DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE STRUCTURE M.Tech CSE for COMPUTER SCIENCE & TECHNOLOGY PROGRAMME

(Applicable for batches admitted from 2019-2020)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

I SEMESTER

S.No	Course Code	Courses	Category	L	T	P	C
1	MTCST1101	**Program Core-1** Mathematical Foundations of Computer Science	PC	3	0	0	3
2	MTCST1102	**Program Core-2** Advanced Data Structures	PC	3	0	0	3
3	MTCST1103	**Program Elective-1** 1. Artificial Intelligence 2. Cloud Computing 3. Digital Image Processing 4. Advanced Operating System 5. Optimization Techniques	PE	3	0	0	3
4	MTCST1104	**Program Elective-2** 1. Big Data Analytics 2. Applied Cryptography 3. Advanced Computer Networks 4. Embedded Computing 5. Parallel Computer Architecture	PE	3	0	0	3
5	MTCST1105	**Research Methodology and IPR**	CC			0	2
6	MTCST1106	**Laboratory-1** Advanced Data Structures Lab	LB	0	0	4	2
7	MTCST1107	**Laboartory-2** Computing Lab	LB	0	0	4	2
8	MTCST1108	**Audit Course-1***	AC	2	0	0	0
Total Credits							18

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

II SEMESTER

S.No	Course Code	Courses	Cate Gory	L	T	P	C
1	MTCST1201	**Program Core-3** Advanced Algorithms	PC	3	0	0	3
2	MTCST1202	**Program Core-4** Machine Learning	PC	3	0	0	3
3	MTCST1203	**Program Elective-3** 1. Soft Computing 2. Advanced Network Principles and Protocols 3.Internet of Things 4.Open Source Programming 5.Pattern Recognition	PE	3	0	0	3
4	MTCST1204	**Program Elective-4** 1. Natural Language Processing 2. Full Stack Technologies 3. Parallel Algorithms 4. Object Oriented Software Engineering 5. Distributed Database	PE	3	0	0	3
5	MTCST1205	**Laboratory-3** Advance AlgorithmLab	LB	0	0	4	2
6	MTCST1206	**Laboartory-4** Machine Learning Lab	LB	0	0	4	2
7	MTCST1207	**Mini Project with Seminar**	MP	2	0	0	2
8	MTCST1208	**Audit Course-2 ***	AC	2	0	0	0
Total Credits							18

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

Audit Course 1 & 2:

1. English for Research Paper Writing
5. Constitution of India

2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills

III-SEMESTER

S.No	Course Code	Courses	Category	L	T	P	C
1	MTCST2101	**Program Elective-5** 1. Deep Learning 2. Ethical Hacking 3. MOOCs-1 through NPTEL/SWAYAM-12 Week Program related to the programme which is not listed in the course structure	PE	3	0	0	3
2	MTCST2102	**Open Elective** 1. MOOCs-2 through NPTEL/SWAYAM- any 12 week course on Engineering/ Management/ Mathematics offered by other than parent department *2.* Course offered by other departments in the college	OE	3	0	0	3
3	MTCST2103	**Dissertation-I/Industrial Project #**	PJ	0	0	20	10
Total Credits							16

#Students going for Industrial Project/Thesis will complete these courses through MOOCs

IV SEMESTER

S.No	Course Code	Courses	Category	L	T	P	C
1	MTCST2201	**Dissertation-II**	PJ	0	0	32	16
Total Credits							16

Open Electives offered to other departments:
1. Python Programming
2. Web Technologies
3. Artificial Intelligence
4. Internet of Things
5. Machine Learning
6. Advanced Data Structures

I Year - I Semester		L	T	P	C
		3	0	0	3

Mathematical Foundations of Computer Science (MTCSE1101)

Course Objectives:

- To understand the mathematical fundamentals that is prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
- To develop the understanding of mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.
- To study various sampling and classification problems.

Course Outcomes:

After completion of course, students would be able to:

- To understand the basic notions of discrete and continuous probability.
- To understand the methods of statistical inference, and the role that sampling distributions play in those methods.
- To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.

Unit I:

Probability mass, density, and cumulative distribution functions, parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains

Unit II:

Random samples, sampling distributions of estimators**,** Methods of Moments and Maximum Likelihood

Unit III:

Statistical inference**,** Introduction to multivariate statistical models: regression and classification problems, principal components analysis**,** The problem of over fitting Model assessment.

Unit IV:

Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems

Unit V:

Recurrence Relation: Order and Degree of Recurrence Relation, Linear Homogeneous and Non-Homogeneous Recurrence Relations, Solutions of Linear Recurrence Relation with Constant Coefficients, Homogeneous Solutions, Particular Solutions, Generating functions, Counting (Combinatorial) Method

Text Books:

1. John Vince, Foundation Mathematics for Computer Science, Springer.
2. K. Trivedi.Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.

Reference Books:

1. M. Mitzenmacher and E. Upfal.Probability and Computing: Randomized Algorithms and Probabilistic Analysis.
2. Alan Tucker, Applied Combinatorics, Wiley
3. Discrete Mathematics -Swapna kumar chakraborty, Bikash kanti sarkar, Oxford Higher Education

I Year - I Semester		L	T	P	C
		3	0	0	3

Advanced Data Structures (MTCSE1102)

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 would be able to:

- Understand the implementation of symbol table using hashing techniques.
- Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
- Develop algorithms for text processing applications.
- Identify suitable data structures and develop algorithms for computational geometry problems.

Unit 1

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. **Hashing:** Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

Unit 2

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

Unit 3

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

Unit 4

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

Unit 5

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad trees, k-D Trees. Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem

Text Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

I Year - I Semester		L	T	P	C
		3	0	0	3
Artificial Intelligence (MTCST11XX)					

Course Objectives:

- Gain a historical perspective of AI and its foundations.
- Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool. Experiment with a machine learning model for simulation and analysis.
- Explore the current scope, potential, limitations, and implications of intelligent systems.

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

- Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents
- Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
- Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing
- Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
- Solve problems with uncertain information using Bayesian approaches.

UNIT-I:

Introduction to artificial intelligence: Introduction , history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI, **Problem solving: state-space search and control strategies:** Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative-deepening a*, constraint satisfaction

UNIT-II:

Problem reduction and game playing: Introduction, problem reduction, game playing, alpha-beta pruning, two-player perfect information games, **Logic concepts:** Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic

UNIT-III:

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames, **advanced knowledge representation techniques:** Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web, **Expert system and applications:** Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools

UNIT-IV:

Uncertainty measure: probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory , **Fuzzy sets and fuzzy logic:** Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

UNIT-V:

Machine learning paradigms: Introduction, machine learning systems, supervised and unsupervised learnings, inductive learning, deductive learning, clustering, support vector machines, case based

reasoning and learning, **Artificial neural networks:** Introduction, artificial networks, single layer feed forward networks, multi layered forward networks, design issues of artificial neural networks

Text Books:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
2. Artificial intelligence, A modern Approach, 2nd ed, Stuart Russel, Peter Norvig, PEA
3. Artificial Intelligence- 3rd ed, Rich, Kevin Knight, Shiv Shankar B Nair, TMH
4. Introduction to Artificial Intelligence, Patterson, PHI

Reference Books:

1. Artificial intelligence, structures and Strategies for Complex problem solving, 5th ed, George F Lugar, PEA
2. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
3. Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier

I Year - I Semester		L	T	P	C
		3	0	0	3
Cloud Computing (MTCST11XX)					

Course Objectives:

- To provide an in-depth and comprehensive knowledge of the Cloud Computing fundamental issues, technologies, applications and implementations.
- To expose the students to the frontier areas of Cloud Computing
- To motivate students to do programming and experiment with the various cloud computing environments
- To shed light on the Security issues in Cloud Computing
- To introduce about the Cloud Standards

Course Outcomes:

- Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
- Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
- Explain the core issues of cloud computing such as security, privacy, and interoperability.
- Provide the appropriate cloud computing solutions and recommendations according to the applications used.
- Collaboratively research and write a research paper, and present the research online.

UNIT I:

History of Centralized and Distributed Computing, Overview of Distributed Computing, Cluster computing, Grid computing. Technologies for Network based systems, System models for Distributed and cloud computing, Software environments for distributed systems and clouds.

UNIT II :

Introduction to Cloud Computing, Cloud issues and challenges, Properties, Characteristics, Service models, Deployment models. Cloud resources: Network and API, Virtual and Physical computational resources, Data-storage. Virtualization concepts, Types of Virtualization: Introduction to Various Hypervisors, High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs .

UNIT III :

Service models, Infrastructure as a Service (IaaS), Resource Virtualization: Server, Storage, Network, Case studies. Platform as a Service (PaaS), Cloud platform & Management: Computation, Storage, Case studies. Software as a Service (SaaS), Web services, Web 2.0, Web OS, Case studies, Anything as a service (XaaS).

UNIT IV :

Cloud Programming and Software Environments, Parallel and Distributed Programming paradigms, Programming on Amazon AWS and Microsoft Azure, Programming support of Google App Engine, Emerging Cloud software Environment.

UNIT V :

Cloud Access: authentication, authorization and accounting, Cloud Provenance and meta-data, Cloud Reliability and fault-tolerance, Cloud Security, privacy, policy and compliance, Cloud federation, interoperability and standards.

Text Book:

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, “Distributed and cloud computing from Parallel Processing to the Internet of Things”, Morgan Kaufmann, Elsevier – 2012

Reference Books:

1. Barrie Sosinsky, “ Cloud Computing Bible” John Wiley & Sons, 2010
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009

I Year - I Semester		L	T	P	C
		3	0	0	3
Digital Image Processing (MTCST11XX)					

Course Objectives:

- To understand basic algorithms for image processing.
- To understand various filters, Point processing, and Arithmetic operations in image processing.
- To introduce key concepts in pattern recognition and machine learning
- To understand different applications of graphics and image processing.

