MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
Accredited by NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act,1956

M.TECH - Computer Science and Engineering

COURSE STRUCTURE (R20)

Applicable From 2020-21 Admitted Batch

S. No	Category	Breakup of credits (Total 68 credits)
1	Programme Core	22
2	Professional Elective	15
3	Open Elective	3
4	Project Work	28
5	Audit Course	-
	Total Credits	**68**

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M.Tech - Computer Science and Engineering
Course Structure (R20)
Applicable From 2020-2021 Admitted Batch

I YEAR I SEMESTER

S.No.	Course Code	Course Title	Course Area	Hours Per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIE)	External (SEE)	Total
1	2015801	Machine Learning	PC	3	0	0	3	30	70	100
2	2015802	Advanced Data Structures	PC	3	0	0	3	30	70	100
3	2015803	Research Methodology & IPR	PC	2	0	0	2	30	70	100
4	Professional Elective – I	1. Information Security 2. Advanced Operating System 3. Advanced Computer Networks	PE	3	0	0	3	30	70	100
5	Professional Elective – II	1. Image and Video Processing 2. Cloud Computing 3. Internet of Things	PE	3	0	0	3	30	70	100
6	2015831	Machine Learning Lab	PC	0	0	4	2	30	70	100
7	2015832	Advanced Data Structures Lab	PC	0	0	4	2	30	70	100
8		Audit Course - I	AC	2	0	0	0	100	-	100
Total Credits				**16**	**0**	**8**	**18**	**310**	**490**	**800**

I YEAR II SEMESTER

S.No.	Course Code	Course Title	Course Area	Hours Per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIE)	External (SEE)	Total
1	2025804	Advanced Algorithms	PC	3	0	0	3	30	70	100
2	2025805	Data Science	PC	3	0	0	3	30	70	100
3	Professional Elective – III	1. Parallel and Distributed Algorithms 2. Block Chain Technology 3. Ad-hoc and Wireless Sensor Networks	PE	3	0	0	3	30	70	100
4	Professional Elective – IV	1. Software Architecture and Design Patterns 2. Design Thinking 3. Big Data Analytics	PE	3	0	0	3	30	70	100
5	2025833	Advanced Algorithms Lab	PC	0	0	4	2	30	70	100
6	2025834	Data Science Lab	PC	0	0	4	2	30	70	100
7	2025835	Mini Project with Seminar	PS	0	0	4	2	30	70	100
8		Audit Course - II	AC	2	0	0	0	100	-	100
Total Credits				**14**	**0**	**12**	**18**	**310**	**490**	**800**

II YEAR I SEMESTER

S.No.	Course Code	Course Title	Course Area	Hours Per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIE)	External (SEE)	Total
1	Professional Elective – V	1. Soft Computing 2. Semantic Web and Social Networks 3. Cognitive Science 4. Optimization Techniques	PE	3	0	0	3	30	70	100
2		Open Elective - I	OE	3	0	0	3	30	70	100
3	2025836	Dissertation Work Phase - I	PS	0	0	12	6	100	0	100
Total Credits				**6**	**0**	**12**	**12**	**160**	**140**	**300**

II YEAR II SEMESTER

S. No.	Course Code	Course Title	Course Area	Hours Per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIE)	External (SEE)	Total
1	2025837	Dissertation Work Phase - II	PS	0	0	12	6	100	0	100
2	2025838	Dissertation Viva - Voce	PS	0	0	28	14	0	100	100
Total Credits				**0**	**0**	**40**	**20**	**100**	**100**	**200**

Professional Elective - I		
S.No	**Course Code**	**Course**
1	2015811	Information Security
2	2015812	Advanced Operating System
3	2015813	Advanced Computer Networks

Professional Elective - II		
S.No	**Course Code**	**Course**
1	2015814	Image and Video Processing
2	2015815	Cloud Computing
3	2015816	Internet of Things

Professional Elective - III		
S.No	**Course Code**	**Course**
1	2025817	Parallel and Distributed Algorithms
2	2025818	Block Chain Technology
3	2025819	Ad-hoc and Wireless Sensor Networks

Professional Elective - IV		
S.No	**Course Code**	**Course**
1	2025820	Software Architecture and Design Patterns
2	2025821	Design Thinking
3	2025822	Big Data Analytics

Professional Elective - V		
S. No	**Course Code**	**Course**
1	2035823	Soft Computing
2	2035824	Semantic Web and Social Networks
3	2035825	Cognitive Science
4	2035826	Optimization Techniques

Open Elective - I		
S. No	**Course Code**	**Course**
1	2035827	Advanced Data Structure
2	2035828	Artificial Intelligence
3	2035829	Data Analytics

Audit Course – I		
S. No	**Course Code**	**Course**
1	2010001	English for Research Paper Writing
2	2010002	Disaster Management
3	2010003	Sanskrit for Technical Knowledge
4	2010004	Value Education

Audit Course – II		
S. No	**Course Code**	**Course**
1	2020005	Constitution of India
2	2021234	Pedagogy Studies
3	2020007	Stress Management by yoga
4	2020008	Personality Development Through Life Enlightenment Skills

I-I

2015801: MACHINE LEARNING

L	T/P	C
3	0/0	3

Course Objectives

- To learn the concept of how to learn patterns and concepts from data
- To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning.
- To explore Deep learning technique and various feature extraction strategies.

Course Outcomes: After completion of course, students would be able to:

- Understand the concepts of computational intelligence like machine learning
- Get the skill to apply machine learning techniques to address the real time problems in different areas.
- Understand the Neural Networks and its usage in machine learning application.

UNIT – I

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

Concept learning and the general to specific ordering –introduction, a concept learning task, concept learning as search, find-S, the candidate elimination algorithm, inductive bias.

Supervised Learning (Classification and Regression)

Basic methods: Distance-based methods, Nearest-Neighbors, Decision Trees, Naive Bayes, Linear models: Linear Regression, Logistic Regression and Generalized Linear Models.

UNIT – II

Unsupervised Learning:

Clustering: K-means/Kernel K-means. Dimensionality Reduction: PCA and kernel PCA. Matrix Factorization and Matrix Completion. Generative Models (mixture models and latent factor models).

UNIT - III

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)

UNIT - IV

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning, feature representation learning. Neural network representation, perceptions, multilayer networks and the back-propagation algorithm.

