COURSESTRUCTURE
&
DETAILED SYLLABUS

of

Master of Technology

M. Tech. (CSE)

(Applicable for Batches Admitted from 2022)

Department of

COMPUTER SCIENCE & ENGINEERING

(Applicable for Batches Admitted from 2022)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Lendi Institute of Engineering and Technology

(Approved by A.I.C.T.E & Permanent Affiliated to JNTUK, Kakinada)

Accredited by NAAC with "A" Grade, Accredited by NBA

Jonnada (Village), Denkada (Mandal), Vizianagaram Dist – 535 005

Phone No. 08922-241111, 241112

E-Mail: lendi_2008@yahoo.com Website: www.lendi.org

R22 Course Structure

I Semester

I Year I Semester							
S.No	**Type of Course**	**Code**	**Course Title**	**Hours per week**			**Credits**
				Lecture	**Tutorial**	**Practical**	
1	CS	MCS1101	Advanced Data Structures & Algorithms Analysis	3	0	0	3
2	CS	MCS1102	Mathematical Essentials of Computer Science	3	0	0	3
3	CS	MCS1103	Advanced Computer Architecture	3	0	0	3
4	CS	MCS1104	Software Architecture & Design Patterns	3	0	0	3
5	CS	MCS1105 MCS1105.1 MCS1105.2 MCS1105.3 MCS1105.4	**Elective-I** Advanced Computer Networks Internet of Things Cryptography & Network Security Artificial Intelligence & Neural Networks	3	0	0	3
6	CS	MCS1106 MCS1106.1 MCS1106.2 MCS1106.3 MCS1106.4	**Elective-II** Natural Language Processing Soft Computing NoSQL Databases Data Science	3	0	0	3
7	CS	MCS1107	Advanced Data Structures & Software Architecture and Design Patterns Lab	0	0	4	2
Total							**20**

*Student has to choose any one audit course listed below.

Audit Course 1:

1. English for Research Paper Writing
2. Disaster Management
3. Value Education
4. Constitution of India
5. Pedagogy Studies
6. Stress Management by Yoga

II Semester

I Year II Semester							
S. No	**Type of Course**	**Code**	**Course Title**	**Hours per week**			**Credits**
				Lecture	**Tutorial**	**Practical**	
1	CS	MCS1201	Machine Learning	3	0	0	3
2	CS	MCS1202	Big Data Analytics	3	0	0	3
3	CS	MCS1203	Web Services	3	0	0	3
4	CS	MCS1204	Cloud Computing	3	0	0	3
5	CS	MCS1205 MCS1205.1 MCS1205.2 MCS1205.3 MCS1205.4	**Elective-III** Digital Image Processing Information Retrieval Systems Mobile Adhoc Networks DevOps	3	0	0	3
6	CS	MCS1206 MCS1206.1 MCS1206.2 MCS1206.3 MCS1206.4	**Elective-IV** Block Chain Technologies Object Oriented Software Engineering Pervasive Computing Intrusion Detection Systems	3	0	0	3
7	CS	MCS1207	Machine Learning Lab (Python)	0	0	4	2
Total							**20**

*Student has to choose any one audit course listed below.

Audit Course 2 :

1. English for Research Paper Writing
2. Disaster Management
3. Value Education
4. Constitution of India
5. Pedagogy Studies
6. Stress Management by Yoga

III- Semester

II Year I Semester							
S. No	**Type of Course**	**Code**	**Course Title**	**Hours per week**			**Credits**
				Lecture	**Tutorial**	**Practical**	
1	CS	MCS2101	**Program Elective:** 1. Deep Learning 2. MOOCS-1 (NPTEL/ SWAYAM) 12 Week Program related to the programme which is not listed in Course Structure.	3	0	0	3
2	CS	MCS2102	Seminar	0	0	0	1
3	CS	MCS2103	Dissertation (Phase-I)	0	0	0	8
4	CS	MCS2104	Audit Course-1*	0	0	0	0
5	CS	MCS2105	Audit Course-2*	0	0	0	0
Total							**12**

IV- Semester

II Year II Semester							
S. No	**Type of Course**	**Code**	**Course Title**	**Hours per week**			**Credits**
				Lecture	**Tutorial**	**Practical**	
1	CS	MCS2201	Dissertation-II	0	0	0	16
Total							**16**

Subject Code	Subject Name	L	T	P	C
MCS1101	**ADVANCED DATA STRUCTURES & ALGORITHM ANAYLSIS**	3	0	0	3

COURSE OBJECTIVES:

- To Demonstrate the importance of Internal and External Sorting Techniques
- Describe the various implements of Hashing Techniques, variants of trees, heaps, queues and analysis
- To Deal with the Optimal, Efficient binary search trees and Multi-way Trees
- To Create awareness on Digital Search trees, Binary ties, Patricia

COURSE OUTCOMES:

1. Understand how to handle massive amounts of data which resides in external memory i.e. disks and CDs etc using external sorting algorithms and apply external sorting algorithm on massive amounts of data.
2. Understand and implement indexing techniques using hashing concepts like static hashing and dynamic hashing.
3. Apply concepts of Binary Heap and binomial queues in real time applications such as event simulations problem, selection problem.
4. Apply the data structures such as AVL, Red-Black and Optimal Binary Search Trees for faster searching in directories.
5. Apply data structures such as M-way search trees, B trees and B+ trees in data base indexing.

UNIT-I:

SORTING: Basic concepts, Sorting by insertion (Insertion sort), selection heap sort), exchange (bubble sort, quick sort), distribution (radix sort) and merging (merge sort) Algorithms.
EXTERNAL SORTING: External Sorting, Introduction, K-way Merging - Buffer Handling for parallel Operation- Run Generation- Optimal Merging of Runs.

Learning outcomes: Student should be able to

1. Understand the Various Internal Sorting Techniques(L2)
2. Understand the External sorting techniques with some examples(L2)
3. Understand Differences between internal and external sorting techniques(L2)
4. Implement the K-way Merging Techniques(L6)

UNIT-II:

HASHING: Introduction-Static Hashing- Hash Table- Hash Functions- Secure Hash Function- Overflow Handling- Theoretical Evaluation of Overflow Techniques, Dynamic Hashing- Motivation for Dynamic Hashing -Dynamic Hashing Using Directories- Directory less Dynamic, Hashing,

Learning outcomes: Student should be able to

1. Understand the Hashing Techniques for Dictionaries(L2)
2. Implement the various techniques of Hashing Techniques(L6)

3. To identify the differences between Directory less and Directory oriented concepts(L2)

UNIT -III:

PRIORITY QUEUES (HEAPS): Model, Simple Implementation, Binary Heap-Structure Property-Heap-Order Property-Basic Heap Operations- Other Heap Operation, Applications of Priority Queues- The Selection Problem Event Simulation Problem, Binomial Queues- Binomial Queue Structure – Binomial Queue Operation- Implementation of Binomial Queues

Learning outcomes: Student should be able to

1. Understand the concepts of Binary Heap and Binomial Queues(L2)
2. Apply the Heap techniques in Priority Queues(L4)

UNIT-IV:

EFFICIENT BINARY SEARCH TREES: Optimal Binary Search Trees, AVL Trees, Red-Black Trees, Definition- Representation of a Red- Black Tree- Searching a Red-Black Tree- Inserting into a Red Black Tree- Deletion from a Red-Black Tree- Joining Red-Black Trees, Splitting a Red-Black tree. Splay tree Introduction

Learning outcomes: Student should be able to

1. Understand different Balanced Binary Search trees like AVL,OBST, Red-Black Trees(L2)
2. Apply the data structures such as AVL, Red-Black and Optimal Binary Search Trees for faster searching in directories. (L4)

UNIT-V:

MULTIWAY SEARCH TREES:M-Way Search Trees, Definition and Properties- Searching an M-Way Search Tree, B-Trees, Definition and Properties- Number of Elements in a B-tree- Insertion into B-Tree- Deletion from a B-Tree- B+-Tree Definition- Searching a B+-Tree- Insertion into B+-tree- Deletion from a B+-Tree.

Learning outcomes: Student should be able to

1. Understand the concepts of B-Trees and B+ -Trees(L2)
2. Apply data structures such as M-way search trees, B trees and B+ trees in data base indexing (L4)

TEXT BOOKS:

1. Data Structures, a Pseudo code Approach, Richard F Gilberg, Behrouz A Forouzan,Cengage
2. Fundamentals of DATA STRUCTURES in C: 2nd ed, , Horowitz , Sahani, Andersonfreed, Universities Press
3. Data structures and Algorithm Analysis in C, 2nd edition, Mark Allen Weiss, Pearson

REFERENCE BOOKS:

1. Web : http://lcm.csa.iisc.ernet.in/dsa/dsa.html
2. http://utubersity.com/?page_id=878
3. http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures
4. http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms
5. File Structures :An Object oriented approach with C++, 3rd ed, Michel J Folk, Greg Riccardi, Bill Zoellick

6. C and Data Structures: A Snap Shot oriented Treatise with Live examples from Science and Engineering, NB Venkateswarlu & EV Prasad, S Chand, 2010.

Subject Code	Subject Name	L	T	P	C
MCS1102	**MATHEMATICAL ESSENTIALS OF COMPUTER SCIENCE**	3	0	0	3

COURSE OBJECTIVES:

1. To develop logical thinking in the field of Computer Science and Engineering.
2. To introduce basic concepts and various algorithms of graphs.
3. To introduce basics of group theory.
4. To familiarise the concepts of various trees (i.e) spanning trees, shortest spanning trees.
5. To Familiarise closed form solution of linear recurrence relations by various methods.
6. To design the logical circuits using Boolean expressions.

COURSE OUTCOMES:

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

1. Test the validity of an argument through enhanced logical capabilities. (L3)
2. Implement Shortest path algorithm for different graphs.(L3)
3. Construct minimal spanning tree using algorithms for the graphs.(L3)
4. Understand the algebraic structures and their properties. (L3)
5. Find a general solution of recurrence equation using suitable method and apply thedifferent properties of lattice to simplify Boolean expressions.(L3)

UNIT-I:

MATHEMATICAL LOGIC

Propositional Calculus: Statements, negation, conjunction, disjunction, conditional and bi-conditional, well formed formulae, tautologies, equivalence of formulae, duality, tautological implications, principal disjunctive and conjunctive normal forms, inference calculus, and rules of inference.