Course Outcomes:

- Students are able to develop software tools such as Games, Animation, and Recognition system
- Key concepts, tools and approaches for pattern recognition on complex data sets

UNIT I:

Digital Image Fundamentals: Image Formation and types, Basic geometric transformations, Fourier Transforms, Walsh, Hadamard, Discrete Cosine, Hotelling Transforms.

UNIT II:

Image Enhancement and Restoration: Histogram Modification Techniques, Image Smoothening, Image Sharpening, Image Restoration, Degradation Model, Noise Models, Spatial Filtering, Frequency Domain Filtering.

UNIT III:

Image Segmentation and Recognition: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Based Segmentation, Morphology operations. Pattern classification, Clustering and Matching, Knowledge representation and use for scene analysis and image understanding (2D and 3D),Object recognition and identification, Case study of various applications.

UNIT IV:

Pattern Recognition:

Key concepts, Supervised/Unsupervised Learning, Loss functions and generalization, Probability Theory, Parametric vs Non-parametric methods, Elements of Computational Learning Theory Ensemble Learning, Bagging, Boosting, Random Forest

UNIT V:

Dimensionality Reduction - CCA, LDA, ICA, NMF - Canonical Variates - Feature Selection vs Feature Extraction, Filter Methods - Sub-space approaches - Embedded methods, Low-Rank approaches - Recommender Systems

Text Books :

1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, Pearson Education, Third edition, 2011.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning.
3. 2. John Shawe-Taylor and NelloCristianini, Kernel Methods for Pattern

Reference Books:

1. Anil Jain K, “Fundamentals of Digital Image Processing”, Prentice-Hall of India, 2001.

I Year - I Semester		L	T	P	C
		3	0	0	3

Advanced Operating Systems (MTCST11XX)

Course Objectives:

- To study the characteristics of OS for Multiprocessor and Multicomputer.
- To learn the issues related to designing OS.
- To learn the latest trends in building Mobile OS.

Course Outcome:

- Knowledge about advanced concepts in OS
- Ability to develop OS for distributed systems
- Ability to develop modules for mobile devices

UNIT I :
Multiprocessor Operating Systems: System Architectures, Structures of OS, OS design issues, Process synchronization, Process Scheduling and Allocation, memory management.

UNIT II:
Distributed Operating Systems: System Architectures, Design issues, Communication models, clock synchronization, mutual exclusion, election algorithms, Distributed Deadlock detection

UNIT III:
Distributed scheduling: Distributed shared memory, Distributed File system, Multimedia file systems, File placement, Caching

UNIT IV:
Database Operating Systems: Requirements of Database OS, Transaction process model, Synchronization primitives, Concurrency control algorithms

UNIT V:
Mobile Operating Systems: ARM and Intel architectures, Power Management, Mobile OS Architectures, Underlying OS, Kernel structure and native level programming, Runtime issues, Approaches to power management

Text Books:
1. M Singhal and NG Shivaratri , Advanced Concepts in Operating Systems, Tata McGraw Hill Inc, 2001

Reference Books :
1. A S Tanenbaum, Distributed Operating Systems, Pearson Education Asia, 2001
2. Source Wikipedia, Mobile Operating Systems, General Books LLC, 2010

I Year - I Semester		L	T	P	C
		3	0	0	3
Optimization Techniques (MTCST11XX)					

Course Objectives:

- To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems.
- To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology.
- To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems.

Course Outcomes:

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

- Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
- Students should able to apply the concept of non-linear programming
- Students should able to carry out sensitivity analysis
- Student should able to model the real world problem and simulate it.

UNIT I :

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT II:

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

UNIT III:

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT IV:

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT V:

Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Text Books:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.

Reference Books :

1. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
2. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
3. Pannerselvam, Operations Research: Prentice Hall of India 2010
4. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

I Year - I Semester		L	T	P	C
		3	0	0	3
Big Data Analytics (MTCST11YY)					

Course Objectives:

The main objective of this course is to

- Provide an overview of an exciting growing field of Big Data analytics
- Introduce the tools required to manage and analyze big data like Hadoop, MapReduce etc.,

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

- Understand the programming requirements viz., generic types and methods to perform data analysis
- Understand the existing technologies and the need of distributed files systems to analyze the big data
- To understand and analyze Map-Reduce programming model for better optimization
- Collect, manage, store, query, and analyze big data; and identify the need of interfaces to perform I/O operations in Hadoop
- Identify the need based tools, viz., Pig and Hive and to handle
- Formulate an effective strategy to implement a successful Data analytics project

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

UNIT-II:

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

UNIT-III:

Writing Map Reduce Programs: A Weather Dataset, Understanding Hadoop API for Map Reduce Framework (Old and New), **Basic programs of Hadoop Map Reduce:** Driver code, Mapper code, Reducer code, Record Reader, Combiner, Partitioner

UNIT-IV

Hadoop I/O: 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

UNIT-V

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, **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

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 and Rafael Coss

Reference Books:

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

Web Resources:

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

I Year - I Semester		L	T	P	C
		3	0	0	3

Applied Cryptography (MTCST11YY)

Course Objectives:

- Student learns the basic concepts of symmetric cryptography and simple encryption methods.
- An understanding of the RSA cryptosystem, the mathematics used in the system, and the ability to encrypt and decrypt clear text using the system.
- To learn the properties of message authentication codes and the ability to use hash functions to build a message authentication code.

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

- Demonstrate the basics of Cryptographic protocols
- Explain the concepts of Stream Ciphers and Public Key Encryption
- Demonstrate Number Theory for Symmetric and Asymmetric Ciphers and discuss various Ciphers
- Discuss Hashing Algorithms and Message Authentication Codes
- Discuss Key-Exchange algorithms and Real world Implementations

UNIT–I: Foundations, Protocol Building Blocks, Basic Protocols, Advanced Protocols - Zero-Knowledge Proofs, Zero-Knowledge Proofs of Identity, Blind Signatures, Identity-Based Public-Key Cryptography, Key Length, Key Management, Electronic Codebook Mode, Block Replay, Cipher Block Chaining Mode, Stream Ciphers, Self-Synchronizing Stream Ciphers, Cipher- Feedback Mode, Synchronous Stream Ciphers, Output-Feedback Mode, Counter Mode, Other Block-Cipher Modes, Choosing a Cipher Mode.

UNIT–II: Information Theory, Complexity Theory, Number Theory, Factoring, Prime Number Generation, Discrete Logarithms in a Finite Field, Data Encryption Standard (DES), IDEA, CAST, Blowfish, RC5, Double Encryption, Triple Encryption.

UNIT–III: Pseudo-Random-Sequence Generators and Stream Ciphers- Linear Congruential Generators, Linear Feedback Shift Registers, Stream Ciphers using LFSRs, RC4, Feedback with Carry Shift Registers, Stream Ciphers Using FCSRs, Nonlinear-Feedback Shift Registers, Other Stream Ciphers, One-Way Hash Functions- MD5, Secure Hash Algorithm (SHA), One Way Hash Functions Using Symmetric Block, Using Public Key Algorithms, Message Authentication Codes.

UNIT–IV: Public-Key Algorithms, Knapsack Algorithms, RSA, Rabinm ElGamal, Elliptic Curve Cryptosystems, Digital Signature Algorithm (DSA), DSA Variants, Gost Digital Signature Algorithm, Discrete Logarithm Signature Schemes, Ong-Schnorr-Shamir, Schnorr, Converting Identification Schemes to Signature Schemes.

UNIT–V: Diffie- Hellman, Station-to-Station Protocol, Multiple-Key Public-Key Cryptography, Subliminal Channel, Undeniable Digital Signatures, Designated Confirmer Signatures, Kerberos, Privacy-Enhanced Mail (PEM), Message Security Protocol (MSP), Pretty Good Privacy (PGP), Smart Cards, Public-Key Cryptography Standards (PKCS).

Text Books:

1. Applied Cryptography: Protocols, Algorithms, and Source Code in C, 2nd Edition, Bruce Schneier, John Wiley & Sons Inc, 1996
2. Cryptography and Network Security, 6th Edition, William Stallings, Pearson Education, March 2013

Reference Books:

1. Modern Cryptography Theory and Practicel, Wenbo Mao, Pearson Education, 2004
2. Cryptography and network security, Behrouz A. Forouzan, McGraw-Hill, Inc., 2008

I Year - I Semester		L	T	P	C
		3	0	0	3
Advanced Computer Networks (MTCST11YY)					

Course Objectives:

- The course is aimed at providing basic understanding of Computer networks starting with OSI Reference Model, Protocols at different layers with special emphasis on IP, TCP & UDP and Routing algorithms.
- Some of the major topics which are included in this course are CSMA/CD, TCP/IP implementation, LANs/WANs, internetworking technologies, Routing and Addressing.
- Provide the mathematical background of routing protocols.
- Develop some familiarity with current research problems and research methods in advance computer networks.

Course Outcomes:

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

- Illustrate reference models with layers, protocols and interfaces.
- Describe Sub netting and Addressing of IP V4and IPV6.
- Describe and Analysis of basic protocols of computer networks, and how they can be used to assist in network design and implementation.
- Discuss the concepts of congestion control and quality of service.
- Demonstrate Data Communications System and its components.

Unit-I:**Network layer:** Network Layer design issues: store-and forward packet switching, services provided transport layers, implementation connection less services, implementation connection oriented services, comparison of virtual –circuit and datagram subnets. **Routing Algorithm** –shortest path routing, flooding, distance vector routing, link state routing, Hierarchical routing, Broadcast routing, Multicasting routing, routing for mobiles Hosts, routing in Adhoc networks- **congestion control algorithms**-Load shedding, Congestion control in Data gram Subnet.