UNIT - V

Scalable Machine Learning, Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Bayesian Learning and Inference. Recent trends in various learning techniques of machine learning.Text Book:

1. Machine Learning –Tom M. Mitchell, -MGH
2. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis

References:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press,2012
2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer,2007

2015802: ADVANCED DATA STRUCTURES

L	T/P	C
3	0/0	3

Pre-Requisites: UG level course in Data Structures

Course Objectives:

- The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- Students should be able to understand the necessary mathematical abstraction to solve problems.
- To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
- Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes: After completion of course, students should be able to:

- Select the data structures that efficiently model the information in a problem.
- Design programs using a variety of data structures, including hash tables, search structures and digital search structures
- Identify suitable data structures and develop algorithms for computational geometry problems.
- Implement and know the application of algorithms for sorting and pattern matching

UNIT - I

Dictionaries:

Definition, Implementation of Dictionaries- (Insertion, search, retrieve, updation, Deletion)

Searching: Linear Search, Binary Search, Multiway Search and its applications.

Sorting: Merge Sort, Quick Sort, Heap Sort and its applications.

Hashing:

Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing and its Applications.

UNIT –II

Heap Structures & Skip Lists

Heap Structures- Introduction, Min-Max Heap, Leftist tree, Binomial Heap, Fibonacci Heap, and its applications.

Skip List- Definition and operations of skip list and its applications.

UNIT - III

Trees & Graphs:

Binary Search Tree, AVL Tree, Red Black Tree, 2-3 Tree, B-Tree, Splay Tree, and its Applications

Graphs : Introduction of graph, Representation of graph , Graph traversals and its Applications

UNIT – IV

Text Processing:

String Operations, Brute-Force Pattern Matching, Boyer- Moore Algorithm, Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, Huffman Coding Algorithm, Longest Common Subsequence Problem (LCS) and its applications

UNIT - V

Computational Geometry:

One Dimensional Range Searching, Two-Dimensional Range Searching, Priority Search Tree and its operations, Priority Range Trees, Quadtrees, k-D Trees, Recent Trends in computational geometry methods and its applications.

TEXT BOOKS:

1. Fundamentals of Data structures in C, E.Horowitz, S.Sahniand Susan Anderson Freed, 2nd Edition, Universities Press
2. Data Structures Using C – A.S. Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson education.

REFERENCES:

1. Fundamentals of Computer Algorithms, 2nd Edition, Ellis Horowitz, Sartaj Sahni
2. Sanguthevar Rajasekaran, Universities Press.C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press

5803: RESEARCH METHODOLOGY & IPR

Course Objectives:

- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

Course Outcomes: At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R &D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT-I:

Introduction to research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT-II:

Effective literature studies approaches, Analysis, Plagiarism, Research ethics.

UNIT-III:

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, Presentation and Assessment by a review committee.

UNIT-IV:

Intellectual Property Rights: Patents, Designs, Trademark and Copyright. Process of Patenting and Development: Technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under Patent Cooperation Treaty(PCT)

UNIT-V:

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

TEXT BOOKS:

1. C R Kothari "Research and Methodologies" New Age Publications
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

http://www.ipindia.nic.in/

REFERENCES:

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.
3. Mayall, "Industrial Design", McGraw Hill,1992.
4. Niebel, "Product Design", McGraw Hill,1974.
5. Asimov, "Introduction to Design", Prentice Hall,1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age",2016.
7. T. Ramappa, "Intellectual Property Rights Under WTO", S Chand, 2008

2015811: Information Security

L	T/P	C
3	0/0	3

Pre-Requisites: Cryptography and Network Security

Course Outcomes

At the end of the course, student will able to

- Understand the fundamentals of information security
- Ability to identify and investigate security threats
- Ability to apply security technologies using cryptographic mechanisms
- Demonstrate the knowledge of cryptography, network security concepts and applications.
- Understand physical security, digital forensic methodology

Unit I Introduction

History of information security, CNSS security model, Approaches to Information Security Implementation, security systems development life cycle.

Need for Security

Threats, Attacks, Secure software development, Laws and ethics in information security

Unit II Risk Management & Planning for Security

Introduction, overview of Risk Management, Risk Identification, Risk Assessment, Risk control strategies

Panning for Security

Information Security Planning and governance, Information security policy, standards and practices.

Unit III Security Technology: Firewalls, VPNs & IDS

Introduction, Access control, Firewalls, Protecting Remote Connections, Virtual Private Networks, Intrusion Detection and prevention systems, Honeypots, hone nets, biometric access control

Cryptography

Introduction, cipher methods, Cryptographic Algorithms, Cryptographic Tools- Public key infrastructure, digital signatures, Protocol for secure communication- HTTP, SSL, S/SMIME, securing TCP/IP with IPsec and PGP, attacks on cryptosystems.

Unit IV Physical Security

Physical access control, fire security and safety, interception of data, remote computing security, implementing information security- information security project management, technical aspects of implementation.

Unit V Security and Personnel

Positioning and staffing the security function, credentials of information security professionals, employment policies and practices

Information security maintenance – security management maintenance models, digital forensic, digital forensics methodology

Text Book :

1. Principles of Information Security: Michael E. Whitman, Herbert J. Mattord, *4th edition* , Cengage Learning- publisher

Reference book

1. Cryptography and Network Security Principles and Practices, Fourth Edition By William Stallings
2. Fundamentals of Digital Forensics, **Kavrestad,** Joakim , springer

2015812 : ADVANCED OPERATING SYSTEMS

L	T/P	C
3	0/0	3

Course Objectives

1. To study, learn, and understand the main concepts of advanced operating systems (parallel processing systems, distributed systems, real time systems, network operating systems, and open source operating systems)
2. Hardware and software features that support these systems.

Course Outcomes

1. Understand the design approaches of advanced operating systems
2. Analyze the design issues of distributed operating systems.
3. Evaluate design issues of multi processor operating systems.
4. Identify the requirements Distributed File System and Distributed Shared Memory.
5. Formulate the solutions to schedule the real time applications.

UNIT - I

Architectures of Distributed Systems: System Architecture Types, Distributed Operating Systems, Issues in Distributed Operating Systems, Communication Primitives. **Theoretical Foundations:** Inherent Limitations of a Distributed System, Lamport's Logical Clocks, Vector Clocks, Causal Ordering of Messages, Termination Detection.

UNIT - II

Distributed Mutual Exclusion: The Classification of Mutual Exclusion Algorithms, **Non-Token – Based Algorithms:** Lamport's Algorithm, The Ricart-Agrawala Algorithm, Maekawa's Algorithm, **Token-Based Algorithms:** Suzuki-Kasami's Broadcast Algorithm, Singhal's Heurisric Algorithm, Raymond's Heuristic Algorithm.

