Course Structure
for
Pre Ph.D. Course Work
Session: 2017-18

DEPARTMENT OF CSE
DIT University Dehradun

Approved by the Academic Council at its 6th Meeting held on 13.05.2017

Pre Ph.D (CSE)

Course Category	Course Code	Course Title	L	T	P	Credit
UC	MS621	Research Methodology	4	0	0	4
DE		Elective -1	4	0	0	4
DE		Elective -2	4	0	0	4
DIS	DS001	Seminar	0	0	2	1
		Total				**13**

List of Electives

Elective – I& Elective II	
CS651	Digital Image Processing
CS652	Cryptography
CS653	Advanced Computer Networks
CS654	Neural Networks & Neuro Fuzzy Systems
CS751	Mobile And Ad-Hoc Networks
CS752	Advanced Datawarehousing& Mining
CS753	Distributed Systems
CS611	Data Structures & Algorithms
CS612	Fuzzy Logic & Genetic Algorithms
CS711	Information & Coding Theory

Note : Apart from above listed Elective courses, Research Scholar may choose any course across departments being offered at PG level, if it is required/suggested by the Research Committee.

Pre Ph.D (CSE)

Subject Code	MS621	Subject Title	Research Methodology					
LTP	4 0 0	Credit	4	Subject Category	UC	Year	1st	Semester	I / II

UNIT – I

Fundamentals of Research: Defining research, Objectives of research, types, research process, deductive and inductive reasoning;

Identifying and formulating a research problem, Literature review: Search for existing literature (World Wide Web, Online data bases), Review the literature selected (Case studies, review articles and Meta-analysis), Develop a theoretical and conceptual framework, Writing up the review,

Definition of variables: Concepts, indicators and variables, Types of variables, Types of measurement scales, Constructing the Hypothesis- Null(Research) and alternative, one-tailed and two-tailed testing, errors in testing. Ethical and Moral Issues in Research, Plagiarism, tools to avoid plagiarism – Intellectual Property Rights – Copy right laws – Patent rights

UNIT – II

Research Design: Design of Experiments: Research Designs -Exploratory, Descriptive and Experimental, Experimental designs- Types of Experimental Designs

UNIT – III

Sampling, Sampling distribution, and Data Collection: Sampling distribution, Normal and binomial distribution, Reasons for sampling, sampling technique, sampling errors. Sources of Data-Primary Data, Secondary Data, Data Collection methods

UNIT – IV

Statistical Data Analysis: Descriptive and inferential statistical analysis. Testing of hypothesis with Z-test, T-test and its variants, Chi-square test, ANOVA, Correlation, Regression Analysis, Introduction to data analysis data using SPSS20.0

UNIT – V

Research Report: Writing a research report- Developing an outline, Formats of Report writing, Key elements- Objective, Introduction, Design or Rationale of work, Experimental Methods, Procedures, Measurements, Results, Discussion, Conclusion, Referencing and various formats for reference writing of books and research papers, Writing a Research Proposal.

Books Recommended:

1. Ganesan R, Research Methodology for Engineers , MJP Publishers, Chennai. 2011
2. C.R.Kothari, "Research Methodology", 5th edition, New Age Publication,
3. Cooper, "Business Research Methods", 9th edition, Tata McGraw hills publication
4. Walpole R.A., Myers R.H., Myers S.L. and Ye, King: Probability & Statistics for Engineers and Scientists, Pearson Prentice Hall, Pearson Education, Inc. 2007.
5. Anderson B.H., Dursaton, and Poole M.: Thesis and assignment writing, Wiley Eastern 1997.
6. Bordens K.S. and Abbott, B.b.: Research Design and Methods, McGraw Hill, 2008.
7. Morris R Cohen: An Introduction to logic and Scientific Method (Allied Publishers) – P 197-222; 391–403

Pre Ph.D (CSE)

Subject Code	CS651	Subject Title	DIGITAL IMAGE PROCESSING					
LTP	4 0 0	Credit	4	Subject Category	DE	Year	1st	Semester	I / II

OBJECTIVE

To learn and understand the fundamentals of digital image processing, and various image Transforms, Image Enhancement Techniques, Image restoration Techniques and methods, image compression and Segmentation used in digital image processing.

Unit 1: **12Hrs**

Introduction and Fundamentals

Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.

Image Enhancement in Spatial Domain

Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions:Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian.

Unit 2: **10Hrs**

Image Enhancement in Frequency Domain

Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Lowpass Filters; Sharpening Frequency Domain Filters – Gaussian Highpass Filters; Homomorphic Filtering.

Image Restoration

A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering – Bandpass Filters; Minimum Mean-square Error Restoration.

Unit 3: **10Hrs**

Color Image Processing

Color Fundamentals, Color Models, Converting Colors to different models, Color Transformation, Smoothing and Sharpening, Color Segmentation.