Unit-II: IPV4 Address: Address space, notations, classful addressing, classless addressing network addressing translation (NAT), **IPV6 Address structure** address space, **Internetworking** need for network layer internet as a data gram, internet as connection less network. **IPV4** datagram, Fragmentation, checksum, options. **IPV6** Advantages, packet format, extension Headers, Transition form IPV4 to IPV6

Unit-III: Process to process delivery: client/server paradigm, multiplexing and Demultiplexing, connectionless versus connection oriented services, reliable versus reliable.**UDP:** well known ports for UDP, user data gram, check sum, UDP operation, and uses of UDP**.TCP:** TCP services, TCP features, segment, A TCP connection, Flow control, error control, congestion control. **SCTP:** SCTP services SCTP features, packet format, An SCTP association, flow control, error control.

Unit–IV: Congestion control: open loop congestion control, closed loop congestion control, Congestion control in TCP, frame relay, **QUALITY OF SERVICE**: flow characteristics, flow classes **TECHNIQUES TO IMPROVE QOS**: scheduling, traffic shaping, resource reservation, admission control. Emerging trends Computer Networks: **Motivation for mobile computing**: protocol Stack Issues in Mobile Computing Environment, Mobility issues in mobile computing, data dissemination security issues mobile networks

Unit–V: Domain name system: The name space, resource records, name servers **E-mail**: architecture and services, the user agent, message formats, message transfer, final delivery. **Www**: architecture overview, static web documents, dynamic web documents, hyper text transfer protocol, performance elements, the wireless web. **Multimedia:** introduction digital a audio , Audio compression, streaming

audio, internet radio, voice over IP, introduction to video, video compression, video on demand, the MBone-the multicast back bone

Text Books:

1. Data communications and networking 4th edition Behrouz A Fourzan,TMH
2. Computer networks 4th edition Andrew S Tanenbaum, Pearson
3. Computer networks, Mayank Dave, CENGAGE

Reference Books:

1. http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Computer%20networks/New_index1.html.
2. http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Computer%20networks/New_index1.html.
3. Computer networks, A system Approach, 5th ed, Larry L Peterson and Bruce S Davie, Elsevier

I Year - I Semester		L	T	P	C
		3	0	0	3
Embedded Computing (MTCST11YY**)**					

Course Objectives:

- To demonstrate the basic functions of the embedded system.
- To summarize the behavior of various software tools like GNU, GCC, gdb.
- To infer GPS and GSM module interfacing
- To develop client server models using TCP and UDP socket programming

Course Outcomes:

By the end of the course students are able to

- Describes the differences between the general computing system and the embedded computing system.
- Summarizes various software development tools like GNU, GCC etc.
- Develop interface modules for various types of sensors
- Write client server program using TCP and UDP sockets

UNIT – I :

Programming on Linux Platform: System Calls, Scheduling, Memory Allocation, Timers, Embedded Linux, Root File System, Busy Box. Operating System Overview: Processes, Tasks, Threads, Multi-Threading, Semaphore, Message Queue.

UNIT – II :

Introduction to Software Development Tools: GNU GCC, make, gdb, static and dynamic linking, C libraries, compiler options, code optimization switches, lint, code profiling tools,.

UNIT – III :

Interfacing Modules: Sensor and actuator interface, data transfer and control, GPS, GSM module interfacing with data processing and display, OpenCV for machine vision, Audio signal processing.

UNIT – IV :

Networking Basics: Sockets, ports, UDP, TCP/IP, client server model, socket programming, 802.11, Bluetooth, ZigBee, SSH, firewalls, network security.

UNIT – V :

IA32 Instruction Set:application binary interface, exception and interrupt handling, interrupt latency, assemblers, assembler directives, macros, simulation and debugging tools.

Text Books:

1. Peter Barry and Patrick Crowley, “Modern Embedded Computing”, 1st Edition., Elsevier/Morgan Kaufmann, 2012.
2. Linux Application Development – Michael K. Johnson, Erik W. Troan, Adission Wesley, 1998.
3. Assembly Language for x86 Processors by Kip R. Irvine
4. Intel® 64 and IA-32 Architectures Software Developer Manuals

Reference Books:

1. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, “Operating System Concepts”, Wiley
2. Maurice J. Bach, “The Design of the UNIX Operating System”, Prentice-Hall
3. W. Richard Stevens, “UNIX Network Programming”, Pearson

I Year - I Semester		L	T	P	C
		3	0	0	3
Parallel Computer Architecture (MTCST11YY)					

Course Objectives:

- To understand the principles of parallel computer architecture
- To understand the design of parallel computer systems including modern parallel architectures
- To assess the communication and computing possibilities of parallel system architecture and to predict the performance of parallel applications

Course Outcome:

- Students accustomed with the representation of data, addressing modes, and instructions sets.
- Students able to understand parallelism both in terms of a single processor and multiple processors Technical knowhow of parallel hardware constructs to include instruction-level parallelism for multi core processor design

Unit – I Fundamentals of Computer Design

Defining Computer Architecture – Trends in Technology – Trends in Power in Integrated Circuits – Trends in Cost – Dependability – Measuring, Reporting and Summarizing Performance – Quantitative Principles of Computer Design – Basic and Intermediate concepts of pipelining – Pipeline Hazards – Pipelining Implementation issues.

Unit – II Instruction-Level Parallelism and Its Exploitation

Instruction-Level Parallelism: Concepts and Challenges – Basic Compiler Techniques for Exposing ILP – Reducing Branch Costs with Prediction – Overcoming Data Hazards with Dynamic Scheduling – Dynamic Scheduling: Algorithm and Examples – Hardware-Based Speculation – Exploiting ILP Using Multiple Issue and Static Scheduling – Exploiting ILP Using Dynamic Scheduling, Multiple Issue and Speculation – Studies of the Limitations of ILP – Limitations on ILP for Realizable Processors – Hardware versus Software Speculation – Using ILP Support to Exploit Thread-Level Parallelism

Unit – III Data-Level and Thread-Level Parallelism

Vector Architecture – SIMD Instruction Set Extensions for Multimedia – Graphics Processing Units – Detecting and Enhancing Loop-Level Parallelism – Centralized Shared-Memory Architectures – Performance of Shared-Memory Multiprocessors – Distributed Shared Memory and Directory Based Coherence – Basics of Synchronization – Models of Memory Consistency – Programming Models and Workloads for Warehouse-Scale Computers – Computer Architecture of Warehouse-Scale Computers – Physical Infrastructure and Costs of Warehouse-Scale Computers

Unit – IV Memory Hierarchy Design

Cache Performance – Six Basic Cache Optimizations – Virtual Memory – Protection and Examples of Virtual Memory – Ten Advanced Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines – The Design of Memory Hierarchies

Unit – V Storage Systems & Case Studies

Advanced Topics in Disk Storage – Definition and Examples of Real Faults and Failures – I/O Performance, Reliability Measures and Benchmarks – Designing and Evaluating an I/O System – The Internet Archive Cluster Case Studies / Lab Exercises: INTEL i3, i5, i7 processor cores, NVIDIA GPUs, AMD, ARM processor cores – Simulators – GEM5, CACTI, SIMICS, Multi2sim and INTEL Software development tools.

Text Books:

1. David.A.Patterson, John L.Hennessy, "Computer Architecture: A Quantitative approach", Elsevier, 5 th Edition 2012.

2. K.Hwang, Naresh Jotwani, “Advanced Computer Architecture, Parallelism, Scalability, Programmability”, Tata McGraw Hill, 2 nd Edition 2010

I Year - I Semester		L	T	P	C
		2	0	0	2
RESEARCH METHODOLOGY AND IPR					

UNIT 1:
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT 2:
Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT 3:
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT 4:
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT 5:
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

REFERENCES:

(1) Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
(2) Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
(3) Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
(4) Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
(5) Mayall, "Industrial Design", McGraw Hill, 1992.
(6) Niebel, "Product Design", McGraw Hill, 1974.
(7) Asimov, "Introduction to Design", Prentice Hall, 1962.
(8) (8) Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
(9) T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

I Year - I Semester		L	T	P	C
		0	0	4	2
Advanced Data Structures Lab (MTCST1106**)**					

List of Experiments:

1. Perform various operations on AVL Trees
2. Perform various operations on BST
3. Implementation of Static Hashing
4. Implementation of Huffman coding
5. Implementation of B Tree.
6. Consider telephone book database of N clients. Make use of a hash table implementation to quickly look up client‘s telephone number.
7. Implement all the functions of a dictionary (ADT) using hashing. Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, Keys must be unique Standard Operations: Insert(key, value), Find(key), Delete(key)
8. For given set of elements create skip list. Find the element in the set that is closest to some given value.
9. Implement KMP algorithm for Pattern Matching
10. Implement Boyer-Moore algorithm for Pattern Matching
11. Implement Naïve string matching algorithm.
12. Implement insertion, deletion, display and search operation in m-way B tree (i.e. a non-leaf node can have atmost m children) for the given data as integers (Test the program for m=3, 5, 7).
13. Implementation of Skiplists

I Year - I Semester		L	T	P	C
		0	0	4	2
Computing Lab (MTCST1107)					

Note: First SIX experiments are mandatory. Remaining experiments can be done based on the students choice of any one specialization.

Common Experiments:

1. (a) Write a python program to print the multiplication table for the given number?
   (b) Write a python program to check whether the given number is prime or not?
   (c) Write a python program to find factorial of the given number?

2. Write a python program to implement simple Chatbot?

3. (a) Write a python program to implement List operations (Nested List, Length, Concatenation, Membership, Iteration, Indexing and Slicing)?
   (b) Write a python program to implement List methods (Add, Append, Extend & Delete).

4. (a) Write a python program to Illustrate Different Set Operations?
   (b) Write a python program to generate Calendar for the given month and year?
   (c) Write a python program to implement Simple Calculator program?

5. (a) Write a python program to Add Two Matrices.
   (b) Write a python program to Transpose a Matrix.

6. (a) Write a python program to remove punctuations from the given string?
   (b) Write a python program to sort the sentence in alphabetical order?