UNIT - III

Distributed Deadlock Detection: Preliminaries, Deadlock Handling Strategies in Distributed Systems, Issues in Deadlock Detection and Resolution, Control Organizations for Distributed Deadlock Detection, Centralized-Deadlock–Detection Algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms

UNIT - IV

Multiprocessor System Architectures: Introduction, Motivation for multiprocessor Systems, Basic Multiprocessor System Architectures

Multi Processor Operating Systems: Introduction, Structures of Multiprocessor Operating Systems, Operating Design Issues, Threads, Process Synchronization, Processor Scheduling.

Distributed File Systems: Architecture, Mechanisms for Building Distributed File Systems, Design Issues

UNIT - V

Distributed Scheduling: Issues in Load Distributing, Components of a Load Distributed Algorithm, Stability, Load Distributing Algorithms, Requirements for Load Distributing, Task Migration, Issues in task Migration

Distributed Shared Memory: Architecture and Motivation, Algorithms for Implementing DSM, Memory Coherence, Coherence Protocols, Design Issue

TEXT BOOK

1. Advanced Concepts in Operating Systems, Mukesh Singhal, Niranjan G. Shivaratri, Tata McGraw-Hill Edition2001

REFERENCES:

1. Distributed Systems: Andrew S. Tanenbaum, Maarten Van Steen, Pearson PrenticeHall,Edition–2,2007

2015813: ADVANCED COMPUTER NETWORKS

L	T/P	C
3	0/0	3

Prerequisites: Data Communication and Computer Networks

Course Objective:

- This course aims to provide advanced background on relevant computer networking topics to have a comprehensive and deep knowledge in computer networks.

Course Outcomes:

- Understanding of holistic approach to computer networking
- Able to understand & perform Routing protocols
- Able to understand the computer networks and their application
- Able to design simulation concepts related to packet forwarding innetworks.
- Able to implement emerging trends in networks-wireless &Mobile networks
- Able to implement live streaming using UDP & HTTP

UNIT – I Introduction

Review of Computer Networks, Internet, OSI Model, TCP/IP protocol suite, Addressing. Data Link control - Error Detection and Error Correction techniques, Multiple Access Protocols, Wired LAN, HDLC, Point- to-Point Protocol, Channelization.

UNIT- II Internetworking and Routing

Logical Addressing, IPv4, IPv6, Unicast routing: Intra-domain Routing Protocols, Inter-domain Routing Protocols, Multicast Routing: MOSPF, DVMRP, PIM, CBT Protocols.

UNIT III Transport and Application Layer

UDP, TCP, TCP Congestion Control, QOS, Techniques to Improve QOS, Soct Programming, DNS, FTP, TelNet, WWW , HTTP and SNMP.

Unit IV Wireless and Mobile Networks

Introduction, Wireless Links and Network Characteristics, WiFi: 802.11 Wireless LANs , Cellular Internet Access, Mobility Management: Mobile IP, Managing Mobility in Cellular Networks, Wireless and Mobility: Impact on Higher-Layer Protocols , Wireless Security.

Unit V Multimedia Networking

Digitizing audio and video, audio and video compression, streaming live audio and video Streaming Stored Video, UDP Streaming, HTTP Streaming, Voice-over-IP, Protocols for Real-Time Interactive Applications, Case Studies: Netflix, YouTube

Text books:

1. Data communications and networking 5th edition Behrouz A Fourzan,TMH
2. Computer Networking: A Top-Down Approach, James F. Kuros and Keith W.Ross, Pearson, 6th Edition,2012.

References:

1. A Practical Guide to Advanced Networking, Jeffrey S. Beasley and PiyasatNilkaew, Pearson, 3rd Edition,2012
2. Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, PrenticeHall.

2015814: IMAGE AND VIDEO PROCESSING

Pre-Requisites: Computer Graphics L T/P C

Course Objectives: 3 0/0 3

- Provides the fundamentals for studying images and videos
- learn fundamental tools and techniques for processing images and videos, and will learn to apply them to a range of practical applications
- Introduces the principles of digital image and video processing, discusses current image and video processing technology, and provides hands-on experience with image/video processing and communication methods.

Course Outcomes:

- Understand the fundamentals of image and video processing and their applications
- Develop familiarity and implement basic image and video processing algorithms.
- Select and apply appropriate technique to real problems in image and video analysis.

UNIT I

Fundamentals of Image processing and Image Transforms: Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2 – D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms

UNIT II

Image Processing Techniques: Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency

Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering

UNIT III

Image Segmentation: Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation Image Compression Image compression fundamentals – coding Redundancy, spatial and temporal redundancy.

Compression Models : Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards

UNIT IV

Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models: 3D motion models, Geometric Image formation, Photometric Image formation, Surveillance, Sampling of video signals, filtering operations

UNIT V

Motion Estimation: Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

TEXT BOOKS

1. Gonzaleze and Woods ,"Digital Image Processing ", 3rd edition , Pearson
2. Yao wang, Joem Ostarmann and Ya – quin Zhang, "Video processing and communication ",1st edition , PHI

REFERENCE TEXT BOOK

1. M. Tekalp ,"Digital video Processing", Prentice Hall International
2. Chris Solomon, Toby Breckon ,"Fundamentals of Digital Image Processing A Practical Approach with Examples in Matlab", John Wiley & Sons,

2015815: CLOUD COMPUTING

L T/P C
3 0/0 3

Course Objectives:

- The student will also learn how to apply trust-based security model to real-world security problems.
- An overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.
- Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.

Course Outcomes: After completion of course, students would be able to:

- Identify security aspects of each cloud model
- Develop a risk-management strategy for moving to the Cloud
- Implement a public cloud instance using a public cloud service provider
- Apply trust-based security model to different layer

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.

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

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.

UNIT -IV Cloud Service Models: Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as 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.

UNIT –V Cloud Service Providers: 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,

TEXT BOOKS:

1. Essentials of cloud Computing: K.Chandrasekhran, CRC press, 2014

REFERENCE BOOKS:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C.Fox, Jack J.Dongarra, Elsevier, 2012.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp2011.

2015816: INTERNET OF THINGS

L	T/P	C
3	0/0	3

Course Objectives:

To introduce the terminology, technology and its applications

- To introduce the concept of M2M (machine to machine) with necessary protocols
- To introduce the Python Scripting Language which is used in many IoT devices
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of web based services on IoT devices.

Course Outcomes:

- Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to network.
- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.

UNIT - I

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

UNIT - II

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT. Basics of IoT System Management with NETCOZF, YANG-NETCONF, YANG, SNMP NETOPEER

UNIT - III

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling. Python packages - JSON, XML, HTTP Lib, URL Lib, SMTP Lib.

UNIT – IV

IoT Physical Devices and Endpoints - Introduction to Raspberry PI - Interfaces (serial, SPI,I2C). Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins. Case studies: Home automation, Garbage collection, Fire alarm.

UNIT - V

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models andcommunication APIs. Webserver – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API.

