

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING  
MANONMANIAM SUNDARANAR UNIVERSITY**

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

**Vision & Mission of the Department**

Vision

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

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Mission

To achieve academic excellence by,

providing an environment that combines Computing practice and research

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

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

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## Preamble

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

MCA is a Professional PG degree Programme which provides students with an opportunity to develop technical computing skills and core competence in the field of software development. The Learning Outcome based Curriculum Framework (LOCF) for the program has been formulated with the Regulations, Program Specific Outcomes, Course outcomes, curriculum structure, the detailed syllabus for the Core, allied, Practical, supportive, and skill-based courses; and the guidelines for the project works / internship activities. The Curriculum focuses on imparting conceptual knowledge, coding skills, software development and debugging, Software Testing and maintenance, and problem-solving using computers.

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## REGULATIONS

**Duration of the Programme:** Two years (4 Semesters)

### Eligibility:

B.C.A degree / Bachelor Degree in Computer Science / B.E. degree in Computer Science and Engineering or equivalent Degree or B.Sc. / B.Com./ B.A. with Mathematics at 10+2 Level or at Graduation Level (with additional bridge courses as per the norms of the concerned University). Obtained at least 50% marks (45% marks in case of candidates belonging to SC/ST category) in Part-III of the qualifying examination.

### Entrance Test:

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

### Selection

- Selection for the M.C.A. programme shall be based on the rank list prepared based on the valid **TANCET score**.
- Vacancy, if exists, shall be filled based on the rank list prepared based on the **consolidated mark as obtained by the student in the Part-III of the Qualifying UG Degree examination and the University Entrance Test score. The weightage for the qualifying UG degree Examinations and the TANCET / UET score shall be 50% each.**
- Selection of students for the available seats shall be based on the rank obtained by the student based on the merit list as per AICTE / Manonmaniam Sundaranar Admission guidelines and the Tamilnadu Government Reservation norms.

### Admission

- The admission of students to the M.C.A. programme shall be made through a two-phase counseling process in which the first phase considers the TANCET Scorers and the second phase shall be for the rest of all eligible candidates. The modalities of the Counseling will be decided by the University at the time of Admission.

- The date and time of counseling shall be communicated through the University website one week in advance. Individual communication will not be sent in this regard. Students shall furnish all the relevant supporting documents during the counseling.

### **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 shall be awarded the respective degree upon successful completion of the programme as per university norms.

### **PROGRAMME SPECIFIC OUTCOMES (PSO):**

The Specific Outcomes of MCA programmes are:

On Successful completion of the MCA degree programme, students will be able to

PSO1: Understand and apply knowledge on analysis, design, development and maintenance of software applications.

PSO2: Integrate and apply efficiently the modern IT tools to computer applications.

PSO3: Utilize skills and knowledge for computing practice with commitment on social, ethical and legal values.

PSO4: Comprehend, explore and build up software projects to meet the requirements of industry using modern technologies.

PSO5: Analyze the societal needs to provide innovative solutions through technology based research.

PSO6: Pursue careers with necessary skills in IT industry/ consultancy/ research and development, teaching and allied areas.

PSO7: Work competently as an individual or in teams and communicate effectively.

### **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**  
**Master of Computer Applications**  
**Course Structure & Scheme of Examination [effect from 2022 – 2023]**

COURSENAME : **Master of Computer Applications**

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		Data Structures, Algorithms and Applications (e-PGPathshala)	4	3	1	0	25	75
4		Problem solving using Python	4	3	1	0	25	75
5		Advanced Database Management System	4	3	1	0	25	75
6		Data Structures, Algorithms and Applications Lab	2	0	0	4	50	50
7		Advanced Database Management System Lab	2	0	0	4	50	50
8		Soft Skill Development	1	0	0	2	50	50
		<b>Total</b>	<b>25</b>	<b>15</b>	<b>5</b>	<b>10</b>		

COURSENAME : **Master of Computer Applications**

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 Operating System	4	3	1	0	25	75
3		Big data Analytics using Machine Learning	4	3	1	0	25	75
4		Advanced Java Programming	4	3	1	0	25	75
5		Elective-I	3	3	0	0	25	75
6		Big data Analytics using Machine Learning Lab	2	0	0	4	50	50
7		Advanced Java Programming 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		
		<b>Total</b>	<b>23</b>	<b>15</b>	<b>5</b>	<b>10</b>		

COURSE NAME : **Master of Computer Applications**

SEMESTER : **III**

Sl. No.	SUB. CODE	SUBJECT TITLE	C	L	T	P	INT	EXT
1		Supportive Course	3	3	0	0	25	75
2		Internet of Things	4	3	1	0	25	75
3		Web Technologies	4	3	1	0	25	75
4		Software Engineering	4	3	1	0	25	75
5		Elective –II	3	3	0	0	25	75
6		Web Technologies 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		
<b>Total</b>			<b>27</b>	<b>15</b>	<b>5</b>	<b>10</b>		

**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 : **Master of Computer Applications**

SEMESTER : **IV**

Sl. No	SUB. CODE	SUBJECT TITLE	C	L	T	P	INT	EXT
1		Major Project	16	0	0	30	50	50
<b>Total Credits</b>			<b>16</b>					

<b>CREDIT SUMMARY FOR Master of Computer Applications</b>	
SEMESTER I	25
SEMESTER II	23
SEMESTER III	27
SEMESTER IV	16
<b>TOTAL CREDITS</b>	<b>91</b>

**LIST OF ELECTIVE COURSES**  
**ELECTIVE I**

Sl. No.	SUB. CODE	SUBJECT TITLE	C	L	T	P	INT	EXT
1.		Human Computer Interaction	3	3	0	0	25	75
2.		Digital Image Processing	3	3	0	0	25	75
3.		Machine Learning	3	3	0	0	25	75
4.		Cloud Computing	3	3	0	0	25	75
5.		Advanced Computer Networks	3	3	0	0	25	75
6.		Mobile Application Development	3	3	0	0	25	75

**ELECTIVE II**

Sl. No.	SUB. CODE	SUBJECT TITLE	C	L	T	P	INT	EXT
1.		Software Project Management	3	3	0	0	25	75
2.		Deep Learning	3	3	0	0	25	75
3.		Cryptography and Network Security	3	3	0	0	25	75
4.		Block Chain Technology	3	3	0	0	25	75
5.		Wireless Sensor Network	3	3	0	0	25	75
6.		Software Testing	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, the 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, and 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		PSO Addressed PSO1 to PSO7		Correlation Level		Cognitive Level K <sub>1</sub> to K <sub>6</sub>
			L/M/H				L/ M/ H		
CO1	PO1		H		PSO6		H		K <sub>4</sub>
CO2	PO1		H		PSO6		M		K <sub>3</sub>
CO3	PO1		H		PSO1		H		K <sub>2</sub>
CO4	PO4		M		PSO4		H		K <sub>4</sub>
CO5	PO2	PO6	M	H	PSO2	PSO3	M	H	K <sub>3</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub>–Evaluate, K<sub>6</sub>– 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 – Chapter 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 course, the student should able to

**CO1:** Find the performance of the system using performance metrics

**CO2:** Perform the arithmetic for computer and design for ALU

**CO3:** Know the concept of various memories

**CO4:** Implement the pipelining concepts

**CO5:** Design algorithms for memory management techniques

**CO6:** Know the concept of parallel processors

**e. 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: Restoring and 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 Memory Access.

