SR ENGINEERING COLLEGE
(Autonomous)
M.TECH (COMPUTER SCIENCE AND ENGINEERING)
(RA18) COURSE STRUCTURE & SYLLABUS
(Applicable from the batch admitted during 2018-19 academic year and onwards)

L : Theory, T: Tutorial, P/D: Practical, C: Credits
CIE: Continuous Internal Evaluation, SEE: Semester End Examination

I Year I Semester

S. No.	Course Code	Course	Hours/Week			
			L	T	P	C
1	18CS201	Advanced Data Structures	3	-	-	3
2	18CS202	Machine Learning	3	-	-	3
3	18CS203 18CS204 18CS205	Advanced Network Programming Wireless Sensor Networks Software Process &Project Management	3	-	-	3
4	18CS206 18CS207 18CS208	Data Sciences Distributed Systems Advanced Wireless Mobile Networks	3	-	-	3
5	18CM201	Research Methodology and IPR	2	-	-	2
6	18CS217	Advanced Data Structures Lab	-	-	4	2
7	18CS218	Program Elective – I Lab	-	-	4	2
8	AC	Audit Course	2	-	-	-
Total						**18**

I Year II Semester

S. No.	Course Code	Course	Hours/Week			
			L	T	P	C
1	18CS209	Advanced Algorithms	3	-	-	3
2	18CS210	Big Data Analytics	3	-	-	3
3	18CS211 18CS212 18CS213	Computer Vision Cryptography and Network Security Soft Computing	3	-	-	3
4	18CS214 18CS215 18CS216	Human Computer Interaction Deep Learning Software Architecture and Design Pattern	3	-	-	3
5	18CS219	Big Data Analytics Lab	-	-	4	2
6	18CS220	Program Elective – III Lab	-	-	4	2
7	18CS221	Mini Project with Seminar	2	-	-	2
8	AC	Audit Course	2	-	-	-
Total						**18**

II Year I Semester

S. No.	Course Code	Course	Hours/Week			
			L	T	P	C
1	18CS222 18CS223 18CS224	Mobile Application and Services Natural Language Processing Web Services and Service Oriented Architecture	3	-	-	3
2	18OE207 18OE208 18OE209 18OE210 18OE211 18OE212	3D Printing Cyber Laws Disaster Management Robotics Block Chain Technology Renewable Energy Sources	3	-	-	3
3	18CS225	Dissertation-I /Industrial Project	-	-	16	10
Total						**16**

II Year II Semester

S. No.	Course Code	Course	Hours/Week			
			L	T	P	C
1	18CS226	Dissertation II	-	-	32	16
Total						**16**

(CS201) ADVANCED DATA STRUCTURES

COURSE OUTCOMES

1. Understand the principles for good program design, especially the uses of data abstraction
2. Analyze algorithms and to determine algorithm correctness and time efficiency class.
3. Develop a variety of advanced abstract data type (ADT) and data structures and their implem entations.
4. Develop different algorithm design techniques (brute-force, divide and conquer, greedy, etc
5. Apply and implement learned algorithm design techniques and data structures to solve proble ms.
6. Analyze different data structure to prepare reliable database design.

UNIT I

Algorithms, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big Oh, Omega and Theta notations, Complexity Analysis Examples. Data structures-Linear and non linear data structures, ADT concept, Linear List ADT, Array representation, Linked representation, Vector representation, singly linked lists -insertion, deletion, search operations, doubly linked lists-insertion, deletion operations, circular lists. Representation of single, two dimensional arrays, Sparse matrices and their representation.

UNIT II

Stack and Queue ADTs, array and linked list representations, infix to postfix conversion using stack, implementation of recursion, Circular queue-insertion and deletion, Dequeue ADT, array and linked list representations, Priority queue ADT, implementation using Heaps, Insertion into a Max Heap, Deletion from a Max Heap, java.util package-ArrayList, Linked List, Vector classes, Stacks and Queues in java.util, Iterators in java.util.

UNIT III

Searching–Linear and binary search methods, Hashing-Hash functions, Collision Resolution methods-Open Addressing, Chaining, Hashing in java.util-HashMap, HashSet, Hashtable. Sorting –Bubble sort, Insertion sort, Quick sort, Merge sort, Heap sort, Radix sort, comparison of sorting methods.

UNIT IV

Trees- Ordinary and Binary trees terminology, Properties of Binary trees, Binary tree ADT, representations, recursive and non recursive traversals, Java code for traversals, Threaded binary trees.

UNIT V

Graphs- Graphs terminology, Graph ADT, representations, graph traversals/search methods-dfs and bfs, Java code for graph traversals, Applications of Graphs-Minimum cost spanning tree using Kruskal’s algorithm, Dijkstra’s algorithm for Single Source Shortest Path Problem.

UNIT VI

Search trees- Binary search tree-Binary search tree ADT, insertion, deletion and searching operations, Balanced search trees, AVL trees-Definition and examples only, Red Black trees – Definition and examples only, B-Trees-definition, insertion and searching operations, Trees in

java.util- TreeSet, Tree Map Classes, Tries(examples only),Comparison of Search trees. Text compression-Huffman coding and decoding, Pattern matching-KMP algorithm.

TEXT BOOKS:

1. S. Sahni, "Data structures, Algorithms and Applications in Java", Universities Press. [ISBN:0-07-109217-x]
2. Adam Drozdek, "Data structures and Algorithms in Java", 3rd edition, Cengage Learning. [ISBN:978-9814239233]

REFERENCE BOOKS:

1. R.Lafore "Data structures and Algorithms in Java", Pearson education. ISBN: 9788 131718124.
2. J.P.Tremblay and G.A.Cheston "Data structures and Software Development in an Object-Oriented Domain", Java edition, Pearson Education.

(CS202) MACHINE LEARNING

COURSE OUTCOMES

1. Understand various machine learning algorithms in a range of real-world applications.
2. Design various machine learning algorithms.
3. Apply machine learning: data, model selection, model complexity, etc.
4. Apply, design and analyze the popular machine learning approaches.
5. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
6. Analyze various machine learning algorithms.

UNIT I

Introduction: Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning **Concept learning and the general to specific ordering –** Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias

UNIT II

Decision Tree learning: Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning **Artificial Neural Networks –** Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition Advanced topics in artificial neural networks. **Evaluation Hypotheses –** Motivation, Estimation hypothesis accuracy, Basics of sampling theory, A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms.

UNIT III

Bayesian learning: Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm

UNIT IV

Computational learning theory – Introduction, Probability learning an approximately correct hypothesis, Sample complexity for Finite Hypothesis Space, Sample Complexity for infinite Hypothesis Spaces, The mistake bound model of learning **Instance-Based Learning-** Introduction, k -Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning **Genetic Algorithms** – Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms.

UNIT V

Learning Sets of Rules: Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution. **Analytical Learning** - Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge

UNIT VI

Combining Inductive and Analytical Learning: Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operators, **Reinforcement Learning** – Introduction, The Learning Task, Q Learning, Non-Deterministic, Rewards and Actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming.

TEXT BOOKS:

1. Tom M. Mitchell,"Machine Learning",MGH,ISBN-13:9780071154673,978-1449303716
2. Stephen Marsland, Taylor & Francis (CRC),"Machine Learning: An Algorithmic Perspective".[ISBN-13:978-1-4200-6718-7]

REFERENCE BOOKS:

1. William W Hsieh, "Machine Learning Methods in the Environmental Sciences, Neural Networks", Cambridge Univ Press.[ISBN:9780521181914]
2. Richard o. Duda, Peter E. Hart and David G. Stork, "pattern classification", John Wiley & Sons Inc.,2001.[ISBN:978-0-471-05669-0]

(CS203) ADVANCED NETWORK PROGRAMMING

COURSE OUTCOMES

1. Understand Java Application Programming Interface and windowing toolkits (AWT, Swing).
2. Develop and design distributed applications with sockets, JSF, EJB.
3. Understand network programming to build effective client–server systems
4. Design GUI clients for network servers
5. Develop concurrent programs with threads, in particular, multithreaded servers
6. Analyze different distributed applications.

UNIT I

Linux Utilities- File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking utilities, Filters, Text processing utilities and Backup utilities. Bourne again shell(bash) - Introduction, pipes and redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples. Review of C programming concepts-arrays, strings (library functions), pointers, function pointers, structures, unions, libraries in C.

UNIT II

Files- File Concept, File types File System Structure, Inodes, File Attributes, file I/O in C using system calls, kernel support for files, file status information-stat family, file and record locking-lockf and fcntl functions, file permissions- chmod, fchmod, file ownership-chown, lchown , fchown, linkssoft links and hard links – symlink, link, unlink.

