMANIAM SUNDARANAR UNIVERSITY

M.Sc. Computer Science
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

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

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 field of computer science has undergone drastic changes in the past three decade. Although Computer Science has an influential presence in all other discipline, the field itself needs to be studied well in order to cope-up with the rapidly changing pace of technology. A three-year B.Sc. (computer Science) or BCA programme could lay a strong foundation in Computer Science at an early stage of the student. The M.Sc. (Computer Science) curriculum on the other hand introduces a student to more advanced development in certain areas and makes them familiar to apply them in the problems concerned with industry and research. This curriculum focuses on (i) the theory and practice behind the core as well as advanced areas of CS (ii) impart the ability to work on research projects (iii) give them an exposure to the emerging area in the form of elective courses. The degree would be awarded upon successful completion of the credit requirements for the course work and satisfactory performance of an independent project work.

REGULATIONS

Duration of the Prgramme: Two years (4 Semesters)

Eligibility:

Bachelor degree in B.Sc. (Computer Science.) / B.Sc. (Information Technology)/ B.Sc. (Software Engineering) B.Sc. (Computer Technology) or B.C.A. obtained from any UGC recognized University or any other degree accepted by the Syndicate of Manonmaniam Sundaranar University as equivalent in the 10+2+3 pattern with **at least 50% marks or above (45% marks or above for the SC/ST Category**) in Part III of the qualifying UG degree examinations are eligible to apply for the programme.

Entrance Test:

Applicants seeking admission to M.Sc. (CS) are required to appear for the **University Entrance Test** to be conducted by Manonmaniam Sundaranar University. Details of the Entrance test will be provided in the University Website at the time of admission notification.

Selection:

Selection of students for the M.Sc. (Computer Science) programme shall be based on the **combined marks obtained by the student in Part-III of the Qualifying UG Degree examination and the University Entrance Test** to be conducted by Manonmaniam Sundaranar University for the M.Sc. (Computer Science) programme for the respective year. **The weightage for the qualifying UG degree examinations and the University Entrance test will be 50% each.**

Selection of students for the available seats shall be based on the rank obtained by the student in the merit list as per Manonmaniam Sundaranar University admission guidelines and the Tamil Nadu Government reservation norms.

Admission:

The Admission of students to the M.Sc. (Computer Science) programme shall be done through a Common Counseling Process. The modalities of the Counseling will be decided by the University at the time of Admission.

Student Evaluation:

- Evaluation is based on continuous internal assessment (25%) and end-semester examination (75%) for theory courses. The Candidates must have a minimum score of 50% in the end semester examinations and 50% of total (internal & External) in each theory courses. The maximum Internal mark is 50 and the maximum External mark is 50 for the Practical courses / Mini Project / Major Project / Field Work / Internship.

- A Minimum of 75% attendance is required to appear for the University Examinations. The student failed to make the minimum required attendance shall not be permitted to appear the end semester examination.

- The student shall be awarded the respective degree upon successful completion of the course as per university norms.

Programme Specific Outcomes (PSO):

On Successful completion of the M.Sc. (Computer Science) degree programme, students will be able to

PSO1: Analyze, design and develop solutions to significant computational problems.
PSO2: Utilize tools and techniques necessary for computing practices.
PSO3: Participate in competitive exams such as SET, NET etc. effectively.
PSO4: Design, develop and evaluate novel projects to meet the desired demands of industry and society.
PSO5: Demonstrate best practices and standards to develop user interactive applications.
PSO6: Work with computing technologies and pursue career in the areas related to Computer Science.
PSO7: Function effectively as an individual or in teams involving multidisciplinary environments.

Programme Outcomes (PO):

On Successful completion of the programme, students will be able to;
PO1: Identify and understand the need for basic mathematical and Computational concepts and apply them to real world problems.
PO2: Design and develop applications to analyse and solve computer science related problems.
PO3: Design, implement and evaluate a computer-based system, process, component, or programme to meet the stakeholder needs.
PO4: Analyze, design and choose efficient algorithms and apply them in appropriate computational solutions.
PO5: Analyse large data sets in the context of real world problems and interpret results using data analytics.
PO6: Understand research methods and apply them to analyse data for decision making.
PO7: Realize the importance of lifelong learning and continuous professional development.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
M.Sc. Computer Science
Course Structure & Scheme of Examination [Effect from AY 2022 – 2023]

COURSE NAME : **M.Sc. (Computer Science)**
SEMESTER : **I**

Sl. No	SUB CODE	SUBJECT TITLE	C	L	T	P	INT	EXT
1		Mathematical Foundations for Computer Science	4	3	1	0	25	75
2		Advanced Computer Architecture	4	3	1	0	25	75
3		Design and Analysis of Algorithms (e-PGPathshala)	4	3	1	0	25	75
4		Advanced Operating System	4	3	1	0	25	75
5		Web Technologies	4	3	1	0	25	75
6		Web Technologies Lab	2	0	0	4	50	50
7		Design and Analysis of Algorithms Lab	2	0	0	4	50	50
8		Soft Skill Development	1	0	0	2	50	50
		TOTAL	**25**	**15**	**5**	**10**		

COURSE NAME : **M.Sc. (Computer Science)**
SEMESTER : **II**

Sl. No	SUB CODE	SUBJECT TITLE	C	L	T	P	INT	EXT
1		Supportive Course	3	3	0	0	25	75
2		Advanced Computer Networks	4	3	1	0	25	75
3		Advanced Database Management System	4	3	1	0	25	75
4		Principles of Compiler Design	4	3	1	0	25	75
5		Elective I	3	3	0	0	25	75
6		Advanced Database Management System Lab	2	0	0	4	50	50
7		Advanced Computer Networks Lab	2	0	0	4	50	50
8		Industrial Seminar & Report Writing	1	0	0	2	50	50
9		Career guidance / Library / Yoga / Mentoring	0	0	2	0		
		TOTAL	**23**	**15**	**5**	**10**		

COURSE NAME : **M.Sc. (Computer Science)**
SEMESTER : **III**

Sl. No	SUB CODE	SUBJECT TITLE	C	L	T	P	INT	EXT
1		Supportive Course	3	3	0	0	25	75
2		Block Chain Technology	4	3	1	0	25	75
3		Big Data Analytics using Machine Learning	4	3	1	0	25	75
4		Internet Of Things	4	3	1	0	25	75
5		Elective II	3	3	0	0	25	75
6		Big Data Analytics using Machine Learning Lab	2	0	0	4	50	50
7		Internship	1	0	0	0	50	50
8		Mini Project	6	0	0	6	50	50
9		Career guidance / Library / Yoga / Mentoring	0	0	2	0		
		TOTAL	**27**	15	5	10		

Note:

- Internship should be completed during summer vacation before third semester commencement.
- Students should bring the completed internship certificate issued by the concerned organization.
- Internship evaluation will be done in the first week of third semester.

COURSE NAME : **M.Sc. (Computer Science)**
SEMESTER : **IV**

S.No	SUB CODE	SUBJECT TITLE	C	L	T	P	INT	EXT
1		Major Project	16	0	0	30	50	50
TOTAL CREDITS 16								

Credit summary for M.Sc. (Computer Science)	
SEMESTER I	25
SEMESTER II	23
SEMESTER III	27
SEMESTER IV	16
TOTAL CREDITS	**91**

LIST OF ELECTIVE COURSES

ELECTIVE I

Sl. No	SUB CODE	SUBJECT TITLE	C	L	T	P	INT	EXT
1.		Cloud Computing	3	3	0	0	25	75
2.		Human Computer Interaction	3	3	0	0	25	75
3.		Embedded Systems	3	3	0	0	25	75
4.		Machine Learning	3	3	0	0	25	75
5.		Evolutionary Algorithms	3	3	0	0	25	75
6.		Digital Image Processing	3	3	0	0	25	75
7.		Cryptography and Network Security	3	3	0	0	25	75

ELECTIVE II

S.No	SUB CODE	SUBJECT TITLE	C	L	T	P	INT	EXT
1.		Deep Learning	3	3	0	0	25	75
2.		Soft Computing	3	3	0	0	25	75
3.		Ethical Hacking	3	3	0	0	25	75
4.		Software Testing	3	3	0	0	25	75
5.		Software Project Management	3	3	0	0	25	75
6.		Bioinformatics	3	3	0	0	25	75
7.		Wireless Sensor Network	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)

MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE

C	L	T	P
4	3	1	0

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

b. Course Objectives:

1. To introduce the concepts of sets and perform associated operations on them.
2. To introduce the concepts of mathematical logic.
3. To provide basic understanding on abstract algebraic structures
4. To construct graphs, automata and discuss its applications
5. To understand queuing systems and their classifications

c. Course Prerequisites:

1. Basic Knowledge in Mathematics
2. Knowledge of the fundamental concepts in the undergraduate level

d. Course Outcomes (COs):

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

CO1: Evaluate the validity of logical arguments and construct mathematical proofs

CO2: administer all the basic operations with sets

CO3: understand abstract algebraic structure like groups and their properties

CO4: Analyse whether given graphs are isomorphic and apply different algorithms to find the shortest path Apply Mathematical techniques into many areas of Computer science like Algorithms, Computer Networks , Cryptography etc.

CO5: Apply Mathematical techniques into many areas of Computer science like Algorithms, Computer Networks , Cryptography etc.

e. Course Outline:

Unit – 1 : Set theory – relations and functions **10 Hours**

Sets – Some operations on sets – The principle of Duality – Relations – Equivalence relation – Functions – Composition of functions

Unit – 2 : Mathematical logic **10 Hours**

Connectives – Converse, contra positive and inverse statements – Tautologies and contradictions – Duality law and dual statements – The other connectives – Functionally complete set of connectives - Normal forms – Canonical forms – The theory of inferences – Quantifiers - Nested Quantifiers

Unit – 3 : Groups **10 Hours**

Algebraic system – Group – Subgroup – Cyclic group – Morphism of groups – Kernel of Homomorphism – Cosets and Lagrange's theorem – Normal subgroup

Unit – 4 : Graph Theory and Automata **15 Hours**

Graph Theory *:* Graphs – Subgraphs – Isomorphism – Some special classes of graphs – connectedness – Euler graphs – Hamiltonian Graphs – Trees – Matrices - Shortest path problem – Dijkstra's Algorithm for shortest path – Kruskal's Algorithms – Spanning trees – Networks

Automata *:* Formal languages – Phase structure grammar – Context free grammar – Automation – Pushdown automation – Regular sets – Finite state automation

Unit – 5 : Probability and Queuing theory **15 Hours**

Probability : Probability theory – Random variables

Queuing Theory : Queuing system – Operating characteristics of a queuing system – Deterministic queuing system – probability distribution in queuing systems – Classification of queuing models – Definition of transient and steady states – Poisson queuing systems

f. Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7		**Correlation Level** L/M/H		**PSO Addressed** PSO1 to PSO7		**Correlation Level** L/ M/ H		**Cognitive Level** K_1 to K_6
CO1	PO1		H		PSO6		H		K_4
CO2	PO1		H		PSO6		M		K_3
CO3	PO1		H		PSO1		H		K_2
CO4	PO4		M		PSO4		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. Textbooks:

Unit – 1 *:* Discrete mathematics by Sankar K, Indian Publishers, Third Edition – Chapter 2

Unit – 2 : Discrete mathematics by Sankar K, Indian Publishers, Third Edition – Chapter 1

Unit – 3 *:* Discrete mathematics by Sankar K, Indian Publishers, Third Edition – Chapter 4, (pg no. 4.1 to 4.51)

Unit – 4 *:* Discrete Mathematics by K. Chandrasekhara Rao, Narosa Publications – Chapter 9 (pg. No. 9.1 to 9.12 and 9.24 to 9.40), Chapter 10 (pg. No 10.1 to 10.32)

Unit – 5 *:* Discrete Mathematics by S. Santha, Cengage Learning Publications – Chaper 11 (pg.no 527 to 565)

Operations Research by Kanti Swarup, P. K Gupta, Man Mohan, Sultan Chand & Sons – Chapter 21 - 21.1 to 21.9 (pg. No. 589 - 624)

ADVANCED COMPUTER ARCHITECTURE

C	L	T	P
4	3	1	0

a. Course Code :

b. Course Objectives:

- Understanding basic computer system.
- To understand the basic pipelining techniques
- To know the working principle of I/O devices
- To understand the memory management techniques

c. Course Prerequisite:

- Should know the basic knowledge of computer system,and knowledge of processor

d. Course Outcome (COs): Upon completion of the student should able to

C01: Find the performance of the system using performance metrics

C02: Perform the arithmetic for computer and design for ALU

C03: Know the concept of various memories

C04: Implement the pipelining concepts

C05: Design algorithms for memory management techniques

CO6: Know the concept of parallel processors

f. Course Outline:

UNIT I: Fundamentals of Computer Systems **12 Hours**

Functional Units of a Digital Computer - Operation and Operands of Computer Hardware – Software Interface – Translation from a High Level Language to Machine Language – Instruction Set Architecture – RISC and CISC Architectures – Addressing Modes – Performance Metrics– Power Law – Amdahl's Law.