**UNIT V: Parallel Processing****12 Hours**

Exploitation of more ILP – Dynamic Scheduling: Tomasulo’s Algorithm – Introduction to Multicourse – Graphics Processing Units – Overview of Next Generation Processors

**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 <sub>1</sub> to K <sub>6</sub>
CO1	PO1		H		PSO2		L		K <sub>1</sub>
CO2	PO1	PO2	H	M	PSO1	PSO4	H	H	K <sub>2</sub>
CO3	PO4	PO1	H	M	PSO1	PSO2	H	H	K <sub>3</sub>
CO4	PO2	PO4	H	M	PSO1		M		K <sub>4</sub>
CO5	PO4		H		PSO6		M		K <sub>5</sub>
CO6	PO6	PO7	H	H	PSO6		H		K <sub>6</sub>

(L – Low, M – Medium, H – High); K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub> – Evaluate, K<sub>6</sub> – 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”, Tenth Edition, Pearson Education, 2016.
4. John L. Hennessy, David A. Patterson, “Computer Architecture – A Quantitative Approach”, Morgan Kaufmann / 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.

# DATA STRUCTURES, ALGORITHMS AND APPLICATIONS (e-PGPathshala)

a. Course Code:-----

C	L	T	P
4	3	1	0

b. Course Objectives:

1. Master the implementation of data structures such as linked lists and trees
2. To be familiar with basic techniques of algorithm analysis
3. Design algorithms using popularly used strategies like greedy, divide and conquer programming etc.
4. To understand the method calculating computational complexity of algorithms

c. Course Prerequisites:

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

d. Course Outcomes (COs):

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

**CO1:** Define data structures

**CO2:** Illustrate the need for data structures

**CO3:** Compute the time complexity of an algorithm

**CO4:** Analyze the role of various data structures to organize data in the main memory

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

e. Course Outline:

**Unit I**

**9 Hours**

**Arrays:** Introduction to data structures: definition – types. Arrays: definition – logical structure – operations – application: sparse matrix multiplication.

**Linked Lists:** definition - Singly Linked List: logical structure – operations: insert – delete – traverse – search –merge. Doubly Linked List: logical structure- operations: insert-delete- application: polynomial manipulation.

**Unit II**

**9 Hours**

**Stack:** definition – logical structure - array and linked list representations - operations - applications of stacks: Towers of Hanoi - reverse a list - arithmetic expression evaluation.

**Queues:** definition - logical structure - array and linked List representations - operations – application: Round Robin algorithm.

**Unit III****12 Hours**

**Trees:** Binary Trees: definition – logical structure - properties –types. Binary search trees:definition – logical structure - array and linked list representations–operations - traversal techniques: in order – pre order – post order - application: Expression trees.

**Graphs:** definition – logical structure - array and linked list representations – traversal techniques: BFS - DFS–applications: shortest path problem - minimum spanning trees: Kruskal’s algorithm - Prim’s algorithm.

**Unit IV****15 Hours**

**Algorithm analysis:** space complexity – definition – examples - time complexity - definition - examples - Asymptotic Notations - example solutions – algorithm design methods: classification - optimization.

**Divide and Conquer method:** general method - finding the maximum and minimum algorithm - merge sort algorithm –binary search algorithm.

**Unit V****15 Hours**

**Greedy Method:** general method - container loading problem - knapsack problem -job sequencing with deadlines. **Dynamic Programming:** general method - multistage graphs- traveling salesperson problem. **Backtracking:** general method - 8-queens problem. **Branch and Bound:** general method - 0/1 knapsack problem.

**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 <sub>1</sub> to K <sub>6</sub>
CO1	PO1	H	PSO1	H	K <sub>1</sub>
CO2	PO1	M	PSO1	M	K <sub>2</sub>
CO3	PO2	H	PSO2	M	K <sub>3</sub>
CO4	PO4	H	PSO6	H	K <sub>4</sub>
CO5	PO6	M	PSO3   PSO5	M   H	K <sub>5</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub>–Evaluate, K<sub>6</sub> – Create)

**g. Reference Books**

1. Web Link: <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQKJvP3a/8Vd3L08tQ==>  
(e-PGPathshala (inflibnet.ac.in))
- 2.Sartaj Sahni, “Data structures algorithms and applications in C++”, ISBN: 0929306325, 9780929306322, 803 pages.
- 3.Fundamentals of Computer Algorithms, Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, ISBN: 454-6-77598-540-3, 485pages.
- 4.Data Structures Using C and C++ Y. Langsam, M. Augenstein and A. M. Tenenbaum, ISBN: 9788120311770, 672 pages.
- 5.Data structures and Algorithms, Alfred V. Aho, John E. Hopcroft and Jeffrey D Ullman, Pearson Education India, ISBN: 9788177588262, 9788177588262, 436 page

## PROBLEM SOLVING USING PYTHON

C	L	T	P
4	3	1	0

a. **Course Code** :.....

**b. Course Objectives:**

1. To learn how to use lists, tuples and dictionaries in python programs.
2. To learn how to build and package python programs for reusability.
3. To learn how to read and write files in python.
4. To learn how to use exception handling in python applications for error handling

**c. Course Prerequisites:**

Experience in any of the Object Oriented Programming language

**d. Course Outcomes\* (COs):**

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

- CO1:** Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in python
- CO2:** Do the decision making and write functions in Python.
- CO3:** Explain how to design GUI Applications in Python and evaluate different database operations
- CO4:** Design and develop Client Server network applications using Python.

**e. Course Outline:**

**Unit I: Introduction**

**12 Hours**

**Introduction to python :** History of Python – Identifiers – Variables, Assignment statements & Expressions– Numeric data types and Operators – Operator Precedence – Type Conversion and Rounding. **Built-in functions:** Common functions – Strings & Characters – objects & methods. **Selections:** Boolean types, values & expressions –if Statements –Two-Way if-else Statements – Nested if and Multi-Way if-elif-else Statements–LogicalOperators–ConditionalExpressions.

**Unit II: Loops, Functions, Tuples, Recursion, Sets, and Dictionaries**

**12 Hours**

**Loops:** while Loop –for Loop – Nested Loops –Keywords break and continue –Case Study. **Functions :** Defining a Function– Calling a Function–Functions with/without Return Values – Positional and Keyword Arguments– Passing Arguments by Reference Values. **Recursion – Recursion** vs. Iteration – Tail Recursion – **Tuples, Sets, and Dictionaries:** Introduction– Tuples – Sets– Comparing the Performance of Sets and Lists – Dictionaries – **Lists :** Introduction– List Basics – Copying Lists – Passing Lists to Functions – Returning a List from a Function – Searching Lists– Sorting Lists.