UNIT III

File and Directory management – Directory contents, Scanning Directories- Directory file APIs. Process- Process concept, Kernel support for process, process attributes, process control – process creation, replacing a process image, waiting for a process, process termination, zombie process, orphan process.

UNIT IV

Signals- Introduction to signals, Signal generation and handling, Kernel support for signals, Signal function, unreliable signals, reliable signals, kill, raise , alarm, pause, abort, sleep functions. Interprocess Communication - Introduction to IPC mechanisms, Pipes- creation, IPC between related processes using unnamed pipes, FIFOs-creation, IPC between unrelated processes using FIFOs(Named pipes), differences between unnamed and named pipes, popen and pclose library functions, Introduction to message queues, semaphores and shared memory.Message Queues- Kernel support for messages, UNIX system V APIs for messages, client/server example. Semaphores-Kernel support for semaphores, UNIX system V APIs for semaphores.

UNIT V

Shared Memory- Kernel support for shared memory, UNIX system V APIs for shared memory, client/server example. Network IPC - Introduction to Unix Sockets, IPC over a network, Client-Server model ,Address formats(Unix domain and Internet domain), Socket system calls for Connection Oriented -Communication, Socket system calls for Connectionless-Communication,

Example-Client/Server Programs- Single Server-Client connection, Multiple simultaneous clients, Socket options – setsockopt, getsockopt, fcntl.

UNIT VI

Network Programming in Java-Network basics, TCP sockets, UDP sockets (datagram sockets), Server programs that can handle one connection at a time and multiple connections (using multithreaded server), Remote Method Invocation (Java RMI)-Basic RMI Process, Implementation details-Client-Server Application.

TEXT BOOKS

1. T.Chan, "Unix System Programming using C++", PHI.
2. Sumitabha Das, "Unix Concepts and Applications", 4th Edition, TMH.

REFERENCE BOOKS

1. Robert Love, "Linux System Programming", O'Reilly, SPD.
2. Jan Graba, "An Introduction to Network Programming with Java", Springer, rp 2010.

(CS204) WIRELESS SENSOR NETWORKS

COURSE OUTCOMES

1. Describe the lower layer issues in wireless communication systems.
2. Understand the communications component of an universal communications environment
3. Provide a foundation to critically analyze state of the art wireless communication systems.
4. Explain the problems and solutions introduced by wireless networks
5. Understand traditional networking, operating systems, human-computer interface, architecture, and security.
6. Analyze wireless sensor networks.

UNIT I

Overview of Wireless Sensor Networks

Key definitions of sensor networks, Advantages of sensor Networks, Unique constraints an challenges, Driving Applications, Enabling Technologies for Wireless Sensor Networks.

Architectures

Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT II

Networking Technologies

Physical Layer and Transceiver Design Considerations, Personal area networks (PANs), hidden node and exposed node problem, Topologies of PANs, MANETs, WANETs.

UNIT III

MAC Protocols for Wireless Sensor Networks

Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention – Based Protocols, Contention – Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

UNIT IV

Routing Protocols

Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols, Proactive Routing.

UNIT V

Transport Layer and Security Protocols

Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

UNIT VI

Security in WSNs

Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

Sensor Network Platforms And Tools

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node- level software platforms, Node-level Simulators, State-centric programming.

Applications of WSN

S Ultra wide band radio communication, Wireless fidelity systems. Future directions, Home automation, smart metering Applications.

TEXT BOOKS

1. Ad Hoc Wireless Networks: Architectures and Protocols – C. Siva Ram Murthy and B.S.Manoj, 2004, PHI
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control – Jagannathan Sarangapani, CRC Press

REFERENCES

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

(CS205) SOFTWARE PROCESS AND PROJECT MANAGEMENT

COURSE OUTCOMES

1. Describe software process maturity framework.
2. Understand the future software project management practices
3. Explain conventional software management and software economics.
4. Discuss software projects and project planning.
5. Analyze project tracking and control.
6. Assess the role of project closure analysis.

UNIT I

Software Process Maturity

Software maturity Framework**,** Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The ptimizing Process.

Process Reference Models

Capability Maturity Model (CMM)**,** CMMI, PCMM, PSP, TSP.

UNIT II

Software Project Management Renaissance

Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way.

Life-Cycle Phases and Process artifacts

Engineering and Production stages, inception phase, elaboration phase, construction phase,transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts,model based software architectures.

UNIT III

Workflows and Checkpoints of process

Software process workflows, Iteration workflows, Major milestones, Minor milestones, Periodic status assessments.

UNIT IV

Process Planning

Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

UNIT V

Project Organizations

Line-of- business organizations, project organizations, evolution of organizations, process automation.

Project Control and process instrumentation

The seven core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic Software metrics and metrics automation.

UNIT VI

CCPDS-R Case Study and Future Software Project Management Practices
Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions.

TEXT BOOKS

1. Watts S.Humphrey,"Managing the Software Process" , Pearson Education.[ISBN-13:978-0201180954]
2. Walker Royce"Software Project Management", Pearson Education. [ISBN: 9788177583786]

REFERENCE BOOKS:

1. Agile, Extreme, Robert Wysocki, "Effective Project Management: Traditional", Sixth edition, Wiley India, rp2011.[ISBN:978-1-118-01619-0]
2. Bob Hughes & Mike Cotterell ,"Software Project Management", fourth edition, TMH, 2006

(CS206) DATA SCIENCE

COURSE OUTCOMES

1. Describe what Data Science is and the skill sets needed to be a data scientist.
2. Explain in basic terms what Statistical Inference means
3. Explain the significance of exploratory data analysis (EDA) in data science. Apply basic to carry out EDA.
4. Apply EDA and the Data Science process in a case study.
5. Explain why Naive Bayes is a better alternative
6. Identify and explain fundamental mathematical and algorithmic ingredients that constitute a recommendation engine

UNIT I

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

UNIT II

Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: RealDirect (online real estate firm). Three Basic Machine Learning Algorithms - Linear Regression - k-Nearest Neighbors (k-NN) - k-means. One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam - Data Wrangling: APIs and other tools for scrapping the Web.

UNIT III

Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests

UNIT IV

Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system

UNIT V

Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighborhood properties in graphs

UNIT VI

Data Visualization - Basic principles, ideas and tools for data visualization

TEXT BOOKS

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.
2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.

REFERENCE BOOKS

1. S Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)
2. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013

(CS207) DISTRIBUTED SYSTEMS

COURSE OUTCOMES

1. Understand the properties of distributed algorithms and safety Properties.
2. Design models of distributed systems, failure and timing model.
3. Analyze basic algorithms for failure detection, leader elections, broadcast and multicast, basic shared memory in distributed systems.
4. Design of selected distributed algorithms in middleware designed for group communication
5. Apply agreement protocols, and group communication
6. Implementation of selected distributed algorithms in middleware designed for group communication.

UNIT I

Characterization of Distributed Systems- Introduction, Examples of Distributed systems, Resource sharing and web, challenges, System models- Introduction, Architectural and Fundamental models, Networking and Internetworking, Inter process Communication. Distributed objects and Remote Invocation-Introduction, Communication between distributed objects, RPC, Events and notifications, Case study-Java RMI.

UNIT II

Operating System Support- Introduction, OS layer, Protection, Processes and Threads, Communication and Invocation, Operating system architecture, Distributed File Systems-Introduction, File Service architecture, case study- SUN network file systems. Name Services-Introduction, Name Services and the Domain Name System, Case study of the Global Name Service, Case study of the X.500 Directory Service.

UNIT III

Peer to Peer Systems-Introduction, Napster and its legacy, Peer to Peer middleware, Routing overlays, Overlay case studies-Pastry, Tapestry, Application case studies-Squirrel, OceanStore. Time and Global States-Introduction, Clocks, events and Process states, Synchronizing physical clocks, logical time and logical clocks, global states, distributed debugging. Coordination and Agreement - Introduction, Distributed mutual exclusion, Elections, Multicast communication, consensus and related problems.

UNIT IV

Transactions and Concurrency control - Introduction, Transactions, Nested Transactions, Locks, Optimistic concurrency control, Timestamp ordering, Comparison of methods for concurrency Controls.

UNIT V

Distributed Transactions - Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery, Replication-Introduction, System model and group communication, Fault tolerant services, Transactions with replicated data.

UNIT VI

Security - Introduction, Overview of Security techniques, Cryptographic algorithms, Digital signatures, Case studies-Kerberos, TLS, 802.11 WiFi. Distributed shared memory, Design and Implementation issues, Sequential consistency and Ivy case study, Release consistency and Munin case study, other consistency models, CORBA case study- Introduction, CORBA RMI, CORBA Services.