TEXT BOOK:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

2015831: MACHINE LEARNING LAB

L	T/P	C
0	0/4	2

Course Objective:

The objective of this lab is to get an overview of the various machine learning techniques and can able to demonstrate using python.

Course Outcomes: After the completion of the "**Machine Learning**" lab, the student can able to:

- Understand complexity of Machine Learning algorithms and their limitations;
- Understand modern notions in data analysis-oriented computing;
- Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;
- Be capable of performing experiments in Machine Learning using real-world data.

List of Experiments

1. 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.
2. 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.
3. Implement linear regression using python.
4. Implement Logistic regression using python.
5. 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.
6. 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. Use Python ML library classes/API.
7. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Use Python ML library classes/API.
8. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
9. 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.
10. 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.
11. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart DiseaseData Set. Use Python ML library classes/API.

Text Books:

1. Machine Learning – Tom M. Mitchell, MGH
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis

2015832: ADVANCED DATA STRUCTURES LAB

L	T/P	C
0	0/4	2

Prerequisites: A course on Computer Programming & Data Structures

Course Objectives:

- Introduces the basic concepts of Abstract Data Types.
- Reviews basic data structures such as stacks and queues.
- Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs, and B-trees.
- Introduces sorting and pattern matching algorithms.

Course Outcomes:

- Ability to select the data structures that efficiently model the information in a problem.
- Ability to assess efficiency trade-offs among different data structure implementations or combinations.
- Implement and know the application of algorithms for sorting and pattern matching.
- Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and B-trees.

List of Programs

1. Write a program to perform the following operations:
   a. Insert an element into a binary search tree.
   b. Delete an element from a binary search tree.
   c. Search for a key element in a binary search tree.
2. Write a program for implementing the following sorting methods:
   a. Mergesort b)Heapsort c) Quicksort
3. Write a program to perform the following operations:
   a. Insert an element into a B-tree.
   b. Delete an element from a B-tree.
   c. Search for a key element in a B-tree.
4. Write a program to perform the following operations:
   a. Insert an element into a Min-Maxheap
   b. Delete an element from a Min-Maxheap
   c. Search for a key element in a Min-Maxheap
5. Write a program to perform the following operations:
   a. Insert an element into a Leftist tree
   b. Delete an element from a Leftisttree
   c. Search for a key element in a Leftisttree

6. Write a program to perform the following operations:
    a. Insert an element into a binomial heap
    b. Delete an element from a binomial heap.
    c. Search for a key element in a binomial heap
7. Write a program to perform the following operations:
    a. Insert an element into a AVLtree.
    b. Delete an element from a AVL tree.
    c. Search for a key element in a AVL tree.
8. Write a program to perform the following operations:
    a. Insert an element into a Red-Blacktree.
    b. Delete an element from a Red-Blacktree.
    c. Search for a key element in a Red-Blacktree.
9. Write a program to implement all the functions of a dictionary using hashing.
10. Write a program for implementing Knuth-Morris-Pratt pattern matching algorithm.
11. Write a program for implementing Brute Force pattern matching algorithm.
12. Write a program for implementing Boyer moore pattern matching algorithm.

TEXT BOOKS:

1. Fundamentals of Data structures in C, E. Horowitz, S.Sahniand Susan Anderson Freed, 2nd Edition, Universities Press
2. Data Structures Using C – A.S. Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson education.

REFERENCES:

1. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press

2010001: ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course – I)

L	T/P	C
2	0/0	0

Prerequisite: None

Course objectives: Students will be able to:

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

UNIT-I:

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

UNIT-II:

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

UNIT-III:

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT-IV:

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

UNIT-V:

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

TEXT BOOKS/ REFERENCES:

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

2010002: DISASTER MANAGEMENT

(Audit Course - I)

L	T/P	C
2	0/0	0

Prerequisite: None

Course Objectives: Students will be able to

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches,
- Planning and programming in different countries, particularly their home country or the countries they working.

UNIT-I:

Introduction:

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

Disaster Prone Areas in India:

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

UNIT-II:

Repercussions of Disasters and Hazards:

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

UNIT-III:

Disaster Preparedness and Management:

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

UNIT-IV:

Risk Assessment Disaster Risk:

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

UNIT-V:

Disaster Mitigation:

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

TEXT BOOKS/ REFERENCES:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal bookCompany.
2. Sahni, PardeepEt. Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, NewDelhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep &Deep Publication Pvt. Ltd., NewDelhi.

2010003: SANSKRIT FOR TECHNICAL KNOWLEDGE
(Audit Course - I)

L	T/P	C
2	0/0	0

Prerequisite: None

Course Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcomes: Students will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

UNIT-I:

Alphabets in Sanskrit.

UNIT-II:

Past/Present/Future Tense, Simple Sentences.

UNIT-III:

Order, Introduction of roots.

UNIT-IV:

Technical information about Sanskrit Literature.

UNIT -IV:

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TEXT BOOKS/ REFERENCES:

1. "Abhyaspustakam" – Dr. Vishwas, Samskrita-Bharti Publication, NewDelhi
2. "Teach Yourself Sanskrit" PrathamaDeeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New DelhiPublication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., NewDelhi.

2010004: VALUE EDUCATION

(Audit Course - I)

L T/P C
2 0/0 0

Prerequisite: None

Course Objectives: Students will be able to

- Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character

Course outcomes: Students will be able to

- Knowledge ofs elf-development
- Learn the importance of Human values
- Developing the overall personality

UNIT-I:

Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non- moral valuation, Standards and principles. Value judgments

UNIT-II:

Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline

UNIT-III:

Personality and Behavior Development - Soul and Scientific attitude, Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness.

UNIT-IV:

Avoid fault Thinking. Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship. Happiness Vs suffering, love for truth, Aware of self- destructive habits, Association and Cooperation. Doing best for saving nature

UNIT-V:

Character and Competence –Holy books vs Blind faith, Self-management and Good health' Science of reincarnation, Equality, Nonviolence, Humility, Role of Women, Allreligions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

TEXT BOOKS/ REFERENCES:

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, NewDelhi

I-II

2025804: ADVANCED ALGORITHMS

L	T/P	C
3	0/0	3

Course Objectives:

- The fundamental design, analysis, and implementation of basic data structures.
- Basic concepts in the specification and analysis of programs.
- Principles for good program design, especially the uses of data abstraction.
- Significance of algorithms in the computer field
- Various aspects of algorithm development
- Qualities of a good solution

Course Outcomes:

- Describe analysis techniques for algorithms.
- Identify appropriate data structure and design techniques for different problems
- Identify appropriate algorithm to be applied for the various application like geometric modeling, robotics, networking, etc.
- Appreciate the role of probability and randomization in the analysis of algorithm
- Analyze various algorithms.
- Differentiate polynomial and non-deterministic polynomial algorithms.