**Unit III: Files and Exception Handling, Modules, Packages****12 Hours**

File Operations –Iterators - Exception handling - Regular Expressions- Creating Modules-Import Statement-Introduction to PIP-Installing Packages via PIP-Using Python Packages.

**Unit IV: GUI Programming****12 Hours**

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts – Colours- Canvas - Widgets (frame, label, button, check box, entry, listbox, message, radiobutton, text, spinbox).

**Unit V: Database and Network****12 Hours**

Database (using NoSQL): Connector module –Cursor – Statements – Exceptions in database. Network connectivity: Socket module – Client – Server – Email –URL Access.

**f. Mapping of Cos to POs and PSOs**

Course Outcome	PO Addressed	Correlation Level	PSO Addressed		Correlation Level		Cognitive Level
CO1	PO1	H	PSO1	PSO2	H	H	K <sub>2</sub> , K <sub>3</sub>
CO2	PO1	H	PSO1	PSO2	H	H	K <sub>2</sub> , K <sub>3</sub>
CO3	PO3	H	PSO2	PSO6	H	H	K <sub>6</sub>
CO4	PO3	H	PSO2	PSO6	H	H	K <sub>6</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub> – Evaluate, K<sub>6</sub> – Create)

**g. Text Books** (if applicable)**Reference Books**

1. Y. Daniel Liang, Introduction to programming using Python, Prentice Hall publishers.
2. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning, ISBN: 978-1111822705
3. Python for Everybody: Exploring data using Python 3 , Dr.Charles R. Severence, 2016

## ADVANCED DATABASE MANAGEMENT SYSTEMS

C	L	T	P
4	3	1	0

a. Course Code: -----

### b. Course Objectives:

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

### c. Course Prerequisites:

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

### d. Course Outcomes (COs):

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

**CO1:** Recognize the importance of Various Data models and Architecture

**CO2:** Analyze and Design the normalized database schema

**CO3:** Decide the database for his problem

**CO4:** Develop database solutions

**CO5:** Write database queries in SQL, PL SQL and NoSQL

### e. Course Outline:

#### Unit I:

**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, Interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism, Interoperation Parallelism.

#### Unit II

**14 Hours**

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

**Unit III:****12 Hours**

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

**Unit IV:****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 <sub>1</sub> to K <sub>6</sub>
CO1	PO1	H	PSO1	M	K <sub>2</sub>
CO2	PO5	H	PSO1	H	K <sub>4</sub>
CO3	PO1	H	PSO2	M	K <sub>4</sub>
CO4	PO2	H	PSO1	H	K <sub>3</sub>
CO5	PO1	H	PSO1   PSO4	H   M	K <sub>2</sub>

(L – Low, M – Medium, H – High); K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub> – Evaluate, K<sub>6</sub> – Create

**g. Reference Books**

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

**h. Web Resources:**

1. [https:// docs.mongodb.com/manual/tut](https://docs.mongodb.com/manual/tut)



## DATA STRUCTURES, ALGORITHMS AND APPLICATIONS - LAB

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

<b>C</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>2</b>	<b>0</b>	<b>0</b>	<b>4</b>

**b.Course Objectives:**

Implement data structures and their operations

Implement applications of data structures

Implement applications of algorithms

**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 –

**CO1:**Gain practical knowledge about data representations in the main memory

**CO2:**Implement data structures and their applications

**CO3:**Solve computing problems using algorithms

**e.Course Outline:**

**List of Experiments:**

**60 hours**

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

- a. Array operations: insert, delete, search, sort and merge
- b. Stack representation
- c. Application of Stack
- d. Queue representation
- e. Application of Queue
- f. Representation of Tree data structure
- g. Binary search tree operations: insert, delete and search
- h. Representation of Graph data structure
- i. Tree traversal algorithms
- j. Graph traversal algorithms
- k. Algorithms using Divide and Conquer method
- l. Algorithms using Greedy method

**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 <sub>1</sub> to K <sub>6</sub>		
	PO1	PO2	PO3	PO4	PO6	M	H	M	M	PSO1	PSO2	PSO5	PSO6	H	M	M			
CO1	PO1	PO2			PO6	M	H	M		PSO1			PSO6	H	M		K <sub>1</sub> , K <sub>2</sub>		
CO2	PO1	PO2	PO4		PO6	H	H	M	M	PSO1	PSO2		PSO6	H	M	M	K <sub>2</sub> , K <sub>3</sub> , K <sub>4</sub>		
CO3	PO1	PO2	PO3	PO4	PO6	L	M	M	L	L	PSO2	PSO4	PSO5	PSO6	M	L	L	M	K <sub>2</sub> , K <sub>3</sub> , K <sub>4</sub> , K <sub>2</sub> , K <sub>3</sub> , K <sub>5</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub> – Evaluate, K<sub>6</sub> – Create)

## ADVANCED DATABASE MANAGEMENT SYSTEM LAB

**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	L	T	P
2	0	0	4

**c.Course Prerequisites:**

4. Knowledge on the fundamentals of database management system

5. Knowledge on the computer architecture

6. 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 EXERCISES**

**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 <sub>1</sub> to K <sub>6</sub>
	PO1	PO2	PO3		PSO1	PSO2	PSO3		
CO1	PO1	PO2	PO3	H	PSO1	PSO2	PSO4	H	K <sub>2</sub>
CO2	PO1			H	PSO2			H	K <sub>4</sub>
CO3	PO2			H	PSO1			M	K <sub>4</sub>
CO4	PO2			H	PSO2	PSO3		H	K <sub>3</sub>

(L – Low, M – Medium, H – High); K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub> – Evaluate, K<sub>6</sub> – Create)

## SOFT SKILLS DEVELOPMENT

C	L	T	P
1	0	0	2

a. **Course Code:** .....

**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**

**6 Hours**

**Communicative Skills**

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****6 Hours****Interactive and Writing Skills**

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****6 Hours****Interview Skills**

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 - FAQs in interviews.

**Unit IV****6 Hours****Soft Skills**

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****6 Hours****Holistic Development**

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**

<b>Course Outcome</b>	<b>PO Addressed</b>	<b>Correlation Level</b>	<b>PSO Addressed</b>	<b>Correlation Level</b>	<b>Cognitive Level</b>
CO1	PO1	M	PSO1	M	K <sub>1</sub>
CO2	PO4	H	PSO5	H	K <sub>2</sub>
CO3	PO6	M	PSO2	M	K <sub>3</sub>
CO4	PO2	M	PSO4	M	K <sub>4</sub>
CO5	PO3	H	PSO6	H	K <sub>5</sub>
CO6	PO5	H	PSO3	H	K <sub>6</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub>– Apply, K<sub>4</sub>– 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 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. Daemon – procedure to check the type of the webserver on a website.