TEXT BOOKS

1. G Coulouris, J Dollimore and T Kindberg "Distributed Systems Concepts and Design", Fourth Edition, Pearson Education.[ISBN:0-13-101621-0]
2. S. Ghosh, Chapman & Hall/CRC, Taylor & Francis Group "Distributed Systems, 2010. [ISBN-13:978-1-58488-564-1]

REFERENCE BOOKS

1. S.Mahajan and S.Shah, "Distributed Computing",Oxford University Press.[ISBN-13:978-0198061861]
2. Pradeep K.Sinha," Distributed Operating Systems Concepts and Design",PHI.[ISBN:7-302-02411-1]

(CS208) ADVANCED WIRELESS MOBILE NETWORKS

COURSE OUTCOMES

1. Understand the principles of wireless communications.
2. Analyze various multiple access schemes used in wireless communication.
3. Understand wireless wide area networks and their performance analysis.
4. Demonstrate wireless local area networks and their specifications.
5. Familiar with some of the existing and emerging wireless standards.
6. Understand the concept of orthogonal frequency division multiplexing.

UNIT I

The Cellular Concept-System Design Fundamentals

Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies- Prioritizing Handoffs, Practical Handoff Considerations, Interference and system capacity — Co channel Interference and system capacity, Channel planning for Wireless Systems, Adjacent Channel interference , Power Control for Reducing interference, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems- Cell Splitting, Sectoring.

UNIT II

Mobile Radio Propagation

Large-Scale Path Loss: Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, The Three Basic Propagation Mechanisms, Reflection-Reflection from Dielectrics, Brewster Angle, Reflection from prefect conductors, Ground Reflection (Two-Ray) Model, Diffraction-Fresnel Zone Geometry, Knife-edge Diffraction Model, Multiple knife-edge Diffraction, Scattering, Outdoor Propagation Models- Longley-Ryce Model, Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, lndoor Propagation Models-Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model, Signal penetration into buildings, Ray Tracing and Site Specific Modeling.

UNIT III

Mobile Radio Propagation

Small-Scale Fading and Multipath: Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel- Relationship between Bandwidth and Received power, Small-Scale Multipath Measurements-Direct RF Pulse System, Spread Spectrum Sliding Correlator Channel Sounding, Frequency Domain Channels Sounding,

UNIT IV

Mobile Radio Propagation

Parameters of Mobile Multipath Channels-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small-Scale Fading-Fading effects Due to Multipath Time Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow fading, Statistical Models for multipath Fading Channels-Clarke’s model for flat fading, spectral shape due to Doppler spread in Clarke’s model,

Simulation of Clarke and Gans Fading Model, Level crossing and fading statistics, Two-ray Rayleigh Fading Model.

UNIT V

Equalization and Diversity

Introduction, Fundamentals of Equalization, Training A Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Non-linear Equalization-Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Algorithms for adaptive equalization-Zero Forcing Algorithm, Least Mean Square Algorithm, Recursive least squares algorithm. Diversity Techniques-Derivation of selection Diversity improvement, Derivation of Maximal Ratio Combining improvement, Practical Space Diversity Consideration-Selection Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, Polarization Diversity, Frequency Diversity, Time Diversity, RAKE Receiver.

UNIT VI

Wireless Networks

Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11 ,IEEE 802.11 Medium Access Control, Comparision of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, Hiper Lan, WLL.

TEXT BOOKS

1. Wireless Communications, Principles, Practice — Theodore, S.Rappaport, 2nd Ed., 2002, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.

REFERENCE BOOKS

1. Principles of Wireless Networks — Kaveh Pah Laven and P. Krishna Murthy, 2002, PE
2. Wireless Digital Communications — Kamilo Feher, 1999, PHI.

(CS209) RESEARCH METHODOLOGY AND IPR

COURSE OUTCOMES

At the end of the course, the students will develop ability to

1. Identify the appropriate research problem and parameters
2. Write a research proposal and understand research design and techniques.
3. Collect the data and analyze the data
4. Understand the basic concepts of Intellectual property Rights.
5. Explain practical aspects of registration of Copy Rights and International Treaties and Conventions on IPRs
6. Explain IP Laws, Cyber Law and Digital Content Protection

UNIT I

Research Problem

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.

UNIT II

Developing a Research Proposal

Format of research proposal, Individual research proposal, Institutional proposal. Proposal of a student – a presentation and assessment by a review committee consisting of Guide and external expert only.

Research Design

Features of Good Design, Types of Research Design, Basic Principles of Experimental Design

UNIT III

Data Collection and Analysis

Accepts of Method Validation**,** Observation and collection of data, Methods of Data collection, Data Processing and analysis strategies and tools, Computers and its role in Research, Introduction to Evolutionary algorithms

UNIT IV

Introduction to IPRs, Basic concepts and need for Intellectual Property – Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT V

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT VI

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

TEXT BOOKS

1. Research Methodology: Methods And Techniques - C. R. Kothari,2nd Edition, New Age International Publishers
2. Fundamentals of IP for Engineers: K.Bansl& P.Bansal

REFERENCE BOOKS

1. Research methodology: an introduction for science & engineering students', by Stuart Melville and Wayne Goddard
2. Research Methodology and Statistical tools –P. Narayana Reddy and GVRK Acharuyulu.1st edition excel books ,New Delhi 2008
3. Intellectual property right, Deborah, E. Bouchoux, Cengage learning
4. Intellectual property right - Unleashing the knowledge economy, Prabuddha Ganguli, Tata McGraw Hill Publishing Company Ltd

(CS218) ADVANCED DATA STRUCTURES LAB

COURSE OUTCOMES

1. Understand a variety of advanced abstract data type (ADT) and data structures.
2. Analyze algorithms and to determine algorithm correctness and time efficiency class.
3. Understand the fundamental design, analysis, and implementation of basic data structures
4. Implement different advanced abstract data types and data structures.
5. Understand different algorithm design techniques (brute-force, divide and conquer, greedy, etc.)
6. Apply and implement learned algorithm design techniques and data structures to solve problems

Sample Problems on Data structures:

1. Write Java programs that use both recursive and non-recursive functions for implementing the following searching methods:
   a) Linear search b) Binary search
2. Write Java programs to implement the following using arrays and linked lists
   a) List ADT
3. Write Java programs to implement the following using an array.
   a) Stack ADT b) Queue ADT
4. Write a Java program that reads an infix expression and converts the expression to postfix form. (Use stack ADT).
5. Write a Java program to implement circular queue ADT using an array.
6. Write a Java program that uses both a stack and a queue to test whether the given string is a palindrome or not.
7. Write Java programs to implement the following using a singly linked list.
   a) Stack ADT b) Queue ADT
8. Write Java programs to implement the deque (double ended queue) ADT using
   a) Array b) Singly linked list c) Doubly linked list.
9. Write a Java program to implement priority queue ADT.
10. Write a Java program to perform the following operations:
    a) Construct a binary search tree of elements.
    b) Search for a key element in the above binary search tree.
    c) Delete an element from the above binary search tree.
11. Write a Java program to implement all the functions of a dictionary (ADT) using Hashing.
12. Write a Java program to implement Dijkstra's algorithm for Single source shortest path problem.
13. Write Java programs that use recursive and non-recursive functions to traverse the given binary tree in
    a) Preorder b) Inorder c) Postorder.
14. Write Java programs for the implementation of bfs and dfs for a given graph.
15. Write Java programs for implementing the following sorting methods:
    a) Bubble sort d) Merge sort g) Binary tree sort
    b) Insertion sort e) Heap sort
    c) Quick sort f) Radix sort
16. Write a Java program to perform the following operations:

a) Insertion into a B-tree b) Searching in a B-tree

17. Write a Java program that implements Kruskal's algorithm to generate minimum cost spanning tree.
18. Write a Java program that implements KMP algorithm for pattern matching.