UNIT II: Arithmetic for Computers **12 Hours**

Addition and Subtraction – Fast Adders – Multiplication: Booths Algorithm, Bit Pair Recoding – Division: Restoringand Non-Restoring – Floating Point Numbers: Single and Double Precision – Arithmetic Operations - ALU Design.

UNIT III: Processor **12 Hours**

Design Convention of a Processor – Building a Datapath and designing a Control Unit – Execution of a Complete Instruction – Hardwired and Micro programmed Control –Instruction Level Parallelism – Basic Concepts of Pipelining – Pipelined Implementation of Datapath and Control Unit – Synchronization - Hazards – Structural, Data and Control Hazards.

UNIT IV: Memory and I/O **12 Hours**

Types of Memories – Need for a hierarchical memory system – Cache memories – Memory Mapping – Improving Cache Performance – Virtual Memory – Memory Management Techniques – accessing I/O devices–Programmed Input/output – Interrupts – Direct MemoryAccess.

UNIT V: Parallel Processing **12 Hours**

Exploitation of more ILP – Dynamic Scheduling: Tomasulo's Algorithm – Introduction to Multicore – Graphics Processing Units – Overview of Next GenerationProcessors.

f. Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO8		**Correlation Level** L/M/H		**PSO Addressed** PSO1 to PSO7		**Correlation Level** L/ M/ H		**Cognitive Level** K_1 to K_6
CO1	PO1		H		PSO2		L		K_1
CO2	PO1	PO2	H	M	PSO1	PSO4	H	H	K_2
CO3	PO4	PO1	H	M	PSO1	PSO2	H	H	K_3
CO4	PO2	PO4	H	M	PSO1		M		K_4
CO5	PO4		H		PSO6		M		K_5
CO6	PO6	PO7	H	H	PSO6		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. References books:

1. David A. Patterson, John L. Hennessy, "Computer Organization and Design: The Hardware / Software Interface", Fifth Edition, Moran Kaufmann / Elsevier,2013.

2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGrawHill, 2012.

3.William Stallings, "Computer Organization and Architecture – Designing for Performance", TenthEdition, Pearson Education, 2016.

4.John L. Hennessey, David A. Patterson, "Computer Architecture – A Quantitative Approach", MorganKaufmann / Elsevier Publishers, Fourth Edition, 2007.

5.V.P. Heuring, H.F. Jordan, "Computer Systems Design and Architecture", Second Edition, Pearson Education, 2004. 6. Behrooz Parhami, "Computer Architecture", Oxford University Press, 2007.

6.Douglas E. Comer, "Essentials of Computer Architecture", Sixth Edition, Pearson Education, 2012.

DESIGN AND ANALYSIS OF ALGORITHMS (e-PGPathshala)

C	L	T	P
4	3	1	0

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

b. Course Objectives:

1. Learn fundamental algorithmic design paradigms
2. Design algorithms using popularly used strategies like greedy, divide and conquer, dynamic programming etc.
3. Analyze the algorithmic procedure to determine the computational complexity of algorithms

c. Course Prerequisites:

1. Exposure to introductory course on programming languages
2. Basic Concepts of Data Structures
3. Some Basic Mathematics

d. Course Outcomes (COs):

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

CO1: Identify the Characteristics of an algorithm

CO2: Understand the problem-solving approaches using computers

CO3: Compute the time complexity of an algorithm

CO4: Analyze the performance of an algorithm in solving a problem

CO5: Compare the performance of various algorithms in solving a specific-problem

CO6: Develop algorithms for solving real-time problems

e. Course Outline:

Unit I: 9 Hours

Elementary Data Structures: logical structure and operations of arrays, lists, stacks,queues. Traversal and Search Techniques: Binary Trees - in order, pre order, post order, Graphs: BFS – DFS.

Unit II: 15 Hours

Applications of data structures: polynomial manipulation – arithmetic expression evaluation – expression tree.

Algorithm analysis: space complexity - definition and examples - time Complexity - definition and examples - Asymptotic Notations - example solutions.

Unit III: 12 Hours

Divide and Conquer algorithms: general method – binary search: algorithm and example– Quick Sort: algorithm and example – Selection sort: algorithm and example - Defective Chessboard: algorithm and example - Strassen's Matrix Multiplication: problem statement, algorithm and example - finding the maximum and minimum: algorithm, example and time complexity analysis - Merge Sort: algorithm, example and time complexity analysis.

Unit IV: **13 Hours**

Greedy algorithms: general method - container loading problem:problem statement, algorithm and example - Knapsack Problem: problem statement, algorithm and example – job sequencing with deadlines: problem statement, algorithm and example - minimum cost spanning trees: definition - Prim's algorithm - Kruskal's algorithm - example.

Dynamic Programming algorithms: general method – multistage graphs: problem statement, algorithm and example– all-pairs shortest paths problem: problem statement, algorithm and example- 0/1 knapsackproblem: problem statement, algorithm and example- traveling salesperson problem: problem statement, algorithm and example.

Unit V: **11 Hours**

Backtrackingalgorithms: general method – 8-queens problem: problem statement, algorithm and example–sum of subsets: problem statement, algorithm and example – graph coloring: problem statement, algorithm and example – Hamiltonian Cycles: problem statement, algorithm and example – knapsack Problem: algorithm and example.

Branch and Bound method: Least Cost search method - 0/1 knapsack Problem: algorithm and example.

f. Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7			**Correlation Level** L/M/H			**PSO addressed** PSO1 to PSO7		**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			PSO6		H		K_4
CO5	PO6			M			PSO3	PSO5	H	M	K_5
CO6	PO3	PO5	PO7	M	H	M	PSO5	PSO7	M	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. References:

1. Web Link: https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQKJvP3a/8Vd3L08tQ== (e-PGPathshala (inflibnet.ac.in)
2. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and SanguthevarRajasekaran, ISBN: 9788173716126, Universities Press.
3. Data Structures Using C and C++ Y. Langsam, M. Augenstein and A. M. Tenenbaum, Prentice - Hall of India Pvt. Ltd. 2013, ISBN: 81-203-1177-9.
4. Data structures and Algorithms, Alfred V. Aho, John E. Hopcroft and Jeffrey D Ullman, Pearson Education India, ISBN: 9788177588262, 9788177588262.
5. Introduction to the Design and Analysis of Algorithms, Anany Levitin, ISBN-10 : 9332585482; ISBN-13 : 978-9332585485, Pearson.

ADVANCED OPERATING SYSTEMS

C	L	T	P
4	3	1	0

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

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 2 **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 3 **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 4 **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 web server on a website. **Connection establishment**: Instructions to Install My SQL on linux - Connecting to the MySQL Server with the my sql Client - Basic Operations with My SQL: show, create, describe, add, delete operations. Managing Services - core components and libraries - Ancillary components - Configuration of system.

Unit 5 **14 Hours**

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 PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7	**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 PSO4	H M	K_3
CO4	PO4	H	PSO6	H	K_4
CO5	PO6	M	PSO3 PSO5	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. References

1. William Stallings - Operating Systems: Internals and Design Principles, 800 pages, Pearson Education,ISBN-10: 9352866711; ISBN-13: 978-9352866717
2. **Richard** Petersen, Linux - The Complete Reference, 830 pages, McGraw Hill Education;ISBN-10: 007149247X; ISBN-13: 978-0071492478.
3. https://web.njit.edu/~alexg/courses/cs332/OLD/S2020/s20hand3/Linux-Tutorial.pdf
4. Andrew S.Tanenbaum - Modern Operating Systems, pages 728, ISBN: 0135881870, 9780135881873,Prentice-Hall international editions
5. Achyut S Godbole- Operating Systems, 692 pages, ISBN: 007059113X, 9780070591134, Tata McGraw-Hill Education
6. Silberschatz, Abraham, Peter B. Galvin, and Greg Gagne. Operating System Concepts. John Wiley & Sons, 951 pages, ISBN: 812650885X, 9788126508853.

WEB TECHNOLOGIES

a. Course Code:

C	L	T	P
4	3	1	0

b. Course Objectives:

1. To learn new emerging web technologies.
2. To gain knowledge and skills required for web development careers.
3. To develop skills in the students to design and implement complete applications over the web.

c. Course Prerequisites:

HTML, HTML5, CSS, XML

d. Course Outcomes* (COs):

At the end of the Course, the student will be able to -

CO1: Understand the working concepts of WWW.

CO2: Design web page to perform form validation using client-side scripting language.

CO3: Develop web applications using PHP.

e. Course Outline:

Unit I: Web Basics and Overview **9 Hours**

Essential elements of WWW - web client – web server – website – web pages – Web Architecture – Protocols governing the web – Internet Standards – Things to be noted during web application development – Exploring web technologies – programming vs. scripting – client side vs. server side – Introduction to web services – website vs. web services.

Unit II: Client Side Programming **14 Hours**

Review of older technologies HTML5, CSS & XML – Introduction to JavaScript: JavaScript language – declaring variables, scope of variables functions, event handlers (on click, on submit etc.), Document Object Model, Form validations. AJAX – XML Http Request (XHR) – Create Object – Request – Response – Ready state.

Unit III: Introduction to PHP **12 Hours**

Evolution of PHP – Variables in PHP – Data Types – Operators and Expressions –Decision handling– Looping concepts– Strings and associated functions– Arrays– Functions – Object Oriented Programming using PHP.

Unit IV: Handling forms with PHP **13 Hours**

Capturing Form Data with PHP – Multiple value fields – Generate Web forms with PHP – Store PHP variables in Forms – Redirecting after form submission –Preserving State With Query Strings, Cookies and Sessions: Saving State with Query Strings – Working with Cookies – Using PHP Sessions to Store Data.

Unit V: PHP with MYSQL **12 Hours**

Introduction to My SQL, data types – SQL commands-CREATE, UPDATE, INSERT, DELETE, SELECT – PHP functions for My SQL connectivity and operation – my sql_connect, my sql_select_db, my sql_query, – Updation and deletion of data using PHP – Displaying data from MySQL in webpage – Displaying data from MySQL in webpage.

f. Mapping of Cos to POs and PSOs

Course Outcome	PO Addressed		Correlation Level		PSO Addressed		Correlation Level		Cognitive Level
CO1	PO1		H		PSO5		H		K_1, K_2
CO2	PO2	PO3	H	H	PSO5	PSO6	H	H	K6
CO3	PO2	PO3	H	H	PSO3	PSO4	H	H	K6

(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. Uttam K Roy, Web Technologies, Oxford University Press, 2013.
2. Luke Welling, Laura Thomson, PHP and My SQL Web Development, Pearson Education, Inc, 2009.
3. Kogent Learning Solutions Inc., Web Technologies Black Book, Dreamtech Press, 2009.