**Connection establishment:** Instructions to Install MySQL on linux - Connecting to the MySQL Server with the mysql Client - Basic Operations with MySQL: show, create, describe, add, delete operations. Managing Services - core components and libraries - Ancillary components - Configuration of system.

**Unit 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 <sub>1</sub> to K <sub>6</sub>
CO1	PO1	H	PSO1	H	K <sub>1</sub>
CO2	PO1	M	PSO1	M	K <sub>2</sub>
CO3	PO2	H	PSO2   PSO4	H   M	K <sub>3</sub>
CO4	PO4	H	PSO6	H	K <sub>4</sub>
CO5	PO6	M	PSO3   PSO5	H   M	K <sub>5</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub> – Evaluate, K<sub>6</sub> – 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.

# 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 different methods.
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 learning approaches.

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

**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:**

<b>Cou rse Outc ome</b>	<b>PO Addressed PO1 to PO8</b>	<b>Correlati onLevel L/M/H</b>	<b>PSO Addressed PSO1 to PSO8</b>	<b>Correlation Level L/ M/ H</b>	<b>Cogniti ve Level K<sub>1</sub> to K<sub>6</sub></b>
CO1	PO1	M	PSO1	M	K <sub>1</sub>
CO2	PO2	H	PSO1	H	K <sub>2</sub>
CO3	PO2, PO4	H	PSO2, PSO3, PSO4	H	K <sub>3</sub>
CO4	PO3, PO4	H	PSO5	H	K <sub>4</sub>
CO5	PO5, PO6	M	PSO3, PSO5	M	K <sub>5</sub>
CO6	PO3, PO5, PO7	H	PSO6, PSO7	M	K <sub>6</sub>

*(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub> – Evaluate, K<sub>6</sub> – Create)*

**g. References:**

1. Raj Kamal, Preeti Saxena - BIG DATA ANALYTICS: Introduction to Hadoop, Spark, and Machine-Learning – McGraw-Hill Education, 2019.

## ADVANCED JAVA PROGRAMMING

C	L	T	P
4	3	1	0

a. Course Code : .....

### b. Course Objectives:

1. To design stand-alone desktop-oriented GUI based Java applications using Swing and access the database using JDBC.
2. To understand the networking components to transfer data over networks.
3. To develop web application based on Java uses Servlet, JSP
4. To design applications using pre-built frameworks.

c. Course Prerequisites: (Specify a minimum of 3 for each course)

- Experience in any of the Object Oriented Programming language
- Basic understanding of the Java language
- Basic knowledge on SQL

### d. Course Outcomes\* (COs):

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

- CO1:** Understand swing components and its usage.
- CO2:** Implement Networking and Data base connectivity in Java for given application.
- CO3:** Implement webpage with dynamic content and server side web application using Servlet and JSP.
- CO4:** Develop Java application using spring framework.

### d. Course Outline:

#### Unit I: Swing

**9 Hours**

Introduction JApplet Class – Image Icon Class – JLabel Class - JButton Class – JTextField Class - JCheckBox Class - JRadioButton Class – JComboBox Class – JTabbedPane Class – JScrollPane Class – JSplitPane Class – Dialogs – File Selection Dialog – JColor Chooser Class – JTable Class – JToolBar Class – JProgressBar Class – JSlider Class – JTree Class – Examples of Menus – Case study

#### Unit II: Java Networking & JDBC

**13 Hours**

Network Basics and Socket overview– TCP/IP client sockets– URL– TCP/IP server sockets– Datagrams– java.net package Socket– ServerSocket– InetAddress– URL– URLConnection

**Java Database Connectivity:** Introduction – Establishing a connection – Creation of data tables – Entering data into the tables – Table updating – Use of Prepared statement – Obtaining Meta data – Using Transactions – Scrollable Result sets – Stored Procedures

#### Unit III: Servlets

**13 Hours**

Introduction – Servlets and Dynamic Web Pages – Life Cycle of a Servlet – Constituents of javax.servlet Package – Retrieving the values of parameters –

Retrieving the values of Initialization parameters – The javax.servlet.http package – cookies – Creating a cookie and sending it to the client – Retrieving the stored cookies – Session Tracking.

**Unit IV: Java Server Pages****13 Hours**

JSP Overview: The Problem with Servlets – Life Cycle of JSP Page– JSP Processing– JSP Application Design with MVC– Setting Up the JSP Environment– JSP Directives– JSP Action– JSP Implicit Objects JSP Form Processing– JSP Session and Cookies Handling– JSP Session Tracking JSP Database Access– JSP Standard Tag Libraries– JSP Custom Tag– JSP Expression Language– JSP Exception Handling– JSP XML Processing

**Unit V: Java Web Frameworks: Spring****12 Hours**

Overview of Spring– Spring Architecture– Environment Set up – Hello world Example – bean life cycle– XML Configuration on Spring– AOP with Spring Framework –JDBC Framework – Managing Database– Managing Transaction

**e. Mapping of Cos to POs and PSOs**

Course Outcome	PO Addressed	Correlation Level	PSO Addressed		Correlation Level		Cognitive Level
CO1	PO2	H	PSO1	PSO4	M	H	K <sub>1</sub>
CO2	PO3	H	PSO2		H		K <sub>6</sub>
CO3	PO3	H	PSO4		H		K <sub>6</sub>
CO4	PO2	H	PSO2		H		K <sub>3</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub> – Evaluate, K<sub>6</sub> – Create)

**g. Text Books****References**

1. Java 2 – The Complete Reference, Herbert Schildt, Tata McGraw Hill, 2021.
2. Beginning JSP, JSF and Tomcat, Giulio Zambon, Apress
3. Spring in Action 3rd edition , Craig walls, Manning Publication
4. <https://www.tutorialspoint.com/>
5. <https://www.geeksforgeeks.org/introduction-java-servlets/>

## **BIG DATA ANALYTICS USING MACHINE LEARNING LAB**

<b>C</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>2</b>	<b>0</b>	<b>0</b>	<b>4</b>

**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 –

**CO1 :** 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 MLlib
12. Classification using Neural Network using Keras

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

<b>Course Outcome</b>	<b>PO Addressed PO1 to PO8</b>	<b>Correlation Level L/M/H</b>	<b>PSO Addressed PSO1 to PSO8</b>	<b>Correlation Level L/ M/ H</b>	<b>Cognitive Level K<sub>1</sub> to K<sub>6</sub></b>
CO1	PO2, PO3, PO4	H/M/H	PSO2, PSO4, PSO5, PSO6, PSO7	H/H/M/H	K <sub>4</sub>
CO2, CO3	PO3, PO4, PO5	H/H/H	PSO2, PSO4, PSO5, PSO6, PSO7	H/H/M/H	K <sub>4</sub> , K <sub>5</sub> , K <sub>6</sub>

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

## ADVANCED JAVA PROGRAMMING LAB

C	L	T	P
2	0	0	4

a.. Course Code:.....