Unit-I: Introduction- Role of algorithm since computing, Analyzing algorithms, Designing Algorithms, Growth of Functions, matrix multiplication, The substitution method for solving recurrences, The recurrence-tree method for solving recurrence, The master method for solving recursions, Probabilistic analysis and random analysis.

Unit - II: Review of Data Structures- Elementary Data Structures, Hash Tables, Binary Search Trees, AVL tree, B-trees Red-Black Trees.

Unit - III: Dynamic Programming - Matrix-chain multiplication, Elements of dynamic programming, Longest common subsequence, Greedy Algorithms - Elements of the greedy strategy, Huffman codes, Amortized Analysis –Aggregate analysis, The accounting method, The potential method, Dynamic tables.

Unit - IV: Graph Algorithms - Elementary Graph Algorithms, Minimal spanning trees, Single-Source Shortest Paths, Maximum flow.

Unit - V: NP-Complete & Approximate Algorithms-Polynomial time, Polynomial-time verification, NP-completeness and reducibility, NP-complete & approximation problems - Clique problem, Vertex- cover problem, formula satisfiability, 3 CNF Satisfiabilty, The subset-sum problem, The traveling- salesman problem, The subset-sum problem.

TEXT BOOKS:

1. "Introduction to Algorithms", Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Third *Edition*, PHIPublication.
2. "Data Structures and Algorithms in C++", M.T. Goodrich, R. TamassiaandD.Mount, Wiley India.

REFERENCES:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, Second Edition, GalgotiaPublication
2. Data structures with C++, J. Hubbard, Schaum'soutlines,TMH.
3. Data structures and Algorithm Analysis in C++, 3rd edition, M. A. Weiss,Pearson.
4. Classic Data Structures, D. Samanta, 2nd edition,PHI.

2025805: DATA SCIENCE

L	T/P	C
3	0/0	3

Course Objectives:

- The fundamental of basic data science
- Basic concepts in the specification and analysis of R
- Principles for good program design, especially the uses of Machine Learning
- Qualities of a social network qualities and data visualization

Learning Outcomes

At the end of the course, students should be able to:

- Describe what Data Science is and the skill sets needed to be a data scientist.
- Explain in basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data.
- Use R to carry out basic statistical modeling and analysis.
- Explain the significance of exploratory data analysis (EDA) in data science.
- Describe the Data Science Process and how its components interact.
- Create effective visualization of given data (to communicate or persuade).

Unit I Introduction: What is Data Science?, Big Data and Data Science hype–and getting past the hype, Why now? –Datafication, Current landscape of perspectives, Statistical Inference: Populations and samples: Statistical modeling, probability distributions, fitting a model, Intro to R.

Unit II: Exploratory Data Analysis and the Data Science Process, Three Basic Machine Learning Algorithms: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: Real Direct (online real estate firm), Linear Regression, k-Nearest Neighbors(k-NN) k-means, Motivating application: Filtering Spam, Naive Bayes, Data Wrangling.

Unit III: Logistics Regression, Timestamp and financial Modeling
Thought Experiments, Classifiers , M6D Logistic Regression Case Study, Kyle Teague and Get Glue, Timestamps, Cathy O'Neil, Thought Experiment, Financial Modeling, The Kaggle Model: Feature Generation and Feature Selection, Feature Selection algorithms: Filters; Wrappers; Decision Trees; Random Forests

Unit IV: Mining Social-Network Graphs and Data Visualization
Social networks as graphs, clustering of graphs, direct discovery of communities in graphs, partitioning of graphs, Neighborhood properties in graphs: Data Visualization, Basic principles, ideas and tools for data visualization

Unit V: Data Engineering, Data Science and Ethical Issues:
Map Reduce, Pregel and Hadoop, Ethical Issues: Discussions on privacy, security, ethics.

Text Book:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.2014.

References Books :

1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)

2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020.2013.

3. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.

4. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009.(free online)

5. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.

6. (Note: this is a book currently being written by the three authors. The authors have made the first draft of their notes for the book available online. The material is intended for a modern theoretical course in computer science.)

7. MohammedJ. Zakiand Wagner MieraJr.Data Miningand Analysis: Fundamenta lConcepts and Algorithms. Cambridge University Press.2014.

8. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition. ISBN 0123814790.2011.

2025817: PARALLEL AND DISTRIBUTED ALGORITHMS

L	T/P	C
3	0/0	3

Course Objectives:

- To learn parallel and distributed algorithms development techniques for shared memory and message passing models.
- To study the main classes of parallel algorithms.
- To study the complexity and correctness models for parallel algorithms.

Course outcomes:

- Apply the principles and concept in analyzing and designing the parallel and distributed system
- Reason about ways to parallelize problems.
- Gain an appreciation on the challenges and opportunities faced by parallel and distributed systems.
- Improve the performance and reliability of distributed and parallel programs.

UNIT-I

Basic Techniques, Parallel Computers for increase Computation speed, Parallel & Cluster Computing.

UNIT-II

Message Passing Technique- Evaluating Parallel programs and debugging, Portioning and Divide and Conquer strategies examples.

UNIT-III

Pipelining- Techniques computing platform, pipeline programs examples.

UNIT-IV

Synchronous Computations, load balancing, distributed termination examples, programming with shared memory, shared memory multiprocessor constructs for specifying parallelist sharing data parallel programming languages and constructs, open MP.

UNIT-V

Distributed shared memory systems and programming achieving constant memory distributed shared memory programming primitives, algorithms – sorting and numerical algorithms.

TEXT BOOK:

1. Parallel Programming, Barry Wilkinson, Michael Allen, Pearson Education, 2nd Edition.

REFERENCE BOOK:

1. Introduction to Parallel algorithms by Jaja from Pearson, 1992.

2025818: BLOCK CHAIN TECHNOLOGY

L	T/P	C
3	0/0	3

COURSE OBJECTIVES

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

- Understand how blockchain systems (mainly Bitcoin and Ethereum) work,
- To securely interact with them,
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from blockchain technology into their own projects.

COURSE OUTCOMES

- Explain design principles of Bitcoin and Ethereum.
- Explain Nakamoto consensus.
- Explain the Simplified Payment Verification protocol.
- List and describe differences between proof-of-work and proof-of-stake consensus.
- Interact with a blockchain system by sending and reading transactions.
- Design, build, and deploy a distributed application.
- Evaluate security, privacy, and efficiency of a given blockchain system.

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.

Unit II:

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

Unit III:

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

Unit IV:

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards,

Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Name coin

Unit V:

Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

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,"Yellow paper.2014.

4. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts

2025819: AD-HOC AND WIRELESS SENSOR NETWORKS

L	T/P	C
3	0/0	3

Course Outcomes:

At the end of the course, the student would be able to:

- Know the basics of Ad hoc networks and Wireless Sensor Networks
- Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement
- Apply the knowledge to identify appropriate physical and MAC layer protocols
- Understand the transport layer and security issues possible in Ad hoc and sensor networks.

Be familiar with the OS used in Wireless Sensor Networks and build basic modules

Unit 1: Ad Hoc Networks – Introduction And Routing Protocols
Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols - Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing(AODV).

Unit II: Sensor Networks – Introduction & Architectures Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

Unit III: Wsn Networking Concepts and Protocols MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Contention based protocols - PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols- Energy Efficient Routing, Challenges and Issues in Transport layerprotocol.

UNIT IV: Senor Network Security Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.

Unit V: Sensor Network Platforms And Tools Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.

Text Books

1. C. Siva Ram Murthy and B. S. Manoj, ―Ad Hoc Wireless Networks Architectures and Protocols‖, Prentice Hall, PTR, 2004. (UNIT I)
2. Holger Karl , Andreas willig, ―Protocol and Architecture for Wireless Sensor Networks‖, John wiley publication, Jan 2006.(UNIT II-V)

Reference Books

1. FengZhao, Leonidas Guibas, ―Wireless Sensor Networks: an information processing approach‖, Elsevier publication,2004.
2. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, ―Wireless sensor networks:a Survey‖, computer networks, Elsevier, 2002, 394 - 422.

2025820: SOFTWARE ARCHITECTURE AND DESIGN PATTERNS

L	T/P	C
3	0/0	3

Course Objectives: After completing this course, the student should be able to:

- To understand the concept of patterns and theCatalog.
- To discuss the Presentation tier design patterns and their effect on: sessions, client access, validation, andconsistency.
- To understand the variety of implemented bad practices related to the Business and Integrationtiers.
- To highlight the evolution ofpatterns.
- To how to add functionality to designs while minimizing complexity
- To understand what design patterns really are, and arenot
- To learn about specific designpatterns.
- To learn how to use design patterns to keep code quality high withoutoverdesign.

UNIT - I

Envisioning Architecture

The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views.

Creating an Architecture

Quality Attributes, Achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

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.

UNIT –III Patterns

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

Creational and Structural patterns

Abstract factory, builder, factory method, prototype, singleton, adapter, bridge, composite, façade, flyweight.

UNIT -IV

Behavioral patterns

Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor.

UNIT - V

Case Studies

A case study in utilizing architectural structures, 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

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.
5. Design Patterns in Java, Steven John Metsker& William C. Wake, Pearson education,2006
6. J2EE Patterns, Deepak Alur, John Crupi& Dan Malks, Pearson education,2003.
7. Design Patterns in C#, Steven John metsker, Pearson education,2004.
8. Pattern Oriented Software Architecture, F. Buschmann& others, John Wiley &Sons.

2025821 DESIGN THINKING

L T P C
3 0 0 3

Course Objectives:

- To introduce the idea of design thinking in product development
- To understand the practice of design thinking
- To leverage use of tools for the design process
- To learn the application of design thinking for the IT industry
- To design using the methodology

Course Outcomes:

- Apply design thinking for product development
- Use design thinking tools
- Identify need for products and disruption
- Design innovative products
- Apply design thinking to improve on existing products in IT
- Facilitate design thinking workshop

UNIT I INTRODUCTION : Understanding Design thinking –Shared model in team based design –Theory and practice in Design thinking –Exploring work of Designers across globe – MVP or Prototyping

UNIT II: Tools for Design Thinking–Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space –Empathy for design –Collaboration in distributed Design

UNIT III: Design Thinking in IT–Design Thinking to Business Process modeling –Agile in Virtual collaboration environment –Scenario based Prototyping

UNIT IV:DT For strategic innovations –Growth –Story telling -Predictability –Strategic Foresight-Change –Sense Making-Maintenance Relevance –Value redefinition-Extreme Competition –experience design-Standardization –Humanization-Creative Culture –Rapid prototyping, Strategy and Organization –Business Model design.

UNIT V: Design Thinking Work shop Empathize, Design, Ideate, Prototype and Test. http://dschool.stanford.edu/dgift/Follow the above link to conduct workshop

REFERENCES:

1. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
2. Hasso Plattner,Christopheinel and Larry Leifer (eds), "Design Thinking: Understand – Improve –Apply", Springer, 2011(Unit III).
3. IdrisMootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons2013.(Unit IV).
4. https://dschool.stanford.edu/.../designresources/.../ModeGuideBOOTCAMP2010L.pdf
5. https://dschool.stanford.edu/use-our-methods/
6. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process

2025822: BIG DATA ANALYTICS

L	T/P	C
3	0/0	3

Course Objectives: This course is aimed at enabling the students to

- To provide an overview of an exciting growing field of big data analytics.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSQL, MapReduce, HIVE, Cassandra, Spark.
- To teach the fundamental techniques and principles in achieving big data analytics withscalability and streaming capability.
- To optimize business decisions and create competitive advantage with Big Data analytics

Course Outcomes:

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

- Illustrate on big data and its use cases from selected business domains.
- Interpret and summarize on No SQL, Cassandra
- Analyze the HADOOP and Map Reduce technologies associated with big data analyticsand explore on Big Data applications Using Hive.
- Make use of Apache Spark, RDDs etc. to work with datasets.
- Assess real time processing with Spark Streaming.

UNIT I: What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT II: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, Working with Cassandra ,Table creation, loading and reading data.

UNIT III: Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance ,with data replication, High availability, Data locality , Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization. Introduction to Hive, data types and file formats, HiveQLdata definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.

UNIT IV: Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames, RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data, Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers- Standalone Mode, Spark on YARN , Spark Logs, The Spark UI- Spark UI History Server, Debugging and Spark First Aid

UNIT V: Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and tate full Processing - Event Time, State full Processing, Windows on Event Time- Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

Text Books:

1. Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj
2. SPARK: The Definitive Guide, Bill Chambers &MateiZaharia, O'Reilley, 2018 Edition
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013
4. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional, 2012
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012

Reference Books:

1. "Hadoop Operations", O'Reilley, Eric Sammer, 2012
2. "Programming Hive", O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen, 2012
3. "HBase: The Definitive Guide", O'Reilley, Lars George, 2011
4. "Cassandra: The Definitive Guide", O'Reilley, Eben Hewitt, 2010
5. "Programming Pig", O'Reilley, Alan Gates, 2011

2025833: ADVANCED ALGORITHMS LAB

L	T/P	C
0	0/4	2

Course Objectives:

- The fundamental design, analysis, and implementation of basic data structures.
- Basic concepts in the specification and analysis of programs.
- Principles for good program design, especially the uses of data abstraction.