WEB TECHNOLOGIES LAB

a. Course Code:

C	L	T	P
2	0	0	4

b. Course Objectives:

1. To learn new emerging web technologies.
2. To gain knowledge and skills required for web development careers.
3. To develop skills in the students to design and implement complete applications over the web.

c. Course Prerequisites:

HTML, HTML5, CSS, XML

d. Course Outcomes* (COs):

At the end of the Course, the student will be able to -

CO1: Understand the working concepts of WWW.

CO2: Design web page to perform form validation using client-side scripting language.

CO3: Develop web applications using PHP.

e. Course Outline: **60 Hours**

List of Experiments

1. Install the following on the local machine: Apache Web Server, Tomcat Application Server locally, Install My SQL and install PHP and configure it to work with Apache web server and My SQL.
2. Write JavaScript Program to show light ON/OFF.
3. Write an HTML page including any required JavaScript that takes a number from one text field in the range of 0 to 999 and shows it in another text field in words. If the number is out of range, it should show "out of range" and if it is not a number, it should show "not a number" message in the result box.
4. Write a HTML page that has one input, which can take multi-line text and a submit button. Once the user clicks the submit button, it should show the number of characters, words and lines in the text entered using an alert message. Words are separated with white spaces and lines are separated with new line character.
5. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).
6. Write a program to print "Welcome to PHP".
7. Write a simple PHP program using expressions and operators.
8. Write a PHP program to demonstrate the use of Decision making control structures using
    a. If statement
    b. If-else statement
    c. Switch statement
9. Write a PHP program for creating and manipulating
    i. Indexed array
    ii. Associative array
    iii. Multidimensional array
10. A. Write a PHP program to-
    a) Calculate length of string.
    b) Count the number of wordsin string without using string functions.

    B. Write a simple PHP program to demonstrate use of various built-in string functions.

11. Design a web page using following form controls:
    a. Text box, b. Radio button, c. Check box, d. Buttons
12. Write a PHP program for sending and receiving plain text message (email)
13. Write simple PHP program to
    a. Set cookies and read it.
    b. Demonstrate session management
14. Develop a simple application to
    1. Enter data into database
    2. Retrieve and present data from database.

15. Develop a simple application to Update, Delete table data from database.

f. Mapping of Cos to POs and PSOs

Course Outcome	**PO Addressed**		**Correlation Level**		**PSO Addressed**		**Correlation Level**		**Cognitive Level**
CO1	PO1		H		PSO5		H		K_1, K_2
CO2	PO2	PO3	H	H	PSO5	PSO6	H	H	K6
CO3	PO2	PO3	H	H	PSO3	PSO4	H	H	K6

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

DESIGN AND ANALYSIS OF ALGORITHMS - LAB

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

C	L	T	P
2	0	0	4

b. Course Objectives:

Implement algorithms using popularly used strategies like greedy, divide and conquer, dynamic programming etc.

c. Course Prerequisites:

1. Exposure to introductory course on programming languages
2. Some Basic Mathematics

d. Course Outcomes (COs):

At the end of the Course ,the student will be able to –

CO: Implement algorithms for solving real-time problems

e. Course Outline:

List of Experiments: **60 Hours**

Lab exercises related to problems that are solved using the below mentioned topics shall be given.

a. Tree traversal algorithms
b. Graph traversal algorithms
c. Algorithms using Divide and Conquer method
    i. Finding maximum and minimum algorithm
    ii. Sorting algorithms
d. Algorithms using Greedy method
    i. Container loading Problem
    ii. Knapsack Problem
    iii. Job sequencing algorithm
    iv. minimum cost spanning tree
    v. Sum of subsets problem
e. Algorithms using Dynamic Programming method
    i. 0/1 Knapsack problem
    ii. Single source shortest paths problem
    iii. All-Pairs Shortest Paths Problem
f. Algorithms using Backtracking method
    i. Travelling Salesman Problem
    ii. 8 Queen's problem

f. Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed**PO1 to PO7				**Correlation Level**/ M/H				**PSO Addressed** PSO1 to PSO7				**Correlation Level** /M/ H				**Cognitive Level** K_1 to K_6
CO	PO1	PO2	PO3	PO4	L	H	M	M	PSO1	PSO3	PSO6	PSO6	M	H	M	M	K_4,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)

SOFT SKILL DEVELOPMENT

a. Course Code:

C	L	T	P
1	0	0	2

b**. Course Objectives:**

1. To bring out professional development of the students by training them towards employability skills, life skills, communicative skills and interview skills which in turn helps the students to move into a desired occupation.
2. To integrate holistically developed individuals, equipped with the appropriate skill sets that enable them to make a difference at the societal level.
3. To help students in career planning through counseling wherein they gather information about themselves in terms of their interests, aptitudes and abilities so that they can choose their career more effectively.

c. Course Prerequisites:

- A well- equipped language lab.
- A well- furnished classroom with projector and PA system.
- Students who aspire to become successful professionals

d. Course Outcomes (COs):

At the end of the Course, the student will be able to -

CO1: Reproduce their educational outcomes and the necessary life skills to take on a successful professional career.

CO2: Transform into a socially responsible citizens through their holistic development.

CO3: Articulate and perform well at placement interviews and other recruitment procedures.

CO4: Experiment and better utilize their potential for success and achievement and help them be better organized.

CO5: Distinguish their inter-personal skills, team management skills, and leadership skills as self-confident individuals.

CO6: Create himself/herself as an empowered leader for tomorrow.

e. Course Outline:

Unit I

Communicative Skills **6 Hours**

Understanding the communicative environment-Communication styles - Listening Comprehension - Listening and answering questions - What to listen for and why– Reading Comprehension -Vocabulary building –Phonetics - Intonation - Ear training - Correct Pronunciation - Sound recognition exercises - Common Errors in English. One to One Conversations - Introducing oneself to the audience - Introducing a topic - Elements of effective presentation - Structure of presentation - Presentation tools -Multimedia presentation - Understanding the basics - What to present and how to present - Voice Modulation- Audience analysis - Video samples

Unit II

Interactive and Writing Skills **6 Hours**

Speaking - When to speak and how - Starting and sustaining a conversation –Speaking in groups– Group Discussion strategies – Understanding groups, conflicts and their resolutions Participating in group discussions - understanding group dynamics - brainstorming the topic - questioning and clarifying -GD strategies - activities to improve GD skills - viewing recorded GD – Activities to improve Group Discussion skills – Mock Group Discussion, Report Writing – Resume preparation - Letter writing/ Email Communication.

Unit III

Interview Skills **6 Hours**

Interview etiquette – Dress code – Body Language – Mock interview – Attending job interviews – Technical interview – Required Key Skills - Skype interview –One to one interview – Panel Interview - Answering confidently – Motivating oneself – Leadership and motivating others - Emotional and cultural intelligence - Corporate culture - FAQsin interviews.

Unit IV

Soft Skills **6 Hours**

Highlights of Developing Soft Skills and Personality - Self-Management Skills – Training in soft skills – Sociability skills – Interpersonal skills – Time Management–Critical thinking – Problem Solving – Team building skills – Leadership skills – Life skills – Adaptability – Building relationships– Facial Expressions –What makes others Like/Dislike you? –Controlling Anger - Team Work - Thinking Out the Box.

Unit V

Holistic Development **6 Hours**

Entrepreneurship – Accountability -Stress Management - Positive Attitude - Sustainable Development - Conflict Resolution -Social Responsibility -Personal Well-being - Managing Relationship in Workplace - Managing Mind and Memory- Improving Memory- Care for Environment – Managing Personality – Managing Freedom, – Business Ethics and Etiquette - Definitions and Types of Mindsets-Learning Mindsets- Secrets of Developing Growth Mindsets.

f. Mapping of Cos to POs and PSOs

Course Outcome	PO Addressed	Correlation Level	PSO Addressed	Correlation Level	Cognitive Level
CO1	PO1	L	PSO1	L	K_1
CO2	PO4	H	PSO5	H	K_2
CO3	PO6	M	PSO2	M	K_3
CO4	PO2	M	PSO4	M	K_4
CO5	PO3	H	PSO6	H	K_5
CO6	PO5	H	PSO3	H	K_6

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

g. Books and References

1. Dorch, Patricia. What Are Soft Skills? New York:Execu Dress Publisher, 2013.
2. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers,Teams, and Leaders. Washington, DC: Pfeiffer&Company, 2013.
3. Klaus, Peggy, Jane Rohman& Molly Hamaker.The Hard Truth about Soft Skills. London:HarperCollins E-books, 2007.
4. Petes S. J., Francis. Soft Skills and ProfessionalCommunication. New Delhi: Tata McGraw-HillEducation, 2011.
5. Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success.Canada: Wiley & Sons, 2006.

ADVANCED COMPUTER NETWORKS

C	L	T	P
4	3	1	0

a) Course code:

b) Course Objectives:

1. have a basic knowledge on the concept of networks
2. know the idea on protocols, OSI layers and its functions.
3. 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

g. Mapping of Cos to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7			**Correlation Level** L/M/H			**PSO Addressed** PSO1 to PSO7		**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	H	M	M	PSO2	PSO4	M	M	K_3
CO4	PO4	PO5		H	M		PSO2		H		K_4, K_5
CO5	PO3	PO5		M	H		PSO4	PSO5	H	M	K_6
CO6	PO6	PO7		M	M		PSO6	PSO7	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**)**

h. References:

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

ADVANCED DATABASE MANAGEMENT SYSTEMS

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 Mongo DB commands.
5) Write several queries such as XML Query, No SQL, 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 No SQL

e. Course Outline:

Unit I: **14 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, Inter-query Parallelism, Intra-query 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 Multi-set, 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: **8 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 PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7		**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	PSO4		H		K_3
CO5	PO1	H	PSO1	PSO2	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 Introduction to Database 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.

Web Resources:

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

PRINCIPLES OF COMPILER DESIGN

a. Course Code:

C	L	T	P
4	3	1	0

b. **Course Objectives:**

1. To learn the various phases of compiler
2. To learn the parsing techniques
3. To understand intermediate code generator and runtime environment
4. To learn to implement front end of the compiler
5. 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 ofa 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 – attributeddefinitions – 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 PO8		**Correlation Level** L/M/H		**PSO Addressed** PSO1 to PSO7		**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	PSO3	M	H	K_2
CO3	PO5	PO1	H	M	PSO1	PSO4	H	H	K_3
CO4	PO2	PO4	H	M	PSO1		M		K_4
CO5	PO4		H		PSO5		H		K_5
CO6	PO6	PO7	H	H	PSO6		H		K_6

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 Principlesand 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.

ADVANCED DATABASE MANAGEMENT SYSTEM LAB

C	L	T	P
2	0	0	4

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

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 PO7			**Correlation Level** L/M/H			**PSO Addressed** PSO1 to PSO7			**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

ADVANCED COMPUTER NETWORKS LAB

a) Course code:

C	L	T	P
2	0	0	4

b) Course Objectives:

1. have a basic knowledge on the concept of networks
2. know the idea on protocols, OSI layers and its functions.
3. get the practical 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: perform simulations of network communication

CO2: analyze the performance of different protocols and topologies.

e) Course Outline: **60 Hours**

1. Perform the simulations of different topologies using the kits.
2. Perform the simulations of various topologies and find the throughput, packet delivery ratio, jitter, delay.
3. Analyze the various topologies based on the above metrics.
4. Write code for simulation of AODV, DSDV, DSR protocols and compare them using Net Sim.
5. Write NS2 code for simulating the topologies.
6. Write NS2 code for simulating AODV,DSDV and DSR protocols
7. Write NS2 code for simulating broadcasting
8. Write NS2 code for simulating TCP and UDP protocols.
9. Write NS2 code for finding the misbehaving node in a network.
10. Write code for implementing RSA Algorithm.