REFERENCE BOOKS

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

(Note: Use packages like java.io, java.util, etc)

(CS219) ADVANCED NETWORK PROGRAMMING LAB

Course Outcomes:

1. Understand Java Application Programming Interface and windowing toolkits (AWT, Swing).
2. Develop and design distributed applications with sockets, JSF, EJB.
3. Understand network programming to build effective client–server systems
4. Design GUI clients for network servers
5. Develop concurrent programs with threads, in particular, multithreaded servers
6. Analyze different distributed applications

LIST OF PROGRAMS

1 Implement the following forms of IPC.
a) Pipes b) FIFO
2. Implement file transfer using Message Queue form of IPC.
3. Write a Program to create an integer variable using Shared Memory concept an increment the variable simultaneously by two processes. Use Semaphores to avoid Race conditions.
4 . Design TCP iterative Client and Server application to reverse the given input sentence.
5. Design TCP concurrent Client and Server application to reverse the given input sentence.
6. Design TCP Client and Server application to transfer file.
7. Design a TCP concurrent Server to convert a given text into upper case using multiplexing system call "select".
8. Design a TCP concurrent Server to echo given set of sentences using Poll functions.
9. Design UDP Client and Server application to reverse the given input sentence.
10. Design UDP Client Server to transfer a file.
11. Design using Poll Client Server application to multiplex TCP and UDP requests for converting a given text into upper case.
12. Design a RPC application to add and subtract a given pair of integers

(CS219) ADVANCED WIRELESS MOBILE NETWORKS LAB

COURSE OUTCOMES

1. Understand the principles of wireless communications.
2. Analyze various multiple access schemes used in wireless communication.
3. Understand wireless wide area networks and their performance analysis.
4. Demonstrate wireless local area networks and their specifications.
5. Familiar with some of the existing and emerging wireless standards.
6. Understand the concept of orthogonal frequency division multiplexing

1	Getting in Touch	Basics of WSN programming using TinyOS.
2	Gathering Data	Sensing data using WSN motes.
3	Simulation with TOSSIM	Simulating WSNs made up of motes running TinyOS using the TinyOS simulation framework TOSSIM. This header file can be used to easily output binary data as a hex dump.
4	Dissemination and over the air programming	Collecting, disseminating and processing data in WSNs and using Deluge to disseminate programs.
5	Encrypted Communication	Introduction to the use of cryptographically secured (private key) communication in WSNs.
6	Advanced Encryption	Using public key cryptography.
7	Sound detection using WSN	Sensing audio data and interpreting results.
8	GPS	Sensing positioning data using GPS and transmitting it.
9	Visualization in WSN	Visualization

Literature and References

1. David Gay, Phil Levis, Rob von Behren, Matt Welsh, Eric Brewer, and David Culler, The nesC Language: A Holistic Approach to Networked Embedded Systems
2. nesC v1.1 Language Reference
3. TinyOS Programming Manual
4. TinyOS Documentation Wiki (includes tutorials)

(CS219) SOFTWARE PROCESS & PROJECT MANAGEMENT LAB

1. Design and implement, in a programming language, an executable solution to a given problem using common software principles and best practices.
2. Choose and adapt suitable elements from among conventional and evolving software development life-cycle processes and apply the resulting process to a software project.
3. Collaborate in teams to develop a significantly sized software system from conceptualization to completion.
4. Communicate effectively design and development decisions through written and graphical demonstration.
5. Correctly create a model of the structure and behavior of a software system
6. Apply appropriate software testing techniques and evaluate the quality of a software product at module, integration, and system granularity levels.

1. Write down the problem statement for a suggested system of relevance.
2. Do requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system.
3. To perform the function oriented diagram: Data Flow Diagram (DFD) and Structured chart.
4. To perform the user‘s view analysis for the suggested system: Use case diagram.
5. To draw the structural view diagram for the system: Class diagram, object diagram.
6. To draw the behavioral view diagram : State-chart diagram, Activity diagram
7. To perform the behavioral view diagram for the suggested system : Sequence diagram, Collaboration diagram
8. To perform the implementation view diagram: Component diagram for the system.
9. To perform the environmental view diagram: Deployment diagram for the system.
10. To perform various testing using the testing tool unit testing, integration testing for a ample code of the suggested system.
11. Perform Estimation of effort using FP Estimation for chosen system.
12. To Prepare time line chart/Gantt Chart/PERT Chart for selected software project.

TEXT BOOKS

1. K.K. Aggarwal & Yogesh Singh, ―Software Engineering‖, New Age International, 2005
2. Pankaj Jalote, ―An Integrated Approach to Software Engineering‖, Second Edition, Springer

(CS210) ADVANCED ALGORITHMS

COURSE OUTCOMES

1. Argue the correctness of algorithms using inductive proofs and invariants.
2. Analyze worst-case running times of algorithms using asymptotic analysis.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
4. Analyse a variety of algorithms with practical applications and the resource requirements of each.
5. Determine the most suitable algorithm for any given task and then apply it to the problem.
6. Compare between different data structures. Pick an appropriate data structure for a design situation.

UNIT I

Algorithm Analysis Asymptotic Notation, Amortization.
Basic Data Structures Stacks and Queues, Vectors, Lists and Sequences, Trees, Priority Queues, Heaps, Dictionaries and Hash Tables.
Search Trees Ordered Dictionaries and Binary Search Trees, AVL Trees, Bounded-Depth Search Trees, and Splay Trees.

UNIT II

Fundamental Techniques The Greedy Method, Divide-and-Conquer, and Dynamic Programming.
Graphs The Graph Abstract Data Type, Data Structures for Graphs, Graph Traversal, Directed Graphs.

UNIT III

Weighted Graphs Single-Source Shortest Paths, All-Pairs Shortest Paths, Minimum Spanning Trees.
Network Flow and Matching Flows and Cuts, Maximum Bipartite Matching, Minimum-Cost Flow.

UNIT IV

Text Processing Strings and Pattern Matching Algorithms, Tries, Text Compression, Text Similarity Testing.

UNIT V

Number Theory and Cryptography Fundamental Algorithms involving numbers, Cryptographic Computations, Information Security Algorithms and Protocols.

UNIT VI

Computational Geometry Range Trees, Priority Search Trees, Quad trees and k-D Trees, Convex Hulls.

TEXT BOOKS

1. 1. M T Goodrich, R Tomassia. "*Algorithm Design – Foundations, Analysis, and Internet Algorithms*", John Wiley, 2006.
2. E Horowitz S Sahani, S Rajasekaran, "C*omputer Algorithms*", Second Edition, Silicon Press, 2007.

REFERENCE BOOKS

1. Aho, A V Hopcraft, Ullman J D, "*The Design and Analysis of Computer Algorithms*", Pearson Education, 2007.
2. Hari Mohan Pandey, "*Design Analysis and Algorithms*", Firewall Media, 2008.

(CS211) BIG DATA & ANALYTICS

COURSE OUTCOMES

1. Demonstrate the hadoop ecosystem and its applications for data analytics.
2. Acquire skills in MapReduce analytics using Hadoop.
3. Operate the big data environment and manage data without SQL.
4. Identify the current applications that need big data usage for analysis.
5. Summarize the importance of hadoop for business analytics.
6. Acquire programming skills in hadoop echo system.

UNIT I

Types of digital data: structured, semi-structured & unstructured. Big data definition: Volume, Velocity, Variety, veracity& value. Big data analytics skills: analytics classification, In-memory analytics, parallel processing & distributed systems. CAP theorem. The Big data Technology landscape: SQL vs NoSQL. Introduction to Hadoop.

UNIT II

Exploring Hadoop architecture: HDFS, The Hadoop Distributed File System. Basic concepts, namenode, datanodes,The design of HDFS, Interfaces basic commands for file system operations, Hadoop I/O.

UNIT III

Introduction to MapReduce programming: Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression. Developing a MapReduce Application (*programming language is not a binding*), MapReduce workflows, MapReduce Types & Formats, Features of MapReduce.

UNIT IV

Introduction to HIVE: Architecture, File format, Hive Query Language (HQL). Programming with Hive.

Introduction to Pig: Pig Latin Overview, data types, running Pig, Execution models, Pig Commands, Application development using Pig. Pig vs Hive

UNIT V

Introduction to HBase: NoSQL a column oriented database. Example schemas &comparisons with RDBMS.

UNIT VI

Introduction to ZooKeeper : Installing & running zookeeper. Zookeeper service.

Introduction to sqoop: A sample import using sqoop. Importing large objects. Working with imported data. A deeper look at sqoop export.

TEXT BOOKS

1. Seema Acharya & Subhashini Chellappan “BIG data and Analytics” Wiley India Publishers,ISBN:978-81-265-5478-2
2. Tom White “Hadoop the Definitive Guide” O’Reilly Publishers,ISBN:978-1-449-31152-0

REFERENCE BOOKS

1. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
2. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.

(CS212) COMPUTER VISION

COURSE OUTCOMES

1. Understand the concepts of digital image formation and low-level processing.
2. Analyze depth estimation and multi-camera views.
3. Understand the concept of future extraction.
4. Demonstrate image segmentation.
5. Analyze pattern analysis.
6. Understand the concept of motion analysis

UNIT I

Digital Image Formation and low-level processing

Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

UNIT II

Depth estimation and Multi-camera views

Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. apparel

UNIT III

Feature Extraction

Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

UNIT IV

Image Segmentation

Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.