Artificial Intelligence Specialization:

1. Write a python program to implement Breadth First Search Traversal?
2. Write a python program to implement Water Jug Problem?
3. Write a program to implement Hangman game using python.
4. Write a program to implement Tic-Tac-Toe game using python.
5. (a)Write a python program to remove stop words for a given passage from a text file using NLTK?
   (b) Write a python program to implement stemming for a given sentence using NLTK?
   (c)Write a python program to POS (Parts of Speech) tagging for the give sentence using NLTK?

Big Data Specialization:

1. (i)Perform setting up and Installing Hadoop in its three operating modes:
   Standalone,
   Pseudo distributed,
   Fully distributed
   (ii)Use web based tools to monitor your Hadoop setup.

2. Implement the following file management tasks in Hadoop:
   • Adding files and directories
   • Retrieving files
   • Deleting files
3. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

4. Write a Map Reduce program that mines weather data.
   Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented.

5. Implement Matrix Multiplication with Hadoop Map Reduce

6. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter Your data.

7. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes

Cryptography Specialization:

Exercise –1:

Write a Java program to perform encryption and decryption using the following algorithms:

a) Ceaser Cipher
b) Substitution Cipher
c) Hill Cipher

Exercise – 2:

Write a Java program to implement the 3 DES and AES algorithms.

Exercise – 3:

Write a JAVA program to implement the BlowFish algorithm

Exercise-4 :

Implement MD-5 using Java

Exercise-5:

Write a Java program to implement RSA (2048 Key Length) Algorithm.

Exercise-6:

Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).

Exercise-7:

Calculate the message digest of a text using the SHA-2 algorithm in JAVA.

I Year - II Semester		L	T	P	C
		3	0	0	3

Advanced Algorithms

Course Objectives:

- Introduce students to the advanced methods of designing and analyzing algorithms.
- The student should be able to choose appropriate algorithms and use it for a specific problem.
- To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
- Students should be able to understand different classes of problems concerning their computation difficulties.
- To introduce the students to recent developments in the area of algorithmic design.

Course Outcomes:

After completion of course, students would be able to:

- Analyze the complexity/performance of different algorithms.
- Determine the appropriate data structure for solving a particular set of problems.
- Categorize the different problems in various classes according to their complexity.
- Students should have an insight of recent activities in the field of the advanced data structure.

UNIT I: Sorting: Review of various sorting algorithms, topological sorting **Graph:** Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

UNIT II: Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. **Graph Matching:** Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

UNIT III: Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.
Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

UNIT IV: Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. **Modulo Representation of integers/polynomials:** Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.
Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm

UNIT V: Linear Programming: Geometry of the feasibility region and Simplex algorithm. **NP-completeness:** Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based on time and interest Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

Text Books:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein, MIT Press
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman, Pearson Education.

References:

1. "Algorithm Design" by Kleinberg and Tardos, Pearson Education

I Year - II Semester		L	T	P	C
		3	0	0	3

Machine Learning

Course Objectives:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To become familiar with regression methods, classification methods, clustering methods.
- To become familiar with the concepts of artificial neural networks.

Course Outcomes:

- Recognize the characteristics of machine learning algorithms and their applications to real world problems
- Able to write and evaluate hypothesis
- Apply kernel methods to solve real world problems.

Unit-I: Introduction-Towards Intelligent Machines, Well posed Problems, Example of Applications in diverse fields, Data Representation, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured / Unstructured, Forms of Learning, Machine Learning and Data Mining, Basic Linear Algebra in Machine Learning Techniques.

Unit-II: Supervised Learning- Rationale and Basics: Learning from Observations, Bias and Why Learning Works: Computational Learning Theory, Occam's Razor Principle and Over fitting Avoidance Heuristic Search in inductive Learning, Estimating Generalization Errors, Metrics for assessing regression, Metris for assessing classification.

Unit-III: Statistical Learning- Machine Learning and Inferential Statistical Analysis, Descriptive Statistics in learning techniques, Bayesian Reasoning: A probabilistic approach to inference, K-Nearest Neighbor Classifier. Discriminant functions and regression functions, Linear Regression with Least Square Error Criterion, Logistic Regression for Classification Tasks, Fisher's Linear Discriminant and Thresholding for Classification, Minimum Description Length Principle.

Unit-IV: Support Vector Machines (SVM)- Introduction, Linear Discriminant Functions for Binary Classification, Perceptron Algorithm, Large Margin Classifier for linearly seperable data, Linear Soft Margin Classifier for Overlapping Classes, Kernel Induced Feature Spaces, Nonlinear Classifier, Regression by Support vector Machines.
Learning with Neural Networks: Towards Cognitive Machine, Neuron Models, Network Architectures, Perceptrons, Linear neuron and the Widrow-Hoff Learning Rule, The error correction delta rule.

Unit -V: Multilayer Perceptron Networks and error back propagation algorithm, Radial Basis Functions Networks. **Decision Tree Learning**: Introduction, Example of classification decision tree, measures of impurity for evaluating splits in decision trees, ID3, C4.5, and CART decision trees, pruning the tree, strengths and weakness of decision tree approach.

Textbooks:

1. Applied Machine Learning, M. Gopal, McGraw Hill Education
2. Machine Learning: A Probabilistic Perspective, Kevin Murphy, MIT Press,2012

Reference Books:

1. Pattern Recognition and Machine Learning, Christopher Bishop, Springer,2007
2. Programming Collective Intelligence: Building Smart Web 2.0 Applications - Toby Segaran
3. Building Machine Learning Systems with Python - WilliRichert, Luis Pedro Coelho
4. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer 2009 (freely available online)

I Year - II Semester		L	T	P	C
		3	0	0	3

Soft Computing

Course Objectives:

- Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
- Introduce students to artificial neural networks and fuzzy theory from an engineering perspective

Course Outcomes:

- Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.
- Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic
- To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations
- Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications
- Reveal different applications of these models to solve engineering and other problems.

UNIT-I: Fuzzy Set Theory: Introduction to Neuro – Fuzzy and Soft Computing, Fuzzy Sets, Basic Definition and Terminology, Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models, Surgeon Fuzzy Models, Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling.

UNIT-II: Optimization: Derivative based Optimization, Descent Methods, The Method of Steepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms, Simulated Annealing and Random Search – Downhill Simplex Search.

UNIT-III: Artificial Intelligence: Introduction, Knowledge Representation, Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning under Uncertainty Basic knowledge Representation Issues Knowledge acquisition, Heuristic Search: Techniques for Heuristic search Heuristic Classification State Space Search: Strategies Implementation of Graph Search based on Recursion Patent directed Search Production System and Learning.

UNIT-IV: Neuro Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference Systems, Architecture – Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

UNIT-V: Applications Of Computational Intelligence: Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Color Recipe Prediction.

Text Books:

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.
2. N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2006.

Reference Books:

1. Elaine Rich & Kevin Knight, Artificial Intelligence, Second Edition, Tata Mcgraw Hill Publishing Comp., 2006, New Delhi.
2. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
3. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989

I Year - II Semester		L	T	P	C
		3	0	0	3

Advanced Network Principles and Protocols

Course Objectives:

- Understand the architecture of the Internet protocols as a layered model
- To understand the fundamentals of data transmission, encoding and multiplexing
- To understand how the various components of wide area networks and local area networks work together

Course Outcomes:

- Familiarization of the different layers of TCP/IP protocol stack
- Understanding of the working principle of different protocols at different layers

Unit-I

Introduction to Networks - Application of Networks - Architecture Topology Switching - SLIP, PPP -ALOHA protocols, CSMA/CD, IEEE 802.3, 802.4, 802.5

Unit-II

Network Layer Issues- Routing, Congestion control- Internetworking - Issues, Address Learning Bridges, Spanning tree, Source routing, Bridges, Routers, Gateway.

Unit-III

Network Protocol- IP datagram - hop by hop routing, ARP, RARP, DHCP -Sub net Addressing, Address Masking, ICMP, RIP, RIPV2, OSPF, DNS, LAN and WAN Multicast.

Unit-IV

Transport Layer- Design issues, Connection Management, Transmission Control Protocol (TCP) - User Datagram Protocol (UDP).

Unit-V

Application Layer Protocol- Telnet - TFTP - FTP - SMTP - Ping Finger, Bootstrap Network Time Protocol- SNMP.

Text Books :

1. Andrew S. Tanenbaum and David J. Wetherall, “Computer Networks”, 5th Edition, Pearson, 2011
2. William Stallings, "Data and Computer Communications”, 9th Edition, Pearson, 2011

Reference Book :

1. W Richard Stevens and G. Gabrani, "TCP/IP Illustrated - Volume I, The protocols", Pearson Education, 2009

I Year - II Semester		L	T	P	C
		3	0	0	3
Internet of Things					

Course Objectives:

- To Understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications.

Course Outcomes:

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

- Summarize on the term 'internet of things' in different contexts.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Rasperry Pi/Arduino
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario

UNIT I:

FUNDAMENTALS OF IoT: Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II:

IoT PROTOCOLS: IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT. Bluetooth Smart Connectivity-Overview, Key Versions, BLE-Bluetooth Low Energy Protocol, Low Energy Architecture.

UNIT III:

DESIGN AND DEVELOPMENT: Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.