Course Outcome	**PO Addressed** PO1 to PO7				**Correlation Level** M/H	**PSO Addressed** PSO1 to PSO7		**Correlation Level** M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	PO2	PO4	PO6	H	PSO1	PSO5	H	K_1,K_6
CO2	PO1	PO2	PO4	PO6	H	PSO1	PSO5	M	K_1,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**)**

INDUSTRIAL SEMINAR & REPORT WRITING

a. Course Code: _____

C	L	T	P
1	0	0	2

b. Course Objectives:

- To educate the learners about industry environment and provide industrial exposure
- To develop the professional and technical skills to fulfill the criteria of industries
- To enhance knowledge, skill, attitude and the right kind of aptitude to meet the manpower requirements of the Industry
- To provide practical training by industry experts to make the students industry ready

c. Course Outcomes (COs):

At the end of the course, the student will be able to
CO1: Understand the Industry environment and possess industry exposure
CO2: Apply for job in Industries and attend the interview with confidence
CO3: Fulfill the requirements of Industry by developing knowledge, skills and right kind of attitude.
CO4: Develop awareness about workplace behavior and team skills
CO5: Prepare professional report and make presentations on real-time projects

d.Course Outline Total Hours: **30 Hours**

Guidelines for conducting Industry Seminar
The following guideline is proposed to conduct Industry Seminar as part of the programme.

- ✓ A minimum of 2 hours per week may be allotted for Industrial Seminar and Report writing
- ✓ An Industry expert may be invited to deliver the seminar on suggested topics.
- ✓ The students may be asked to submit a report on seminar deliverance after attending the seminar. At end of the semester, every student is required to prepare a file containing documentary report on delivered content as proof of the activity. The evaluation of these activities will be done by Course Coordinator and score may be awarded.
- ✓ Online Quiz/Test/ Mock Interview may be conducted at regular interval to evaluate the performance of the students. Internal marks will be awarded based on the performance.

Suggested Topics

- ➢ Human Resources
- ➢ Data Management
- ➢ Solution Building
- ➢ Product Management
- ➢ Design – Visual UI/UX
- ➢ Project Management
- ➢ Quality in Software
- ➢ Software Testing & Regression
- ➢ Product Marketing
- ➢ Software sales and pre-sales
- ➢ Data Analytics – Artificial Intelligence /Machine Learning
- ➢ Developments & Deployment in cloud
- ➢ Software Security

- Internet of Things
- Industry 4.0 & Software

e. Mapping Matrix of COs with Pos and PSOs.

Course Outcome	**PO Addressed** PO1 to PO7		**Correlation Level** L/M/H		**PSO Addressed** PSO1 to PSO7		**Correlation Level** L/ M/ H		**Cognitive Level** K_1 to K_6
CO1	PO3		M		PSO2	PSO6	M		K_2
CO2	PO3	PO7	M	M	PSO3	PSO5	M	H	K_3
CO3	PO3	PO6	M	M	PSO2	PSO6	H	M	K_6
CO4	PO2	PO3	M	H	PSO7		H		K_5
CO5	PO3	PO4	H	H	PSO4	PSO5	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

BLOCK CHAIN TECHNOLOGY

a) Course code:

C	L	T	P
4	3	1	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 PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7	**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	PSO4, PSO5	M, H	K_6
CO6	PO2, PO6	M, L	PSO4	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

BIG DATA ANALYTICS USING MACHINE LEARNING

C	L	T	P
4	3	1	0

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

b. Course Objectives:

1. To understand the need of Big Data Analytics and Machine Learning challenges with differentmethods.
2. Understanding of Hadoop Architecture and Spark with its complete Ecosystems.
3. Processing of Data with Advanced architectures like Spark.
4. Understand the Machine Learning algorithms.
5. Write own Machine Learning programs from the scratch.

c. Course Prerequisites:

1. Basic understanding of Hadoop, Machine Learning and Data Analytics preliminary concepts.
2. Basic level programming knowledge in Python/ Java and basic Windows command statements.

d. Course Outcomes (COs):

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

C01 : Understand and work on Hadoop Framework and its Ecosystems.

C02 : Analyse the Big Data using Map-reduce programming in Both Hadoop and by using Sparkframework.

C03 : Understand Spark Programming by programming in python.

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

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

C06 : To be able to work with latest cutting edge techniques for the Industry and the Research.

e. Course Outline:

UNIT-1 BIGDATA ANALYTICS & HADOOP **Hours: 12**

Introduction to Big Data - Introduction – Big Data – Designing Data Architecture – Data Sources, Quality, Pre-Processing and Storing – Data Storage and Analytics – Big Data Analytics Applications and Case Studies. **Hadoop** : Hadoop and its ecosystem – Hadoop Distributed File System – Mapreduce

Framework and Programming Model – Hadoop YARN – Hadoop Ecosystem Tools.

UNIT-2 NoSQL BIG DATA MANAGEMENT **Hours:12**

NoSQL Database: Introduction – NoSQL Data Store – NoSQL Data Architecture Patterns – NoSQL to Manage Big Data – MongoDB Database.

UNIT-3 MapReduce, Hive, HiveQL, Pig Latin **Hours: 12**

MapReduce: MapReduce Map Tasks, Reduce Tasks and MapReduce Execution – Composing Map Reduce for Calculations and Algorithms – **Hive:** Hive - HiveQL – **Pig**.

UNIT-4 SPARK PROGRAMMING& ESTIMATING RELATIONSHIPS **Hours: 12**

Spark: Introduction to Data Analysis with Spark – Downloading Spark and Programming with RDDs and MLib – Data ETL Process – Introduction to Analytics, Reporting and Visualizing. **Machine Learning for Big Data Analytics:** Introduction – Estimating the Relationships – Regression Analysis – Simple Linear Regression.

UNIT-5 ADVANCED MACHINE LEARNING **Hours: 12**

Cluster Analysis: K-Means - **Classification**: k-Nearest Neighbour – Support Vector Machine – Decision Tree – Random Forest – AdaBoost and other Ensemble Classifiers.

f. Mapping of COs to POs and PSOs:

Course Outcome	**PO Addressed** PO1 to PO8	**CorrelationLevel** L/M/H	**PSO Addressed** PSO1 to PSO8	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	M	PSO1	M	K_1
CO2	PO2	H	PSO1	H	K_2
CO3	PO2, PO4	H	PSO2, PSO3, PSO4	H	K_3
CO4	PO3, PO4	H	PSO5	H	K_4
CO5	PO5, PO6	M	PSO3, PSO5	M	K_5
CO6	PO3, PO5, PO7	H	PSO6, PSO7	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. Raj Kamal, Preeti Saxena - BIG DATA ANALYTICS: Introduction to Hadoop, Spark, and Machine-Learning – McGraw-Hill Education, 2019.

INTERNET OF THINGS

C	L	T	P
4	3	1	0

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

b. Course Objectives:

This Course is intended to make the students

1. To understand about the fundamentals of Internet of Things and its building blocks along with their characteristics
2. To understand the recent application domains of IoT in day-to-day life
3. To understand the protocols and standards designed for IoT.
4. To understand the other associated technologies like cloud, fog and Edge computing in the domain of IoT
5. To understand the ongoing developments of **Indian smart cities** project and conceptualise the future needs.

c. Course Prerequisites:

1. Basic Knowledge on Networking and Internet
2. Knowledge on wireless and Mobile Technologies
3. Fundamental knowledge on problem solving and programming

d. Course Outcomes (COs):

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

CO1 : Describe what IoT is and how it works today
CO2 : Recognise the factors that contributed to the emergence of IoT
CO3 : Able to apply IoT system design techniques to different paradigms
CO4 : Use IoT protocols for communication
CO5 : Define the infrastructure requirement for IoT deployments in smart cities
CO6 : Ability to conceptualize new ideas and present them as intellectual property

e. Course Outline (Unit wise)

Unit I - IOT Basics **12 Hours**

Genesis of IoT - IoT and Digitization - IoT Impact - Connected Roadways - Connected Factory - Smart Connected Buildings - Smart Creatures - Convergence of IT and OT - IoT Challenges. IoT Network Architecture and Design: Drivers behind New Network Architectures. Scale - Security - Constrained Devices and Networks.

Unit II – IOT Architecture reference Models **12 Hours**

The three layer oneM2M IoT Standardized Architecture - The 7 layer IoT World Forum (IoTWF) Standardized Architecture – Additional reference models – Simplified IOT reference model. Core IOT functional stack. Things layer, Communication layer, Application and analytics layer – IOT data management and Control stack. FOG, Edge and Cloud Computing.

Unit III - Smart IOT Objects and communication protocols **12 Hours**

Sensors, Actuators, MEMS and Smart Objects – Sensor networks and WSN, Communication protocols for wsn. Connecting smart objects: Different Communication criteria – IOT Access technologies: IEEE 802.15.4, Protocol Stacks Utilizing IEEE 802.15.4, IEEE 802.15.4g and 802.15.4e: IEEE 1901.2a, IEEE 802.11ah, LoRaWAN, NB-IoT and Other LTE Variations: LTE CAT-0, LTE M, NB-IOT

Unit IV - IP and Application Protocols **12 Hours**

Advantages of IP for IOT, need for Optimization in IP, Optimizing IP for IOT. Application Protocol for IOT: Transport layer, IoT Application Transport Methods, SCADA, CoAP and MQTT - message formats and communication, comparison of CoAP and MQTT.

Unit V - IOT Security and Application Case Study **12 Hours**

A Brief History of OT Security - IOT Security: Challenges- How IT and OT Security Practices and Systems Vary - Formal Risk Analysis Structures: OCTAVE and FAIR. Application Case study: **Smart cities in India** - Introduction to General Characteristics of Smart City Planning Bridging the Gap - Smart City Design and Planning - The intersection of ICT, City Design and City Planning - Benefits of IoT and ICT in Urban Design and Planning. What makes a city smart? - Data-driven Urban Design and Urban Planning - Urban Simulation - Sustainable Urban Planning 5 Smart Cities: Top-down and Bottom-up-Tools for participation - Competency building - Emerging Issues

f. Mapping of COs to POs and PSOs (To be mapped)

Course Outcome	**PO Addressed** PO1 to PO7		**Correlation Level** L/M/H		**PSO Addressed** PSO1 to PSO7		**Correlation Level** L/ M/ H		**Cognitive Level** K_1 to K_6
CO1	PO1		M		PSO2		M		K_1, K_2
CO2	PO1	PO2	M	H	PSO2		H		K_1
CO3	PO3	PO4	M	L	PSO2		M		K_2
CO4	PO3		H	M	PSO4	PSO2	M	L	K_2
CO5	PO5		M		PSO4		M		K_3
CO6	PO6	PO7	M	M	PSO5		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. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things - David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton & Jerome Henry, Cisco Press 2017. (for Unit I to Unit V)
2. Design Planning Smart Cities with IoT/ICT, Release-2.0, DOT, Ministry of Communications, **Govt. of India**, **January 2019** (Unit V)
3. Introduction to IoT, Cambridge University Press, Sudip Misra , Anandarup Mukherjee , Arijit Roy, March 2022.
4. Internet of Things A Hands-On Approach by Arshdeep Bahga, Vijay Madisetti, Universities press (India) Pvt. Ltd, 2015

BIG DATA ANALYTICS USING MACHINE LEARNING LAB

C	L	T	P
2	0	0	4

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

b. Course Objectives:

1. To get hands on experience in Big Data Analytics using Hadoops.
2. To perform Big Data Analytics tasks and run Machine Learning algorithms.

c. Course Prerequisites:

1. Exposure to introductory course on python and some standard programming concepts.

d. Course Outcomes (COs):

At the end of the Course, the student will be able to –

C01 : Work on Hadoop, MongoDB, Tableau, JSON, Python and other Python Libraries

CO2 : Analyse the Data using Spark Programming.