**b. Course Objectives:**

1. To design stand-alone desktop-oriented GUI based Java applications using Swing and access the database using JDBC.
2. To understand the networking components to transfer data over networks.
3. To develop web application based on Java uses Servlet, JSP
4. To design applications using pre-built frameworks.

**c. Course Prerequisites:**(Specify a minimum of 3 for each course)

- Experience in any of the Object Oriented Programming language
- Basic understanding of the Java language
- Basic knowledge on SQL

**d. Course Outcomes\* (COs):**

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

- CO1:** Understand swing components and its usage.
- CO2:** Implement Networking and Data base connectivity in Java for given application.
- CO3:** Implement webpage with dynamic content and server side web application using Servlet and JSP.
- CO4:** Develop Java application using spring framework.

**e. Course Outline:**

**List of Experiments:**

**60 Hours**

1. Java swing program to create a Student information System using JApplet.(Use the necessary swing components to create a rich user interface)
2. Java Swing program to implement file operations.
3. Implement TCP Server for transferring files using Socket and ServerSocket.
4. Implement student registration form with enrollment number, first name, last name, semester, contact number. Store the details in database using JDBC. Also implement delete and modify facility for student records.
5. Write a Servlet program to print system date and time.
6. Write an application to demonstrate the session tracking in Servlet.
7. Implement cookies to store firstname and lastname using Java server pages.
8. Implement the shopping cart for users for the online shopping. Apply the concept of session.
9. Write a simple spring Application to print a greeting message.
10. Write an application to keep record and retrieve record of student. The record includes student id, enrollment number, semester, SPI. Use MVC architecture.

**f. Mapping of Cos to POs and PSOs**

<b>Course Outcome</b>	<b>PO Addressed</b>	<b>Correlation Level</b>	<b>PSO Addressed</b>		<b>Correlation Level</b>		<b>Cognitive Level</b>
CO1	PO2	H	PSO1	PSO4	M	H	K <sub>1</sub>
CO2	PO3	H	PSO2		H		K <sub>6</sub>
CO3	PO3	H	PSO4		H		K <sub>6</sub>
CO4	PO2	H	PSO2		H		K <sub>3</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub> – Evaluate, K<sub>6</sub> – Create)

## INDUSTRIAL SEMINAR & REPORT WRITING

C	L	T	P
1	0	0	2

a. Course Code: .....

### 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

#### Guidelines for conducting Industry Seminar

**30 Hours**

**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 <sub>1</sub> to K <sub>6</sub>
CO1	PO3		M		PSO2	PSO6	M	M	K <sub>2</sub>
CO2	PO3	PO7	M	M	PSO3	PSO5	M	H	K <sub>3</sub>
CO3	PO3	PO6	M	M	PSO2	PSO6	H	M	K <sub>6</sub>
CO4	PO2	PO3	M	H	PSO7		H		K <sub>5</sub>
CO5	PO3	PO4	H	H	PSO4	PSO5	M	M	K <sub>3</sub>

(L – Low, M – Medium, H – High);

K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> –Analyze, K<sub>5</sub>–Evaluate, K<sub>6</sub> – Create

# INTERNET OF THINGS

<b>C</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>4</b>	<b>3</b>	<b>1</b>	<b>0</b>

**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:**

- Basic Knowledge on Networking and Internet
- Knowledge on wireless and Mobile Technologies
- 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**

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 <sub>1</sub> to K <sub>6</sub>
CO1	PO1		M		PSO2	M		K <sub>1</sub> , K <sub>2</sub>
CO2	PO1	PO2	M	H	PSO2	H		K <sub>1</sub>
CO3	PO3	PO4	M	L	PSO2	M		K <sub>2</sub>
CO4	PO3		H	M	PSO4   PSO2	M	L	K <sub>2</sub>
CO5	PO5		M		PSO4	M		K <sub>3</sub>
CO6	PO6	PO7	M	M	PSO5	M		K <sub>5</sub>

(L – Low, M – Medium, H – High); K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub> – Evaluate, K<sub>6</sub> – 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 Madiseti, Universities press (India) Pvt. Ltd, 2015 .

## WEB TECHNOLOGIES

C	L	T	P
4	3	1	0

a. Course Code:.....

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

**12Hours**

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

**12 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****12 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 MySQL, datatypes – SQL commands-CREATE, UPDATE, INSERT, DELETE, SELECT – PHP functions for MySQL connectivity and operation – mysql\_connect, mysql\_select\_db, mysql\_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	PO2	H	PSO1		H		K <sub>1</sub> , K <sub>2</sub>
CO2	PO3	H	PSO2	PSO4	M	H	K <sub>6</sub>
CO3	PO3	H	PSO4	PSO6	H	H	K <sub>6</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub>–Evaluate, K<sub>6</sub>– Create)

**g. References**

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

## SOFTWARE ENGINEERING

C	L	T	P
4	3	1	0

a. Course Code: .....

### b. Course Objective

1. To understand the software engineering principles and techniques
2. To understand the phases of software engineering and learn the phases in detail
3. To apply the software engineering methodologies in real time applications
4. To explore the tools available for software engineering
5. To learn the emerging trends in software engineering

### c. Course Outcomes (COs):

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

**CO1:** Understand the various models and phases of software developments

**CO2:** Identify the suitable requirement gathering techniques and design techniques and apply them in software development

**CO3:** Review the codes and identify the testing methods to analyze the code

**CO4:** Understand the need of software maintenance, estimate the maintenance cost and apply the reusability techniques in software development

**CO5:** Involve in software development with required skill and apply the software engineering techniques effectively.

### d. Course Outline (Unit wise)

#### Unit I

**10 Hours**

**Introduction:** Evolution – Software Development Projects – Exploratory style of Software Development- Emergence of Software Engineering. Software Life Cycle Models: Water fall model, RAD, Agile Development Models – Spiral Model – Comparison of Different Life Cycle Models.

#### Unit II

**14 Hours**

**Requirement Analysis, Specification:** Requirement gathering and Analysis, Software requirement specification, formal system specification, Axiomatic Specification, Algebraic Specification, Executable Specification and 4GL. Software Design : Overview of design process – characterize a good software design – cohesion and coupling – Layered arrangement of modules- approaches to software design- Function oriented software design : structured Analysis – development of DFD model- structured design – detailed design.

**Unit III****12 Hours**

**Coding and Testing :** Coding –Code review – software documentation – testing – unit testing – black-box testing – white-box testing –integration testing – system testing – general issues associated with testing - debugging- program analysis tools.

**Unit IV****12 Hours**

**Software Maintenance:** Characteristics of software maintenance – software reverse engineering- software maintenance process models – estimation of maintenance cost - Software reuse: basic issues in reusing a program – reuse approaches – reuse of organization level .

**Unit V****Emerging Trends , Tools and Scope of Software Engineer****12 Hours**

Emerging trends: Client-server Software, client-server Architecture – Service oriented Architecture. Tools: Requirements engineering tools, design modeling tools, software development tools- Testing tools- Skills required for software engineer - Scope for software engineer.