UNIT IV:

Arm Based Embedded System Design: ARM Cortex-A class processor, Embedded Devices-ARM Cortex-M Class processor, Networking-Bluetooth Smart Technology

Introduction to embedded systems: CPUs vs MCU's vs Embedded Systems, Examples, Options for Building Embedded Systems, Features of Embedded Systems, Building Embedded Systems, Building Embedded Systems using MCUs, Introduction to mbedTM Platform

UNIT V:

CASE STUDIES/INDUSTRIAL APPLICATIONS: Cisco IoT system, IBM Watson IoT platform, Manufacturing, Converged Plant wide Ethernet Model (CPwE), Power Utility Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

Text Books:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017
2. The Definative Guide to ARM Cortex-MR3 and M4 Processor, 3rd Edition, Joseph Yiu

Reference Books:

1. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015

2. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).
2. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Jan Ho¨ ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
3. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.
4. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O'Reilly Media, 2011.
5. Cortex–A series Programmer's Guide for ARMv7-A by Arm http://infocenter.arm.com/help/index.jsp?topic=/com.arm.doc.den0013d/index.htmlc

I Year - II Semester		L	T	P	C
		3	0	0	3

Open Source Programming

Course Objective:
To understand Open Source Programming concepts
To build applications based on Open Source Softwares

Course Outcome:
After successful completion of the course, students will be able to:

- develop codes in open source web applications
- understand the risks associated with the open source codes
- write secure CGI scripts

UNIT I – INTRODUCTION:
Introduction to open source programming languages, advantages and drawbacks of open source programming, threats and vulnerabilities in open source languages, Operating System – Ubuntu Linux – Introduction to shell programming.

UNIT II – PHP:
PHP Language Basics, Functions - calling a function, variable function, and anonymous function, Strings - cleaning, encoding and escaping, and comparing strings, Arrays – storing data in arrays, extracting multiple values, traversing, and sorting arrays, Objects – creation, introspection, and serialization, Web Techniques – processing forms and maintaining state.

UNIT III – WEB DATABASE APPLICATIONS:
Three-tier architecture, Introduction to Object oriented programming with PHP 5, Database basics, MYSQL - querying web databases, writing to web databases, validation with Javascript, Form based authentication, protecting data on the web.

UNIT IV – PERL, TCL, AND PYTHON :
Numbers and Strings, Control Statements, Lists and Arrays, Files, Pattern matching, Hashes, Functions. Introduction to TCL/TK, Introduction to Python.

UNIT V – SECURITY IN WEB APPLICATIONS :
Recognizing web application security threats, Code Grinder, Building functional and secure web applications, Security problems with Javascript, vulnerable GCI scripts, Code Auditing and Reverse Engineering, types of security used in applications.

Text Books:
1. Kevin Tatroe, Peter MacIntyre, Rasmus Lerdorf, “Programming PHP”, O’Reilly Media, 2012.
2. Michael Cross, “Developer’s Guide to Web Application Security”, Syngress Publishers, 2007.
3. Hugh E. Williams, David Lane, “Web Database applications with PHP and MYSQL”, Second Edition, O’Reilly Media, 2004.

Reference Books:
1. Tom Christiansen, Brian D Foy, Larry Wall, Jon Orwant, “Programming Perl”, Fourth Edition, O’Reilly Media, 2012.

I Year - II Semester		L	T	P	C
		3	0	0	3
Pattern Recognition					

Course Objectives:

- To implement pattern recognition and machine learning theories
- To design and implement certain important pattern recognition techniques
- To apply the pattern recognition theories to applications of interest
- To implement the entropy minimization, clustering transformation and feature ordering

Course Outcomes:

- Design systems and algorithms for pattern recognition (signal classification), with focus on sequences of patterns that are analyzed using, e.g., hidden Markov models (HMM)
- Analyze classification problems probabilistically and estimate classifier performance,
- Understand and analyze methods for automatic training of classification systems,
- Apply Maximum-likelihood parameter estimation in relatively complex probabilistic models, such as mixture density models and hidden Markov models
- Understand the principles of Bayesian parameter estimation and apply them in relatively simple probabilistic models

UNIT- I: Introduction - Basic concepts, Applications, Fundamental problems in pattern Recognition system design, Design concepts and methodologies, Examples of Automatic Pattern recognition systems, Simple pattern recognition model, Decision and Distance Functions - Linear and generalized decision functions, Pattern space and weight space, Geometrical properties, implementations of decision functions, Minimum-distance pattern classifications.

UNIT-II: Probability-Probability of events, Random variables, Joint distributions and densities, Movements of random variables, Estimation of parameter from samples, Statistical Decision Making - Introduction, Baye's theorem, Multiple features, Conditionally independent features, Decision boundaries, Unequal cost of error, estimation of error rates, the leaving-one-out-techniques, characteristic curves, estimating the composition of populations. Baye's classifier for normal patterns.

UNIT-III: Non Parametric Decision Making - Introduction, histogram, kernel and window estimation, nearest neighbor classification techniques. Adaptive decision boundaries, adaptive discriminate functions, Minimum squared error
Discriminate functions, choosing a decision making techniques. Clustering and Partitioning - Hierarchical Clustering: Introduction, agglomerative clustering algorithm, the single-linkage, complete-linkage and average-linkage algorithm. Ward's method Partition clustering-Forg's algorithm, K-means's algorithm, Isodata algorithm.

UNIT-IV: Pattern Preprocessing and Feature Selection: Introduction, distance measures, clustering transformation and feature ordering, clustering in feature selection through entropy minimization, features selection through orthogonal expansion, binary feature selection.

UNIT-V: Syntactic Pattern Recognition & Application Of Pattern Recognition: Introduction, concepts from formal language theory, formulation of syntactic pattern recognition problem, syntactic pattern description, recognition grammars, automata as pattern recognizers, Application of pattern recognition techniques in bio-metric, facial recognition, IRIS scan, Finger prints, etc.,

Text Books:

1. Gose. Johnsonbaugh. Jost. " Pattern recognition and Image Analysis",PHI.
   Tou. Rafael. Gonzalez. "Pattern Recognition Principle", PearsonEducation

Reference Book:

1. Richard duda, Hart., David Strok, "Pattern Classification", John Wiley.

I Year - II Semester		L	T	P	C
		3	0	0	3

Natural Language Processing

Course Objectives:

- Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate the above mentioned concepts.
- Teach them to recognize the significance of pragmatics for natural language understanding.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Course Outcomes:

- Explain approaches to syntax and semantics in NLP.
- Demonstrate approaches to discourse, generation, dialogue and summarization within NLP.
- Explain current methods for statistical approaches to machine translation.
- Identify machine learning techniques used in NLP, including hidden Markov models and probabilistic
- Explain context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP

UNIT-I: Introduction:

NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, question answering, and machine translation. The problem of ambiguity. The role of machine learning. Brief history of the field.

UNIT-II:

N-gram Language Models: The role of language models, Simple Ngram models. Estimating parameters and smoothing. Evaluating language models. **Part of Speech Tagging and Sequence Labeling:** Lexical syntax. Hidden Markov Models. Maximum Entropy Models. Conditional Random Fields

UNIT-III: Syntactic parsing:

Grammar formalisms and tree banks. Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Lexicalized PCFGs.

UNIT-IV: Semantic Analysis:

Lexical semantics and word-sense disambiguation. Compositional semantics. Semantic Role Labeling and Semantic Parsing.

UNIT- V: Information Extraction (IE) and Machine Translation (MT):

Named entity recognition and relation extraction. IE using sequence labeling. Basic issues in MT. Statistical translation, word alignment, phrase based translation, and synchronous grammars. Dialogues: Turns and utterances, grounding, dialogue acts and structures Natural Language Generation: Introduction to language generation, architecture, discourse planning (text schemata, rhetorical relations).

Text Books:

1. D. Jurafsky & J. H. Martin – "Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition", Pearson Education

References:

1. Allen, James. 1995. – "Natural Language Understanding". Benjamin/ Cummings, 2ed.
2. Bharathi, A., Vineet Chaitanya and Rajeev Sangal. 1995. Natural Language Processing- "A Pananian Perspective". Prentice Hll India, Eastern Economy Edition.
3. Eugene Cherniak: "Statistical Language Learning", MIT Press, 1993.
4. Manning, Christopher and Heinrich Schutze. 1999. "Foundations of Statistical Natural Language Processing". MIT Press.

I Year - II Semester		L	T	P	C
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Full Stack Technologies

Course Objectives:
From the course the student will learn

- Translate user requirements into the overall architecture and implementation of new systems and Manage Project and coordinate with the Client.
- Write backend code in Python/Java, PHP languages and Writing optimized front end code HTML and JavaScript.
- Understand, create and debug database related queries and Create test code to validate the applications against client requirement.
- Monitor the performance of web applications & infrastructure and Troubleshooting web application with a fast and accurate a resolution.

Course Outcomes(COs): At the end of the course, student will be able to

- Identify the Basic Concepts of Web & Markup Languages
- Develop web Applications using Scripting Languages & Frameworks
- Creating & Running Applications using JSP libraries
- Creating Our First Controller Working with and Displaying in Angular Js and Nested Forms with ng-form
- Working with the Files in React JS and Constructing Elements with Data

UNIT – I: HTML
Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message-Web Clients Web Servers. Markup Languages: XHTML an Introduction to HTML, History, Versions, Basic, XHTML Syntax and Semantics Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-HTML 5.0.

UNIT – II: Cascading Style Sheets (CSS)
Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML- Style Rule Cascading and Inheritance-Text Properties-Box Model Normal Flow Box Layout beyond the Normal Flow-CSS3.0, Boot strap basics, Boot strap CSS3, Introduction to Java Script, Jscript basics, JScripts objects, JSON, Don.

UNIT – III: Jscript
Separating Programming and Presentation: JSP Technology, Introduction to JSP and Servlets-Running JSP Applications, Basic JSP-JavaBeans Classes and JSP-Tag Libraries and Files-Support for the Model-View-Controller Paradigm- Mongo DB, JQuery, Mean stack Fundamentals

UNIT – IV: Angular Js
Introducing AngularJS, Starting Out with AngularJS, Basic AngularJS, Directives and Controllers, AngularJS Modules, Creating First Controller, working with and Displaying, Arrays, more Directives, working with ng-repeat, Unit Testing in AngularJS, Forms, Inputs, and Services, Working with ng-model, Working with Forms, Leverage Data-Binding and Models, Form Validation and States, Error Handling with Forms, ngModelOptions, Nested Forms with ng-form, Other Form Controls.