CO3 : Write Machine Learning applications in Python.

e. Course Outline:

List of Experiments:

1. Install Hadoop Single Node Cluster in Ubuntu Linux/ Cloudera Hortonworks in Windows.
2. Monitor and Manage Hadoop resources and processes using Ambari Server
3. Implement a Word Count Program using Map Reduce API in Java
4. Create a database and work using Hive QL Functions from Apache Hive
5. Load an external CSV file into Hadoop using PIG Latin and Order by a single column. Then display the data in the Grunt Shell.
6. Import MySQL Database to Hadoop using import functions in Apache Sqoop
7. Add a Collection with database to insert some documents using MongoDB
8. Load and Create a Dashboard for any problem domain using Tableau
9. K-Means Clustering algorithm in scikit-learns
10. Naïve Bayes Classification model in Python using scikit-learn
11. Classification using Gradient Boosted Trees in PySpark MLib
12. Classification using Neural Network using Keras

f. Mapping of COs to POs and PSOs:

Course Outcome	**PO Addressed** PO1 to PO8	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO8	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO2, PO3, PO4	H/M/H	PSO2, PSO4, PSO5, PSO6, PSO7	H/H/M/H	K_4
CO2, CO3	PO3, PO4, PO5	H/H/H	PSO2, PSO4, PSO5, PSO6, PSO7	H/H/M/H	K_4, K_5, K_6

(L – Low, M – Medium, H – High; K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5–Evaluate, K6 – Create)

GUIDELINES FOR INTERNSHIP TRAINING

C	L	T	P
1	0	0	0

1. Introduction:

During the summer vacation-before the Third semester classes commence, each student pursuing M.Sc. (CS) shall undergo Internship training in any Software Company under development / Real-time training for a minimum duration of minimum two weeks.

Internship Objectives:

The main objective of the Internship is to inculcate the behavioral change in the students by gaining industrial experience in a particular tools/ language or skills. However, there are a variety of objectives that will be met in this Internship Training period:

1. Receive real world experience and develop their skills.
2. Expand the knowledge curve of the Candidate by working on Real-time projects to gain knowledge in a particular tool/ language.
3. Gain insights on improving Communication Skills
4. Emphasis the skills already learned from the College Campus
5. Bridge the knowledge gap that arises when combining Computer Science and Engineering with the different career like architecture, engineering, healthcare, economics, advertising and many more.
6. Gain the first-hand experience in Research/ Industry.
7. Build a strong and emphasized resume for future jobs

2. Evaluation Procedure:

The Internship will be mentored and assessed based on the Internal and External evaluation.

Internal marks (max)	External marks (max)	Total Marks
50	50	100

2.1 Internal Assessment:

Internal assessment shall be made by the guide as assigned by the department, during the third semester. The students should submit the following documents for the assessment.

1. Submission of Formal Confirmation letter from the company
2. Correspondence through mail to the faculty guide in the Department
3. Copy of Internship Attendance maintained in the Company
4. Certificate copy /Internship Competition Letter from Company
5. Problem Statement/ Abstract
6. Methodology/ Data Flow/ Process Flow

2.2. External Assessment:

Internship Report should be submitted at the end of the third semester. The Department will assign Two Examiners to evaluate the Internship work. The External marks will be assigned to the student based on the Internship Report Submission and the Public Viva Voce.

The scheme for External Assessment may follow the given format:

Sl. No.	Reg. No	Student Name	Report (30 Marks)	Presentation (10 Marks)	Viva-voce (10 Marks)	Total External (50 Marks)

2.3. Passing Criteria:

Student shall secure a minimum of 50 % marks in the external evaluation and shall secure a minimum of 50 % marks in combined Internal and External evaluation. (There is no passing minimum for the internal evaluation)

3. Outcome of the Internship Training

As the outcome of the Internship Training, the student can showcase their professional skills by creating a public GitHub repository and contributing to the Open Source Community. The links can be included in their CV and showcased to the future employers. Further this can be showcased in the University Department web page section in Student Internship Activities.

GUIDELINES FOR MINI PROJECT WORK

Maximum Marks :	Internal	External
100	50	50

Mode of Mini Project : Individual Project

Guide : Each Student shall be allotted under the Guidance of a Department faculty member by the M.Sc. Programme Co-ordinator

Nature of Mini Project : Every student shall undertake a unique project title (Novel Concept/ idea/system or a research work which shall be implemented using available software development tool /programming language) approved by his/her guide.

Duration : One semester - (6 hours per week in case of Mini & 30 hrs per week for Major project) Major project students may opt for company projects with prior permission from the Department

Continuous Assessment : Based on periodic reviews (Three reviews during the semester)

Evaluation criteria

Each student is evaluated by the Internal Examiner (Guide) continuously during the respective semester. External Examination will be conducted at the end of the respective semester.

Passing Criteria: Student shall secure a minimum of **50 % marks in the external** evaluation and shall secure a **minimum of 50 % marks in combined Internal and External evaluation**. (There is no passing minimum for the internal evaluation)

Internal (50 Marks) (All the three reviews are mandatory)		**External (50 Marks)**	
Review I (Problem identification, Title & Abstract submission, Novelty of the idea, proposed outcomes, issues in existing methods, tools to be used)	15 Marks	Both Internal and External Examiner Shall evaluate the student based on the following criteria at the end of the semester: (Guide or any other department faculty decided by the HOD shall be internal examiner. External Examiner will be appointed by the Vice-Chancellor	
Review II System Design / Database Design / Methodology / Algorithms and Techniques/ detailed Implementation plan	15 Marks	**Internal Examiner** Project Report	20 Marks
Review III System Implementation status, Testing, outcomes and report writing	20 Marks	**External Examiner shall evaluate under the following criteria** • Presentation of the Mini Project • Running the Demonstration of the Mini project • Viva -voce	 10 Marks 10 Marks 10 Marks
Total	**50 Marks**		**50 Marks**

GUIDELINES FOR MAJOR PROJECT WORK

Maximum Marks :	Internal	External
100	50	50

Mode of Major Project : Individual Project

Guide : Each Student shall be allotted under the Guidance of a Department faculty member by the M.Sc. Programme Co-ordinator

Nature of Major Project : Every student shall undertake a unique project title (Novel Concept/ idea/system or a research work which shall be implemented using available software development tool /programming language) approved by his/her guide.

Duration : One semester - (6 hours per week in case of Mini & 30 hrs per week for Major project) Major project students may opt for company projects with prior permission from the Department

Continuous Assessment : Based on periodic reviews (Three reviews during the semester)

Evaluation criteria

Each student is evaluated by the Internal Examiner (Guide) continuously during the respective semester. External Examination will be conducted at the end of the respective semester.

Passing Criteria: Student shall secure a minimum of **50 % marks in the external** evaluation and shall secure a **minimum of 50 % marks in combined Internal and External evaluation**. (There is no passing minimum for the internal evaluation)

Internal (50 Marks) (All the three reviews are mandatory)		**External (50 Marks)**	
Review I (Problem identification, Title & Abstract submission, Novelty of the idea, proposed outcomes, issues in existing methods, tools to be used)	15 Marks	Both Internal and External Examiner Shall evaluate the student based on the following criteria at the end of the semester: (Guide or any other department faculty decided by the HOD shall be internal examiner. External Examiner will be appointed by the Vice-Chancellor	
Review II System Design / Database Design / Methodology / Algorithms and Techniques/ detailed Implementation plan	15 Marks	**Internal Examiner** Project Report	 20 Marks
Review III System Implementation status, Testing, outcomes and report writing	20 Marks	**External Examiner shall evaluate under the following criteria** • Presentation of the Mini Project • Running the Demonstration of the Mini project • Viva -voce	 10 Marks 10 Marks 10 Marks
Total	**50 Marks**		**50 Marks**

ELECTIVE I

- Cloud Computing
- Human Computer Interaction
- Embedded Systems
- Machine Learning
- Evolutionary Algorithms
- Digital Image Processing
- Cryptography and Network Security

CLOUD COMPUTING

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

C	L	T	P
4	3	1	0

b. Course Objectives:

The course is intended to meet the following objectives:
Students will gain the following

1) The fundamental ideas behind Cloud Computing, The evolution of the paradigm, its applicability; benefits, as well as current and future challenges;
2) Acquire knowledge to use Virtualization, Task Scheduling algorithms, apply Map-Reduce concept to applications.
3) Develop ideas to build Private Cloud and to know the impact of engineering on legal and societal issues involved.
4) Knowledge about open source Cloud storage technologies and idea to use them

c. Course Prerequisites:

1. Knowledge of fundamental Networking concepts
2. Basic Knowledge of Operating Systems
3. Basic Programming Knowledge

d. Course Outcomes (COs):

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

CO1 : Interpret the key dimensions of the challenges of Cloud Computing
CO2 : Examine the economics, financial, and technological implications for selecting cloud computing for own organization
CO3 : Assessing the technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications
CO4 : Evaluate own organizations' needs for capacity building and training in cloud computing-related IT areas
CO5 : Illustrate Virtualization for Data-Centre Automation

e. Course Outline:

Unit - I **9 Hours**

High-Performance Computing Paradigms: Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio-computing, Mobile Computing, Quantum Computing, Optical Computing, Nano-computing, Network Computing.

Cloud Computing Fundamentals: Motivation for Cloud Computing, The Need for Cloud Computing. Defining Cloud Computing: NIST Definition of Cloud Computing, Cloud Computing Is a Service, Cloud Computing Is a Platform 5-4-3 Principles of Cloud computing: Five Essential Characteristics, Four Cloud Deployment Models, Three Service Offering Models Cloud Ecosystem, Requirements for Cloud Services, Cloud Application, Benefits and Drawbacks

Unit - II **9 Hours**

Cloud Computing Architecture and Management: Cloud Architecture, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Migrating Application to Cloud. Cloud Deployment Models Private Cloud, Public Cloud, Community Cloud, Hybrid **Cloud Service Models**: Infrastructure as a Service - Platform as a Service - Software as a Service - Other Cloud Service Models

Unit - III **9 Hours**

Technological Drivers for Cloud Computing : SOA and Cloud: SOA and SOC, Benefits of SOA, Technologies Used by SOA, Similarities and Differences between SOA and Cloud Computing. Virtualization: Approaches in Virtualization, Hypervisor and Its Role, Types of Virtualization, Multicore Technology, Memory and Storage Technologies, Networking Technologies **Web 2.0**: Characteristics and applications. **Web 3.0**: Characteristics and applications.

Unit IV **9Hours**

Software Process Models for Cloud: Types of Software Models : Waterfall Model - V Model - Incremental Model - RAD Model - Agile Model - Iterative Model - Spiral Model. **Agile SDLC Model**, advantages, 6 ways of enhancing agile model**. Cloud Programming models: BSP, MAPREDUCE, SAGA, Transformer and Grid Batch frameworks. Pervasive Computing in Cloud.** Operating Systems Role of OS in Cloud Computing, Features of Cloud OS, Cloud OS Requirements, Cloud-Based OS, Application Environment

Unit - V **9 Hours**

Application Environment: Need for Effective ADE, Application Development Methodologies, Power of Cloud Computing in Application Development, **Cloud application development platforms:** Windows Azure, Google app Engine, Force.com, ***Manjrasoft Aneka.*** **Cloud Computing APIs**: Rack space, IBM, Intel Networking for Cloud Computing Overview of Data Center Environment, Networking Issues in Data Centers Security Aspects Data Security, Virtualization Security, Network Security Platform-Related Security, Security Issues in Cloud Service Models, Software-as-a-Service Security Issues, Platform-as-a-Service Security Issues, Infrastructure-as-a-Service Security Issues

f. Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO8	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO8	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1	L	K_1, K_2
CO2	PO2	L	PSO4	M	K_3
CO3	PO3 PO4	M M	PSO4 PSO5	M M	K_3, K_4
CO4	PO3	H	PSO4	M	K_5
CO5	PO6	H	PSO6	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

h. Reference Books:

1. K. Chandrasekaran, Essentials of Cloud Computing, CRC Press Taylor & Francis Group , 2015
2. Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra, MK Elsevier, 2012
3. Cloud Computing, Theory and Practice, Dan C Marinescu, MK, Elsevier. 2013
4. Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madisetti, University Press, 2014
5. Moving to the Cloud, Dinkar Sitaram, Geetha Manjunath, Syngress (Elsevier) publications, 2014.
6. Cloud Computing Simplified: Explore Application of Cloud, Cloud Deployment Models, Service models and Mobile Cloud Computing ,1st Edition, BPB publications, Apr 2021.