Predicate Calculus: Predicative logic, free & bound variables, quantifiers, rules of inference.

Learning Outcomes:

At the end of this unit, the student will be able to

- Evaluate the basic logic statements (including compound statements, implications, inverses, converses and contrapositives) using truth tables and the properties of logic. (l3)
- Reduce the given proposition into normal forms using properties of equivalence and implications.(l3)
- Express a logic statement in terms of predicates using quantifiers and logical connectives. (l2)
- Apply rules of inferences to verify the consistence of data. (L3)

UNIT-II:

GRAPH THEORY

Introduction to relations, Graph, finite and infinite graphs, incidence and degree, types of Graphs, isomorphism, Adjacency Matrix, sub graphs, walk, path and circuit, connected and

disconnected graphs, components, Euler graphs, Euler's theorem, Hamiltonian paths and circuits, Shortest-path algorithm (Dijkstra's Algorithm), planar graphs.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify different types graphs. (l2)
- Represent a graph using an adjacency matrix.(l2)
- Construct Euler and Hamiltonian paths.(l3)
- Implement Dijkstra's Algorithm for the given graph(L4)

UNIT-III:

TREES AND DIRECTED GRAPHS (Theorems without proofs)

Properties of trees, binary trees, spanning trees, minimal spanning trees, Kruskal's algorithm, Prim's algorithm, tree traversals, DFS, BFS, Binary search tree, directed graph, graph coloring, chromatic number for various graphs and trees.

Learning Outcomes:

At the end of this unit, the student will be able to

- Construct the spanning tree and binary tree from the given graphs. (L3)
- Build minimal spanning tree by using different algorithms. (L3)
- Implement DFS, BFS algorithm for the given graph(L3)
- Determine the chromatic number of a given graph/ tree. (L3)

UNIT-IV:

ALGEBRAIC STRUCTURES:

Algebraic Structures (semi groups, monoids, group and abelian groups), Sub groups, homomorphism, isomorphism, coset, Lagrange's theorem, normal subgroups, permutation groups and cyclic groups.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identity the given algebraic structure is a group or not.(l2)
- Understand the concepts of sub groups, normal subgroups, cosets, cyclic groups, permutation groups, homomorphism and isomorphism of groups . (l2)
- Apply error detection and correction techniques in the design of computer systems using group codes(L3)

UNIT-V:

LATTICE THEORY & RECURRENCE RELATIONS

Lattice Theory: POSET, Hasse diagram, Lattice, Distributive lattice, Modular Lattice, complement, De-morgans laws, Boolean algebra (definition only)

Recurrence relations: Recurrence relations, substitution method, solving homogeneous linear recurrence relations by characteristic roots method, non – homogeneous linear recurrence relations.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of Poset and Lattice(L2)
- Apply the different properties of lattice to simplifying Boolean expressions(L3)
- Formulate recurrence relations of the sequences.(L3)
- Apply substitution method to solve recurrence relations.(L3)

- Solve non-homogeneous linear recurrence relations by characteristic roots method.(L3)

TEXT BOOKS:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 1997. (for Unit 1,4, 5 (Lattice theory))
2. Joe L. Mott, Abraham Kandel and T. P. Baker, Discrete Mathematics for computer scientists & Mathematicians, 2/e, Prentice Hall of India Ltd, 2012.(for Unit 2,3,5 (recurrence relations))

REFERENCE BOOKS:

1. Keneth. H. Rosen, Discrete Mathematics and its Applications, 6/e, Tata McGraw-Hill,2009.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science,Prentice Hall of India, 2006.
3. Susanna S. Epp, Discrete Mathematics with Application, Brooks/Colt Cengage learning,fourth edition.
4. Richard Johnsonburg, Discrete mathematics, 7/e, Pearson Education, 2008.
5. T. Koshy, Discrete Mathematics with Applications, Elsevier, New York, (2004).
6. J. A. Bondy, U. S. R. Murty, Graph Theory, Springer-Verlag, New York, (2008).
7. K. D. Joshi, Foundations of Discrete Mathematics, New Age International, (1989).

Subject Code	Subject Name	L	T	P	C
MCS1103	**ADVANCED COMPUTER ARCHITECTURE**	3	0	0	3

COURSE OBJECTIVES:

1. Understand the Concept of parallel processing and its applications.
2. Implement the Hardware for Arithmetic Operations.
3. Analyze the performance of different scalar Computers.
4. Develop the Pipelining Concept for a given set of Instructions.
5. Distinguish the performance of pipelining and non pipelining environment in a processor.

COURSE OUTCOMES:

The students should be able to:

1. Understand the Concept of Parallel Processing and its applications
2. Implement the Hardware for Arithmetic Operations
3. Analyze the performance of different scalar Computers
4. Develop the Pipelining Concept for a given set of Instructions
5. Understand the performance of pipelining and non pipelining environment in a processor

UNIT – I:

Pipeline and vector processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors.

Learning outcomes:

At the end of this unit, student will be able to

- Understand the Parallelism concepts in Programming.
- Understand the concepts of parallel computing and system architecture

UNIT – II:

Computer Arithmetic: Addition and Subtraction, Hardware Implementation, Multiplication Algorithms and Hardware Implementation, Division Algorithms and Hardware Implementation, Floating Point Arithmetic Operations.

Learning outcomes:

At the end of this unit, student will be able to

- Understand the hardware technologies
- Understand the Arithmetic operations.

UNIT –III:

Parallel Computer Models: Evolution of Computer Architecture, System Attributes to Performance, Shared Memory Multiprocessors, Distributed Memory Multicomputer, Vector Super Computers, SIMD Super Computers.

Learning outcomes:

At the end of this unit, student will be able to

- Understand the Shared memory concepts.

- Understand the advanced processor architectures to the students.

UNIT – IV:

Processors and Memory Hierarchy: Advanced Processor Technology: Design Space of Processors, Instruction-Set Architectures, CISC scalar Processors, RISC scalar Processors, Super Scalar and Vector Processors: Superscalar Processors.

Learning outcomes:

At the end of this unit, student will be able to

- Understand the memory hierarchy

UNIT-V

Pipelining and Superscalar Techniques: Linear Pipeline Processors: Asynchronous and Synchronous models, Clocking and Timing Control, Speedup, Efficiency and Throughput, Pipeline Schedule Optimization, Instruction Pipeline Design: Instruction Execution Phases, Mechanisms for Instruction Pipelining, Dynamic Instruction Scheduling, Branch Handling Techniques.

Learning outcomes:

At the end of this unit, student will be able to

- Understand the pipeline processors
- Understand the super scalar techniques.

TEXT BOOK:

1. Computer System Architecture, Morris M. Mano, 3rd edition, Pearson/Prentice Hall India.
2. Advanced Computer Architecture, Kai Hwang, McGraw-Hill, India.

REFERENCE BOOKS:

1. Computer Organization and Achitecture, William Stallings, 8th edition, PHI
2. Computer Organization, Carl Hamachar, Vranesic, Zaky, 5th edition, McGraw Hill.

Subject Code	Subject Name	L	T	P	C
MCS1104	**SOFTWARE ARCHITECTURE & DESIGN PATTERNS**	3	0	0	3

COURSE OUTCOMESS:

The students should be able to:

1. Understand interrelationships, principles and guidelines governing architecture and evolution over time.
2. Understand various architectural styles of software systems.
3. Understand design patterns and their underlying object-oriented concepts.
4. Understand implementation of design patterns and providing solutions to real world software design problems.
5. Understand patterns with each other and understanding the consequences of combining patterns on the overall quality of a system.

UNIT-I:

Envisioning Architecture
The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views.
Creating and Architecture Quality Attributes, Achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

Learning Outcomes:
At the end student will be able to
- Understand the necessity of Architecture Business Cycle and importance of Software Architecture.
- Understand software architecture with various reference models.
- Understand documenting software architectures.
- Analyse the Quality Attributes.

UNIT-II:

Analyzing Architectures
Architecture Evaluation, Architecture design decision making, ATAM, CBAM
Moving from One System to Many
Software Product Lines, Building systems from off the shelf components, Software architecture in future.

Learning Outcomes:
At the end student will be able to
- Understand Architecture Evaluation.
- Understand different analysis models.
- Analyse Architecture design decision making.
- Analyse how software architectures can used in different software applications.

UNIT-III:

Patterns: Pattern Description, Organizing catalogs, role in solving design problems, Selection and usage.

Creational Patterns

Abstract factory, Builder, Factory method, Prototype, Singleton

Learning Outcomes:

At the end student will be able to

- Understand what is the use of design patterns.
- Analyse how problems can be solved using design patterns.
- Analyse how to use creational design patterns for different problems.
- Evaluate the product design can be independent or not.

UNIT-IV:

Structural Patterns

Adapter, Bridge, Composite, Decorator, Façade, Flyweight, PROXY.

Learning Outcomes:

At the end student will be able to

- Understand the structure of design patterns.
- Analyse how classes and objects are composed to form large structures.
- Understands the logic of design patterns.

UNIT-V:

Behavioural Patterns

Chain of responsibility, command, Interpreter, state, strategy, template method, visitor.

The World Wide Web - a case study in Interoperability, Air Traffic Control – a case study in designing for high availability, Celsius Tech – a case study in product line development.

Learning Outcomes:

At the end student will be able to

- Analyse responsibilities between objects of classes.
- Apply complex control flow in applications.
- Analyse various dependencies between objects with respect to classes.

TEXT BOOKS:

1. Software Architecture in Practice, second edition, Len Bass, Paul Clements &Rick Kazman, Pearson Education, 2003.
2. Design Patterns, Erich Gamma, Pearson Education, 1995.

REFERENCE BOOKS:

1. Beyond Software architecture, Luke Hohmann, Addison wesley, 2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. Software Design, David Budgen, second edition, Pearson education, 2003
4. Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.

Subject Code	Subject Name	L	T	P	C
MCS1105.1	ADVANCED COMPUTER NETWORKS	3	0	0	3

COURSE OBJECTIVES:

1. To make the addressing mechanisms and address translation familiar to the student.
2. To identify the fields in the Packet and its importance.
3. Understand the Routing Protocols and its importance.
4. Analyse the difference between connection oriented and connection less protocols.
5. Understand the data transfer applications.