UNIT – V: React JS
Introduction to React, Obstacles and Roadblocks, keeping Up with the Changes, Working with the Files, Pure React, Page Setup, The Virtual DOM, React Elements, ReactDOM, Children, Constructing Elements with Data, React Components, DOM Rendering, Factories

Text Books:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006
2. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007
3. AngularJS: Up and Running Enhanced Productivity with Structured Web Apps By Brad Green, Shyam Seshadri Publisher: O'Reilly Media
4. Learning React Functional Web Development with React and Redux By Alex Banks, Eve Porcello Publisher: O'Reilly Media

Reference Books:

1. Head First Java, 2nd Edition by Bert Bates, Kathy Sierra Publisher: O'Reilly Media, Inc

I Year - II Semester		L	T	P	C
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Parallel Algorithms

Course Objective: The student will learn How to work on Parallel Programming Platforms, Principles of Parallel Algorithm Design, Parallelization aspects , Parallel sorting methods, Mapping and scheduling aspects of algorithms

Course Outcomes (COs):

Upon the successful completion of the course, students will be able to:

1. Understand fundamental concepts of parallelism- pipeline, Amdahl's law.
2. Know the physical limits of linear approach and solving problems in parallel.
3. How to design & analyze parallel algorithms and implement them with parallel processors.
4. Understand various approaches in parallel sorting and Searching.
5. Gain knowledge on various parallel processor architectures and know how to embed one Architecture into another.

UNIT1: Introduction :

Computational demand in various application areas, advent of parallel processing, terminology-pipelining, Data parallelism and control parallelism-Amdahl's law.

UNIT II: Scheduling:

Organizational features of Processor Arrays, Multi processors and multi-computers. Mapping and scheduling aspects of algorithms. Mapping into meshes and hyper cubes-Load balancing-List scheduling algorithm Coffman-graham scheduling algorithm for parallel processors.

UNIT III: Algorithms :

Elementary Parallel algorithms on SIMD and MIMD machines, Analysis of these algorithms. Matrix Multiplication algorithms on SIMD and MIMD models. Fast Fourier Transform algorithms. Implementation on Hyper cube architectures. Solving linear file -system of equations, parallelizing aspects of sequential methods back substitution and Tri diagonal.

UNIT IV: Sorting:

Parallel sorting methods, Odd-even transposition Sorting on processor arrays, Biotonic ,merge sort on shuffle - exchange ID , Array processor,2D-Mesh processor and Hypercube Processor Array. Parallel Quick-sort on Multi processors. Hyper Quick sort on hypercube multi computers. Parallel search operations. Ellis algorithm and Manber and ladner's Algorithms for dictionary operations.

UNIT V: Searching

Parallel algorithms for Graph searching, All Pairs shortest paths and inimum cost spanning tree. Parallelization aspects of combinatorial search algorithms with Focus on Branch and Bound Methods and Alpha-beta Search methods.

Text Books:

1. Parallel computing theory and practice, Michel J.Quinn
2. Programming Parallel Algorithms, Guy E. Blelloch, Communications of the ACM

Reference Books:

1. Introduction to Parallel Computing, 2e, Ananth Grama, Anushul Guptha, George Karypis, vipin kumar, Addison- Wesley

I Year - II Semester		L	T	P	C
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Object Oriented Software Engineering

Course Objectives:

In the course the student will learn

- Gain Knowledge in both the principles of software engineering as well as the practices of various object-oriented tools, processes, and products.
- Design and construction of modular, reusable, extensible and portable software using object oriented programming languages.

Course Outcomes:

- Apply object-oriented programming principles to real-time problems..
- Analyze of a formally specified problem statement with respect to its accuracy and completeness, to effective testing of the software product.
- Examine the specialised knowledge, skill and judgement needed to develop complex software by formulating relevant responses at each stage of the software development life-cycle.
- Produce appropriate documentation accurately and to a professional standard.
- Apply skills relevant for academic progression and career development within the sector.

UNIT–I: Introduction to Software Engineering- What is Software Engineering, Software Engineering Concepts, Software Engineering Development Activities, Managing Software Development, Case Study, **Modeling with UML-** Introduction – Overview of UML – Modeling Concepts – Deeper View into UML.

UNIT–II: Project Organization and Communications- Introduction, An Overview of Projects, Project Organization Concepts, Project Communication Concepts, Organizational Activities, **Analysis-** Introduction, Overview of Analysis, Analysis Concepts, Analysis Activities, Managing Analysis, Case study.

UNIT–III: System Design- Overview of System Design, System Design Concepts, System Design activities, Managing System Design, Case study, **Object Design-** Overview of Object design, Reuse Concepts, Reuse Activities, Managing Reuse, Case study.

UNIT–IV: Mapping Models to Code- Overview of mapping, Mapping concepts, Mapping Activities, Mapping Implementation, Case study, **Configuration Management and Project Management-** Configuration Management Overview, Concepts, Activities and Managing Configuration Management, Overview of Project management, Project Management Concepts, Project Management Activities.

UNIT–V: Software Life Cycle- Introduction, IEEE 1074, Characterizing the Maturity to Software Life Cycle Models, Life cycle Models, **Methodologies-** Introduction, Project Environment, Methodology Issues, A Spectrum of Methodologies, Case studies.

Text Books:

1. Object-Oriented Software Engineering: Practical software development using UML, Patterns and java, Second Edition, Bernd Bruegge and Allen Dutoit, Pearson Education, 2004. ISBN-10: 0130471100

Reference Books:

1. Object-Oriented Software Engineering: Conquering Complex and Changing Systems, Bernd Bruegge and Allen H. Dutoit, Pearson Education,2002. ISBN 0-13-489725-0
2. Object-oriented Software Engineering: The Professional Developer's Guide, Addison-Wesley, George Wilkie, 1993. ISBN-10: 0201627671

I Year - II Semester		L	T	P	C
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Distributed Databases

Course Objectives: The aim of this module is to build on the previous background of database systems by Deepening the understanding of the theoretical and practical aspects of the database technologies, showing the need for distributed database technology to tackle deficiencies of the centralized database systems and finally introducing the concepts and techniques of distributed database including principles, architectures, design, implementation and major domain of application

Course Outcomes:
After completion of this course, student will be able to:

- Identify the introductory distributed database concepts and its structures.
- Describe terms related to distributed object database design and management.
- Produce the transaction management and query processing techniques in DDBMS.
- Relate the importance and application of emerging database technology.

Unit I: Introductory concepts and design of (DDBMS)
Data Fragmentation; Replication; and allocation techniques for DDBMS; Methods for designing and implementing DDBMS, designing a distributed relational database; Architectures for DDBMS: cluster federated, parallel databases and client server architecture.

Unit II: Query processing & Transaction Management
Overview Of Query Processing: Query processing problem; Objectives of Query Processing; Complexity of Relational Algebra operations; characterization of Query processors; Layers of Query Processing Introduction To Transaction Management: Definition of Transaction, Properties of Transaction, types of transaction ; Distributed Concurrency Control: Serializability theory; Taxonomy of concurrency control mechanisms; locking bases concurrency control algorithms.

Unit III: Distributed Object Database Management systems
Fundamental Object concepts and Object models; Object distribution design; Architectural issues; Object management; Distributed object storage; Object query processing

Unit IV: Current trends & developments related to Distributed database applications technologies
Distributed Object/component-based DBMS; Database Interoperability including CORBA; DCOM and Java RMI; Distributed document-based systems; XML and Workflow management.

Unit V: Emerging related database technologies
Parallel Database; Mobile database; Multimedia Database; Spatial Database and Web Databases

Text Books:

1. Distributed Databases - Principles and Systems; Stefano Ceri; Guiseppe Pelagatti; Tata McGraw Hill; 1985.
2. Fundamental of Database Systems; Elmasri & Navathe; Pearson Education; Asia
3. Database System Concepts; Korth & Sudarshan; TMH
4. Principles of Distributed Database Systems; M. Tamer Özsu; and Patrick Valduriez Prentice Hall

Reference Books:

1. Data Base Management System; Leon & Leon; Vikas Publications
2. Introduction to Database Systems; Bipin C Desai; Galgotia

I Year - II Semester		L	T	P	C
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Advance Algorithms Lab

Course Objectives:
From the course the student will learn

- Knowing about oops concepts for a specific problem.
- Various advanced data structures concepts like arrays, stacks, queues, linked lists, graphs and trees.

Course Outcomes:

- Identify classes, objects, members of a class and relationships among them needed for a specific problem.
- Examine algorithms performance using Prior analysis and asymptotic notations.
- Organize and apply to solve the complex problems using advanced data structures (like arrays, stacks, queues, linked lists, graphs and trees.)
- Apply and analyze functions of Dictionary

List of Experiments:

Experiment 1:
Write a program to implement Multi stacks.

Experiment 2:
Write a program to implement Double Ended Queue (Dequeues) & Circular Queues.

Experiment 3:
Write a program to implement various Recursive operations on Binary Search Tree.

Experiment 4:
Write a program to implement various Non-Recursive operations on Binary Search Tree.

Experiment 5:
Write a program to implement BFS for a Graph

Experiment 6:
Write a program to implement DFS for a Graph.

Experiment 7:
Write a program to implement Merge & Heap Sort of given elements.

Experiment 8:
Write a program to implement Quick Sort of given elements.

Experiment 9:
Write a program to implement various operations on AVL trees.

Experiment 10:
Write a program to implement B: Tree operations.

Experiment 11:
Write a program to implementation of Binary trees and Traversals (DFT, BFT)

Experiment 12:
Write a program to implement Krushkal's algorithm to generate a min-cost spanning tree.

Experiment 13:
Write a program to implement Prim's algorithm to generate a min-cost spanning tree.

Experiment 14:
Write a program to implement functions of Dictionary using Hashing.

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Machine Learning Lab

Course Objectives:

This course will enable students to

- To learn and understand different Data sets in implementing the machine learning algorithms.
- Implement the machine learning concepts and algorithms in any suitable language of choice.