HUMAN COMPUTER INTERACTION

C	L	T	P
4	3	1	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 **9 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.

UNIT2 **9 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.

UNIT3 **9 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.

UNIT4 **9 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.

UNIT5 **9 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 PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7	**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, PSO6	H/M	K_2
CO3	PO1, PO2, PO5	H, M, M	PSO4	M	K_3
CO4	PO1, PO5	H, M	PSO4	H	K_4
CO5	PO3, PO4	H, M	PSO4, PSO5	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

EMBEDDED SYSTEM

C	L	T	P
4	3	1	0

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

b. Course Objectives:

To impart knowledge on the following Topics Building Blocks of Embedded System

- Various Embedded Development Strategies
- Basics of Real time operating system and example tutorials to discuss on one real time
- Various processor scheduling algorithms.
- Bus Communication in processors, Input/output interfacing.
- Operating system tool.

c. Course Prerequisites:

- Basic Level understanding Embedded Systems
- Understanding based on functionality and performance requirements, embedded systems

d. Course Outcomes (COs):

- CO1 : Ability to understand and analyze Embedded systems.
- CO2 : Ability to suggest an embedded system for a given application.
- CO3 : Ability to operate various Embedded Development Strategies
- CO4 : Ability to study about the bus Communication in processors.
- CO5 : Ability to acquire knowledge on various processor scheduling algorithms.
- CO6 : Ability to understand basics of Real time operating system.

e. Course Outline:

Unit I **9 Hours**

Introduction to Embedded Systems – Structural units in Embedded processor, selection on processor and memory devices – DMA – Memory management methods – Timer and counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

Unit II **9 Hours**

Embedded Networking: Introduction, I/O Devices Ports and Buses – Serial Bus communication protocols RS232 standard – RS422 – RS485 – CAN Bus – Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) – need for device drivers.

Unit III **9 Hours**

Embedded Firmware Development Environment: Embedded Product Development Life Cycle – objectives, different phases of EDLC, Modeling of EDLC; issues in Hardware – software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, and Object oriented Model.

Unit IV **9 Hours**

RTOS based Embedded System Design: Introduction to basic concepts of RTOS – Task, Process and threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing – Inter process Communication – synchronization between processes – semaphores, Mailbox, pipes, priority in version, priority inheritance.

Unit V **9 Hours**

Embedded System Application and Development: Case Study of Washing Machine – Automotive Application – Smartcard System Application – ATM machine – Digital camera

f. Mapping of COs to POs and PSOs

Course Outcome	PO Addressed PO1 to PO7	Correlation Level L/M/H	PSO Addressed PSO1 to PSO7	Correlation Level L/ M/ H	Cognitive Level K_1 to K_6
CO1	PO1	H	PSO1	H	K_1
CO2	PO1 PO2	M H	PSO1	M	K_2
CO3	PO2	H	PSO2	M	K_3
CO4	PO4	H	PSO6	H	K_4
CO5	PO6	M	PSO3 PSO5	M H	K_5
CO6	PO3 PO5 PO7	M H H	PSO5 PSO7	M 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. Peckol, “Embedded system Design”, John Wiley & Sons,2010
2. Lyla B Das, ”Embedded Systems-An Integrated Approach”, Pearson, 2013
3. Shibu. K.V, “Introduction to Embedded Systems”, 2e, McgrawHill, 2017
4. Raj Kamal, ˆEmbedded System - Architecture, Programming, Design, Mc GrawHill, 2013.
5. C. R. Sarma, “Embedded Systems Engineering”, University Press (India) Pvt. Ltd,2013.
6. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier,2006.
7. Han-Way Huang, “Embedded system Design UsingC8051”, Cengage Learning, 2009.
8. Rajib Mall, “Real-Time systems Theory and Practice, ”Pearson Education, 2007.

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 **9 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 **9 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 **9 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

9 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 PO8			**Correlation Level** L/M/H			**PSO Addressed** PSO1 to PSO8			**Correlation Level** L/ M/ H			**Cognitive Level** K_1 to K_6
CO1	PO1			H			PSO1			H			K_1
CO2	PO2			M			PSO1	PSO2		M	H		K_2
CO3	PO3			H			PSO3	PSO4		M	H		K_3
CO4	PO3	PO4	PO7	M	M	M	PSO5			H			K_4
CO5	PO5	PO6	PO7	H	H	M	PSO2	PSO3	PSO5	M	M	H	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.
   Python Cookbook 3rd Edition – Recepies for Mastering Python 3, David Beazley and Brian K. Jones, O'Reilly.

EVOLUTIONARY ALGORITHMS

C	L	T	P
4	3	1	0

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

b. Course Objectives:

1) Understand the concepts of Meta-heuristics and Evolutionary Algorithms.
2) Formulate a given problem as an optimization problem and apply Evolutionary Algorithms.
3) Practice the optimization techniques using search strategies.
4) Design new evolutionary representations and fitness functions for specific applications.
5) Analyze the state-of-the-art research in Evolutionary Computing.

c. Course Prerequisites:

1. Knowledge of fundamental concepts of Designing Strategies.
2. Basic Knowledge of optimization theory
3. Basic knowledge in current research problems.

d. Course Outcomes (COs):

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

CO1: Recognize the importance of optimization methods
CO2: Describe and develop various evolutionary algorithms for real-world applications
CO3: Apply evolutionary algorithms for optimizing mathematical problems and interpret results.
CO4: Analyze evolutionary computing techniques in the context of modern heuristic methods
CO5: Evaluate the routing problems using evolutionary algorithms
CO6: Construct scientific research papers and present them in a seminar.

e. Course Outline:

Unit I: **9 Hours**

Introduction – Terminology - Optimization Problem – Constraints – Multi Objective OptimizationProblem – Optimization Techniques – Optimization Functions – Introduction Standard Optimization Functions – Travelling Sales Man Problem – Hill Climbing.

Unit II: **9 Hours**

Genetic Algorithm – Introduction – Terminology – Fundamental Concepts – Selection – Cross over–Mutation – Algorithm and Pseudocode – Flowchart – Example – Differential Evolution- Introduction – Terminology –Fundamental Concepts – Algorithm and Pseudocode – Flowchart – Example.

Unit III: **9 Hours**

Particle Swarm Optimization - Introduction – Terminology – Evolution of Particle Swarm Optimization – Fundamental Concepts – Algorithm and Pseudocode – Flowchart – Example - Artificial Bee Colony - Introduction – Terminology - Fundamental Concepts - Algorithm and Pseudocode – Flowchart – Example.

Unit IV: **9 Hours**

Shuffled Frog Leaping Algorithm - Introduction – Terminology - Fundamental Concepts – Algorithm and Pseudocode – Flowchart – Example – Grey Wolf Optimizer - Introduction – Terminology - Fundamental Concepts - Algorithm and Pseudocode – Flowchart – Example.

Unit V: **9 Hours**

Introduction to Other Optimization Techniques – Introduction – Bacteria Foraging Algorithm – Whale Optimization – Bat Algorithm – Fire fly Algorithm – Real Time Applications of PSO - Optimization Techniques in Python.

f. Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7		**Correlation Level** L/M/H		**PSO Addressed** PSO1 to PSO7		**Correlation Level** L/ M/ H		**Cognitive Level** K_1 to K_6
CO1	PO1		H		PSO3		M		K_1
CO2	PO1	PO2	H	M	PSO1	PSO4	H	H	K_2
CO3	PO5	PO1	H	M	PSO1	PSO2	H	H	K_3
CO4	PO2	PO4	H	M	PSO1		H		K_4
CO5	PO4		H		PSO6		M		K_5
CO6	PO6	PO7	H	H	PSO6		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. Altaf Q.H.Badar , " Evolutionary Optimization Algorithms", CRC Press , Taylor & Francis Group , First Edition, 2022.
2. A.Vasuki , " Nature – Inspired Optimization Algorithms", CRC Press , Taylor & Francis Group , First Edition, 2020.
3. Alain Petrowski, Sana ben – Hamida,"Evolutionary Algorithms", John Wiley Publications, 2017.

DIGITAL IMAGE PROCESSING

C	L	T	P
4	3	1	0

a. Course Code:

b. Course Objectives:

1. To understand the basic principles of digital image processing.
2. To design an algorithm for image transformation and enhancement.
3. To understand the techniques of image restoration and construction.
4. To develop an algorithm for image compression and Segmentation.
5. To understand the concepts of Multispectral image processing and its applications.

c. Course Prerequisites:

1. Basic Concepts of Computer Graphics & Multimedia
2. Some Basic Mathematics

d. Course Outcomes:

At the end of this course, the students should able to

CO1 : Review the fundamental concepts of a digital image processing system and Analyze images in the frequency domain using various transforms.

CO2 : Evaluate the techniques for image enhancement and image restoration. Categorize various Compression techniques.

CO3 : Interpret Image compression standards, and Interpret image segmentation and representation techniques.

e. Course Outline:

UNIT-1 Introduction and Digital Image Fundamentals 9 Hours

Introduction: What is Digital Image Processing? - Examples of Fields that Use Digital Image Processing - Fundamental Steps in Digital Image Processing -Components of an Image Processing System- Digital Image Fundamentals: Elements of Visual Perception -Light and the Electromagnetic Spectrum - Image Sensing and Acquisition - Image Sampling and Quantization - Some Basic Relationships between Pixels - Introduction to the Basic Mathematical Tools Used in Digital Image Processing.

UNIT – II Image Enhancement and Frequency Domain Filtering 9 Hours

Image Enhancement: Background - Some Basic Intensity Transformation Functions -Histogram Processing - Fundamentals of Spatial Filtering -Smoothing Spatial Filters - Sharpening Spatial Filters - Filtering in the Frequency Domain: Background - Preliminary Concepts - The Basics of Filtering in the Frequency Domain - Image Smoothing Using Low pass Frequency Domain Filters - Image Sharpening Using High pass Filters - The Fast Fourier Transform.

UNIT – III Image Restoration and Image Transforms 9 Hours

Image Restoration: Model of the Image Degradation/Restoration process – Noise Models - Noise Only—Spatial Filtering - Periodic Noise Reduction Using FDF -Inverse Filtering - Minimum Mean Square Error Filtering -Constrained Least Squares Filtering - Geometric Mean Filter Wavelet and Other Image Transforms - Preliminaries - Matrix- based Transforms - Correlation .

UNIT – IV Color Image Processing and Image Compression 9 Hours

Color Image Processing: Color Fundamentals - Color Models - Pseudo color Image Processing - Basics of Full-Color Image Processing - Color Transformations - Color Image Smoothing and Sharpening - Using Color in Image Segmentation - Noise in Color Images - Color Image Compression. Image Compression and Watermarking - Fundamentals - Huffman Coding - Arithmetic Coding – LZW Coding - Run-length Coding - Symbol-based Coding - Bit-plane Coding -Block Transform Coding - Predictive Coding - Digital Image Watermarking.