UNIT V

Pattern Analysis

Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

UNIT VI

Motion Analysis

Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

Shape from X

Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.

TEXTBOOKS

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

REFERENCE BOOKS

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.

(CS213) CRYPTOGRAPHY AND NETWORK SECURITY

COURSE OUTCOMES

1. Explore to the different system attacks and viruses.
2. Apply the concepts of private and public encryption techniques.
3. Explain the key management and Authentication services.
4. Explain the IP security and web security concepts.
5. Explain and generation the hash function using different techniques.
6. Design an effective intrusion detection systems and trusted systems through firewall architecture.

UNIT I

Introduction

Attributes of Security, Integrity, Authenticity, Non-repudiation, Confidentiality Authorization, Anonymity, Types of Attacks, DoS, IP Spoofing, Replay, Man-in-the-Middle attacks General Threats to Computer Network, Worms, Viruses, -Trojans

UNIT II

Secret Key Cryptography

DES, Triple DES, AES, Key distribution, Attacks

UNIT III

Public Key Cryptography

RSA, ECC, Key Exchange (Diffie-Hellman), Java Cryptography Extensions, Attacks

UNIT IV

Integrity, Authentication and Non-Repudiation

Hash Function (MD5, SHA5), Message Authentication Code (MAC), Digital Signature (RSA, DSA Signatures), Biometric Authentication.

UNIT V

PKI Interface

Digital Certificates, Certifying Authorities, POP Key Interface, System Security using Firewalls and VPN's.

Smart Cards

Application Security using Smart Cards, Zero Knowledge Protocols and their use in Smart Cards, Attacks on Smart Cards

UNIT VI

Applications

Kerberos, Web Security Protocols (SSL), IPSec, Electronic Payments, E-cash, Secure Electronic Transaction (SET), Micro Payments, Case Studies of Enterprise Security (.NET and J2EE)

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security", 4th Edition. Pearson,. 2009.
2. Behrouz A Forouzan, "Cryptography and Network Security" , TMH, 2009

REFERENCE BOOKS

1. Joseph Migga Kizza, "A Guide to Computer Network Security", Springer, 2010
2. Dario Cataiano, "Contemporary Cryptology", Springer, 2010.

(CS214) SOFT COMPUTING

COURSE OUTCOMES

1. Understand the concepts soft computing and neural networks.
2. Analyze different genetic algorithms.
3. Understand the principles of neural networks.
4. Demonstrate the concept of fuzzy logic.
5. Understand the concept of neuro-fuzzy modeling
6. Analyze neuro-fuzzy modeling and fuzzy logic.

UNIT I

Introduction to Soft Computing and Neural Networks

Evolution of Computing Soft Computing Constituents From Conventional AI to Computational Intelligence-Machine Learning Basics.

UNIT II

Genetic Algorithms

Introduction to Genetic Algorithms (GA) –Applications of GA in Machine Learning-Machine Learning Approach to Knowledge Acquisition.

UNIT III

Neural networks

Machine Learning Using Neural Network, Adaptive Networks –Feed forward Networks – Supervised Learning Neural Networks–Radial Basis Function Networks-Reinforcement Learning

UNIT IV

Neural networks

Unsupervised Learning Neural Networks–Adaptive Resonance architectures – Advances in Neural networks.

UNIT V

Fuzzy Logic

Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems ,Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT VI

Neuro-Fuzzy Modeling

Adaptive neuro, Fuzzy Inference Systems, Coactive Neuro, Fuzzy Modeling, Classification and Regression Trees, Data Clustering Algorithms, Rule base Structure Identification, Neuro-Fuzzy Control, Case studies.

TEXT BOOKS

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "*Neuro-Fuzzy and Soft Computing*", Prentice-Hall of India, 2003.
2. George J. Klir and Bo Yuan, "*Fuzzy Sets and Fuzzy Logic-Theory and Applications*",Prentice Hall, 1995.

REFERENCE BOOKS

1. James A. Freeman and David M. Skapura, "*Neural Networks Algorithms, Applications, and Programming Techniques*", Pearson Edn., 2003.
2. Mitchell Melanie, "*An Introduction to Genetic Algorithm*", Prentice Hall, 1998.

(CS215) HUMAN COMPUTER INTERACTION

COURSE OUTCOMES

1. Explain the human components functions regarding interaction with computer
2. Define key terms used in interaction design
3. Implement Interaction design basics
4. Apply Design rules
5. Produce Implementation supports and use Evaluation techniques
6. Demonstrate Universal design.

UNIT I

Interaction Paradigms

Computing Environments, Analyzing Interaction Paradigms, Interaction Paradigms

Interaction Frameworks and Styles

Frameworks for Understanding Interaction, Coping with Complexity, Interaction Styles

UNIT II

Interaction Design Process

Iterative Design, User-Centered Design, Interaction Design Models, Overview of Interaction Design Models

Discovery: Discovery Phase Framework, Collection, Interpretation , Documentation

Design: Conceptual Design, Physical Design, Evaluation, Interface Design Standards, Designing the Facets of the Interface

UNIT III

Design Principles: Principles of Interaction Design, Comprehensibility, Learnability, Effectiveness/Usefulness, Efficiency/Usability, Grouping, Stimulus Intensity, Proportion, Screen Complexity, Resolution/Closure, Usability Goals

UNIT IV

Interaction Design Models Model Human Processor, Keyboard Level Model, GOMS, Modeling Structure, Modeling Dynamics, Physical Models

Usability Testing Usability, Usability Test, Design the Test, Prepare for the Test, Perform the Test, Process the Data

UNIT V

Interface Components: The WIMP Interface, Other Components

Icons Human Issues Concerning Icons, Using Icons in Interaction Design, Technical Issues Concerning Icons

Color The Human Perceptual System, Using Color in Interaction Design, Color Concerns for Interaction Design, Technical Issues Concerning Color

UNIT VI

Text Human Issues Concerning Text, Using Text in Interaction Design, Technical Issues Concerning Text

Speech and Hearing The Human Perceptual System, Using Sound in Interaction Design, Technical Issues Concerning Sound

Touch and Movement The Human Perceptual System, Using Haptics in Interaction Design, Technical Issues Concerning Haptics

TEXT BOOKS

1. Steven Heim, *The Resonant Interface: HCI Foundations for Interaction Design*, Addison-Wesley, 2007
2. J. Preece, Y. Rogers, and H. Sharp, *Interaction Design: Beyond Human-Computer Interaction*, Wiley & Sons, 2nd Ed., 2007

REFERENCE BOOKS

1. Ben Shneiderman , Catherine Plaisant, Designing the User Interface: Strategies for Effective Human-Computer Interaction, 5th edition, , Addison-Wesley, 2009.
2. J. Preece, Y. Rogers, and H. Sharp, *Interaction Design: Beyond Human-Computer Interaction*, Wiley & Sons, 2nd Ed., 2007

(CS216) DEEP LEARNING

COURSE OUTCOMES

1. Understand the fundamental principles, theory and approaches for learning with deep neural networks
2. Analyze the variations of deep learning (such convolutional and recurrent architectures), and their typical applications
3. Understand the key concepts, issues and practices when training and modeling with deep architectures; as well as have hands-on experience in using deep learning frameworks for this purpose
4. Implement basic versions of some of the core deep network algorithms
5. Analyze deep learning fits within the context of other ML approaches.
6. Analyze audio processing , image captioning and vision

UNIT I

Fundamentals of modern multi-layered neural networks.

UNIT II

Common forms of model architectures and primarily the algorithms.

UNIT III

Basics of neural networks, convolution networks, recurrent networks.

UNIT IV

Introduction to: dropout, batch normalization, types of hyper-parameter optimization,

UNIT V

Distributed and constrained computing variants.

UNIT VI

Applications in the area of audio processing and image captioning and vision

TEXT BOOKS

1. Reading list available via the UCL Library catalogue:

(CS217) SOFTWARE ARCHITECTURE AND DESIGN PATTERN

COURSE OUTCOMES

1. Understand the concepts software Architecture and architectural patterns.
2. Analyze different software architectures.
3. Understand envisioning architecture
4. Demonstrate the concepts of patterns.
5. Understand the concept of behavioral patterns
6. Analyze different patterns.