COURSE OUTCOMES:

The students should be able to:

1. Understand the Addressing Mechanisms.
2. Understand the packet Format and Various security fields in it.
3. Analyse the working of Routing Protocols.
4. Understand the Transport Layer Protocols.
5. Understand the e-mail architecture and file transfer.

UNIT -I:

IP ADDRESSING

Address Space, Notations, Classical addressing, Classless addressing, Network Address Translation (NAT).

Internet Protocol(IP): Datagram Format, Fragmentation, Options.

ICMPv4: Messages, Debugging Tools, ICMP Checksum,

Mobile IP: Addressing, Agents, Three Phases. Inefficiency in Mobile IP. Virtual Private Network Technology.

Learning Outcomes:

At the end student will be able to

- Understand the addressing mechanisms. (L2).
- Understand the calculation of Check Sum.(L2)
- Analyze packet format.(L4).

UNIT -II:

IPv6 ADDRESSING:

Representation, address space, address space allocation, Auto configuration, Re numbering. Transition from IPv4 to IPv6:Dual Stack, Tunnelling, Header Translation.

IPv6 Protocol: Packet format, Extension Header.

Learning Outcomes:

At the end student will be able to

- Understand the IPV6 addressing .(L2).
- Analyze IPV6 Header fields. (L4).
- Understand the IPV6 format. (L2).

UNIT -III:

INTRODUCTION:
Inter-domain, Intra-domain Routing.
Routing Algorithms: Distance Vector Routing, Bellman—Ford algorithm, Link State Routing, Path Vector Routing.
Unicast Routing Protocols: Internet Structure, Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol Version 4(BGP4).
Protocols: Multicast Distance Vector (DVMRP), Multicast Link State (MOSPF), Protocol Independent Multicast (PIM).

Learning Outcomes:
At the end student will be able to

- Understand the Network Layer concepts. (L2)
- Understand the types of routing algorithms. (L2)

UNIT -IV:

User Datagram Protocol: User Datagram, UDP Services, UDP Applications**.**
Transmission Control Protocol: TCP Services, TCP features, Segment, ATCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers, Options.
SCTP: SCTP Services, SCTP Features, Packet Format, Flow Control, Error Control.

Learning Outcomes:
At the end student will be able to

- Understand the Transport Layer protocols.(L2)
- Understand which protocols are used for Flow Control and Error Control.(L2)

UNIT -V:

World Wide Web and HTTP, FTP, TFTP,E-mail : Architecture, SMTP, POP, email security, MIME, Remote Login: Telnet and SSH.

Learning Outcomes:
At the end student will be able to

- Understand E-mail architecture(L2)
- Understand security in Email.(L2)

TEXT BOOKS:

1. Data Communications and Networking ,Behrouz A Forouzan, Fourth Edition.
2. Inter Networking with TCP/IP Volume 1 Fourth Edition, Prentice Hall India Private Limited.

REFERENCE BOOKS:

1. Computer Networks: A Top Down Approach, Behrouz A. Forouzan, Firouz Mosharraf, McGraw Hill Education
2. Advanced Computer Network, B. M. Harwani and D T Editorial, Dream Tech

Subject Code	Subject Name	L	T	P	C
MCS1105.2	**INTERNET OF THINGS (IOT)**	3	0	0	3

COURSE OBJECTIVES:

1. Introduce the fundamental concepts of IoT and physical computing.
2. Expose the student to a variety of embedded boards and IoT Platforms.
3. To introduce the Raspberry PI platform, that is widely used in IoT applications.
4. Create a basic understanding of the communication protocols in IoT communications.
5. Familiarize the student with application program interfaces for IoT.
6. Enable students to create simple IoT applications and implementation of web based services on IoT devices.

COURSE OUTCOMES:

The students should be able to:

1. Illustrate the architecture and principles in Internet of Things.
2. Outline the Arduino platform and its applications.
3. Develop applications using Raspberry Pi .
4. Select protocols for a specific IoT application.
5. Utilize the cloud platform and APIs for IoT application.

UNIT -I:

Overview of IoT:

The Internet of Things: An Overview; The Flavor of the Internet of Things, The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?, M2M Communications, Examples of IOT, Design Principles for Connected Devices, Calm and Ambient Technology, Privacy; Keeping Secrets, Whose Data Is It Anyway?, Web Thinking for Connected Devices, Small Pieces, Loosely Joined, First-Class Citizens On The Internet; Graceful Degradation, Business Models for Business Processes in the Internet Of Things.

Learning Outcomes:

At the end student will be able to

- Explain IoT architecture. [L2]
- Interpret the design principles that govern connected devices [L2]
- Summarize the roles of various organizations for IoT [L2]

UNIT – II:

Embedded Devices - I:

Embedded Computing Basics, Microcontrollers, System-on-Chips, Choosing Your Platform, Arduino, Introduction to Arduino Developing on the Arduino, Some Notes on the Hardware, Openness.

Learning Outcomes:

At the end student will be able to

- Explain the basics of microcontrollers [L2]
- Outline the architecture of Arduino [L2]
- Develop simple applications using Arduino [L3]

UNIT – III:

Embedded Devices - II:
Raspberry Pi: Introduction to Raspberry Pi, Cases and Extension Boards, Developing on the Raspberry Pi, Some Notes on the Hardware; Openness, Other notable platforms, Mobile phones and tablets, Plug Computing, Always-on Internet of Things

Learning Outcomes:
At the end student will be able to

- Outline the architecture of Raspberry Pi [L2]
- Develop simple applications using Raspberry Pi [L3]
- Select a platform for a particular embedded computing application [L3]

UNIT -IV:

Communication in the IoT:
Internet Principle & Internet Communications: An Overview, Message Communication Protocols, IP, TCP, The IP Protocol Suite (TCP/IP), UDP, IP Addresses, DNS, Static IP Address Assignment, Dynamic IP Address Assignment, IPv6, MAC Addresses, TCP and UDP Ports, An Example: HTTP Ports, Other Common Ports,
Application Layer Protocols: HTTP, HTTPS: Encrypted HTTP, Other Application Layer Protocols & Constrained Application Protocol.

Learning Outcomes:
At the end student will be able to

- Interpret different protocols and compare them [L2]
- Select which protocol can be used for a specific application [L3]
- Utilize the Internet communication protocols for IoT applications [L3]

UNIT -V:

Prototyping Online Components:
Getting Started with an API; Data Acquiring, Organizing data, Mashing Up APIs, Scraping, Legalities, Writing a New API, Clockodillo, Security, Implementing the API, Using Curl to Test, Going Further; Real-Time Reactions, Polling, Comet,

Sensor Technology: Introduction of sensor technology, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless Sensor Network Technology, Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms.

Learning Outcomes:
At the end student will be able to

- Select IoT APIs for an application [L3]
- Design and develop a solution for a given application using APIs [L6]
- Test for errors in the application [L4]
- Implement Cloud platform for IOT applications and services[L3]

TEXT BOOKS:

1 Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012
2 Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
3 Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti,Universities Press, 2015, ISBN: 9788173719547

REFERENCE BOOKS:

1. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

REFERENCE SITES:

https://www.arduino.cc/
https://www.raspberrypi.org/

Subject Code	Subject Name	L	T	P	C
MCS1105.3	**CRYPTOGRAPHY & NETWORK SECURITY**	3	0	0	3

COURSE OBJECTIVES:

1. Classical systems, symmetric block ciphers (DES, AES, other contemporary symmetric ciphers) are Introduced.
2. Introduction to Public-key cryptography (RSA, discrete logarithms) is provided.
3. Algorithms for factoring and discrete logarithms, cryptographic protocols, hash functions, authentication, key management, key exchange, signature schemes are learnt.
4. An overview of e-mail and web security is provided.
5. An overview of viruses, firewalls and system security is provided.

COURSE OUTCOMES:

The students should be able to

1. Understand the basics of Cryptography ,the goals, services and mechanisms.
2. Understand the Symmetric Cryptographic Algorithms.
3. Understand the Asymmetric Cryptographic Algorithms.
4. Understand the Digital signature Schemes.
5. Understand the email security and system security.

UNIT- I:

Basic Principles Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography

Learning Outcomes:
At the end student will be able to

- Understand what is meant by Cryptography
- Understand the goals, mechanisms and services of Cryptography.

UNIT- II:

Symmetric Encryption Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard.

Learning Outcomes:
At the end student will be able to

- Understand symmetric key Cryptography
- Analyse the various algorithms of Symmetric key Cryptography

UNIT- III:

Asymmetric Encryption Mathematics of Asymmetric Key Cryptography, Asymmetric Key Cryptography

Learning Outcomes:
At the end student will be able to

- Understand asymmetric key Cryptography
- Analyse the various algorithms of Asymmetric key Cryptography

UNIT- IV:

Data Integrity, Digital Signature Schemes & Key Management Message Integrity and Message Authentication, Cryptographic Hash Functions, Digital Signature, Key Management.

Learning Outcomes:
At the end student will be able to

- Understand about Digital Signature and the security schemes.
- Understand the Hash functions and its importance

UNIT -V:

Network Security: Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, IPSec, System Security.

Learning Outcomes:
At the end student will be able to

- Understand email-security.
- Understand the mechanisms of Transport Layer Security.
- Understand about system security.

TEXT BOOKS:

1) Cryptography and Network Security, Behrouz A Forouzan, Debdeep Mukhopadhyay (3e) Mc Graw Hill.
2) Cryptography and Network Security, William Stallings, (6e) Pearson.
3) Everyday Cryptography, Keith M.Martin, Oxford.

REFERENCE BOOKS:

1) Network Security and Cryptography, Bernard Meneges, Cengage Learning

Subject Code	Subject Name	L	T	P	C
MCS1105.4	**ARTIFICIAL NEURAL NETWORKS**	3	0	0	3

COURSE OBJECTIVE:

- The main objective of this course is to provide the student with the basic understanding of neural networks fundamentals.
- Program the related algorithms and Design the required and related systems.

COURSE OUTCOMES:

The students should be able to

- Demonstrate ANN structure and activation Functions
- Define foundations and learning mechanisms and state-space concepts
- Identify structure and learning of perceptions
- Explain Feed forward, multi-layer feed forward networks and Back propagation algorithms
- Analyze Radial Basis Function Networks, Theor Regularization and RBF networks

UNIT-I:

Introduction and ANN Structure, Biological neurons and artificial neurons, Model of an ANN, Activation functions used in ANNs, Typical classes of network architectures.