Sample Problems on Data structures:

1. Write Java programs that use both recursive and non-recursive functions for implementing the following searching methods:

a) Linear search b) Binary search

2. Write Java programs to implement the following using arrays and linked lists

a) ListADT

3. Write Java programs to implement the following using anarray.

a) StackADT b) QueueADT

4. Write a Java program that reads an infix expression and converts the expression to postfix form. (Use stack ADT).
5. Write a Java program to implement circular queue ADT using anarray.
6. Write a Java program that uses both a stack and a queue to test whether the given string is a palindrome or not.
7. Write Java programs to implement the following using a singly linkedlist.

a) StackADT b) QueueADT

8. Write Java programs to implement the deque (double ended queue) ADTusing

a) Array b) Singly linked list c) Doubly linked list.

9. Write a Java program to implement priority queue ADT.
10. Write a Java program to perform the following operations:

a) Construct a binary search tree of elements.

b) Search for a key element in the above binary search tree.

c) Delete an element from the above binary search tree.

11. Write a Java program to implement all the functions of a dictionary (ADT) using Hashing.
12. Write a Java program to implement Dijkstra's algorithm for Single source shortest path problem.
13. Write Java programs that use recursive and non-recursive functions to traverse the given binary tree in

a) Preorder b)In order c)Post order.

14. Write Java programs for the implementation of bfs and dfs fora given graph.

15. Write Java programs for implementing the following sorting methods:
    a) Bubble sort d)Merge sort g) Binary tree sort
    b) Insertion sort e) Heapsort
    c) Quicksort f) Radix sort
16. Write a Java program to perform the following operations:
    a. Insertion into a B-tree b. Searching in a B-tree.
17. Write a Java program that implements Kruskal's algorithm to generate minimum cost spanning tree.
18. Write a Java program that implements KMP algorithm for pattern matching.

REFERENCE BOOKS:

1. Data Structures and Algorithms in java, 3rd edition, A. Drozdek, Cengage Learning.
2. Data Structures with Java, J.R.Hubbard, 2nd edition, Schaum's Outlines, TMH.

2025834: DATA SCIENCE LAB

L	T/P	C
0	0/4	2

LIST OF PROGRAMS:

1. Write an R-Program to print Hello World
2. Write an R-Program to demonstrate working with operators (Arithmetic, Relational, Logical, Assignment operators).
3. Write an R Program to Check if a Number is Odd or Even
4. Write an R Program to check if the given Number is a Prime Number
5. Write an R Program to Find the Factorial of a Number
6. Write an R Program to Make a Simple Calculator
7. Write an R Program to create a Vector and to access elements in a Vector
8. Write an R Program to create a Matrix using cbind() and rbind() functions.
9. Write an R Program to create a Matrix from a Vector using dim() function.
10. Write an R Program to create a List and modify its components.
11. Write an R Program to create a Data Frame.
12. Write an R Program to access a Data Frame like a List.
13. Write an R program to demonstrate Loop functions.
14. Write an R Program to simulate linear model.

2020005: VALUE EDUCATION

L	T/P	C
2	0/0	0

Prerequisite: None

Course Objectives: Students will be able to:

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

Course Outcomes: Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indianpolitics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution inIndia.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the IndianConstitution.
- Discuss the passage of the Hindu Code Bill of1956.

UNIT-I:

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working), **Philosophy of the Indian Constitution:** Preamble**,** SalientFeatures.

UNIT-II:

Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality**,** Right to Freedom**,** Right against Exploitation**,** Right to Freedom of Religion**,** Cultural and Educational Rights**,** Right to Constitutional Remedies, Directive Principles of State Policy**,** Fundamental Duties.

UNIT-III:

Organs of Governance: Parliament**,** Composition**,** Qualifications and Disqualifications**,** Powers and Functions**,** Executive**,** President**,** Governor**,** Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions.

UNIT-IV:

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT-V:

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

TEXT BOOKS/ REFERENCES:

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

2020006: PEDAGOGY STUDIES

L	T/P	C
2	0/0	0

Prerequisite: None

Course Objectives: Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes: Students will be able to understand:

- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT-I:

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

UNIT-II:

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT-III:

Evidence on the effectiveness of pedagogical practices, Methodology for the indepth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the scho curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-IV:

Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

UNIT-V:

Research gaps and future directions: Research design**,** Contexts**,** Pedagogy**,** Teacher education**,** Curriculum and assessment**,** Dissemination and research impact.

TEXT BOOKS/ REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3):361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London:DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3):272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston:Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read'campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

2020007: STRESS MANAGEMENT BY YOGA

L	T/P	C
2	0/0	0

Prerequisite: None

Course Objectives:

- To achieve overall health of body and mind
- To over come stress

Course Outcomes: Students will be able to:

- Develop healthy mind in a healthy body thus improving social healthalso
- Improve efficiency

UNIT-I:

Definitions of Eight parts of yog. (Ashtanga)

UNIT-II:

Yam and Niyam.

UNIT-III:

Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramha chary a and aparigraha

ii) Shaucha, santosh, tapa, swadhyay,ishwarpranidhan

UNIT-IV:

Asan and Pranayam

UNIT-V:

i) Various yogposesand their benefits for mind &body

ii) Regularization of breathing techniques and its effects-Types of pranayam

TEXT BOOKS/ REFERENCES:

1. 'Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama(Publication Department), Kolkata.

2020008: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

L	T/P	C
2	0/0	0

Prerequisite: None

Course Objectives:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcomes: Students will be able to

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

UNIT-I:

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22(wisdom)
- Verses- 29,31,32 (pride &heroism)
- Verses- 26,28,63,65(virtue)

UNIT-II:

Neetisatakam-Holistic development of personality

- Verses- 52,53,59(dont's)
- Verses- 71,73,75,78(do's)

UNIT-III:

Approach to day to day work and duties.

- ShrimadBhagwadGeeta: Chapter 2-Verses 41,47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23,35,
- Chapter 18-Verses 45, 46,48.

UNIT-IV:

Statements of basic knowledge.

- ShrimadBhagwadGeeta: Chapter2-Verses 56, 62,68
- Chapter 12 -Verses 13, 14, 15, 16,17,18
- Personality of Role model. ShrimadBhagwadGeeta:

UNIT-V:

- Chapter2-Verses 17, Chapter 3-Verses36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses37,38,63

TEXT BOOKS/ REFERENCES:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram(Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, NewDelhi.