UNIT I

Envisioning Architecture

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

UNIT II

Envisioning Architecture

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

UNIT III

Analyzing Architectures

Architecture Evaluation, Architecture design decision making, ATAM, CBAM. Moving from one system to many Software Product Lines, Building systems from off the shelf components, Software architecture in future.

UNIT IV

Patterns

Pattern Description, Organizing catalogs, role in solving design problems, Selection and usage. Creational and Structural patterns Abstract factory, builder, factory method, prototype, singleton, adapter, bridge, composite, façade, flyweight.

UNIT V

Behavioral patterns

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

UNIT VI

Case Studies

A-7E – A case study in utilizing architectural structures, The World Wide Web - a case study in interoperability, Air Traffic Control – a case study in designing for high availability, Celsius Tech – a case study in product line development,

TEXT BOOKS

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

REFERENCE BOOKS

1. Beyond Software architecture, Luke Hohmann, Addison wesley, 2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001

(CS220) BIG DATA ANALYTICS LAB

COURSE OUTCOMES

1. Demonstrate the hadoop ecosystem and its applications for data analytics.
2. Acquire skills in MapReduce analytics using Hadoop.
3. Operate the big data environment and manage data without SQL.
4. Identify the current applications that need big data usage for analysis.
5. Summarize the importance of hadoop for business analytics.
6. Acquire programming skills in hadoop echo system.

LAB EXERCISES

1. i. Perform setting up and Installing Hadoop in its two operating modes: Pseudo distributed, fully distributed.
   ii. Use web based tools to monitor your Hadoop setup.
2. i. Implement the following file management tasks in Hadoop: Adding files and directories Retrieving files Deleting files ii) Benchmark and stress test an Apache Hadoop cluster
3. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm. Find the number of occurrence of each word appearing in the input file(s) Performing a MapReduce Job for word search count (look for specific keywords in a file)
4. Stop word elimination problem: Input: o A large textual file containing one sentence per line o A small file containing a set of stop words (One stop word per line) Output: o A textual file containing the same sentences of the large input file without the words appearing in the small file.
5. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented. Data available at: https://github.com/tomwhite/hadoopbook/tree/master/input/ncdc/all. Find average, max and min temperature for each year in NCDC data set? Filter the readings of a set based on value of the measurement, Output the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.
6. Purchases.txt Dataset Instead of breaking the sales down by store, give us a sales breakdown by product category across our entire stores o what is the value of total sales for the following categories? Toys Consumer Electronics Find the monetary value for the highest individual sale for each separate store. What are the values for the following stores? Reno Toledo Chandler. Find the total sales value across all the stores, and the total number of sales.
7. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your Data.
8. Write a Pig Latin scripts for finding TF-IDF value for book dataset (A corpus of eBooks Available at: Project Gutenberg)
9. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, Functions, and indexes.
10. Install, Deploy & configure Apache Spark Cluster. Run apache spark applications using Scala.
11. Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together. Write a single Spark application that: Transposes the

original Amazon food dataset, obtaining a PairRDD of the type: → o Counts the frequencies of all the pairs of products reviewed together; Writes on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency.

(CS221) CRYPTOGRAPHY AND NETWORK SECURITY LAB

COURSE OUTCOMES

1. Explore to the different system attacks and viruses.
2. Apply the concepts of private and public encryption techniques.
3. Explain the key management and Authentication services.
4. Explain the IP security and web security concepts.
5. Explain and generation the hash function using different techniques.
6. Design an effective intrusion detection systems and trusted systems through firewall architecture.

1. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a Java program to perform encryption and decryption using the following algorithms
   a. Ceaser cipher b. Substitution cipher c. Hill Cipher
4. Write a C/JAVA program to implement the DES algorithm logic.
5. Write a C/JAVA program to implement the Blowfish algorithm logic.
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Write the RC4 logic in Java Using Java cryptography; encrypt the text "Hello world" using Blowfish. Create your own key using Java key tool.
8. Write a Java program to implement RSA algorithm.
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
11. Calculate the message digest of a text using the MD5 algorithm in JAVA.

(CS221) SOFT COMPUTING LAB

COURSE OUTCOMES

1. Understand the concepts soft computing and neural networks.
2. Analyze different genetic algorithms.
3. Understand the principles of neural networks.
4. Demonstrate the concept of fuzzy logic.
5. Understand the concept of neuro-fuzzy modeling
6. Analyze neuro-fuzzy modeling and fuzzy logic.

1. Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights.
2. Create a simple ADALINE network with appropriate no. of input and output nodes. Train it using delta learning rule until no change in weights is required. Output the final weights.
3. Train the auto correlator by given patterns: A1=(-1,1,-1,1), A2=(1,1,1,-1), A3=(-1, -1, -
4. 1, 1). Test it using patterns: Ax=(-1,1,-1,1), Ay=(1,1,1,1), Az=(-1,-1,-1,-1).
5. Train the hetrocorrelator using multiple training encoding strategy for given patterns:
6. A1=(000111001) B1=(010000111), A2=(111001110) B2=(100000001), A3=(110110101)
7. B3(101001010). Test it using pattern A2.
8. Implement Union, Intersection, Complement and Difference operations on fuzzy sets.
9. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max min composition on any two fuzzy relations.
10. Solve Greg Viot's fuzzy cruise controller using MATLAB Fuzzy logic toolbox.
11. Solve Air Conditioner Controller using MATLAB Fuzzy logic toolbox
12. Implement TSP using GA

(CS223) MOBILE APPLICATION AND SERVICES

COURSE OUTCOMES

1. Understand technology and business trends impacting mobile applications
2. Analyze characterization and architecture of mobile applications.
3. Understand enterprise scale requirements of mobile applications.
4. Designing mobile applications using one application development framework
5. Understand the concept of geographical location:
6. Develop mobile applications using one application development framework.

UNIT I

Introduction to Android platform: virtual machine, development tools, Java packages, emulators, services

UNIT II

Structure and lifecycle of an application for Android system. Graphical User Interface: preparing containers and components, management of component layout, event handling

UNIT III

Processing of application resources, content providers, file system. Data persistence: backups, databases

UNIT IV

Application security and permissions: security architecture, application signing, user identification, file access, declaration and verification of permissions. Network communication and internet applications

UNIT V

Wi-Fi connections. Multimedia, 2D and 3D graphics processing. Simple game programming

UNIT VI

Geographical location: use of GPS data. Bluetooth communication: basics, permissions, Bluetooth device discovery, device connectivity as a client, server creation, connection management. Deployment of applications: localisation of applications, application signing, version management, licences, preparing for distribution

TEXT BOOKS:

1. Reto Meier, "Professional Android 4 Application Development", Wrox Publication.
2. Pradeep Kothari, "Android Application Development (With Kitkat Support) Black Book", Dream Tech Press, 2014.

REFERENCE BOOK:

1. Rick Boyer and Kyle Mew, "Android Application Development Cookbook", 2nd Edition, Packt Publishing.

(CS224) NATURAL LANGUAGE PROCESSING

COURSE OUTCOMES

1. Understand the mathematical and linguistic concepts of NLP.
2. Design and implement algorithms for NLP problems
3. Learn about major NLP issues and solutions
4. Become agile with NLP programming
5. Asses NLP problems
6. Get the gist of relevant research papers

UNIT I

Natural Language Processing – Linguistic Background -– Mathematical Foundations - Morphological Analysis-Tokenization- Stemming-Lemmatization – Boundary determination.

UNIT II

Reading unstructured data - Representing text data - Part of speech tagging – Syntactic representation - Text similarity - Word Net based similarity- Shallow parsing –Semantic representation.

UNIT III

Information retrieval and Information extraction - Named Entity Recognition – Relation Identification-Template filling.

UNIT IV

Language model - Probabilistic Models - n-gram language models- Hidden Markov Model-Topic Modelling

UNIT V

Graph Models -Feature Selection and classifiers -Rule-based Classifiers - Maximum entropy classifier – Clustering-Word and Phrase-based Clustering.

UNIT VI

Tools – Natural Language Tool kit, Apache OpenNLP. Applications of Text Analytics – Applications in Social media - Life science - Legal Text–Visualization -Case studies.

TEXT BOOKS:

1. Daniel Jurafsky and James H.Martin, “Speech and Language Processing", Pearson Education (Singapore) Pvt. Ltd., 2002.
2. Christopher D. Manning and Hinrich Schutze, “Foundations of Statistical Natural Language Processing”, MIT Press, 1999.

REFERENCES

1. Steven Struhl, “Practical Text Analytics: Interpreting Text and Unstructured Data for Business Intelligence”, Kogan Page, 2015.
2. Matthew A. Russell, “Mining the Social Web”, O'Reilly Media, 2013.
3. Steven Bird, Ewan Klein and Edward Loper, “Natural Language Processing with Python”, 1stEdition, O'Reilly Media, 2009.