Learning Outcomes:
At the end student will be able to

- Able to define artificial neural network and differentiate between artificial neuron and biological neuron.
- Able to learn what the activation function is., and different types of activation functions.

UNIT-II:

Mathematical Foundations and Learning mechanisms. Re-visiting vector and matrix algebra, State-space concepts, Concepts of optimization, Error-correction learning. Memory based learning, Hebbian learning. Competitive learning.

Learning Outcomes:
At the end student will be able to

- Able to learn how errors can be reduced using error-correction learning mechanism of neurons.

UNIT-III:

Single layer perceptrons, Structure and learning of perceptrons, Pattern classifier, introduction and Bayes' classifiers, Perceptron as a pattern classifier, Perceptron convergence. Limitations of a perceptrons.

Learning Outcomes:
At the end student will be able to

- Define what is a perceptron , its structure and types of classifiers.

UNIT-IV:
Feed forward ANN, Structures of Multi-layer feed forward networks. Back propagation algorithm, Back propagation - training and convergence, Functional approximation with back propagation. Practical and design issues of back propagation learning.

Learning Outcomes:
At the end student will be able to

- Able to work with different forward and backward mechanisms of neuron propagation.
- Defining about various back propagation learning issues.

UNIT-V:

Radial Basis Function Networks, Pattern separability and interpolation, Regularization Theory Regularization and RBF networks. RBF network design and training. Approximation properties of RBF.

Learning Outcomes:
At the end student will be able to

- Learning about RBF and linear separability and interpolation.
- How RBF design is and what properties it consists of.
- Some of the RBF applications.

TEXT BOOKS:

1. Simon Haykin, "Neural Networks: A comprehensive foundation", Second Edition, Pearson Education Asia.
2. Satish Kumar, "Neural Networks: A classroom approach", Tata McGraw Hill, 2004.

REFERENCE BOOKS:

1. Robert J. Schalkoff, "Artificial Neural Networks", McGraw-Hill International Editions, 1997.

Subject Code	Subject Name	L	T	P	C
MCS1106.1	**NATURAL LANGUAGE PROCESSING**	3	1	0	4

COURSE OBJECTIVES:

1. To learn the fundamentals of natural language processing
2. To understand the use of CFG and PCFG in NLP
3. To understand the role of semantics of sentences and Pragmatics
4. To gain knowledge in automated natural language generation and machine translation
5. To understand language modelling

COURSE OUTCOMES:

The students should be able to

1. Illustrate fundamentals of basic Language features
2. Analyze the words involved in NLP
3. Outline the syntactic analysis involved in NLP
4. Utilize semantics of NLP
5. Compare different statistical approaches of NLP applications.

UNIT – I:

INTRODUCTION

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling errors.

Learning Outcomes:

At the end student will be able to

- Outline different grammar based languages **(L2)**
- Illustrate the fundamentals of natural language processing**(L2)**

UNIT-II:

WORD LEVEL ANALYSIS

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

Learning Outcomes:

At the end student will be able to

- Demonstrate N-Grams in NLP**(L2)**
- Analyze the Different Stochastic and Transformation-based tagging (L4)

UNIT - III:

SYNTACTIC ANALYSIS
Context-Free Grammars, Grammar rules for English, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

Learning Outcomes:
At the end student will be able to

- Interpret CFG and PCFG in NLP **(L2)**
- Outline the syntactic importance in NLP **(L2)**

UNIT -IV:

SEMANTICS ANALYSIS
Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selection restrictions – Word Sense Disambiguation

Learning Outcomes:
At the end student will be able to

- Understand different order logics **(L2)**
- Understand requirements of semantics of NLP(**L2**)

UNIT -V:

DISCOURSE ANALYSIS AND LEXICAL RESOURCES
Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, Word Net, Prop Bank, Frame Net, Brown Corpus, British National Corpus (BNC).

Learning Outcomes:
At the end student will be able to

- Understand Segmentation and Coherence**(L2)**
- Determining statistical approaches for NLP applications (**L3**)

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics andSpeech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing withPython, First Edition, OReilly Media, 2009.

REFERENCE BOOKS:

1. Breck Baldwin, ―Language Processing with Java and Ling Pipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, ―Natural Language Processing with Java, OReilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

Subject Code	Subject Name	L	T	P	C
MCS1106.2	**SOFT COMPUTING**	3	0	0	3

COURSE OBJECTIVES:

1. To make the students to be familiar with the concept of classification techniques to solve real problems.
2. To Familiarize with Soft computing concepts.
3. To have a detailed study of neural networks, Fuzzy Logic and uses of Heuristics based on human experience.
4. To introduce the concepts of genetic algorithm and its applications to soft computing using some applications
5. To make the students to have general overview on selection and decision making strategies.

COURSE OUTCOMES

The students should be able to

1. Analyse the Learning Process of Soft Computing.
2. Solve classification and selection problems.
3. Analyse the Fuzzy Logic system.
4. Solve Engineering problems using decision tree learning algorithms.
5. Apply algorithms to solve engineering problems.

UNIT - I:

INTRODUCTION: what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural

Learning Outcomes:
At the end student will be able to

- Identify and describe soft computing techniques and their roles in building intelligent machines.
- Learn neural networks and architectures with directed graphs

UNIT - II:

LEARNING PROCESS: Error Correction learning, Memory based learning, Hebbian learning, Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process.

Learning Outcomes:
At the end student will be able to

- Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications
- Recognize the feasibility of applying a soft computing methodology for a particular problem

UNIT - III:

CLASSICAL & FUZZY SETS: Introduction to classical sets – properties, operations and relations; Fuzzy sets – memberships, uncertainty, operations, properties, fuzzy relations, cardinalities, membership functions.

Learning Outcomes:
At the end student will be able to

- List the facts and outline the different process carried out in fuzzy logic, ANN and Genetic Algorithms.
- Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic

UNIT - IV:

FUZZY LOGIC SYSTEM COMPONENTS
Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods

Learning Outcomes:
At the end student will be able to

- Apply basics of Fuzzy logic and neural networks.
- Discuss the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems

UNIT - V:

CONCEPT LEARNING:
Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm

DECISION TREE LEARNING:
Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning

Learning Outcomes:
At the end student will be able to

- Apply neural networks to pattern classification and regression problems.
- Effectively use existing software tools to solve real problems using a soft computing approach.
- To be able to solve Engineering problems using decision tree learning algorithms.

TEXT BOOKS:

1) Neural networks A comprehensive foundations, Simon Hhaykin, Pearson Education 2nd edition2004
2) Neural Networks, Fuzzy Logic, Genetic Algorithms: Sysnthesis and Applications by Rajasekharan and Pai, PHI Publications
3) Machine Learning, Tom M. Mitchell, MGH

REFERENCE BOOKS:

1) Simon Haykin , “Neural Networks: A Comprehensive Foundation “, PHI Publication.
2) C. Eliasmith and CH. Anderson, “Neural Engineering “, PHI.
3) John Yen and Reza Langari , “Fuzzy Logic¨Intelligence, Control and Information”, Pearson Publication.

Subject Code	Subject Name	L	T	P	C
MCS1106.3	**No SQL DATABASES**	3	0	0	3

COURSE OBJECTIVES:

- Understand the fundamentals of NoSQL databases.
- Understand NoSQL Data Models and their
- Understand MongoDB environment and its transactions.
- Understand Column Oriented Databases like HBase.
- Implement NoSQL Graph Databases.

COURSE OUTCOMES:

The students should be able to

1. Understand the fundamentals of NoSQL databases.
2. Understand NoSQL Data Models and their
3. Understand MongoDB environment and its transactions.
4. Understand Column Oriented Databases like HBase.
5. Implement NoSQL Graph Databases.

UNIT -I:

Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.

Learning Outcomes:
At the end student will be able to

- Explain different types of NoSQL Databases.(L2)
- Illustrate the Emergence of NoSQL.(L2)
- Outline the application and Integration of NoSQL Databases.(L2)

UNIT - II:

Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

Learning Outcomes:
At the end student will be able to

- Compare Relational Database to No SQL stores (L2)
- Explain the challenges of No SQL approach (L2)
- Explain Sharding and Replication.(L2)

UNIT -III:

NoSQL Key-Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

Learning Outcomes:
At the end student will be able to

- Outline the features of key/Value databases.(L2)
- Explain the Document-oriented NoSQL databases.(L2)
- Illustrate E-commerce applications and different aggregate structures. (L2)

UNIT -IV:

Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

Learning Outcomes:
At the end student will be able to

- Define column oriented No SQL Database.(L1)
- Explain the Column-Family Data Store Features.(L2)
- Summarize Event Logging, Content Management Systems.(L2)

UNIT -V:

NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets. Graph NoSQL databases using Neo4,NoSQL database development tools and programming languages, Graph Databases, Graph Database. Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.

Learning Outcomes:
At the end student will be able to

- Explain NoSQL Key-Value databases using riak.(L2)
- Apply No SQL Development tools with suitable use case. (L3)
- Explain the detailed architecture and performance tune of Graph NoSQL databases.(L2)

TEXT BOOKS:

1) Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition ,2019.

WEB REFERENCES:

1) https://www.ibm.com/cloud/learn/nosql-databases
2) https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
3) https://www.geeksforgeeks.org/introduction-to-nosql/
4) https://www.javatpoint.com/nosql-databa

Subject Code	Subject Name	L	T	P	C
MCS1106.4	**DATA SCIENCE**	3	0	0	3

COURSE OBJECTIVES:

- Understand the significance of data science
- Exploring data preparation and analysis
- Understand statistical methods and models
- Implement data visualization techniques
- Implement machine learning techniques

COURSE OUTCOMES:

The students should be able to

- Describe the significance of data science and understand the Data Science process. (L2)
- Explain how data is collected, managed and stored for data science.(L2)
- Build, and prepare data for use with a variety of statistical methods and models (L3)
- Analyse Data using various Visualization techniques. (L4)
- Choose contemporary models, such as machine learning, AI, techniques to solve practical problems (L4)

UNIT – I:

Introduction To Data Science:
Definition, Big Data and Data Science Hype, Datafication , Data Science Profile, Meta Definition, Data Scientist, Statistical Inference, Populations and Samples, Populations and Samples of Big Data, Big Data Can Mean Big Assumptions, Modelling, Philosophy of Exploratory Data Analysis, The Data Science Process , A Data Scientist's Role in this Process Case Study: Real Direct.