UNIT – V Morphological Processing & Image Segmentation **9 Hours**

Morphological Image Processing - Preliminaries - Erosion and Dilation - Some Basic Morphological Algorithms – Morphological Reconstruction Image Segmentation – Fundamentals Point, Line, and Edge Detection - Thresholding - segmentation by Region Growing and by Region Splitting and Merging - Region Segmentation Using Clustering and Super pixels - Region Segmentation Using Graph Cuts-The Use of Motion in Segmentation-Active Contours.

f. Mapping of COs, POs and PSOs:

Course Outcome	**PO Addressed PO1 to PO 7**			**Correlation Level L/M/H**			**PSO Addressed PSO1 to PSO7**		**Correlation Level L/ M/ H**		**Cognitive Level K1 to K6**
CO1	PO1	PO2		H	H		PSO1		H		K1
CO2	PO3	PO4	PO5	M	M	M	PSO1	PSO2	H	H	K5
CO3	PO1	PO6		H	H		PSO3	PSO4	H	H	K3, K4, K6

(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. Digital Image Processing, Fourth Edition, Rafel C. Gonzalez and Richard E.Woods, Pearson Education, 2018.
2. Hands-On Image Processing with Python: Expert techniques for advanced imageanalysis and effective interpretation of image data, by Sandipan Dey, Packt Publishing ,2018.
3. Digital Image Processing Using Matlab, Third Edition, Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Gatesmark Publishing,2020.
4. D. Sundararajan, Digital Image Processing: A Signal Processing and Algorithmic Approach, Springer, 2017.

WEB RESOURCE(S):

1. https://nptel.ac.in/courses/117/105/117105079
2. https://www.mygreatlearning.com/blog/digital-image-processing-explained/.
3. http://www.imageprocessingplace.com/root_files_V3/tutorials.htm

CRYPTOGRAPHY AND NETWORK SECURITY

a) Course code:

C	L	T	P
4	3	1	0

b) Course Objectives:

1. Understand Cryptography Theories, Algorithms and Systems
2. Understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.
3. Know about the malicious software & firewalls.

c) Course Prerequisites:

1. Basic knowledge on mathematics.
2. Exposure to modern security threats.
3. Knowledge on computer networks

d) Course outcomes (COs):

After completion of this course, students will be able to

CO1: Understand the fundamentals of networks security, security architecture, threats and vulnerabilities

CO2: Apply the different cryptographic operations of symmetric/asymmetric cryptographic algorithms.

CO3: Analyze various authentication protocols and apply them in real time.

CO4: Analyze the security threats and study the various countermeasures.

CO5: Identify the applications of network security in various fields.

CO6: Design and Develop a security model.

e) Course Outline:

Unit I INTRODUCTION **9 Hours**

Introduction –Security goals - attacks – Security services and mechanisms – Techniques – Mathematics of cryptography - Classical encryption techniques: substitution techniques, transposition techniques, Stream and block ciphers

Unit II SYMMETRIC AND ASYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY, INTEGRITY **9 Hours**

Symmetric Encryption Principles, DES Structure – Analysis – Multiple DES – AES Introduction – transformations – key expansion – ciphers – Use of Modern Block and stream – RSA Cryptosystem – ElGamal Cryptosystem – Message Integrity and authentication

Unit III CRYPTOGRAPHIC HASH FUNCTIONS AND DIGITAL SIGNATURES **9 Hours**

SHA 512 – Digital signature comparison – process –services – attacks on digital signatures – Digital signature schemes – Entity authentication – introduction – passwords – Challenge response – zero knowledge - biometrics

Unit IV KEY MANAGEMENT **9 Hours**

IP Security –Symmetric key distribution – KERBEROS – Email – PGP – S/MIME – SSL Architecture – protocols –IPSec.

Unit V INTRUDERS AND INTRUSION DETECTION **9 Hours**

Intruders - Intruders, Intrusion Detection, Password Management - Malicious Software: Virus and Related Threats, Virus Countermeasures, Distributed Denial of Service Attacks. Firewalls: Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation.

f. Mapping of COs, POs and PSOs:

Course Outcome	**PO Addressed** PO1 to PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1	H	K_1,K_2
CO2	PO2 PO3	M M	PSO2	M	K_3
CO3	PO4 PO7	L M	PSO2 PSO3 PSO4	L M H	K_4,K_5
CO4	PO4 PO5 PO7	M M H	PSO2 PSO3 PSO4	M M M	K_4,K_5
CO5	PO5 PO7	M M	PSO4 PSO5 PSO6	M H L	K_5
CO6	PO2, PO5 PO6	L M M	PSO4 PSO5 PSO6	H M L	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.Behrouz A. Ferouzan, “Cryptography & Network Security”, Tata Mc Graw Hill, 2007, Reprint 2015.

2. Stallings William, “Cryptography and Network Security- Principles and Practice 2017.

3. William Stallings, “Network Security Essentials Applications and Standards ”Third Edition, Pearson Education, 2008.

4. Man Young Rhee, “Internet Security: Cryptographic Principles”, “Algorithms And Protocols”, Wiley Publications, 2003.

5. Charles Pfleeger, “Security In Computing”, 4th Edition, Prentice Hall Of India, 2006.

Ulysess Black, “Internet Security Protocols”, Pearson Education Asia, 2000.

6. Charlie Kaufman And Radia Perlman, Mike Speciner, “Network Security, Second Edition, Private Communication In Public World”, PHI 2002.

7. Bruce Schneier And Neils Ferguson, “Practical Cryptography”, First Edition, Wiley Dreamtech India Pvt Ltd, 2003.

8. Http://Nptel.ac.in/.

ELECTIVE II

- Deep Learning
- Soft Computing
- Ethical Hacking
- Software Testing
- Software Project Management
- Bioinformatics
- Wireless Sensor Network

DEEP LEARNING

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

C	L	T	P
4	3	1	0

b. Course objectives :

- To learn the fundamentals of Neural Network.
- To learn components, architectures and applications of CNN.
- To study RNN , LSTM, GPU and Deep RNN.
- To study about different types of Autoencoders and RBM.
- To know about Open-Source Frameworks for Deep Learning.
- To implement Image Classification, Stock Market Prediction and Tamil Handwritten Character Optical Recognition Applications using Deep Learning.

c. Course Outcomes:

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

CO1: Explain various components, architectures and applications of CNN.
CO2: Understand RNN, LSTM, GPU and Deep RNN architectures.
CO3: Know about different types of Autoencoders and RBM.
CO4: Explain various Open-Source Frameworks for Deep Learning.
CO5: Implement Image Classification, Stock Market Prediction, Tamil Handwritten Character Optical Recognition Applications using Deep Learning Models.

e. Course Outline:

Unit 1: 9 Hours

Fundamentals of Neural Network: Introduction – Types of Machine Learning **(**Classification Problem, The Regression Problem, Overfitting and Underfitting, Bias and Variance**)** – Overview of Artificial Neural Networks(Biological neuron, Types of Artificial Neural Networks, Optimization Techniques, Vanishing Gradient problem, Exploding Gradient problem, Weight Initialization, What is Deep Learning**)**.

Unit 2: 9 Hours

Convolutional Neural Network: Introduction – Components of CNN Architecture**(**Convolution Layer, Pooling or Downsampling Layer, Flattening Layer, Fully Connected Layer**)** – ReLu Layer**(**Leaky ReLU and Randomized ReLU**)** – ELU**(**Maxout**)** – Unique Properties of CNN**(**Weight Sharing, Translation Invariance**)** – Architectures of CNN**(**LeNet, AlexNet, ZFNet, GoogLeNet,VGGNet,ResNet,DenseNet**)** – Applications of CNN**(**Object Detection, Face Recognition, Scene Labeling, Optical Character Recognition OCR, Handwritten Digit Recognition**)**.

Recurrent Neural Network: Basic Concepts: Introduction **(**RNN versus CNN, Feedforward Neural Network versus RNN**)** – Simple RNN (**Training** an RNN, Backpropogation through Time (BPTT) Illusrtation,RNN Topology, Challenges with Vanishing Gradients, Bidirectional and Stateful RNNs**)-** LSTM– LSTM Implementation – Gated Recurrent Unit (GRU) – Deep RNN.

Unit 3: 9 Hours

Autoencoders: Introduction – Features of Autoencoder – Types of Autoencoder(Vanilla AutoEncoder, MultiLayer Autencoder, Stacked Autoencoder, Deep Autoencoder,Denoising Autoencoder, Convolutional autoencoder,Regularization in Autoencoder**)**

Restricted Boltzmann Machine: Boltzmann Machine – RBM Architecture(Energy based Model, Gibbs Distribution Model, Gibbs Sampler, Contrastive Divergence) – Example – Types of RBM.

Unit 4: **9 Hours**

Open-Source Frameworks for Deep Learning: Environment Setup – Deep Learning with Python – Scientific Python **(**Numerical Python(Numpy), Matplotlib, Pandas**)** – Frameworks**(**TensorFlow, Keras, PyTorch**)**.

Unit 5: **9 Hours**

Applications of Deep Learning:

Introduction – Image Classification Using CNN **(**Problem Description, Language and Framework, Dataset, Code Snippets, Complete Code, Result**)** – Stock Market Prediction Using RNN **(**Problem Description, Language and Framework, Dataset, Code Snippets, Complete Code, Result**)** – Tamil Handwritten Character Optical Recognition Using CRNN**(**Problem Description, Language and Framework, Dataset, Code Snippets, Complete Code, Result**)**.

f. Mapping of COs to POs and PSOs

Course Outcome	PO Addressed PO1 to PO7		Correlation Level L/M/H		PSO Addressed PSO1 to PSO7		Correlation Level L/ M/ H		Cognitive Level K1 to K6
CO1	PO1		M		PS01	PSO5	M	H	K1
CO2	P02	PO3	M	H	PS02	PSO3	M	H	K2, K3,K6
CO3	PO4		M		PSO4		M		K2, K3
CO4	PO5		M		PSO5		M		K2, K4, K5, K6
CO5	PO2	PO6	M	H	PSO2	PS06	M	H	K3,K4,K5,

(L – Low, M – Medium, H – High; K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5–Evaluate, K6 – Create)

g. Reference Books:

1. Deep Learning using Python - Lovelyn, S., Rose, L. Ashok kumar, D. Karthika Renuka, Wiley India Pvt. Ltd., First Edition, 2019.

2. Deep Learning with TensorFlow 2 and Keras - Antonio Gulli, Amita Kapoor, Sujit Pal, Packt Publishing, Second Edition, 2019.

3. Advanced Deep Learning with TensorFlow 2 and Keras - Rowel Atienza, , Packt Publishing, Second Edition,2020.

4. On Deep Learning Algorithms with Python- Sudharsan Ravichandiran, Hands,- Packt Publishing,2019.

SOFT COMPUTING

a. Course Code:

C	L	T	P
4	3	1	0

b. Course Objectives:

1. To learn the key aspects of Soft computing
2. To know about the components and building block hypothesis of Genetic algorithm.
3. To understand the features of neural network and its applications
4. To study and analyze the fuzzy logic components.
5. To gain insight onto Neuro Fuzzy modeling and control.

c. Course Prerequisites:

1. Basic Concepts of algorithm analysis, Data Structures.
2. Some Basic Mathematics.

d. Course Outcomes:

At the end of this course, the students should able to

CO1: To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations.

CO2: Comprehend the fuzzy logic and the concept of fuzziness Involved in various systems and fuzzy set theory.

CO3: Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzyinference systems, and fuzzy logic.

CO4: Understand appropriate learning rules for each of the architectures and learn several Genetic algorithms paradigms and its applications.

e. Course Outline:

UNIT I INTRODUCTION **9 Hours**

Introduction: Soft Computing Constituents – Soft Computing Vs Hard Computing – Characteristics - Expert system – Introduction – Example From Conventional AI to Computational Intelligence Applications - Artificial Neural Network (ANN): Fundamental Concept – Application Scope - Basic Terminologies – Neural Network Architecture – Learning Process – Basic Models of ANN: McCulloch-Pitts Model – Hebb Network – Linear Separability.