**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 <sub>1</sub> to K <sub>6</sub>
CO1	PO1		M		PSO2	PSO6	M	M	K <sub>2</sub>
CO2	PO2	PO7	M	M	PSO3	PSO5	M	H	K <sub>5</sub>
CO3	PO3	PO6	M	M	PSO2	PSO6	H	M	K <sub>4</sub>
CO4	PO2	PO3	M	H	PSO7		H		K <sub>1</sub>
CO5	PO3	PO4	H	H	PSO4	PSO5	M	M	K <sub>6</sub>

(L – Low, M – Medium, H – High); K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> –Analyze, K<sub>5</sub>–Evaluate, K<sub>6</sub> – Create

**f.References:**

- 1. Software Engineering: A Practitioner's Approach**, Ph.D. Pressman, Roger S. , Ph.D. Maxim, Bruce R. ,Publisher : McGraw-Hill College; 9th edition (9 September 2019), ISBN-10 : 126042331X , ISBN-13 : 978-1260423310
- 2.Fundamentals of Software Engineering**, [Rajib Mall](#) , PHI Learning; 5th edition (30 November 2018) ISBN-10 : 9789388028028, ISBN-13 : 978-9388028028
- 3.Software Engineering** |, [Ian Sommerville](#), Pearson Education; Tenth edition (24 May 2017) ISBN-10 : 9332582696, ISBN-13 : 978-9332582699
- 4.Automotive Software Engineering: Principles, Processes, Methods, and Tools**, [Jorg Schauffele](#) ,SAE International (8 March 2006), ISBN-10 : 0768014905, ISBN-13 : 978-0768014907

## 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:**

### List of Experiments

**60 Hours**

1. Install the following on the local machine: Apache Web Server, Tomcat Application Server locally, Install MySQL and install PHP and configure it to work with Apache web server and MySQL.
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 words in string without using string functions.
  - c) 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
  - i. Enter data into database
  - ii. 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	PO2	H	PSO1		H		K <sub>1</sub> , K <sub>2</sub>
CO2	PO3	H	PSO2	PSO4	M	H	K <sub>6</sub>
CO3	PO3	H	PSO4	PSO6	H	H	K <sub>6</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub> – Evaluate, K<sub>6</sub> – Create)

## GUIDELINES FOR INTERNSHIP TRAINING

<b>C</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>

### 1. Introduction:

During the summer vacation-before the Third semester classes commence, each student pursuing M.C.A 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/Major Project Guide** : Individual Project  
: Each Student shall be allotted under the Guidance of a Department faculty member by the MCA 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)

<b>Internal (50 Marks)</b> (All the three reviews are mandatory)		<b>External (50 Marks)</b>	
<b>Review I</b> (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)	
<b>Review II</b> System Design / Database Design / Methodology / Algorithms and Techniques/ detailed Implementation plan	15 Marks	<b>Internal Examiner</b>  Project Report	20 Marks
<b>Review III</b> System Implementation status, Testing, outcomes and report writing	20 Marks	<b>External Examiner shall evaluate under the following criteria</b> <ul style="list-style-type: none"> <li>• Presentation of the Mini Project</li> <li>• Running the Demonstration of the Mini project</li> <li>• Viva -voce</li> </ul>	10 Marks  10 Marks  10 Marks
<b>Total</b>	<b>50 Marks</b>		<b>50 Marks</b>

## Guidelines for Major Project work

Maximum Marks	Internal	External
100	50	50

- Mode of Mini/Major Project Guide** : Individual Project  
: Each Student shall be allotted under the Guidance of a Department faculty member by the MCA 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)

<b>Internal (50 Marks)</b> (All the three reviews are mandatory)		<b>External (50 Marks)</b>	
<b>Review I</b> (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)	
<b>Review II</b> System Design / Database Design / Methodology / Algorithms and Techniques/ detailed Implementation plan	15 Marks	<b>Internal Examiner</b> Project Report	20 Marks
<b>Review III</b> System Implementation status, Testing, outcomes and report writing	20 Marks	<b>External Examiner shall evaluate under the following criteria</b> <ul style="list-style-type: none"> <li>• Presentation of the Mini Project</li> <li>• Running the Demonstration of the Mini project</li> <li>• Viva -voce</li> </ul>	10 Marks 10 Marks 10 Marks
<b>Total</b>	<b>50 Marks</b>		<b>50 Marks</b>

## **ELECTIVE - I**

- **Human Computer Interaction**
- **Digital Image Processing**
- **Machine Learning**
- **Cloud Computing**
  
- **Advanced Computer Networks**
- **Mobile Application Development**

## HUMAN COMPUTER INTERACTION

C	L	T	P
3	3	0	0

a. Course Code: -----

### b. Course Objectives:

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

### c. Course Prerequisites:

1. Exposure to programming skill in some practical programming languages such as Java, C#, HTML for Processing.
2. Basic Concepts of Mobile Computing and Software Engineering.
3. Some Basic Mathematics and 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.

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

#### UNIT 2

**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****9Hours**

**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 <sub>1</sub> to K <sub>6</sub>		
CO1	PO3			H		PSO1	H		K <sub>1</sub>		
CO2	PO3	PO6		H	M	PSO2	PSO6	H	M	K <sub>2</sub>	
CO3	PO1	PO2	PO5	H	M	M	PSO4	M		K <sub>3</sub>	
CO4	PO1, PO5			H	M		PSO4	H		K <sub>4</sub>	
CO5	PO3, PO4			H	M		PSO4	PSO5	H	M	K <sub>5</sub> ,K <sub>6</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> –Remember, K<sub>2</sub> - Understand, K<sub>3</sub> –Apply, K<sub>4</sub>–Analyze, K<sub>5</sub>– Evaluate, K<sub>6</sub>– 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



## DIGITAL IMAGE PROCESSING

C	L	T	P
3	3	0	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			CorrelationLevel L/M/H			PSO Addressed PSO1 to PSO7		Correlation Level L/ M/ H		CognitiveLevel K <sub>1</sub> to K <sub>6</sub>
	PO1	PO2	PO3	H	M	L	PSO1	PSO2	H	H	
CO1	PO1	PO2		H	M		PSO1		H		K <sub>1</sub>
CO2	PO3	PO4	PO5	M	M	M	PSO1	PSO2	H	H	K <sub>5</sub>
CO3	PO1	PO6		H	H		PSO3	PSO4	H	H	K <sub>3</sub> ,K <sub>4</sub> ,K <sub>6</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub>– Apply, K<sub>4</sub>– Analyze, K<sub>5</sub>–Evaluate, K<sub>6</sub>– Create).