(CS225) WEB SERVICES AND SERVICE ORIENTED ARCHITECTURE

COURSE OUTCOMES

1. Understand the concepts of web services
2. Analyze web service architecture.
3. Understand the concepts of XML.
4. Demonstrate registering and discovering services
5. Understand the concept of creation of SOA compliant web service using various technologies:
6. Understand the basics of .NET and J2EE.

UNIT I

Evolution and Emergence of Web Services – Evolution of distributed computing. Core distributed computing technologies – client/server, CORBA, JAVA RMI, Micro Soft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA). Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services.

UNIT II

Web Service Architecture – Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, basic steps of implementing web services. Describing Web Services – WSDL introduction, non functional service description, WSDL1.1 Vs WSDL 2.0, WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type, limitations of WSDL.

UNIT III

Brief Over View of XML – XML Document structure, XML namespaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation. SOAP : Simple bject Access Protocol, Inter-application communication and wire protocols, SOAP as a messaging protocol,Structure of a SOAP message, SOAP envelope, Encoding, Service Oriented Architectures, SOA revisited, Service roles in a SOA, Reliable messaging, The enterprise Service Bus, SOA Development Lifecycle, SOAP HTTP binding, SOAP communication model, Error handling in SOAP.

UNIT IV

Registering and Discovering Services : The role of service registries, Service discovery, Universal Description, Discovery, and Integration, UDDI Architecture, UDDI Data Model, Interfaces, UDDI Implementation, UDDI with WSDL, UDDI specification, Service Addressing and Notification, Referencing and addressing Web Services, Web Services Notification.

UNIT V

SOA and web services security considerations, Network-level security mechanisms, Application-level security topologies, XML security standards, Semantics and Web Services, The semantic interoperability problem, The role of metadata, Service metadata.

UNIT VI

Overview of .NET and J2EE, SOA and Web Service Management, Managing Distributed System, Enterprise management Framework, Standard distributed management frameworks, Web service management, Richer schema languages, WS-Metadata Exchange.

TEXT BOOKS

1. Michael P. Papazoglou, "Web Services & SOA Principles and Technology", Second Edition.
2. R. Nagappan, R. Skoczylas, R.P. Sriganesh "Developing Java Web Services", Wiley India.

REFERENCE BOOKS

1. S. Chatterjee, J. Webber, "Developing Enterprise Web Services", Pearson Education.
2. S. Graham and others, "Building web Services with Java", 2nd Edition, Pearson Education.

(OE208) 3D PRINTING

COURSE OUTCOMES

1. Understand public reports of 3D printing in the media
2. Develop the access specific resources needed to 3D print an object; include CAD software, CAD libraries, additional CAD and printing web tutorials, and 3D printing service providers.
3. Develop new three-dimensional object files from scratch.
4. Prepare and optimize those files for 3D printing
5. understand open, view, manipulate and edit three dimensional object files
6. Analyze clearly what makes 3D printing unique from other traditional methods

UNIT I

Loading Fusion 360 ,The CAD Environment Best Practices for Running CAD, Common CAD Files Types, CAD Libraries.

UNIT II

A Short History of Digital Manufacturing, Interactive Exercise: Design for 3D Print, Fusion 360 Modeling, Sketching, Extruding, Collaborating on Files.

UNIT III

Fusion 360 Sculpting, Moving between Environments, Matching Imported Geometry, Working with Meshes, Scanning Tools, Editing Scanned Files, Fixing Scan Bugs.

UNIT IV

Optimizing for Print, Making Assemblies, Moving and Aligning Parts, Joints ,Motion Studies.

UNIT V

Fasteners, Finishes, Advanced Modeling Tools, Working with service providers, Optimizing Files for Different Methods , Debugging Print.

UNIT VI

CAD Rendering , Mechanical Drawings, Photographing Parts.

TEXT BOOKS

1. Fabricated: The New World of 3D Printing by Hod Lipson and Melba Kurman
2. Design and Modeling for 3D Printing by Matthew Griffin

REFERENCES

1. http://fusion360.autodesk.com
2. http://www.123dapp.com/Gallery/content/all

(OE209) CYBER LAWS

COURSE OUTCOMES

1. Discuss and evaluate the current trends and technologies such as e-commerce and egovernance with reference to free market economy.
2. Sketch the importance of digital signature in electronic records.
3. Formulate the importance and role of cyberspace laws and cyber crimes.
4. Summarize about the IT act in India and generate the new IT acts for current cyber space.
5. Compare and contrast cyber laws in India and cyber laws in council of Europe.
6. Describe the importance role of electronic evidence in cyber-crimes.

UNIT I

Internet, E-Commerce and E-Governance with reference to Free Market Economy: Understanding Computers, Internet and Cyber laws, Conceptual Framework of E-commerce: E-Governance, the role of Electronic Signatures in E-commerce with Reference to Free Market Economy in India.

UNIT II

Law Relating to Electronic Records and Intellectual Property Rights in India: Legal aspects of Electronic records / Digital signatures, The roles and regulations of Certifying Authorities in India, Protection of Intellectual Property Rights in Cyberspace in India.

UNIT III

International Efforts Relating to Cyberspace Laws and Cyber Crimes: International efforts related to Cyber laws, Council of Europe (COE) convention on Cyber Crimes.

UNIT IV

Penalties, Compensation and Offences Under the Cyberspace and Internet in India: Penalties, Compensation and Adjunction of violations of provisions of IT Act and Judicial review, some important offences under the Cyberspace law and the Internet in India, Other offences under the Information Technology Act in India.

UNIT V

Miscellaneous Provisions of IT Act and Conclusions: The role of Electronic Evidence and miscellaneous provisions of the IT Act.

UNIT VI

Cyber Crimes & Legal Framework, Cyber Crimes against, Individuals, Institution and State, Hacking, Digital Forgery Cyber Stalking/Harassment Cyber Pornography Identity Theft & Fraud Cyber terrorism Cyber Defamation Different offences under IT Act, 2000

TEXT BOOK

1. Harish Chander, “Cyber Laws and IT Protection”, PHI, 2012.

REFERENCE BOOKS

1. George Kostopoulos, “Cyberspace and Cyber Security”, Auerbach Publications, 2012.

2. Albert Marcella, Jr., Doug Menendez, “Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes”, Auerbach Publications, 2nd Edition, 2007.

(OE210) DISASTER MANAGEMENT

COURSE OUTCOMES

1. Identify and recognize the cause and effect of disaster.
2. Design management cycle to minimize the risk.
3. Distinguish natural and manmade disaster and preparedness in mitigating the disaster.
4. Evaluate the disaster management teams capacity building, community based disaster management.
5. Estimate the damages and justify the rehabilitation and reconstruction activity.
6. Create capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insights into the potential and limitation of science, its role in society and peoples responsibility for how it is used.

UNIT I

Introduction: Overview of Disaster Management(DM) - Concepts and definitions - Disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation - Disaster classification- natural, manmade.

UNIT II

Natural Disasters: Meaning and nature of natural Disasters, their types and effects- floods, Drought, Cyclone, Earth Quakes, Tsunami, Volcanoes, Coastal erosion, Climate Change- Global warming, Sea level rise, Ozone depletion.

UNIT III

Manmade Disasters: Nuclear disaster, Chemical disaster, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, Deforestation, Industrial waste water pollution, Road accidents, Rail accidents, Air accidents, Sea accidents.

UNIT IV

Disaster Risk Reduction: Effects to migrate natural disaster at national and global level - International strategy for disaster reduction- Concept of disaster management - National disaster management framework - Financial agreements - Role and responsibilities of NGO's - Community based organization and media Central - State - District and local administration - Armed forces in disaster response- Police and other organizations.

UNIT V

Project Work: Project work for students to understand vulnerabilities and to work in reducing disaster risks and to build a culture of safety. E.g. remote sensing and GIS/GPS for disaster management, dams, urbanization. Projects must be conceived creatively based on the geographic location and hazard profile of a region.

UNIT VI

Case Studies - Some examples could be- identifying how a large dam, road/ highway or an embankment or the location of an industry affects local environment, resources or how displacement of large sections of people creates severe vulnerabilities, remote sensing and GIS/GPS etc. may be mapped by student project work.

TEXT BOOKS

1. Pradepe Sahni, “Disaster Mitigation: Experiences and Reflections”, 2013.
2. R.B. Singh, “Environmental Geography”, Heritage Publishers, New Delhi, 1990.