Morphological Image Processing: Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening

Unit-4: **10Hrs**

Registration:

Introduction, Geometric Transformation – Plane to Plane transformation, Mapping, Stereo Imaging – Algorithms to Establish Correspondence, Algorithms to Recover Depth

Segmentation: Introduction, Region Extraction, Pixel-Based Approach, Multi-level Thresholding, Local Thresholding, Region-based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresholding, Edge Detector Performance, Line Detection, Corner Detection.

Unit-5: **10 Hrs**

Feature Extraction: Representation, Topological Attributes, Geometric AttributesDescription,Boundary-based Description, Region-based Description and Relationship.

Object Recognition: Deterministic Methods, Clustering, Statistical Classification, Syntactic Recognition, Tree Search, Graph Matching

COURSE OUTCOME:

At the end of the coursethe student will learn:

CO1. The fundamentals of digital image processing
CO2. Image transform used in digital image processing
CO3. Image enhancement techniques used in digital image processing
CO4. Image restoration techniques and methods used in digital image processing
CO5. Image compression and Segmentation used in digital image processing

TEXT BOOKS

1. Rafael C. Gonzalvez and Richard E.Woods,Digital Image Processing 3rd Edition , PearsonEducation,2016.

REFERENCES

1. R.J. Schalkoff. ,Digital Image Processing and Computer Vision ,John Wiley and Sons, NY,1989
2. A.K. Jain. , Fundamentals of Digital Image Processing, ,Prentice Hall, Upper Saddle River, NJ,2002(second edition)

Pre Ph.D (CSE)

Subject Code	CS652	Subject Title	CRYPTOGRAPHY						
LTP	4 0 0	Credit	4	Subject Category	DE	Year	1st	Semester	I / II

OBJECTIVE

Security attacks, mechanisms, and services.Network security and access security models.Overview of secret-key and public-key cryptography.Authentication protocols and key management.Network security practice. Email security. IP security and web security.Intrusion detection and prevention systems.Firewalls and virtual private networks. Wireless network security.

Unit 1: **12 Hrs**

Introduction to Security in Networks, Characteristics of Networks, Intrusion, Kinds of security breaches, Plan of attack, Points of vulnerability, Methods of defense , Control measures , Effectiveness of controls .

Unit 2: **10 Hrs**

Basic encryption and decryption, Encryption techniques, Characteristics of good encryption Systems, Secret key cryptography, Data Encryption Standard, International Data Encryption Algorithm, Advanced Encryption Standard.

Unit 3: **10 Hrs**

Public Key encryptions, Introduction to number theory, RSA algorithm, Diffie-Hellman, Digital Signature standard, Elliptic Curve cryptography, Digital signatures and authentication Trusted intermediaries, Security handshake pitfalls, Hash and MAC algorithms, Security standards, Kerberos.X.509AuthenticationService

Unit-4: **10 Hrs**

Secure sockets, IPsec overview, IP security architecture, IPsec-Internet Key Exchanging (IKE) , IKE phases ,encoding , Internet security ,Threats to privacy ,Packet sniffing, Spoofing , Web security requirements , Real Time communication security .

Unit-5: **10 Hrs**

Secret Sharing Schemes, The Shamir Threshold Scheme, Access Structure and General Secret key sharing, Information Rate and Construction of Efficient Schemes, Multicast Security and Copyright production-Multicast Security, Broadcast Encryption ,Multicast Rekeying, Copyright Protection ,Tracing Illegally Redistribution keys.

COURSE OUTCOME:

At the end of the course, the student will learn:

CO1. Have internalized the fundamental notions of threat, vulnerability, attack and countermeasure.

CO2. Able to identify the security goals of an information system, point out contradictory goals and suggest compromises.

CO3. Have a theoretical understanding of the principles underlying cryptography and cryptanalysis and have a technical understanding of the main cryptographic concepts and technologies available today, including symmetric and asymmetric encryption, hashing, and digital signatures.

CO4. Understand the purpose of security protocols and be witness to the difficulties of their verification.

CO5. Understand how malicious code functions (e.g., viruses), what the vulnerabilities that make propagation possible (e.g., buffer overflows), and what methods and practices are available for mitigation (e.g., the Common Criteria).

CO6. Explain the main authorization mechanisms in an operating system

TEXT BOOKS

1.William Stallings, “Cryptography and Network Security: Principles and Standards”, Prentice Hall India, 3rd Edition, 2003.

2.Charlie Kaufman, Radia Perlman and Mike Speciner, “Network Security: Private

3.Communication in a public world”, Prentice Hall India, 2nd Edition, 2002.

REFERENCES

1.Charles P. Pleeger, “Security in Computing”, Pearson Education Asia, 5th Edition, 2001.

2.William Stallings, “Network Security Essentials: Applications and standards”, Person Education Asia, 2000.