Learning Outcomes:
At the end student will be able to

- Understand the basics of data science(L1)
- Summarize testable predictions for real-time data(L2)
- Understand Data Scientist's Role in the analysis Process (L2)

UNIT –II:

Mathematical Preliminaries:
Probability, Descriptive Statistics, Correlation Analysis Data Munging: Properties of Data, Languages for Data Science, Collecting Data, Cleaning Data, Crowdsourcing.

Learning Outcomes:
At the end student will be able to

- Understand the concepts of Data collection and management (L1)
- Establish sources of data ((L2)
- Explain various mathematical concepts for Data Science (L2)

UNIT – III:

Scores and Rankings:
Developing Scoring Systems, Z-scores and Normalization, Advanced Ranking Techniques Statistical Analysis: Sampling from Distributions, Statistical Distributions, Statistical Significance, Permutation Tests and P-values

Learning Outcomes:
At the end student will be able to

- Use the concepts of statistics. (L3)
- Identify distribution properties of data using statistical concepts. (L3)

UNIT- IV:

Visualizing Data:
Exploratory Data Analysis, Developing a Visualization Aesthetic, Chart Types, Great Visualizations Mathematical Models: Philosophies of Modelling, A Taxonomy of Models, Baseline Models, Evaluating Models, Evaluation Environment

Learning Outcomes:
At the end student will be able to

- Understand types of data Visualization techniques (L1)
- Use the measures for model evaluation(L3)
- Evaluate models for multiple environments. (L4)

UNIT-V:

Supervised Learning: Linear Regression, Better Regression Models, Regression as Parameter Fitting, Simplifying Models through Regularization Classification and Logistic Regression, Issues in Logistic Classification, Naive Bayes, Decision Trees Classifiers

Learning Outcomes:
At the end student will be able to

- Understand regression techniques (L1)
- Compare multiple classification techniques (L3)
- Interpret multiple techniques for solving Data science applications .(L4)

TEXTBOOKS:

1. StevenS.Skiena,"TheDataScienceDesignManual",Springer 2017.
2. RachelSchutt&O'neil,"DoingDataScience",StraightTalkfromTheFrontlineO'REILLY,ISBN:978-1-449-35865-5,1stedition, October2013.

REFERENCE BOOKS:

1. Joel Grus,"Data Science from Scratch" First Edition, April 2015
2. Gareth James, Daniela Witten, Trevor Hatie, Roberst Tibhirani, "An Introduction to Statistical Learning- with Applications in R", 2013
3. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2 edition (30 September 2014)
4. R Programming for Data Science, Roger D. Peng, LeanPub, 2015.

WEBREFERENCES:

1."Data science for engineers "https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs28/

Subject Code	Subject Name	L	T	P	C
MS1107	**ADVANCED DATA STRUCTURES & SOFTWARE ARCHITECTURE AND DESIGN PATTERNS LAB**	0	0	3	1.5

COURSE OUTCOMES:

The students should be able to

- Understanding of queues and stacks
- Comprehensive understanding of dictionaries, hashing mechanism which supports faster retrieval
- Illustration of Balanced trees and their operations
- Comprehension of heaps, queues and their operations and detailed knowledge of nonlinear data structures and various algorithms using them

EXPERIMENTS:

PART- I:

1. To implement Prim's algorithm to generate a min-cost spanning tree.
2. To implement Krushkal's algorithm to generate a min-cost spanning tree.
3. To implement Dijkstra's algorithm to find shortest path in the graph.
4. To implement Static Hashing
5. To implement of Huffman Coding
6. To implement of B-tree

PART-II:

Introduction to working with an industrial strength software development environment, namely Rational Rose: how to write and maintain a UML specification; configuration management; architecture design.

1. Use case diagram for Librarian scenario.
2. Design Abstract Factory Design Patten for Library Management System.
3. Design Abstract Bridge Design Patten for Library Management System.
4. Design Flyweight Design Patten for Library Management System.
5. Design Facade Design Patten for Library Management System.
6. Design Mediator Design Patten for Library Management System.

II Semester

Subject Code	Subject Name	L	T	P	C
MCS1201	**MACHINE LEARNING**	3	0	0	3

COURSE OBJECTIVES:

1. To familiarize with a set of well-known supervised unsupervised and semi-supervised learning algorithms.
2. The ability to implement some basic machine learning algorithms
3. Understanding of how machine learning algorithms are evaluated
4. To be able to formulate machine learning problems corresponding to different applications.
5. To understand a range of machine learning algorithms along with their strengths and weaknesses.

COURSE OUTCOMES:

The students should be able to

1. Understand the characteristics of machine learning that make it useful to real-world Problems.
2. Understand various Machine Learning approaches.
3. Understand data Classification using decision trees.
4. Apply theoretical foundations of Bayesian classifier to label data points
5. Understand the concept of Computational and instance based Learning.

UNIT - I:

INTRODUCTION

Well- posed learning problems, designing a learning system, Perspectives and issues in machine learning. Applications of machine learning

Learning Outcomes:

At the end student will be able to

- Summarize the process of machine learning.(L2)
- Recognize various machine learning Applications.(L1)

UNIT – II:

CONCEPT LEARNING

Concept learning and the general to specific ordering. Introduction, A concept learning task, Concept learning as search, Find-s: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias.

Learning Outcomes:

At the end student will be able to

- Recognize various steps in machine learning.(L1)
- Understand various candidate elimination algorithms (L2)

UNIT - III:

DECISION TREE LEARNING
Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning

Learning Outcomes:
At the end student will be able to

- Summarize the process of classification.(L2)
- Construct a decision tree for any sample data.(L3)

UNIT – IV:

BAYESIAN LEARNING
Bayes theorem, Byes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Bayes optimal classifier, An example learning to classify text, Bayesian belief networks

Learning Outcomes:
At the end student will be able to

- Calculate Bayes probability for any given data(L4)
- Calculate Naïve Bayes probability.((L4)
- Distinguish the process of Bayes and Naïve Bayes probability calculation (L4)

UNIT - V:

COMPUTATIONAL LEARNING THEORY - 1
Probability learning an approximately correct hypothesis, Sample complexity for infinite Hypothesis spaces, The mistake bound model of learning- Instance- Based learning- Introduction.

COMPUTATIONAL LEARNING THEORY – 2
K- Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning

Learning Outcomes:
At the end student will be able to

- Understand Probability learning and Instance- Based learning(L2)
- Understand the concept of classification (L2)
- Distinguish lazy Lazy and Eager Learning.(L4)

TEXT BOOKS:

1.Tom M. Mitchell, Machine Learning, MGH

REFERENCE BOOKS:

1. Ethem Alpaydin, Introduction to machine learning, 2nd edition, PHI.
2. Kevin P. Murphy, "Machine Learning," A Probabilistic Perspective, MIT Press, 2012

Subject Code	Subject Name	L	T	P	C
MCS1202	**BIG DATA ANALYTICS**	3	0	0	3

COURSE OBJECTIVES:

- Optimize business decisions and learn the advantage with Big Data analytics.
- Introducing Java concepts required for developing map reduce programs.
- Imparting the architectural concepts of Hadoop.
- Introducing the use of map reduce paradigm.
- To introduce programming tools PIG & HIVE in Hadoop echo system.

COURSE OUTCOMES:

The students should be able to

- Apply the data structures and serialization in Java.
- Understand the Hadoop Distributed File System.
- Apply the Map Reduce Paradigm on various case studies.
- Apply the Pig Scripts and understand Pig architecture.
- Apply the Hive Query Language

UNIT – I:

Data structures in Java:
Linked List, Stacks, Queues, Sets, Maps; Generics: Generic classes and Type parameters, Implementing Generic Types, Generic Methods, Wrapper Classes, Concept of Serialization.

Learning Outcomes:
At the end student will be able to

- After Completion of this unit, student will be able to
- Understand the concepts of data structures in JAVA.
- Understand the concepts of Generics.

UNIT – II:

Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, JobTracker, Task Tracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files.

Learning Outcomes:
At the end student will be able to

- After Completion of this unit, student will be able to
- Learn File systems in Hadoop.
- Understand Configurations of Hadoop clusters and XML Files.
- Understand HDFS file.

UNIT – III:

Writing MapReduce Programs: A Weather Dataset, Understanding Hadoop API for MapReduce Framework (Old and New), Basic programs of Hadoop MapReduce: Driver code, Mapper code, Reducer code, Record Reader, Combiner, Partitioner. The Writable Interface, Writable Comparable and comparators, Writable Classes: Writable wrappers for Java primitives, Text, Bytes Writable, Null Writable, Object Writable and Generic Writable, Writable collections, Implementing a Custom Writable: Implementing a Raw Comparator for speed, Custom comparators

Learning Outcomes:
At the end student will be able to

- Work with large data sets.
- Structure Map reduce frameworks, and use them to solve complex problems, which require massive computation power.

UNIT – IV:

Pig: Hadoop Programming Made Easier Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin

Learning Outcomes:
At the end student will be able to

- After Completion of this unit, student will be able to
- Work with Pig Latin Command Interfaces.
- Work on the Big Data to solve complex problems.

UNIT – V:
Applying Structure to Hadoop Data with Hive: Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data

Learning Outcomes:
At the end student will be able to

- use relational data in a Hadoop environment, using Hive and Hbase tools of the Hadoop Ecosystem.

TEXT BOOKS:

1) Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC
2) Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
3) Hadoop in Action by Chuck Lam, MANNING Publ.
4) Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss

REFERENCE BOOKS:

1) Hadoop in Practice by Alex Holmes, MANNING Publ.
2) Hadoop MapReduce Cookbook,Srinath Perera, Thilina Gunarathne

SOFTWARE LINKS:

1) Hadoop:http://hadoop.apache.org/
2) Hive: https://cwiki.apache.org/confluence/display/Hive/Home
3) Pig Latin: http://pig.apache.org/docs/r0.7.0/tutorial.html

Subject Code	Subject Name	L	T	P	C
MCS1203	**WEB SERVICES**	4	1	0	3

COURSE OBJECTIVES:

- Understand web services and Service oriented architecture (SOA).
- Implement java generic classes and annotations.
- Implement java persistence using JSON and XML Parsers.
- Implement XML Web services using WSDL and JAX-WS.
- Implement RESTFul Web Services using JAX-RS.