II-I

2035823: SOFT COMPUTING

L	T/P	C
3	0/0	3

Objectives:

The student should be made to: Classify the various soft computing frame works

- Be familiar with the design of neural networks, fuzzy logic and fuzzy systems
- Learn mathematical background for optimized genetic programming
- Be exposed to neuro-fuzzy hybrid systems and its applications

Course Outcomes:

At the end of the course, the student should be able to:

Apply various soft computing concepts for practical applications

- Choose and design suitable neural network for real time problems
- Use fuzzy rules and reasoning to develop decision making and expert system
- Explain the importance of optimization techniques and genetic programming
- Review the various hybrid soft computing techniques and apply in real time problems

UNIT I INTRODUCTION TO SOFT COMPUTING

Soft Computing Constituents-From Conventional AI to Computational Intelligence- Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks - basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts.

UNIT II NEURAL NETWORKS

McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNNassociative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network –unsupervised learning networks: Kohonen self-organizing feature maps, LVQ – CP networks, ART network.

UNIT III FUZZY LOGIC

Membership functions: features, fuzzification, methods of membership value assignments Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems overview of fuzzy expert system-fuzzy decision making.

UNIT IV GENETIC ALGORITHM

Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts - operators – Encoding scheme – Fitness evaluation – crossover - mutation - genetic programming – multilevel optimization – real life problem-advances in GA .

UNIT V HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS

Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

TEXT BOOKS:

1. J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004.
2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

REFERENCES:

1. S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.
2. George J. Klir, Ute St. Clair, Bo Yuan, "Fuzzy Set Theory: Foundations and Applications" Prentice Hall, 1997.
3. David E. Goldberg, "Genetic Algorithm in Search Optimization and Machine Learning" Pearson Education India, 2013.
4. James A. Freeman, David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India, 1991. 5. Simon Haykin, "Neural Networks Comprehensive Foundation" Second Edition, Pearson Education, 2005.

2035824: Semantic Web and Social Networks

L	T/P	C
3	0/0	3

Course Objectives:

- To learn Web Intelligence
- To learn Knowledge Representation for the Semantic Web
- To learn Ontology Engineering
- To learn Semantic Web Applications, Services and Technology
- To learn Social Network Analysis and semantic web
-

UNIT –I: Web Intelligence:

Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.

UNIT -II: Knowledge Representation for the Semantic Web:

Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web – Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema.

UNIT-III: Ontology Engineering:

Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

UNIT-IV: Semantic Web Applications, Services and Technology:

Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods,

UNIT-V: Social Network Analysis and semantic web:

What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.

TEXT BOOKS:

- Thinking on the Web – Berners Lee, Godel and Turing, Wiley inter science, 2008.
- Social Networks and the Semantic Web, Peter Mika, Springer, 2007.

REFERENCE BOOKS:

- Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R. Studer, P. Warren, John Wiley & Sons.
- Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
- Information sharing on the semantic Web – Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications.
- Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD.

2035825: COGNITIVE SCIENCE

L	T/P	C
3	0/0	3

Unit 1 Introduction to Cognitive Science

Introduction to the study of cognitive sciences. A brief history of cognitive science. Methodological concerns in philosophy, artificial intelligence and psychology

Psychology, Nervous system and brain Structure and constituents of the brain; Brief history of neuroscience; Mathematical models; Looking at brain signals

Unit 2 Brain and sensory motor information

Processing of sensory information in the brain; Representation of sensory information: Neural Network Models; Processing of sensory information in the brain; motor and sensory areas; Brain Imaging, fMRI, MEG, PET, EEG,

Unit 3 Sensation to Cognition

Roots of Cognitive Science: Multisensory integration in cortex; information fusion; from sensation to cognition, cybernetics; From physics to meaning; Analog vs. Digital: Code duality , Language: What is language?; Linguistic knowledge: Syntax, semantics, (and pragmatics); Generative linguistics; Brain and language; Language disorders; Lateralization; The great past tense debate

Unit 4 Affordances in biological and artificial systems

Affordances, direct perception, Ecological Psychology, affordance learning in robotics, **Cognitive Development** Development, child and robotic development

Unit 5: Learning Categories and concepts

Concept learning; Logic ; Machine learning Memory Constructing memories; Explicit vs. implicit memory; Information processing (three-boxes) model of memory; Sensory memory; Short term memory; Long term memory

Reference Books

1. Gardner, The Mind’s New Science, Gardner, Howard E. The mind's new science: A history of the cognitive revolution. Basic books, 2008.
2. Kihlstrom and Park, "Cognitive Psychology, Overview", Encyclopedia of the Human Brain, 2002
3. Bermúdez, José Luis. Cognitive science: An introduction to the science of the mind. Cambridge University Press, 2014.
4. Hilgard, Ernest Ropiequet, Richard C. Atkinson, and Rita L. Atkinson. Introduction to psychology. Oxford and IBH Publishing, 1975.
5. Gazzaniga, Michael S. "Organization of the human brain." Science 245.4921 (1989): 947-952.

2035826: OPTIMIZATION TECHNIQUES

L	T/P	C
3	0/0	3

Unit 1 Introduction to Optimization:

Engineering application of Optimization – Statement of an Optimization problem - Optimal Problem formulation - Classification of Optimization problem. Optimum design concepts: Definition of Global and Local optima – Optimality criteria - Review of basic calculus concepts – Global optimality

Unit 2 Linear programming methods for optimum design:
Review of Linear programming methods for optimum design – Post optimality analysis - Application of LPP models in design and manufacturing.

Unit 3 Optimization algorithms:
Optimization algorithms for solving unconstrained optimization problems – Gradient based method: Cauchy's steepest descent method, Newton's method, Conjugate gradient method.

Unit 4 Optimization algorithms for solving constrained optimization problems – direct methods – penalty function methods – steepest descent method - Engineering applications of constrained and unconstrained algorithms.

Unit 5 Modern methods of Optimization:
Genetic Algorithms - Simulated Annealing - Ant colony optimization - Tabu search – Neural-Network based Optimization – Fuzzy optimization techniques – Applications. Use of Mat lab to solve optimization problems.

Text Book

1. Rao S. S. - 'Engineering Optimization, Theory and Practice' - New Age International Publishers - 2012 - 4th Edition

Referenced Books

1. Deb K. - 'Optimization for Engineering Design Algorithms and Examples' – PHI - 2000
2. Arora J. - 'Introduction to Optimization Design' - Elsevier Academic Press, New Delhi - 2004
3. Saravanan R. - 'Manufacturing Optimization through Intelligent Techniques' - Taylor & Francis (CRC Press) - 2006
4. Hardley G. -'Linear Programming' - Narosa Book Distributors Private Ltd. - 2002