Pre Ph.D (CSE)

Subject Code	CS653	Subject Title	ADVANCED COMPUTER NETWORKS					
LTP	4 00	Credit	4	Subject Category	DE	Year	1st	Semester	I / II

OBJECTIVE

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

Unit 1: **12 Hrs**

Network Layer design Issues, IPv4, IPv6, Shortest Path Routing, Distance Vector Routing, Flooding, Hierarchical Routing, Broadcast Routing, Multicast Routing.

Unit 2: **10 Hrs**

Wireless Networks, GSM Architecture, CDMA, Mobility in networks, Handoffs.Mobile IP- IP Packet Delivery, Agent Discovery, Registration, Tunneling and Encapsulation.

Unit 3: **10 Hrs**

Mobile TCP- Traditional TCP (Congestion Control, Slow Start, Fast Retransmit/Fast Recovery), Indirect TCP, Snooping TCP, Mobile TCP, Selective Retransmission, Transaction Oriented TCP.

Unit-4: **10 Hrs**

Wireless LAN- Infrared Vs Radio Transmission, Infrastructure and Ad-hoc Network, IEEE 802.11-System Architecture, Protocol Architecture, Physical Layer, Bluetooth.

Unit-5: **10 Hrs**

IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management, SSL.

COURSE OUTCOME:

At the end of the coursethe student will learn:

CO1. To master the terminology and concepts of the OSI reference model and the TCP-IP Reference model.

CO2. To master the concepts of protocols, network interfaces, and Design/performance issues in local area networks and wide area networks,

CO3. To be familiar with wireless networking concepts,

CO4. To be familiar with contemporary issues in networking technologies,To be familiar with network tools and network programming

TEXT BOOKS

1. JochenSchiller"Mobile "Communications", 2008(second edition)
2. Andrew S. Tanenbaum ,"Computer Networks," Pearson Education, fifth edition

REFERENCES

1. Forouzan, B.A., Data communication and Networking, McGraw Hill (2006) (fouth edition)

Pre Ph.D (CSE)

Subject Code	CS654	Subject Title	NEURAL NETWORKS & NEURO FUZZY SYSTEMS						
LTP	4 0 0	Credit	4	Subject Category	DE	Year	1st	Semester	I / II

OBJECTIVE

It deals with Introduction and different architectures of neural network and with the Application of Neural Networks.

Unit 1: **12 Hrs**

Introduction: Biological neural system, Artificial Intelligent Systems, Modeling human performance. Uncertain & incomplete knowledge, Expert Systems Vs Neural Networks.

Unit 2: **10 Hrs**

Foundations for connectionist networks. Architecture, Activation functions, Characteristics of Neural Networks, McCulloch-Pitts Neurons, Liner Separability

Unit 3: **10 Hrs**

Perceptron learning, Pattern Classification. Hebb Rule. Adaline.Madaline.Delta Rule.Back propagation learning, Competitive learning, Hebbian learning, BAMs.

Unit-4: **10 Hrs**

Supervised and Unsupervised learning. Reinforcement learning, Kohonen Self Organizing Maps, Applications of SOMs ,Adaptive Resonance Theory, Neural Network Applications.

Unit-5: **10 Hrs**

Neuro-Fuzzy Systems: Types of Fuzzy Neural Nets, Neural components in a Fuzzy System Fuzzy-ANN Contoroller, Support Vector Machines, Appliactions of SVMs.

COURSE OUTCOME:

At the end of the coursethe student will learn:

- **CO1.** The student will be able to obtain the fundamentals and types of neural networks
- **CO2.** The student will have a broad knowledge in developing the different algorithms for neural networks.
- **CO3.** Student will be able analyze neural controllers
- **CO4.** Student will be able to determine different methods of Deffuzification

TEXT BOOKS

1. Simon Haykin, “Neural Networks : A Comprehensive Foundation” , Prentice Hall (2nd edition)2002
2. Nils J. Nilsson, “Artificial Intelligence - A New Synthesis”, Morgan Kaufmann Publishers(1st edition)1998
3. Robert J. Scholkoof“ Artifical Neural Networks”; McGraw Hill Eductaion, 2011

REFERENCES

1. “Fuzzy Logic with Engineering Applications” ,Timothy J. Ross, Wiley India(fourth edition 2016)
2. ”Artificial Intelligence A Modern Approach” ,Stuart Russel, Peter Norvig, Pearson (3rd edition)

Pre Ph.D (CSE)

Subject Code	CS751	Subject Title	MOBILE AND AD-HOC NETWORKS					
LTP	4 0 0	Credit	4	Subject Category	DE	Year	1st	Semester	I / II

OBJECTIVE

This course covers major aspects of ad hoc networks, from design through performance issues to application requirements. It starts with characteristics features, applications of ad hoc networks, Modulation techniques and voice coding. It also covers the IEEE 802.11 Wireless LAN and Bluetooth standards.