**g. Reference books**

- 1.Digital Image Processing, Fourth Edition, Rafael 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](http://www.imageprocessingplace.com/root_files_V3/tutorials.htm)

# MACHINE LEARNING

C	L	T	P
3	3	0	0

a. Course Code: -----

**b. Course Objectives:**

1. To Learn about Machine Intelligence and Machine Learning applications.
2. To implement and apply machine learning algorithms to real- world applications.
3. To identify and apply the appropriate machine learning technique to classification, 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.
- CO3** :Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
- CO4** :Have an understanding of the strengths and weaknesses of many popular machine learning approaches.
- CO5** :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 PO7			Correlation Level L/M/H			PSO Addressed PSO1 to PSO7			Correlation Level L/ M/ H			Cognitive Level K <sub>1</sub> to K <sub>6</sub>
CO1	PO1			H			PSO1			H			K <sub>1</sub>
CO2	PO2			M			PSO1	PSO2		H	H		K <sub>2</sub>
CO3	PO3			H			PSO3	PSO4		H	H		K <sub>3</sub>
CO4	PO3	PO4	PO7	M	M	M	PSO5			H			K <sub>4</sub>
CO5	PO5	PO6	PO7	H	H	H	PSO2	PSO3	PSO5	M	M	M	K <sub>5</sub> , K <sub>6</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub> – Evaluate, K<sub>6</sub> – 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 Language, Fabio Nelli, Apress.
4. Python Cookbook 3<sup>rd</sup> Edition – Recipes for Mastering Python 3, David Beazley and Brian K. Jones, O'Reilly.

## CLOUD COMPUTING

C	L	T	P
3	3	0	0

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

### **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****9 Hours**

**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

**a. Mapping of COs to POs and PSOs**

<b>Course Outcome</b>	<b>PO Addressed</b> PO1 to PO8		<b>Correlati on Level</b> L/M/H		<b>PSO Addressed</b> PSO1 to PSO8		<b>Correlati on Level</b> L/ M/ H		<b>Cogniti ve Level</b> K <sub>1</sub> to K <sub>6</sub>
CO1	PO1		H		PSO1		L		K <sub>1</sub> , K <sub>2</sub>
CO2	PO2		L		PSO4		M		K <sub>3</sub>
CO3	PO3	PO4	M	M	PSO4	PSO5	M	M	K <sub>3</sub> , K <sub>4</sub>
CO4	PO3		H		PSO4		M		K <sub>5</sub>
CO5	PO6		H		PSO6		H		K <sub>5</sub>

(L – Low, M – Medium, H – High); K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub> – Evaluate, K<sub>6</sub> – Create

**h .Reference Books:**

1. K. Chandrasekaran, Essentials of Cloud Computing, CRC Press Taylor & Francis Group , 2015
2. Distributed and Cloud Computing, Kai Hwang, Geoffrey 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.

## ADVANCED COMPUTER NETWORKS

C	L	T	P
3	3	0	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**

**9 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**

**9 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**

**9 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**

**9 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.

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

**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 <sub>1</sub> to K <sub>6</sub>
CO1	PO1			H			PSO1	PSO3	H	H	K <sub>1</sub>
CO2	PO1			H			PSO1		M		K <sub>2</sub>
CO3	PO2	PO4	PO5	M	M	M	PSO2	PSO4	M	M	K <sub>3</sub>
CO4	PO4		PO5	M	M		PSO2		H		K <sub>4</sub> ,K <sub>5</sub>
CO5	PO3		PO5	M	M		PSO4	PSO5	M	M	K <sub>6</sub>
CO6	PO6		PO7	M	M		PSO6	PSO7	M	M	K <sub>6</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub>–Evaluate, K<sub>6</sub> – Create)

**g. References:**

1. Data communications and networking – Behrouz A Forouzan McGraw Hill 4<sup>th</sup> 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



# MOBILE APPLICATION DEVELOPMENT

C	L	T	P
3	3	0	0

a. **Course code:** .....

b. **Course Objectives:**

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

c. **Course Outcome:**

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

**CO1:** Describe the requirements for mobile applications

**CO2:** Explain the challenges in mobile application design and development

**CO3:** Develop design for mobile applications for specific requirements

**CO4:** Implement the design using Android SDK

**CO5:** Implement the design using Objective C and iOS

**CO6:** Deploy mobile applications in Android and iPhone market place for distribution

d. **Course Prerequisite:**

Should have knowledge of Android Application, and wireless networks

e. **Course Outline:**

**UNIT I:**

**9 Hours**

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

**UNIT II**

**9 Hours**

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

**UNIT III**

**9 Hours**

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

**UNIT IV****9Hours**

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

**UNIT V****9 Hours**

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

**f. Mapping of COs to POs and PSOs**

Course Outcome	PO Addressed PO1 to PO7		Correlation Level L/M/H		PSO Addressed PSO1 to PSO7		Correlation Level L/ M/ H		Cognitive Level K <sub>1</sub> to K <sub>6</sub>
CO1	PO1		H		PSO3		L		K <sub>1</sub>
CO2	PO2	PO3	M	M	PSO1	PSO4	M	H	K <sub>2</sub>
CO3	PO2	PO4	H	M	PSO1	PSO2	H	H	K <sub>3</sub>
CO4	PO1	PO5	H	M	PSO1		H		K <sub>4</sub>
CO5	PO4		H		PSO6		M		K <sub>5</sub>
CO6	PO6	PO7	H	H	PSO6		H		K <sub>6</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub>–Evaluate, K<sub>6</sub>– Create)

**g. Reference books**

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

## **ELECTIVE – II**

- **Software Project Management**
- **Deep Learning**
- **Cryptography and Network Security**
- **Block Chain Technology**
- **Wireless Sensor Networks**
- **Software Testing**

## SOFTWARE PROJECT MANAGEMENT

a. **Course Code:** .....

C	L	T	P
3	3	0	0

b. **Course Objectives:**

1. To understand, how to do project planning for the software process.
2. To analyze the cost estimation during the analysis of the project.
3. To understand the estimation techniques available in the IT industry .
4. To understand the risks available in the Software Management.
5. To differentiate the Global standards and social impacts on globalization...

c. **Course Prerequisites:**

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

9Hours

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 K <sub>1</sub> to K <sub>6</sub>	
CO1	PO1	PO2	H			PSO1		H		K <sub>1</sub>	
CO2	PO3	PO4	PO5	M	H	M	PSO1	PSO2	H	H	K <sub>5</sub>
CO3	PO1	PO6	H	H		PSO3	PSO4	M	M	K <sub>3</sub> ,K <sub>4</sub> ,K <sub>6</sub>	
CO4	PO1	PO5	M	M		PSO1	PSO3	H	M	K <sub>2</sub> ,K <sub>3</sub> ,K <sub>4</sub>	
CO5	PO3	PO6	M	M		PSO4		M		K <sub>5</sub> ,K <sub>6</sub>	

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub>–Evaluate, K<sub>6</sub> – Create)

#### g. Reference Books:

1. Bob Hughes, Mike Cotterell&Rajib Mall, “Software Project Management”, TataMcGraw-HillPublications, 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.