COURSE OUTCOMES:

The students should be able to

- Understand the importance of Web Services and Service Oriented Architecture.
- Implement Java Generic data Structures and Annotations.
- Implement object persistence using different APIs.
- Apply XML Web Services using JAX-WS APIs.
- Apply RESTFul Web Services using JAX-RS APIs.

UNIT-I:

Introduction to Web Services - Client Server Distributed Computing, Web Services, Features and characteristics of web services, Web service architecture, WS Components, Soap Web Services, Rest Web services, Soap vs Rest, Service Oriented Architecture, Micro services, Web Services vs Micro Services.

Learning Outcomes:
At the end student will be able to

- Understand Web Service Architecture (L2).
- Understand Soap and Rest Web services(L2)
- Understand Web Services architecture and its role in services. (L2).

UNIT -II:

Generics & Annotations:
Generics in Java, Advantages of generics, Generic Classes, Type Parameters, Wild Cards, Nested Collections, Annotations, Annotation Elements, Built-in Annotations, Custom Annotations.

Learning Outcomes:
At the end student will be able to

- Understand java generics and annotations (L2).
- Implement Wild cards for generic types and classes (L4).
- Implement Custom annotations and for complex java classes. (L4).

UNIT - III:

Object Persistence: XML, Rules of XML Document, XML Schema and NameSpace, Marshalling and UnMarshalling XML document using JAXB, DOM Parser, JSON Object, JSON Array, Serializing and De-serializing JSON, JSON Parsing using Jackson APIs.

Learning Outcomes:
At the end student will be able to

- Understand structure of XML document(L2).
- Implement XML parsers using JAXBAPIs and DOM (L4).
- Implement JSON binding using JACKSON APIs (L4).

UNIT IV:

SOAP Web Services: Introduction to SOAP, SOAP Architecture, WSDL, Structure of WSDL, WSDL Document Elements: Definitions, Types, Message, Operation, portType, binding, port & services, Schema Types and Binding styles, Publishing SOAP Web Services, Consuming Web Services, Exploring javax.xml.ws.*.

Learning Outcomes:
At the end student will be able to

- Understand the structure of SOAP and WSDL (L2)
- Implement WSDL using JAX-WS APIs.(L4)

UNIT V:

RESTFul Web Services: Introduction to RESTFul Web Services, HTTP Request & Response Header, HTTP Methods, Publishing and Consuming Rest based XML Web Services, Publishing and Consuming REST based JSON web services, Exploring JAX-RS through Jersey APIs: javax.ws.rs.*.

Learning Outcomes:
At the end student will be able to

- Understand RESTFul Web Services and its structure. (L2)
- Analyze end point Web Services using JAX-RS. (L4)

TEXT BOOKS:

1. Java, How to Program, 9th Edition, Dieitel&Deitel, 2012.
2. Java Web Services: Up and Running, 2nd Edition by Martin Kalin, 2013, Orielly Media.
3. Java XML and JSON, 2nd Edition, Jeff Friesen, Apress.

REFERENCE BOOKS:

1. XML, Web Services, and the Data Revolution, F.P.Coyle, Pearson Education.
2. Building web Services with Java, 2nd Edition, S. Graham and others, Pearson Education.
3. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly, SPD.

Subject Code	Subject Name	L	T	P	C
MCS1204	**CLOUD COMPUTING**	3	0	0	3

COURSE OBJECTIVES:

- Cloud Computing is a large scale distributed computing paradigm which has become a driving force for information technology over the past several years.
- This course introduce cloud computing technology to undergraduate engineering students, so they can learn, apply and use this technology in their future careers.

COURSE OUTCOMES

The students should be able to

- Understand and analyze different computing paradigms
- Understand the basics of cloud computing and different cloud deployment models.
- Understand different cloud implementation and management strategies.
- Understand and evaluate different cloud service models.
- Identify, analyze and use different cloud services/applications/tools available from key cloud providers.

UNIT-I:

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

Learning Outcomes:

At the end student will be able to

UNIT-II:

Cloud Computing Fundamentals: Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud Computing, Cloud Computing is a Service, Cloud Computing is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models

Learning Outcomes:

At the end student will be able to

UNIT-III:

Cloud Computing Architecture and Management: Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure, Managing the Cloud Application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.

Learning Outcomes:

At the end student will be able to

UNIT-IV:

Cloud Service Models: Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platformas a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models.

Learning Outcomes:
At the end student will be able to

UNIT-V:

Cloud Providers and Applications: EMC, EMC IT, Captiva Cloud Toolkit, Google Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM, Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud Platform, Virtualization Services Provided by SAP, Sales force, Sales Cloud, Service Cloud: Knowledge as a Service, Rackspace, VMware, Manjra soft, Aneka Platform**.**

Learning Outcomes:
At the end student will be able to

TEXT BOOK:

- Essentials of Cloud Computing, K. Chandrasekhran, CRC press.

REFERENCE BOOKS:

- Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley.
- Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier.
- Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumara swamy, Shahed Latif, O'Reilly.

Subject Code	Subject Name	L	T	P	C
MCS1205.1	**DIGITAL IMAGE PROCESSING**	3	0	0	3

COURSE OBJECTIVE:

- To learn about digital image fundamentals and exposed to simple image processing fundamentals.
- To be familiar with image segmentation techniques along with feature extraction and basic image classification fundamentals.

COURSE OUTCOMES:

After complete the course, Student can able to

- Review the fundamentals of digital image processing and its steps.
- Analyse the images in frequency and spatial domain.
- Evaluate the techniques for image restoration and reconstruction
- Understand the concept of image segmentation.
- Understand the basics of image feature extraction and image classification.

UNIT-I:

INTRODUCTION:
What is Digital Image Processing, The Origins of 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.

Learning Outcomes:
At the end student will be able to

- Review the fundamentals of digital image processing.
- Understand the basics steps in digital image processing.

UNIT-II:

FILTERING USING SPATIAL AND FREQUENCY DOMAIN:

Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering: Smoothing (Lowpass) Spatial Filters, Sharpening (High pass) Spatial Filters
Frequency Domain: Image Smoothing Using Lowpass Frequency Domain Filters Image Sharpening Using High pass Filters.

Learning Outcomes:
At the end student will be able to

- Analyse the need of spatial and frequency domain in digital image processing.
- Understand the need and type of filters for smoothing and sharpening the image.

UNIT-III:

IMAGE RESTORATION AND RECONSTRUCTION:
A Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only—Spatial Filtering, Periodic Noise Reduction Using Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimating the degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering, Geometric Mean Filter.

Learning Outcomes:
At the end student will be able to

- Evaluate the need of restoration and reconstruction of an image when its processing.
- Understand the basics of various filters used to perform restoration and reconstruction.

UNIT-IV:

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.

Learning Outcomes:
At the end student will be able to

- Understand the concept of image segmentation.
- Remember the types of segmentation process in digital image processing.

UNIT-V:

FEATURE EXTRACTION:
Introduction, Boundary Pre-processing, Boundary Feature Descriptors Region Feature Descriptors, Principal Components as Feature Descriptors Whole-Image Features.

IMAGE CLASSIFICATION:
Patterns and Pattern Classes Pattern Classification by Prototype Matching.

Learning Outcomes:
At the end student will be able to

- Understand the basics of Feature extraction and its process
- Understand the need of image classification in digital image processing.

TEXT BOOK:

1. Digital Image Processing, Rafel C. Gonzalez, Richard E. Woods, 4th Edition, Pearson Education.
2. Digital Image Processing, S. Sridhar, 1st edition, Oxford publication.

REFERENCE BOOKS:

1. Fundamentals of Digital Image Processing, Anil Jain K PHI Learning Pvt. Ltd., 2011.
2. Digital Image Processing, William K Pratt John Willey, 2002.

Subject Code	Subject Name	L	T	P	C
MCS1205.2	**INFORMATION RETRIEVAL SYSTEMS**	3	0	0	3

COURSE OBJECTIVE:

- To learn about fundamentals of information retrieval system and its evaluation.
- To understand about various information retrieval models like Boolean, vector, probabilistic, language and Content Based Image Retrieval.

COURSE OUTCOMES:

After complete the course, Student can able to

- Review the fundamentals of information retrieval system and its evaluation system.
- Understand the concept of Boolean retrieval model and vector space model.
- Understand about probabilistic and language model for information retrieval.
- Remember about text summarization and content-based image retrieval
- Analyse the various algorithms for finding the relevance feedback.

UNIT-I:

Fundamental of Information Retrieval: Introduction, Blocked Sort-Based Indexing, Single-Pass In-Memory Indexing, Distributed Indexing, Dynamic Indexing, Advanced Indexing. Information Retrieval Evaluation: introduction.

Learning Outcomes:
At the end student will be able to

- Able to understand the basic concepts of information retrieval system.
- Analyse the evaluation system of information retrieval.

UNIT-II:

Boolean Information Retrieval Model: Introduction, Boolean Retrieval, Representation of Boolean Model. Vector Space Information Retrieval Model: Introduction, What Is Document Similarity, Cosine Similarity, TF-IDF Weighting, Named-Entity Recognition, State-of-the-Art NER Models.

Learning Outcomes:
At the end student will be able to

- Able to understand the concept of Boolean and vector information retrieval model.
- Able to differentiate the Boolean and vector space model of informational retrieval system.

UNIT-III:

Probabilistic Information Retrieval Model: Introduction, Background, Probabilistic Information, Retrieval Models. Language Models for Information Retrieval: Introduction, Language Models, Types of Language Models, Query Likelihood Model.

Learning Outcomes:
At the end student will be able to

- Able to understand the probabilistic and language models for information retrieval system.
- Able to differentiate the probabilistic and language models for information retrieval system.

UNIT-IV:

Text Summarization: Introduction, Abstractive Summarization Approach, Extractive Text, summarization Technique, The Role of Artificial Intelligence in IR. Content-based Image Retrieval: Introduction, Need of CBIR, Image colour Feature Extraction, ISFE-Image Shape Feature Extraction, ITFE-Image Texture Feature Extraction

Learning Outcomes:
At the end student will be able to

- Able to understand the text summarization.
- Able to understand the basics of Content Based Image Retrieval.

UNIT-V:

Relevance Feedback: Introduction, The Rocchio Algorithm for RF, Algorithm, Probabilistic RF, Assumptions for RF, RF Disadvantages, Pseudo/Blind RF, Indirect RF, RF on Web

Learning Outcomes:
At the end student will be able to

- Able to Analyse various algorithms of relevance feedback for information retrieval system.