UNIT II SUPERVISED LEARNING NETWORKS **9 Hours**

Supervised Learning Networks: Perceptron Networks – Adaline and Madaline Networks – Back Propagation Network –Radial Basis Function Network. Associative Memory Networks – BAM - Hopfield Network - Boltzmann Machine. Unsupervised Learning Networks: Kohonen Self Organizing Network – Counter Propagation Network – ART Network. Case study : Identification and control of linear and nonlinear dynamic systems

UNIT III FUZZY SETS **9 Hours**

Fuzzy Sets: Basic Concept – Crisp Set Vs Fuzzy Set - Operations onFuzzy Set – Properties of Fuzzy Sets– Fuzzy Relations: Concept – Fuzzy Composition – Fuzzy Equivalence and Tolerance Relation - Membership Functions: Features – Fuzzification – Methods of Membership value assignments – Defuzzification –Methods.

UNIT IV GENETIC ALGORITHM **9 Hours**

Genetic Algorithm: Fundamental Concept – Basic Terminologies– Traditional Vs Genetic Algorithm- Elements of GA - Encoding - Fitness Function – Genetic Operators: Selection – Cross Over - Inversion and Deletion - Mutation – Simple and General GA – The Schema Theorem - Classification of Genetic Algorithm – Genetic Programming – Applications of GA.

UNIT V Applications of Soft Computing **9 Hours**

Introduction- Travelling Sales Person Problem using Genetic Algorithm- Soft Computing based Neuro Fuzzy Controller- ANFIS Modeling- Genetic Neuro Hybrid Systems.

f. Mapping of COs, POs and PSOs:

Course Outcome	PO Addressed PO1 to PO 7			Correlation Level L/M/H			PSO Addressed PSO1 to PSO7		Correlation Level L/ M/ H		Cognitive Level K1 to K6
CO1	PO1	PO2		H			PSO1		H		K1
CO2	PO3	PO4	PO5	M	M	H	PSO1	PSO2	H	H	K5
CO3	PO1	PO6		H	M		PSO3	PSO4	H	M	K3, K4, K6
CO4	PO1	PO5		M	L		PSO1	PS03	H	M	K2, K3, K4

(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. S.N.Sivanandam, S.N.Deepa, “Principles of Soft Computing”,Third Edition ,Wiley,2018.
2. Ross Timothy J, Fuzzy Logic with Engineering Applications, Wiley India Pvt Ltd, New Delhi,2010.
3. Prathikar D.K,”Soft computing: fundamentals and applications”, revised edition ,2015.
4. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”,Addison Wesley, 2007,

WEB RESOURCE(S):

1. https://towardsdatascience.com/soft-computing-6cef872f7704
2. http://www.soft-computing.de/def.html.
3. https://www.igi-global.com/dictionary/soft-methods-automatic-drug-infusion/27620

ETHICAL HACKING

C	L	T	P
4	3	1	0

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

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 **9 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 **9 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 **9 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 **9 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 **9 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 PO7**	**Correlation Level L/M/H**	**PSO Addressed PSO1 to PSO7**	**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 PSO 3	M H	K_3
CO4	PO4	H	PSO6	H	K_4
CO5	PO5	M	PSO5	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.

SOFTWARE TESTING

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

C	L	T	P
4	3	1	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 **9 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 **9 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 **9 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 a Data Warehouse - Case Study for Web Application Testing.

Unit IV **9 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 **9 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 PO7		Correlation Level L/M/H		PSO Addressed PSO1 to PSO7	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		PSO6	H	K_4
CO5	PO5	PO6	M	M	PSO5	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.

SOFTWARE PROJECT MANAGEMENT

a. Course Code:

C	L	T	P
4	3	1	0

b. Course Objectives:

CO1 :To understand, how to do project planning for the software process.

CO2 :To analyze the cost estimation during the analysis of the project.

CO3 :To understand the estimation techniques available in the IT industry .

CO4 :To understand the risks available in the Software Management.

CO5 : To differentiate the Global standards and social impacts on globalization..

c. Course Prerequisites:

1. Basic Concepts of Software Engineering

d. Course Outcomes:

At the end of this course, the students should able to

CO1: Understand the activities during the project scheduling of any software application.
CO2: Solve the risk management activities and the resource allocation for the projects.
CO3: Apply the software estimation and recent quality standards for evaluation of the software Projects.
CO4: Analyze knowledge and skills needed for the construction of highly reliable software project.
CO5: Implement reliable, replicable estimation that links to the requirements of project planning and managing .

e. Course Outline:

Unit I INTRODUCTION 9 Hours

Introduction to Software Project Management: An Overview of Project Planning: Select Project, Identifying Project scope and objectives, infrastructure, project products and Characteristics. Estimate efforts, Identify activity risks, and allocate resources- TQM, Six Sigma, Software Quality: defining software quality, ISO9126, External Standards.

UNIT II SOFTWARE EVALUATION AND COSTING 9 Hours

Project Evaluation: Strategic Assessment, Technical Assessment, cost-benefit analysis, Cash flow forecasting, cost-benefit evaluation techniques, Risk Evaluation. Selection of Appropriate Project approach: Choosing technologies, choice of process models, structured methods.

Unit III SOFTWARE ESTIMATION TECHNIQUES 9 Hours

Software Effort Estimation: Problems with over and under estimations, Basis of software Estimation, Software estimation techniques, expert Judgment, Estimating by analogy. Activity Planning: Project schedules, projects and activities, sequencing and scheduling Activities, networks planning models, formulating a network model. Case Study: Effort Estimation models.

UNIT IV RISK MANAGEMENT 9 Hours

Risk Management: Nature of Risk, Managing Risk, Risk Identification and Analysis, Reducing the Risk. Resource Allocation: Scheduling resources, Critical Paths, Cost scheduling, Monitoring and Control: Creating Framework, cost monitoring, prioritizing monitoring Case Study: Risk on Complex projects.

UNIT V GLOBALIZATION ISSUES IN PROJECT MANAGEMENT 9 Hours

Globalization issues in project management: Evolution of globalization- challenges in building global teams-models for the execution of some effective management techniques for managing global teams. Impact of the internet on project management– managing projects for the internet – project management activities. Comparison of project management software's: dot Project, Launch pad, openProj. Case study.

f. Mapping of COs, POs and PSOs:

Course Outcome	PO Addressed PO1 to PO 7			Correlation Level L/M/H			PSO Addressed PSO1 to PSO7		Correlation Level L/ M/ H		Cognitive Level K1 to K6
CO1	PO1	PO2		H			PSO1		H		K_1
CO2	PO3	PO4	PO5	M	H	M	PSO1	PSO2	H	H	K_5
CO3	PO1	PO6		H	H		PSO3	PSO4	M	M	K3, K4, K6
CO4	PO1	PO5		M	M		PSO1	PSO3	H	M	K2,K3, K4
CO5	PO3	PO6		M	M		PSO4		M		K5,K6

(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. Bob Hughes, Mike Cotterell & Rajib Mall, "Software Project Management", TataMcGraw- Hill Publications, Sixth Edition 2017
2. Futrell , "Quality Software Project Management", Pearson Education India, 2008.
3. S. A. Kelkar, "Software Project Management" PHI, New Delhi, Third Edition ,2013.

BIOINFORMATICS

C	L	T	P
4	3	1	0

a. Course Code:

b. Course Objectives:

To gain the theoretical knowledge on biological sequence structure
To explore the databases available for biological sequences and its format
To study the algorithms and techniques for sequence alignment
To understand the computational techniques used for biological sequence analysis
To know the advancement in bioinformatics

c. Course Outcomes (COs):

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

CO1: Understand the biological sequence structure
CO2: Identify the suitable database for research analysis
CO3: Understand the techniques and create an algorithm for sequence alignment
CO4: Apply the suitable algorithm for biological sequence analysis
CO5: Determine the appropriate computing technique for solving bioinformatics problems

e. **Course Outline**:

UNIT 1

Introduction to Bioinformatics **9 Hours**

Bioinformatics- Definition, History, Nature and Types of biological data, Single letter code of nucleotides and amino acids, Sequence file formats, Application of Bioinformatics in various fields, Need for Bioinformatics technologies, Overview of Bioinformatics technologies- scope for bioinformatics.

UNIT 2

Biological Databases **9 Hours**

Classification of biological databases - Primary & derivative database, Public databases - NCBI, EBI, Entrez Literature & Molecular resources, Querying NCBI databases, Nucleic acid databases: GenBankMBL, DDBJ; Protein Sequence Databases-SwissProt, PIR; Structure Database-RCSB PDB, CSD; Chemical Structure Database: Pubchem; Derived Databases: Sequence – InterPro, Prosite Pfam, ProDom; Structure Classification Database - CATH, SCOP, FSSP; Specialized Databases: OMIM; KEGG; Genecard; GPCRdb.

UNIT 3

Biological sequence Analysis **9 Hours**

Concept of sequence Alignment, Scoring matrices: PAM &BLOSUM; Alignment of Pairs of sequences: Dot Plot. Alignment Algorithms-Needleman and Wunsch Algorithm, Smith Waterman Algorithm. Search for Homologous sequences. Multiple Sequence Alignment: Dynamic Programming and progressive alignment. Homology Concept and Alignment of pairs of sequence, Global & Local Alignment-Multiple sequence alignment and its applications. Computational Gene Prediction and Genome annotation

UNIT 4

Computation techniques for bioinformatics **9 Hours**

Sequence representation - feature extraction- classification - Clustering – encoding schemes for biological sequences – compression techniques – machine learning algorithms for searching sequence patterns-genetic algorithms and their applications in Bioinformatics, Support Vector Machine and their applications in Bioinformatics, Neural Networks and their applications in Bioinformatics

UNIT 5

Advances in Bioinformatics **9 Hours**

Applications of Bioinformatics- Bioinformatics Tools and Software- Computer-Aided Drug Designing- Next Generation Sequencing-Bioinformatics in Personalized Medicine-Bioinformatics for Image Processing-Artificial Intelligence in Bioinformatics- Big Data Analysis in Bioinformatics-Soft Computing in Bioinformatics

References

1. Introduction to Bioinformatics by Arthur Lesk, 4th Edition, Oxford University press, 2013
2. Algorithms in Bioinformatics: A Practical Introduction - Wing-Kin Sung, 2009, 1ed.
3. Algorithmic Aspects of Bioinformatics - Böckenhauer & Bongartz, 2010, 1ed.
4. M. Michael Gromiha, Protein Bioinformatics: From Sequence to Function, Academic Press, 2010
5. D.E. Krane and M.L. Raymer, Fundamental concepts of bioinformatics, Pearson Education Inc. 2006
6. Advances in Bioinformatics , Vijai Singh ,Ajay Kumar , Publisher : Springer; 1st ed. 2021 edition (August 2, 2021)
7. Computational Methods with Applications in Bioinformatics Analysis, Jeffrey J P Tsai , Ka-Lok Ng , 2017

f. Mapping of COs, POs and PSOs:

Course Outcome	**PO Addressed** PO1 to PO8	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO8	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	L	PSO1 PSO6	M	K_2
CO2	PO2 PO5	M M	PSO2 PSO4	M H	K_3, K_2
CO3	PO4 PO6	M M	PSO4 PSO6	H H	K_2, K_3 K_4
CO4	PO4 PO6	M H	PSO4 PSO6	H H	K_4,K_5
CO5	PO2 PO3 PO7	H H M	PSO4 PSO6 PSO7	M H 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

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 **9 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 **9 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 **9 Hours**

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

Unit IV LOCALIZATION **9 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 **9 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 Out come	**PO Addressed** PO1 to PO7				**Correlation Level** L/M/H				**PSO Addressed** PSO1 to PSO7		**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	PO7	M	M	M		PSO4	PSO5	M	H	K_5
CO6	PO2	PO5	PO6	PO7	H	H	M	M	PSO4	PSO6	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