## DEEP LEARNING

C	L	T	P
3	3	0	0

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

**b.Course Objectives:**

- To learn the fundamentals of Neural Network.
- To learn components, architectures of CNN.
- To study RNN, LSTM, GPU and Deep RNN.
- To study about different types of Auto encoders 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 Prerequisites:**

- Programming is the fundamental requirement of deep learning.
- Exposure to programming skill in some practical programming language such as Python or R i.e., To have a solid background in computer programming.
- Statistics refer to the study of using data and its visualization.
- Calculus forms the basis for many machine learning algorithms.
- Some Basic Mathematics and knowledge of fundamental concepts of designing strategies.
- Critical thinking and Creativity.

**d.Course Outcomes (COs):**

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

**CO1:** Explain various components, architectures of CNN.

**CO2:** Understand RNN, LSTM, GPU and Deep RNN architectures.

**CO3:** Know about different types of Auto encoders and RBM.

Explain various Open-Source Frameworks for Deep Learning.

**CO4:** 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, Over fitting and Under fitting, 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 Down sampling 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).

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

**Unit 3: 9 Hours**

**Auto encoders:** Introduction – Features of Auto encoder – Types of Auto encoder (Vanilla Auto Encoder, MultiLayerAu encoder, Stacked Auto encoder, Deep Autoencoder,DenoisingAuto encoder, Convolutional autoencoder,Regularization in Auto encoder)

**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: 9Hours**

**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 andPSOs**

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 <sub>1</sub> to K <sub>6</sub>
CO1	P01		M		PS01	PSO5	M	M	K <sub>1</sub>
CO2	P02	PO3	H	H	PS02	PSO3	H	H	K <sub>2</sub> ,K <sub>3</sub> ,K <sub>6</sub>
CO3	PO4		M		PSO4		M		K <sub>2</sub> ,K <sub>3</sub>
CO4	PO5		M		PSO5		M		K <sub>2</sub> ,K <sub>4</sub> ,K <sub>5</sub> ,K <sub>6</sub>
CO5	PO2	PO6	H	H	PSO2	PSO6	H	H	K <sub>3</sub> ,K <sub>4</sub> , K <sub>5</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub>–Evaluate, K<sub>6</sub> – Create)

### **g.References:**

- Deep Learning using Python - Lovelyn, S., Rose, L. Ashok kumar, D. Karthika Renuka, Wiley India Pvt. Ltd., First Edition, 2019.
- On Deep Learning Algorithms with Python- Sudharsan Ravichandiran, Hands,- Packt Publishing,2019.
- Deep Learning with Tensor Flow 2 and Keras - Antonio Gulli, Amita Kapoor, Sujit Pal, Packt Publishing, Second Edition, 2019.
- Advanced Deep Learning with Tensor Flow 2 and Keras - Rowel Atienza, Packt Publishing, Second Edition, 2020.



# CRYPTOGRAPHY AND NETWORK SECURITY

a) **Course code:** .....

C	L	T	P
3	3	0	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, INTEGRIT

**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 to POs andPSOs**

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 <sub>1</sub> to K <sub>6</sub>		
CO1	PO1			H			PSO1			H			K <sub>1</sub> , K <sub>2</sub>		
CO2	PO2	PO3		M	M		PSO2			M			K <sub>3</sub>		
CO3	PO4	PO7		M	M		PSO2,	PSO3	PSO4	M	M	M	K <sub>4</sub> ,K <sub>5</sub>		
CO4	PO4	PO5	PO7	M	M	M	PSO2,	PSO3	PSO4	M	M	M	K <sub>4</sub> ,K <sub>5</sub>		
CO5	PO5	PO7		M	M		PSO4	PSO5	PSO6	H	H	H	K <sub>5</sub>		
CO6	PO2,	PO5	PO6	M	M	M	PSO4,	PSO5	PSO6	PSO7	M	M	M	M	K <sub>6</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub>–Evaluate, K<sub>6</sub>– Create)

**g.References**

- 1.Behrouz A. Forouzan, “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/](http://Nptel.ac.in/).

# BLOCK CHAIN TECHNOLOGY

C	L	T	P
3	3	0	0

a. **Course code:** .....

**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 cryptocurrencies.

**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**

**9 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**

**9 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**

**9 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**

**9 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****9 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 <sub>1</sub> to K <sub>6</sub>	
CO1	PO1			H	PSO1	PSO3	H	H	K <sub>1</sub>	
CO2	PO1			M	PSO1		M		K <sub>2</sub>	
CO3	PO1	PO4		H	H	PSO2		M	K <sub>3</sub>	
CO4	PO4	PO5	PO6	M	M	M	PSO2		H	K <sub>4</sub> ,K <sub>5</sub>
CO5	PO3			M		PSO4	PSO5	M	M	K <sub>6</sub>
CO6	PO2	PO6		M	M	PSO4		M		K <sub>6</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub>–Evaluate, K<sub>6</sub> – Create)

**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

## WIRELESS SENSOR NETWORKS

C	L	T	P
3	3	0	0

**a. Course code:** .....

**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 sensors
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:** Design and Develop WSN based on the need.

**e. Course Outline:**

**Unit I INTRODUCTION**

**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 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 <sub>1</sub> to K <sub>6</sub>
CO1	PO1				H				PSO1			H			K <sub>1</sub>
CO2	PO1				M				PSO1			M			K <sub>2</sub>
CO3	PO3	PO4	PO5		M	M	M		PSO2		PSO3	M	M		K <sub>3</sub> ,K <sub>5</sub>
CO4	PO4		PO5		M				PSO2		PSO3	H	H		K <sub>4</sub> ,K <sub>5</sub>
CO5	PO5	PO6	PO7		M	M		M		PSO4		PSO5	M		K <sub>5</sub>
CO6	PO2	PO5	PO6	PO7	M	M	M	M	PSO4	PSO6	PSO7	M	M	M	K <sub>6</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub>–Evaluate, K<sub>6</sub> – Create)

### g. References:

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

## SOFTWARE TESTING

C	L	T	P
3	3	0	0

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

**b.Course Objectives:**

- To understand Standard Software Testing Principles.
- To learn the Functionality of Automated testing tools.
- To find any defects or bugs that may have been created when the software was being developed
- To increase confidence in the quality of the software
- 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):**

After completion of this course, students will be able to

- 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 Webbased 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 <sub>1</sub> to K <sub>6</sub>
CO1	PO1		H		PSO1	H	K <sub>1</sub>
CO2	PO2		M		PSO1	M	K <sub>2</sub>
CO3	PO3	PO4	M	H	PSO2	H	K <sub>3</sub>
CO4	PO4		H		PSO6	H	K <sub>4</sub>
CO5	PO5	PO6	M	H	PSO5	H	K <sub>5</sub>

(L – Low, M – Medium, H – High; K<sub>1</sub> – Remember, K<sub>2</sub> – Understand, K<sub>3</sub> – Apply, K<sub>4</sub> – Analyze, K<sub>5</sub> – Evaluate, K<sub>6</sub> – Create)

**g. Text 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. Besterfield 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
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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.