TEXT BOOK:

1) Information Retrieval: Models and Concepts, Badal Soni, Suganya Devi.K, 1st Edition Wiley Publications.

REFERENCE BOOKS:

1) Introduction to information retrieval, Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze, Cambridge Press,2008.
2) Information Retrieval System: A Linguistic Study, R C Pandey, Abhijeet Publications.

Subject Code	Subject Name	L	T	P	C
MCS1205.3	**MOBILE Ad-hoc NETWORKS**	3	0	0	3

COURSE OBJECTIVE:

- To introduce major aspects of the mobile ad-hoc networks
- To introduce characteristics, features and applications
- Understand ad-hoc mobility models
- Learn IEEE standards
- Understand Mac and Routing protocols
- Understand Transport layer and cross layer design

COURSE OUTCOMES:

After complete the course, Student can able to

- Acquires basic knowledge of ad-hoc networks. (L2)
- Analyze MAC2 protocols. (L4)
- Analyze various routing algorithms (L4)
- Discuss various Transport layer functionalities.(L2)
- Acquire knowledge on cross layer design (L2)

UNIT-I:

INTRODUCTION: Introduction to ad-hoc networks – definition, characteristics features, applications. Characteristics of wireless channel, ad-hoc mobility models: indoor and outdoor models.

Learning Outcomes:
At the end student will be able to

- Distinguish MANET and WLAN (L4)
- Classify Ad-hoc mobility models (L2)
- Demonstrate major characteristics, features and applications of MANET(L2)

UNIT-II:

MEDIUM ACCESS PROTOCOLS:

MAC Protocols: Design issues, goals and classification. Contention based protocols – with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

Learning Outcomes:
At the end student will be able to

- Analyze scheduling algorithms (L4)
- classify various IEEE standards(L2)

UNIT-III:

NETWORK PROTOCOLS:

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, energy aware routing algorithm, hierarchical routing, QoS aware routing.

Learning Outcomes:
At the end student will be able to

- Distinguish proactive and reactive routing protocols (L4)
- Analyze various routing algorithms (L4)

UNIT-IV:

END – END DELIVERY AND SECURITY:

Transport Layer: Issues in designing – Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

Learning Outcomes:
At the end student will be able to

- Acquire knowledge on transport layer functionalities (L2)
- Analyze network security attacks. (L4)

UNIT-V:

CROSS LAYER DESIGN:
Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of adhoc with Mobile IP networks.

Learning Outcomes:
At the end student will be able to

- Analyze the cross layer design functionalities(L4)
- Acquire knowledge on optimization (L2)

TEXT BOOKS:

1. C. Siva Ram Murthy and B. S. Manoj, Ad hoc Wireless Networks Architecture and Protocols, 2nd edition, Pearson Edition, 2007.

REFERENCE BOOKS:

1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobile ad-hoc networking, Wiley-IEEE press, 2004.
2. Mohammad Ilyas, The handbook of ad-hoc wireless networks, CRC press, 2002.
3. T. Camp, J. Boleng, and V. Davies " A Survey of Mobility Models for Ad-hoc Network"
4. Research, "Wireless Commun, and Mobile Comp.. Special Issue on Mobile Ad-hoc Networking Research, Trends and Applications, Vol. 2, no. 5, 2002, pp. 483 – 502.
5. A survey of integrating IP mobility protocols and Mobile Ad-hoc networks, Fekri M. bduljalil and Shrikant K. Bodhe, IEEE communication Survey and tutorials, no: 12007.

Subject Code	Subject Name	L	T	P	C
MCS1205.4	**DevOps**	3	0	0	3

COURSE OBJECTIVES:

- Understand the fundamentals DevOps.
- Understand DevOps improves collaboration and productivity by automating infrastructure
- Understand Workflows and continuously measuring applications performance.
- Implement DevOps Applications

COURSE OUTCOMES:

After complete the course, Student can able to

- Enumerate the principles of continuous development and deployment, automation of Configuration management, inter-team collaboration, and IT service agility
- Describe DevOps & DevSecOps methodologies and their key concepts
- Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models
- Set up complete private infrastructure using version control systems and CI/CD tools
- Understand about DevOps maturity model.

UNIT - I:

Phases of Software Development life cycle. Values and principles of agile software development.

Learning Outcomes:
At the end student will be able to

- Explain different types Phases of Software Development life cycle.(L2)
- Illustrate the Software development.(L2)
- Outline the application and Integration of SDLC.(L2)

UNIT - II:

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.

Learning Outcomes:
At the end student will be able to

- Explain DevOps Architecture, (L2)
- Illustrate Orchestration, of DevOps (L2)
- Explain application of DevOps.(L2)
- Illustrate DevOps delivery pipeline of DevOps (L2)
- Illustrate DevOps eco system

UNIT - III:

DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes.

Learning Outcomes:
At the end student will be able to

- Outline the features of key/Value databases.(L2)
- Explain the Agiling Techniqes.(L2)
- Illustrate Tool stack implementation. (L2)
- Explain People aspect, processes. (L2)

UNIT - IV:
CI/CD: Introduction to Continuous Integration, Continuous Delivery and Deployment, Benefits of CI/CD, Metrics to track CICD practices

Learning Outcomes:
At the end student will be able to

- Define CI/CD .(L1)
- Explain the Continuous Delivery and Deployment.(L2)
- Explain Benefits of CI/CD.(L2)
- Summarize Metrics to track CICD practices.(L2)

UNIT - V:

Devops Maturity Model: Key factors of DevOps maturity model, stages of Devops maturity model, DevOps maturity Assessment

Learning Outcomes:
At the end student will be able to

- Explain factors of DevOps maturity model.(L2)
- Explain stages of Devops maturity model.(L2)
- Apply DevOps maturity Assessment. (L3)

TEXT BOOKS:

1. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations is considered the DevOps bible. It is written by Gene Kim, Jez Humble, Patrick Debois, and John Willis
2. Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation, is by Jez Humble and David Farley
3. Effective DevOps: Building A Culture of Collaboration, Affinity, and Tooling at Scale by Jennifer Davis & Ryn Daniels.

WEB REFERENCES:

1. https://www.udacity.com/course/intro-to-devops--ud611 - Good online course with sample exercises.

2. http://www.edureka.co/devops - Online Training covering high level process and tools. (Needs Registration)
3. https://www.edx.org/course?search_query=devops – Has no. of courses from MS and Redhat.
4. https://www.codementor.io/devops/tutorial - Basic Tutorial on DevOps.
5. https://mva.microsoft.com/training-topics/devops#!lang=1033 – Lists no. of courses related to DevOps and various tools, methods used.
6. http://devops.com/ - A good blog, has lots of contents.
7. https://dzone.com/devops-tutorials-tools-news - Lots of links and tutorials

Subject Code	Subject Name	L	T	P	C
MCS1206.1	**BLOCK CHAIN TECHNOLOGIES**	3	0	0	3

COURSE OBJECTIVES:

- Understand how Block chain systems (mainly Bit coin and Ethereal) work,
- To securely interact with Block chain systems,
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from Block chain technology into their own projects.
- To identify the importance of crypto currency.

COURSE OUTCOMES:

After complete the course, Student can able to

- Acquire basic skills and knowledge of Distributed Database and Cryptography.
- Interact with a Block chain system by sending and reading transactions.
- Design, build, and deploy a distributed application.
- Understand the Basic knowledge of Crypto currency.
- Understand the Basic knowledge of Crypto currency Regulation.

UNIT - I:

Basics Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

Learning Outcomes:
At the end student will be able to

- Acquire basic skills and knowledge of Cryptography.
- Understanding of current trends of Block chain, and ability to imagine its use cases and future.

UNIT - II:

Blockchain: Introduction, Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public Block chain.

Learning Outcomes:
At the end student will be able to

- To understand the applications of Block chain.

UNIT -III:

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

Learning Outcomes:
At the end student will be able to

- Identify the challenges in Distributed Consensus.

UNIT - IV:

Crypto currency: History, Distributed Ledger, Bit coin protocols - Mining strategy and rewards, Ethereum -Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Side chain, Name coin.

Learning Outcomes:
At the end student will be able to

- Understand the Basic knowledge of Crypto currency.
- Analyze how Bit coin Crypto currency works uses in global market.

UNIT - V:

Crypto currency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy.

Learning Outcomes:
At the end student will be able to

- Understand the Basic knowledge of Crypto currency Regulation.

TEXT BOOK:

1) Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

REFERENCE BOOKS:

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies.
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellowpaper.2014.
4. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum
2. Smart contracts.

Subject Code	Subject Name	L	T	P	C
MCS1206.2	**OBJECT ORIENTED SOFTWARE ENGINEERING**	3	0	0	3

COURSE OBJECTIVES:

- To elicit, analyze and specify software requirements through a productive working
- relationship with various stakeholders of the project.
- To understand the what software life cycle is, how software projects are planned and
- managed, types of resources involved in software development projects, risks are
- identified and assessed, predictions and assessments are made.
- To identify, formulate, and solve software engineering problems, including the
- specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements

COURSE OUTCOMES:

After complete the course, Student can able to

- Apply the Object Oriented Software-Development Process to design software
- Analyze and Specify software requirements through a SRS documents.
- Design and Plan software solutions to problems using an object-oriented strategy.
- Model the object oriented software systems using Unified Modeling Language (UML)
- Estimate the cost of constructing object oriented software.

UNIT I:

Introduction to Software Engineering: Software, Software Crisis, Software Engineering definition, Evolution of Software Engineering Methodologies, Software Engineering Challenges. Software Processes: Software Process, Process Classification, Phased development life cycle, Software Development Process Models- Process, use, applicability and Advantages/limitations.

Learning Outcomes:
At the end student will be able to

UNIT II:

Object oriented Paradigm, Object oriented Concepts, Classes, Objects, Attributes, Methods and services, Messages, Encapsulation, Inheritance, Polymorphism, Identifying the elements of object model, management of object oriented Software projects, Object Oriented Analysis, Domain Analysis, Generic Components of OOA model,, OOA Process, Object Relationship model, Object Behavior Model, Object Oriented Design: Design for Object- Oriented systems, The Generic components of the OO design model, The System design process, The Object design process, Design Patterns, Object Oriented Programming.