REFERENCE BOOKS

1. R.B. Singh, “Disaster Management”, Rawat Publications, New Delhi, 2000.
2. H.K. Gupta, “Disaster Management”, Universities Press, India, 2013.
3. Author Name “Title of Book” Publisher name, Edition, year.

(OE211) ROBOTICS

COURSE OUTCOMES

1. Understand the basics of robot
2. Analyze End effectors and robot controls
3. Demonstrate Robot Transformations and Sensors
4. Demonstrate Micro/Nano robotic systems
5. Understand Robot cell design and applications
6. Analyze Micro/Nano robotic systems

UNIT I

Introduction

Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems Specifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems Hydraulic, Pneumatic and Electric system.

UNIT II

End Effectors and Robot Controls

Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems

UNIT III

End Effectors and Robot Controls

Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.

UNIT IV

Robot Transformations and Sensors

Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation- Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors.

UNIT V

Robot Cell Design and Applications

Robot work cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions-Robot applications ,Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot.

UNIT VI

Micro/Nano Robotics System

Micro/Nanorobotics system overview-Scaling effect-Top down and bottom up approach-Actuators of Micro/Nano robotics system-Nano robot communication techniques-Fabrication of

micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nanorobot in targeted drug delivery system.

TEXT BOOKS

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012

REFERECES

1. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, Robotics Engineering an Integrated Approach, Phi Learning., 2009.
2. Francis N. Nagy, Andras Siegler, Engineering foundation of Robotics, Prentice Hall Inc.1987.

(OE212) BLOCK CHAIN TECHNOLOGY

COURSE OUTCOMES

1. Understand Distributed Ledger Technologies and how they work
2. Gain knowledge of Bitcoin.
3. Gain knowledge of Ethereum.
4. Gain knowledge of Hyperledger fabric.
5. Differentiate Bitcoin, Ethereum and Hyperledger fabrics mechanisms.
6. Understandings of current trends of Blockchain, and ability to imagine its usecases and future.

UNIT I

Introduction to Block Chain: What is Blcokchain, Public Ledgers, Blockchain as public ledgers, Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, The chain and the longest chain cryptocurrency to blockchain 2.0, permissioned model of blockchain, cryptographic hash function, properties of a has function, hash pointer and merkle tree.

Crypto primitives and bitcoin: Digital signature, public key, cryptography, a basic cryptocurrency, creation of coins, payments and double spending, forth – the precursor for bitcoin scripting, bitcoin scripts, bitcoin P2P Network, transaction in bitcoin network, block mining, block propagation and block relay. Why consensus, distributed consensus in open environments, consensus in a bitcoin network.

Consensus: Bitcoin consensus, proof of work (PoW) – basic introduction, hashcash PoW, Bitcoin PoW, attacks on PoW and the monopoly problem, proof of stake proof of burn and proof of elapsed time, the life of a bitcoin miner, mining difficulty, mining pool, permissioned model and use cases, design issues for permissioned blockchains, execute contracts, state machine replication, consensus models for permissioned blockchain, distributed consensus in closed environment, paxos.

UNIT II

Permissioned Blockchain: RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems, practical byzantine fault tolerance, three phase commit, view change, Concepts and benefits of blockchain for enterprise, the hyperledger project, actors in a blockchain, components in blcokchain design, ledger in blockchain,

Hyperledger Fabric: fabric architecture, transaction flow in fabric, ordering services, channels in fabric, fabric peer and certificate authority, Organization and Consortium Network, Membership Service Provide, Transaction Signing, Steps for network setup, Endorsement policies, Setup Blockchain networks, Experience blockchain network as different organizations, Deploy a simple application on IBM cloud.

UNIT III

Fabric Demo: Deploy a simple application on IBM Cloud, Marbles (asset transfer), Example smart contract code, client SDK code, Perform blockchain transactions using a cool UII, Install and instantiate marbles chaincode, Run application on the network you created, Goals of Hyperledger Composer, Key concepts for the business service provide, Key development concepts – model files, Access control lists, transaction processors, business network definition,

Key concepts for administrators, how composer maps to fabric chaincode, deploy a simple composer application on IBM Cloud

Blockchain Use Cases-Finance: Sample use cases by industry, Business Problems and Participants, Communities in Blockchian network, Cross border payments, Steller and Ripple protocols, Project Ubin, Know Your Customer (KYC), Privacy Consents, Mortgage over Blockchain, Blockchain enabled Trade, We. Trade-Trade Finance Network, Supply Chain Financing, Blockchain for Trade Logistics, Global Trade Digitization, Blockchain for Container Management.

UNIT IV

Blockchain Use Cases – Industry: Food Safety and Food Traceability, Supply Chain Orchestration, Everledger, The Diamond Lifecycle, Addressing Supply Chain Fraud through Blockchain, Blockchain in Healthcare, Blockchain in Energy Markets Blockchian in Media, Blockchain and Government, Preventing Cyber Crime through blockchain, Government Use-cases, Auditing and compliance, Blockchian for Defense, e-Estonia:A Case Study.

Blockchain in Government and Blockchain Security: Digital Identity and Single Sign On (SSO) Principles of Digital Identity Management, Why Blockchain, Indy for Digital Identity Management, How Indy Works, Blockchain for Tax Payments, Blockchain for Managing Land Registry Records, Security Properties, Security Considerations for Blockchain, Intel SGX, Identities and Policies, Membership and Access Control, Blockchain Crypto Service Providers

UNIT V

Security and Research Aspects: Privacy in a Blockchain System, Privacy through Fabric Channels, Smart Contract Confidentially, Side DB, Motivation, Side DB overview, PoW vs BFT Consensus, Consensus Finally Consensus Scalability, Fairness and Scalability in Nakamoto Consensus, Bitcoin-NG: Working Principles Key Blocks and Microblocks, Authority and Digital Signature, Collective Signing (CoSi) Shnoor Multisignature and BLS Signature

Research Aspects in Blockchain: Strong non-probabilistic consistency, BFT over Bitcoin – increasing scalability, Byzcoin Design and Performance, Strong Synchrony vs Weak Synchrony, Avoiding Forks, Transaction Neutrality and Frictionless Evolution, Asynchronous networks as network fault, Cross fault Tolerant (XFT) architecture, XPaxos, Multi-Party Computation (MPC), Fairness in MPC, MPC over Blockchain ensuring fairness, Big Data and Big Network, Why Blockchain for Big data application aspects, BigChain DB-The Blockchain Database

UNIT VI

AI, Blockckahin and Big Data: Data analysis over Blockchain, Logic over Blockchain network, Inferring Decisions through AI, Architecture and concepts, Smart contracts, Ecosystem, Motivation and concepts, Architecture Transaction processing and consensus, Key Features, Transactions and flows, Consensus and architecture details, Final Remarks.

TEXT BOOKS

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos
2. Blockchain by Melanie Swa, O'Reilly

REFERENCES

3. Hyperledger Fabric – https://www.hyperledger.org/projects/fabric

4. Zero to Blockchain – An IBM Redbooks course, by Bob Dill, David Smits – http://www.redbooks.ibm.com/Redbooks.nsf/RedbooksAbstracts/crse0401.html

(OE213) RENEWABLE ENERGY RESOURCES

COURSE OUTCOMES

1. Outline the energy demand of world, nation and available resources to fulfill the demand.
2. Categorize the technologies that are used to harness the power of solar energy
3. Illustrate the applications of solar energy.
4. Identify the importance of wind energy and biomass energy.
5. State the importance of geothermal energy and ocean energy.
6. Define the principles of direct energy conversion.

UNIT I

Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT II

Solar Energy Storage: Different methods, Sensible, latent heat and stratified storage, solar ponds, Solar Applications.

UNIT III

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, minihydel power plants, and their economics.

UNIT IV

BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking.

UNIT V

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

UNIT VI

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, Figure of merit, materials, applications, Fuel cells, principles, Faraday's laws, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS

1. JA Duffie and WA Beckman, "Solar Energy - Thermal Processes", John Wiley, 2001.
2. Tiwari and Ghosal, "Renewable Energy Resources", 1st Ed., Narosa Publications, 2007.

REFERENCE BOOKS

1. Sukhatme, “Solar Energy”, 3rd Ed., Tata McGraw Hill, 2008.
2. Ashok V Desai, “Non-Conventional Energy”, 2nd Ed., New Age International, 2008.
3. B H Khan, “Non Conventional Energy Sources”, 1st Ed., Tata McGraw Hill, 2009.
4. G D Rai, “Non-Conventional Energy Sources”, 2nd Ed., Standards Publishers, 2004.