Course Outcomes(COs): At the end of the course, student will be able to

Implement procedures for the machine learning algorithms
Apply appropriate data sets to the Machine Learning algorithms
Identify and apply Machine Learning algorithms to solve real world problems
Design Python programs for various Learning algorithms

Experiments:

Note: Implement using R and Python.

Experiment-1:

Write a program to apply the following machine learning methods on any chosen dataset: a) Linear Regression b) Logistic Regression.

Experiment-2:

Write a program to implement Support Vector Machines.

Experiment-3:

Perform Exploratory Data Analysis for Classification using Pandas and Matplotlib.

Experiment-4:

Write a program to implement to analyze Bias, Variance, and Cross Validation.

Experiment-5:

Write a program to simulate a perception network for pattern classification and function approximation.

Experiment-6:

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.

Experiment-7:

Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

Experiment-8:

Write a program to implement the naïve Bayesian classifier for Iris data set. Compute the accuracy of the classifier, considering few test data sets.

Experiment-9:

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.

Experiment-10:

Apply EM algorithm to cluster a Heart Disease Data Set. 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.

Experiment-11:
Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

Experiment-12:
Implementing data visualization using R

- Find the data distributions using box and scatter plot.
- Find the outliers using plot.
- Plot the histogram, bar chart and pie chart on sample data.

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Deep Learning

Course Objectives:

At the end of the course, the students will be expected to:

- Learn deep learning methods for working with sequential data,
- Learn deep recurrent and memory networks,
- Apply such deep learning mechanisms to various learning problems.
- Learn deep Turing machines, the open issues in deep learning, and have a grasp of the current research directions.

Course Outcomes:

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

- 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

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.

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

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

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

Text Books:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016..
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.

Reference Books:

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
2. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
3. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004
4. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996

I Year - II Semester		L	T	P	C
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Ethical Hacking

Course Objectives:

The main objectives of the course are

- To gain knowledge about Ethical hacking and penetration testing.
- To learn about various types of attacks, attackers and security threats and vulnerabilities present in the computer system.
- To examine how social engineering can be done by attacker to gain access of useful & sensitive information about the confidential data.
- To learn about cryptography, and basics of web application attacks.
- To gain knowledge of the tools , techniques and ethical issues likely to face the domain of ethical hacking and ethical responsibilities.

Course Outcomes:

By the end of the course students will

- Learn various hacking methods.
- Perform system security vulnerability testing.
- Perform system vulnerability exploit attacks.
- Produce a security assessment report
- Learn various issues related to hacking.

UNIT I:

Hacking Windows: BIOS Passwords, Windows Login Passwords, Changing Windows Visuals, Cleaning Your Tracks, Internet Explorer Users, Cookies, URL Address Bar, Netscape Communicator, Cookies URL History, The Registry, Baby Sitter Programs.

UNIT II:

Advanced Windows Hacking: Editing your Operating Systems by editing Explorer.exe, The Registry, The Registry Editor, Description of .reg file, Command Line Registry Arguments, Other System Files, Some Windows & DOS Tricks, Customize DOS, Clearing the CMOS without opening your PC, The Untold Windows Tips and Tricks Manual, Exiting Windows the Cool and Quick Way, Ban Shutdowns: A Trick to Play, Disabling Display of Drives in My Computer, Take Over the Screen Saver, Pop a Banner each time Windows Boots, Change the Default Locations, Secure your Desktop Icons and Settings.

UNIT III:

Getting Past the Password: Passwords: An Introduction, Password Cracking, Cracking the Windows Login Password, The Glide Code, Windows Screen Saver Password, XOR, Internet Connection Password, Sam Attacks, Cracking Unix Password Files, HTTP Basic Authentication, BIOS Passwords, Cracking Other Passwords.

UNIT IV:

The Perl Manual: Perl: The Basics, Scalars, Interacting with User by getting Input, Chomp() and Chop(), Operators, Binary Arithmetic Operators, The Exponentiation Operator(**), The Unary Arithmetic Operators, Other General Operators, Conditional Statements, Assignment Operators. The : Operator, Loops, The While Loop, The For Loop, Arrays, THE FOR EACH LOOP: Moving through an Array, Functions Associated with Arrays, Push() and Pop(), Unshift() and Shift(), Splice(), Default Variables, $_, @ARGV, Input Output, Opening Files for Reading, Another Special Variables.

UNIT V:

Virus Working, Boot Sector Viruses (MBR or Master Boot Record), File or Program Viruses, Multipartite Viruses, Stealth Viruses, Polymorphic Viruses, Macro Viruses, Blocking Direct Disk Access, Recognizing Master Boot Record (MBR) Modifications, Identifying Unknown Device Drivers, making own Virus, Macro Viruses, Using Assembly to Create your own Virus, Modifying a Virus so Scan won't Catch it, Creating New Virus Strains, Simple Encryption Methods.

Text Books:

1. Patrick Engbreston: "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy",1st Edition, Syngress publication,2011.
2. Ankit Fadia : "Unofficial Guide to Ethical Hacking", 3rd Edition , McMillan India Ltd,2006.

Reference Books:

1. Simpson/backman/corley, "HandsOn Ethical Hacking & Network Defense International", 2nd Edition,Cengageint,2011.

I Year - II Semester		L	T	P	C
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Python Programming					

Course Objectives:

- Knowledge and understanding of the different concepts of Python.
- Using the GUI Programming and Testing in real-time applications.
- Using package Python modules for reusability.

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

- Understand and comprehend the basics of python programming.
- Demonstrate the principles of structured programming and be able to describe, design, implement, and test structured programs using currently accepted methodology.
- Explain the use of the built-in data structures list, sets, tuples and dictionary.
- Make use of functions and its applications.
- Identify real-world applications using oops, files and exception handling provided by python.

UNIT–I: Introduction- History of Python, Python Language, Features of Python, Applications of Python, Using the REPL (Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

UNIT–II: Types, Operators and Expressions-Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations, Control Flow- if, if-elif-else, for, while, break, continue, pass.

UNIT–III: Data Structures-Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences, Comprehensions.

UNIT–IV: Functions- Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables, Modules: Creating modules, import statement, from.. import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions.

UNIT–V: Object Oriented Programming OOP in Python-Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Datahiding, Brief Tour of the Standard Library - Operating System Interface - String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics, Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

Text Books:

1. Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage
2. Introduction to Programming Using Python, Y. Daniel Liang, Pearson

Reference Books:

1. Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press
2. Think Python, Allen Downey, Green Tea Press
3. Core Python Programming, W. Chun, Pearson

I Year - II Semester		L	T	P	C
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Web Technologies					

Course Objective:
To develop the web applications for different end users by using set of development tools like XHTML, CSS, JavaScript, XML, Ajax, PHP, PERL and Ruby Rails.

Course Outcomes:
Upon completion of the course the student will be able to,

1. Understand the concepts of Java Script and develop a dynamic webpage by the use of Java Script.
2. Write a well formed / valid XML document and describe the concepts of Ajax.
3. Creating & Running PHP script and also to connect & working with DBMS such as MySql.
4. Understand the concepts PERL and develop the web applications by using PERL.
5. Understand the concepts RUBY and develop the web applications by using RUBY.

UNIT-I:
Javascript : The Basic of Javascript: Objects, Primitives Operations and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modfication, Arrays, Functions, Constructors, Patttern Matching using Regular Expressions

UNIT-II:
XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches, **AJAX A New Approach:** Introduction to AJAX, Integrating PHP and AJAX.

UNIT-III:
PHP Programming: Introducing PHP: Creating PHP script, Running PHP script.**Working with variables and constants:** Using variables, Using constants, Data types, Operators. **Controlling program flow:** Conditional statements, Control statements, Arrays, functions. Working with forms and Databases such as MySQL.

UNIT-IV:
PERL: Introduction to PERL, Operators and if statements, Program design and control structures, Arrays, Hashs and File handling, Regular expressions, Subroutines, Retrieving documents from the web with Perl.

UNIT-V:
RUBY: Introduction to Ruby, Variables, types, simple I/O, Control, Arrays, Hashes, Methods, Classes, Iterators, Pattern Matching. Overview of Rails.

Text Books:

1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. The Web Warrior Guide to Web Programming, Bai, Ekedahl, Farrelll, Gosselin, Zak, Karparhi, Maclntyre, Morrissey, Cengage

Reference Books:

1. Ruby on Rails Up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, Oreilly (2006)
2. Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, Oreilly (2012)
3. Web Technologies, HTML< JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
4. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning
5. http://www.upriss.org.uk/perl/PerlCourse.html

I Year - II Semester		L	T	P	C
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Artificial Intelligence					

Course Objectives:

- Gain a historical perspective of AI and its foundations.
- Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool. Experiment with a machine learning model for simulation and analysis.
- Explore the current scope, potential, limitations, and implications of intelligent systems.

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

- Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents
- Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
- Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing
- Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
- Solve problems with uncertain information using Bayesian approaches.

UNIT-I:

Introduction to artificial intelligence: Introduction , history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI, **Problem solving: state-space search and control strategies:** Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative-deepening a*, constraint satisfaction

UNIT-II:

Problem reduction and game playing: Introduction, problem reduction, game playing, alpha-beta pruning, two-player perfect information games, **Logic concepts:** Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic

UNIT-III:

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames, **advanced knowledge representation techniques:** Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web, **Expert system and applications:** Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools

UNIT-IV:

Uncertainty measure: probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory , **Fuzzy sets and fuzzy logic:** Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

UNIT-V:

Machine learning paradigms: Introduction, machine learning systems, supervised and unsupervised learnings, inductive learning, deductive learning, clustering, support vector machines, case based reasoning and learning, **Artificial neural networks:** Introduction, artificial networks, single layer feed forward networks, multi layered forward networks, design issues of artificial neural networks

Text Books:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
2. Artificial intelligence, A modern Approach, 2nd ed, Stuart Russel, Peter Norvig, PEA

Reference Books:

1. Artificial Intelligence- 3rd ed, Rich, Kevin Knight, Shiv Shankar B Nair, TMH
2. Introduction to Artificial Intelligence, Patterson, PHI
3. Artificial intelligence, structures and Strategies for Complex problem solving, 5th ed, George F Lugar, PEA

I Year - II Semester		L	T	P	C
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Internet of Things					

Course Objectives:

- To Understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications.