Learning Outcomes:
At the end student will be able to

UNIT III:

Object Oriented testing: Broadening the view of Testing, Testing of OOA and OOD models, Object-Oriented testing strategies, Test case design for OO software, testing methods applicable at the class level, Interclass test case design

Learning Outcomes:
At the end student will be able to

UNIT IV:

Technical Metrics for Object Oriented Systems: The Intent of Object Oriented metrics, The distinguishing Characteristics, Metrics for the OO Design model, Class-Oriented metrics, Operation-Oriented Metrics, Metrics foe Object Oriented testing, Metrics for Object Oriented projects

Learning Outcomes:
At the end student will be able to

UNIT V:

Computer-Aided Software Engineering: What is CASE?, Building blocks for CASE, A taxonomy of CASE tools, Integrated CASE environments, The Integration Architecture, The CASE Repository

Learning Outcomes:
At the end student will be able to

TEXT BOOKS:

1. Object Oriented and Classical Software Engineering, 7/e, Stephen R. Schach, TMH.
2. Object oriented and Classical Software Engineering, Timothy Lethbridge, Robert Laganiere, TMH
3. Software Engineering by Roger S Pressman, Tata McGraw Hill.

REFERENCE BOOKS:

1) Component based Software Engineering: ivica Crnkovic, Springer.

Subject Code	Subject Name	L	T	P	C
MCS1206.3	**PERVASIVE COMPUTING**	3	0	0	3

COURSE OBJECTIVES

- To study the pervasive computing and its applications
- To study the pervasive computing web based applications
- To study voice enabling pervasive computing
- To study PDA in pervasive computing
- To study user interface issues in pervasive computing

COURSE OUTCOMES:

After complete the course, Student can able to

- Understand the fundamental theoretical concepts in pervasive computing.
- Understand the aspects of context awareness
- Study the methods for efficient resource allocation and task migration
- Learn and Analyze the HCI Service Selection and HCI migration framework
- Design and implement pervasive application systems

UNIT – I:

Pervasive Computing Concepts: Perspectives of Pervasive Computing, Challenges, Technology; The Structure and Elements of Pervasive Computing Systems: Infrastructure and Devices, Middleware for Pervasive Computing Systems, Pervasive Computing Environments

Learning Outcomes:
At the end student will be able to

UNIT – II:

Context Collection, User Tracking, and Context Reasoning; Resource Management in Pervasive Computing: Efficient Resource Allocation in Pervasive Environments, Transparent Task Migration, Implementation and Illustrations.

Learning Outcomes:
At the end student will be able to

UNIT – III:

HCI interface in Pervasive Environments: HCI Service and Interaction Migration, Context- Driven HCI Service Selection, Scenario Study: Video Calls at a Smart Office, A Web Service– Based HCI Migration Framework .

Learning Outcomes:

At the end student will be able to

UNIT – IV:

Pervasive Mobile Transactions: Mobile Transaction Framework, Context-Aware Pervasive Transaction Model, Dynamic Transaction Management, Formal Transaction Verification, Evaluations

Learning Outcomes:
At the end student will be able to

UNIT – V:

Case Studies: iCampus Prototype, IPSpace: An IPv6-Enabled Intelligent Space.

Learning Outcomes:
At the end student will be able to

TEXT BOOKS:

1.Minyi Guo, Jingyu Zhou, Feilong Tang, Yao Shen ,"Pervasive Computing: Concepts, Technologies and Applications", CRC Press, 2016.

2.Obaidat, Mohammad S., Mieso Denko, and Isaac Woungang, eds. Pervasive computing and networking. John Wiley & Sons, 2011.

3.Laurence T. Yang, Handbook On Mobile And Ubiquitous Computing Status And Perspective, 2012, CRC Press.

Subject Code	Subject Name	L	T	P	C
MCS1206.4	**INTRUSION DETECTION SYSTEM**	3	0	0	3

COURSE OBJECTIVES:

- Student will understand Intrusion Detection and their principles.
- The course will cover details of concept of security, Introduction to Intrusion,
- The course will cover Classification of Intrusion Detection,
- The course will cover Vulnerabilities Sources, Counter measures against attacks.

COURSE OUTCOMES:

After complete the course, Student can able to

- Understanding the modern concept of Intrusion Detection System.
- Understand various sources of vulnerabilities
- Analyze network traffic, and formulating rules
- Compare various tools and approaches to detect attacks and secure the resources

UNIT - I:

Intrusion Detection System: History of Intrusion Detection, Cyber audit, Terminologies of Detection System, Sources of Vulnerabilities, Introduction to Detection System, Types of Detection System – Network, Host and Distributed. IDS Detection Techniques, Common Vulnerability and Exposure (CVE) standards.

Learning Outcomes:
At the end student will be able to

UNIT – II:

Network Traffic Signatures and Prevention System: Fundamentals of Network Traffic, Intrusion Detection Vs Intrusion Prevention, IDS/IPS Architecture, Network Based Intrusion System, Host Based Intrusion System, Signature analysis, detecting traffic signatures, Identifying suspicious events.

Learning Outcomes:
At the end student will be able to

UNIT- III:
Snort and OSSEC: Introduction to Snort, Installation of Snort – Windows, Linux. Internal working of Snort. Installation and Understanding of OSSEC – Linux

Learning Outcomes:
At the end student will be able to

UNIT -IV:
Snort Rules: Dissecting Rules, Using Variables, Understanding Rule headers, Rules Options, Rule Writing.

Learning Outcomes:

At the end student will be able to

UNIT -V:
Countermeasure of Attacks: CERT, Access control, Cyber security audits – Data Security, Network Security, System Security, Physical Security, Intelligent Intrusion Detection using Machine Learning, Data Collection from Detection System.

Learning Outcomes:
At the end student will be able to

TEXT BOOKS:

1. "Intrusion Detection Systems", Advances in Information Security, 2008. Available: 10.1007/978-0-387-77265-3
2. Ali A. Ghorbani, Network intrusion detection and prevention concepts and techniques, Springer, 2010

REFERENCE BOOKS:

1. Rafeeq Rehman : " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, Prentice Hall , 2003
2. C. Endorf, E. Schultz and J. Mellander, Intrusion Detection & Prevention, McGrawHill/Osborne, 2004.

Subject Code	Subject Name	L	T	P	C
MCS1207	MACHINE LEARNING LAB	3	0	0	3

COURSE OUTCOMES:

After complete the course, Student can able to

- Implement machine learning algorithms to real world problems
- Choose appropriate machine learning algorithm for a problem
- Interpret the results of two different machine learning algorithms

EXPERIMENTS:

1. Implement Principal Component Analysis (PCA) and Singular Value Decomposition (SVD) using NumPy.
2. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
3. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
4. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
5. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
6. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
7. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
8. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
9. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
10. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
11. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
12. Create the following plots using Matplotlib, Pandas Visualization, Seaborn on iris dataset, wine reviews datasets. a) Scatter Plot , b) Line chart, c) Histogram, d) Heatmap

TEXT BOOKS:

1. Hands–On Machine Learning with Scikit–Learn and TensorFlow 2nd Edition: Concepts, Tools, and Techniques to Build Intelligent Systems, Aurelien Geron, 2019.

REFERENCES BOOKS:

1. https://scikit-learn.org/stable/tutorial/index.html
2. https://archive.ics.uci.edu/ml/index.php

3. https://towardsdatascience.com/pca-and-svd-explained-with-numpy-5d13b0d2a4d8
4. https://towardsdatascience.com/introduction-to-data-visualization-in-python-89a54c97fbe

III Semester

Subject Code	Subject Name	L	T	P	C
MCS2101	**DEEP LEARNING**	3	0	0	3

COURSE OBJECTIVES:

- To provide exposure to these advances and facilitate in depth discussions on deep learning.

COURSE OUTCOMES:

- Demonstrate the basic concepts fundamental learning techniques and layers.
- Discuss the Neural Network training, various random models.
- Explain different types of deep learning network models.
- Classify the Probabilistic Neural Networks
- Implement tools on Deep Learning techniques.

UNIT-I :

Introduction:
Various paradigms of learning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques. Feed forward neural network: Artificial Neural Network, activation function, multi-layer neural network

Learning Outcomes:
At the end student will be able to
- Understand the fundamentals of Deep Learning. (L2).
- Summarize the architecture of multi-layer network. (L2)

UNIT-II:

Training Neural Network: Risk minimization, loss function, back propagation, regularization, model selection, and optimization. Deep Neural Networks: Difficulty of training deep neural networks, Greedy layer wise training.

Learning Outcomes:
At the end student will be able to
- Understand back propagation and Optimization strategies. (L2)
- Apply the training models on neural networks. (L4)

UNIT-III:

Deep Learning: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolution Neural Network, Recurrent Neural Network, and Deep Belief Network.

Learning Outcomes:
At the end student will be able to
- Understand the architectures of CNN, RNN and DBN. (L2)
- Training deep feed forward networks for regularizations. (L4)

UNIT-IV:

Probabilistic Neural Network: Hopfield Net, Boltzmann machine, RBMs, Sigmoid net, Auto encoders.

Learning Outcomes:
At the end student will be able to

- Understand the Deep neural network auto-encoders.

UNIT-V:

Applications: Object recognition, sparse coding, computer vision, natural language processing. Introduction to Deep Learning Tools: Tensor Flow, Caffe, Theano, Torch.

Learning Outcomes:
At the end student will be able to

- Understand object detection and recognition strategies. (L2)
- Training deep neural networks using Tensor Flow, Cafee and PyTorch etc. (L4)

TEXT BOOKS:

1. I. Goodfellow, Bengio Y., Courville A., "Deep learning", Volume 1, MIT Press.
2. François Duval, "Deep Learning for Beginners: Practical Guide with Python and Tensorflow", Data Science Series, CreateSpace Independent Publishers.

REFERENCE BOOKS:

1. Sebastian Raschka, Vahid Mirjalili, "Python Machine Learning: Machine Learning and Deep
2. Learning with Python, scikit-learn, and TensorFlow", 2nd edition, Packt Publishers.
3. Minyi Guo, Jingyu Zhou, Feilong Tang, Yao Shen ,"Pervasive Computing: Concepts, Technologies and Applications",CRC Press, 2016.
4. Obaidat, Mohammad S., Mieso Denko, and Isaac Woungang, eds. Pervasive computing and networking. John Wiley & Sons, 2011.
5. Laurence T. Yang, Handbook On Mobile And Ubiquitous Computing Status And Perspective, 2012, CRC Press.