Course Outcomes:

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

- Summarize on the term 'internet of things' in different contexts.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Rasperry Pi/Arduino
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario

UNIT I:

FUNDAMENTALS OF IoT: Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II:

IoT PROTOCOLS: IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT. Bluetooth Smart Connectivity-Overview, Key Versions, BLE-Bluetooth Low Energy Protocol, Low Energy Architecture.

UNIT III:

DESIGN AND DEVELOPMENT: Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.

UNIT IV:

Arm Based Embedded System Design: ARM Cortex-A class processor, Embedded Devices-ARM Cortex-M Class processor, Networking-Bluetooth Smart Technology

Introduction to embedded systems: CPUs vs MCU's vs Embedded Systems, Examples, Options for Building Embedded Systems, Features of Embedded Systems, Building Embedded Systems, Building Embedded Systems using MCUs, Introduction to mbedTM Platform

UNIT V:

CASE STUDIES/INDUSTRIAL APPLICATIONS: Cisco IoT system, IBM Watson IoT platform, Manufacturing, Converged Plant wide Ethernet Model (CPwE), Power Utility Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

Text Books:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017
2. The Definative Guide to ARM Cortex-MR3 and M4 Processor, 3rd Edition, Joseph Yiu

Reference Books:

1. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015
2. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).
6. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Jan Ho¨ ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
7. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.
8. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O'Reilly Media, 2011.
9. Cortex–A series Programmer's Guide for ARMv7-A by Arm http://infocenter.arm.com/help/index.jsp?topic=/com.arm.doc.den0013d/index.htmlc

I Year - II Semester		L	T	P	C
		3	0	0	3

Machine Learning

Course Objectives:

Machine Learning course will

- Develop an appreciation for what is involved in learning from data.
- Demonstrate a wide variety of learning algorithms.
- Demonstrate how to apply a variety of learning algorithms to data.
- Demonstrate how to perform evaluation of learning algorithms and model selection.

Course Outcomes:

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

- Domain Knowledge for Productive use of Machine Learning and Diversity of Data.
- Demonstrate on Supervised and Computational Learning
- Analyze on Statistics in learning techniques and Logistic Regression
- Illustrate on Support Vector Machines and Perceptron Algorithm
- Design a Multilayer Perceptron Networks and classification of decision tree

Unit-I: Introduction-Towards Intelligent Machines, Well posed Problems, Example of Applications in diverse fields, Data Representation, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured / Unstructured, Forms of Learning, Machine Learning and Data Mining, Basic Linear Algebra in Machine Learning Techniques.

Unit-II: Supervised Learning- Rationale and Basics: Learning from Observations, Bias and Why Learning Works: Computational Learning Theory, Occam's Razor Principle and Over fitting Avoidance Heuristic Search in inductive Learning, Estimating Generalization Errors, Metrics for assessing regression, Metris for assessing classification.

Unit-III: Statistical Learning- Machine Learning and Inferential Statistical Analysis, Descriptive Statistics in learning techniques, Bayesian Reasoning: A probabilistic approach to inference, K-Nearest Neighbor Classifier. Discriminant functions and regression functions, Linear Regression with Least Square Error Criterion, Logistic Regression for Classification Tasks, Fisher's Linear Discriminant and Thresholding for Classification, Minimum Description Length Principle.

Unit-IV: Support Vector Machines (SVM)- Introduction, Linear Discriminant Functions for Binary Classification, Perceptron Algorithm, Large Margin Classifier for linearly seperable data, Linear Soft Margin Classifier for Overlapping Classes, Kernel Induced Feature Spaces, Nonlinear Classifier, Regression by Support vector Machines.

Learning with Neural Networks: Towards Cognitive Machine, Neuron Models, Network Architectures, Perceptrons, Linear neuron and the Widrow-Hoff Learning Rule, The error correction delta rule.

Unit -V: Multilayer Perceptron Networks and error back propagation algorithm, Radial Basis Functions Networks. **Decision Tree Learning**: Introduction, Example of classification decision tree, measures of impurity for evaluating splits in decision trees, ID3, C4.5, and CART decision trees, pruning the tree, strengths and weakness of decision tree approach.

Textbooks:

1. Applied Machine Learning, M. Gopal, McGraw Hill Education
2. Machine Learning: A Probabilistic Perspective, Kevin Murphy, MIT Press,2012

Reference Books:

1. Pattern Recognition and Machine Learning, Christopher Bishop, Springer,2007
2. Programming Collective Intelligence: Building Smart Web 2.0 Applications - Toby Segaran
3. Building Machine Learning Systems with Python - WilliRichert, Luis Pedro Coelho

I Year - II Semester		L	T	P	C
		3	0	0	3
Advanced 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 would be able to:

- Understand the implementation of symbol table using hashing techniques.
- Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
- Develop algorithms for text processing applications.
- Identify suitable data structures and develop algorithms for computational geometry problems.

Unit I:

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. **Hashing:** Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

Unit II:

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

Unit III:

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

Unit IV:

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

Unit V:

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad trees, k-D Trees. Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem

Text Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

References:

1. Data structures and algorithms in C++, by Adam Drozdek, Mc Graw Hill

IV Semester

L	T	P	C
0	0	32	16

(DISSERTATION) DISSERTATION PHASE – I AND PHASE – II

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following

- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Problems of national importance
- Research and development in various domain

The student should complete the following:

- Literature survey Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

- Experimental verification / Proof of concept.
- Design, fabrication, testing of Communication System.
- The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Phase – I and II at M. Tech. (Electronics):

- As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.
- The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.
- After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.
- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.
- Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.
- Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q &A. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.

- During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.
- Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, a record of continuous progress.
- Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q &A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work

Course Outcomes:

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

1. Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
2. Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
3. Ability to present the findings of their technical solution in a written report.
4. Presenting the work in International/ National conference or reputed journals.

AUDIT 1 and 2: ENGLISH FOR RESEARCH PAPER WRITING

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

Syllabus

Units	CONTENTS	Hours
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4
2	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	4
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4
4	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,	4
5	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	4
6	useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	4

Suggested Studies:

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

AUDIT 1 and 2: DISASTER MANAGEMENT

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 work in

Syllabus		
Units	**CONTENTS**	**Hours**
1	**Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4
2	**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.	4
3	**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	4
4	**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.	4
5	**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.	4
6	**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.	4

Suggested Readings:

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

AUDIT 1 and 2: SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Objectives

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

Syllabus

Unit	Content	Hours
1	Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences	4
2	Order Introduction of roots Technical information about Sanskrit Literature	4
3	Technical concepts of Engineering-Electrical,	4
4	Technical concepts of Engineering - Mechanical.	4
5	Technical concepts of Engineering - Architecture.	4
6	Technical concepts of Engineering – Mathematics.	4

Suggested reading

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Output

Students will be able to

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

AUDIT 1 and 2: VALUE EDUCATION

Course Objectives

Students will be able to

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

Syllabus

Unit	Content	Hours
1	Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements	4
2	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	4
3	Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking.	4
4	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	4
5	Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence ,Humility, Role of Women.	4
6	All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively	4

Suggested reading

1 Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

Course outcomes

Students will be able to 1.Knowledge of self-development
2.Learn the importance of Human values 3.Developing the overall personality

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

AUDIT 1 and 2: CONSTITUTION OF INDIA

Course Objectives:
Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. 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 Indian nationalism.
3. 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 Indian Constitution.

Syllabus		
Units	**Content**	**Hours**
1	**History of Making of the Indian Constitution:** History Drafting Committee, (Composition & Working)	4
2	**Philosophy of the Indian Constitution:** Preamble Salient Features	4
3	**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.	4
4	**Organs of Governance:** Parliament Composition Qualifications and Disqualifications Powers and Functions Executive President Governor Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions	4
5	**Local Administration:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CE 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	4
6	**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.	4

Suggested reading

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.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. 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 Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

AUDIT 1 and 2: PEDAGOGY STUDIES

Course Objectives:

Students will be able to:

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

Syllabus		
Units	**Content**	**Hours**
1	**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.	4
2	Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.	4
3	Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?	4
4	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.	4
5	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	4
6	**Research gaps and future directions** Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact.	4

Suggested reading

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.

Course Outcomes:

Students will be able to understand:

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

AUDIT 1 and 2: STRESS MANAGEMENT BY YOGA

Course Objectives

1. To achieve overall health of body and mind
2. To overcome stress

Syllabus

Unit	Content	Hours
1	Definitions of Eight parts of yog. (Ashtanga)	5
2	Yam and Niyam. Do`s and Don't's in life. Ahinsa, satya, astheya, bramhacharya and aparigraha	5
3	Yam and Niyam. Do`s and Don't's in life. Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	5
4	Asan and Pranayam Various yog poses and their benefits for mind & body	5
5	Regularization of breathing techniques and its effects-Types of pranayam	4

Suggested reading

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

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

AUDIT 1 and 2: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Objectives

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

Syllabus

Unit	Content	Hours
1	Neetisatakam-Holistic development of personality Verses- 19,20,21,22 (wisdom) Verses- 29,31,32 (pride & heroism) Verses- 26,28,63,65 (virtue)	4
2	Neetisatakam-Holistic development of personality Verses- 52,53,59 (dont's) Verses- 71,73,75,78 (do's)	4
3	Approach to day to day work and duties. Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,	4
4	Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.	4
5	Statements of basic knowledge. Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18	4
6	Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63	4

Suggested reading

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, New Delhi.

Course Outcomes

Students will be able to

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

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