Unit 1: **12 Hrs**

Issues in Mobile Computing, Wireless Telephony: Frequency Reuse, Cell Design, Cellular Architecture. Second Generation Cellular System- IS-95, GSM, IS-41, Data Operations- CDPD, HCSD, & GPRS. Third Generation Cellular System- 3G Concept, 3G Spectrum Allocation, 3G Service Classes & Application, UMTS, Introduction to Future Trends- 4G and Beyond.

Unit 2: **10 Hrs**

WLAN Overview, Infrared LAN, Spread-Spectrum LAN, Narrowband Microwave LAN, MAC issues, Wireless Multiple Access Protocols- MACA & MACAW, IEEE 802.11 variants, HIPERLAN, PAN Technologies- Bluetooth and HomeRF, Wireless Metropolitan Area Networks (Wireless Local Loop).

Unit 3: **10 Hrs**

Wireless Internet: IP Limitations, Mobile IP &its working, Issues in Mobile IP. TCP over Wireless, Wireless Access Protocol (WAP): Architecture & Protocol Stack. Security in Wireless Systems- WEP and Virtual Private Networks, Mobile Agents Computing, Transaction Processing in Mobile Computing Environment

Unit-4: **10 Hrs**

Ad Hoc Networks: Ad Hoc Networks vs. Cellular Networks, Issues in Ad Hoc Wireless Networks, Routing Protocols for Ad Hoc Wireless Networks-Design Issues and Classification, Vehicular AdHoc Networks-Introduction and Routing in VANETs, Delay Tolerant Networks- Introduction and Routing in DTNs.

Unit-5: **10 Hrs**

Wireless Sensor Networks: Overview, Application Areas, Sensor Nodes' Architecture,
Data Aggregation, Routing, and Query Processing in WSN. Intermittently Connected Delay Tolerant WSN-Introduction, End-to-End Reliability, Routing, and Link Layer Protocols in ICDT-WSN.

COURSE OUTCOME:

At the end of the coursethe student will learn:

CO1. Have gained an understanding of the current topics in MANETs and WSNs, both from an industry and research point of views.

CO2. Have an understanding of the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks.

CO3. Understand how proactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

TEXT BOOKS

1. Jochen H. Schiller, "Mobile Communication",2nded, Addison-Wesley, Pearson Education 2003.
2. Sipra Das Bit, Biplab K. Sikdar, Mobile Computing, PHI Learning 2009.
3. Vijay Garg, Elsevier,Wireless Communication & Networking , Morgan Kaufmann Publisher 2007.

REFERENCES

1. Subir K Sarkar, T G Basavaraju, C Puttamadappa, Ad Hoc Mobile Wireless Networks, Auerbach Publication 2007.
2. A. Ananda, MunChoon Chan, Mobile, Wireless & Sensor Networks,Wei Tsang Ooi , IEEE
3. press, Willy Intersciences.

Pre Ph.D (CSE)

Subject Code	CS752	Subject Title	ADVANCED DATA WAREHOUSING AND MINING					
LTP	4 0 0	Credit	4	Subject Category	DE	Year	1st	Semester	I / II

OBJECTIVE

To introduce the basic concepts of Data Warehouse and Data Mining techniques. Examine the types of the data to be mined and apply preprocessing methods on raw data. Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

Unit 1: **12 Hrs**

Evolution of Database System Technology, Architecture of Data Mining System, Data Warehouse, Advanced Data and Information Systems and Advanced Applications, Data Mining Functionalities, Data Mining Task Primitives

Unit 2: **10 Hrs**

Data Preprocessing, Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation

Unit 3: **10 Hrs**

Data Warehouse Architecture, Data Warehouse Schemas, Multidimensional Data Model, OLTP, OLAP, OLAP operations, ROLAP, MOLAP, HOLAP

Unit-4: **10 Hrs**

Market Basket Analysis, Apriori Algorithm, Mining Multilevel Association Rules, Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation

Unit-5: **10 Hrs**

Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, K-Means Method, K-Medoids Method, DBSCAN, OPTICS. Mining Sequence pattern in Biological Data, Mining Multidimensional, Multilevel Sequential Pattern

COURSE OUTCOME:

At the end of the coursethe student will learn:

CO1. Process raw data to make it suitable for various data mining algorithms.

CO2. Discover and measure interesting patterns from different kinds of databases.

CO3. Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data.

TEXT BOOKS

1. Jiawei Han and Micheline Kamber, “Data Mining: Concepts and Techniques”.

REFERENCES

1. M.H.Dunham, ”Data Mining: Introductory and Advanced Topics” , Pearson Education,1st ed.

2. Mallach ,Data Warehousing System McGraw –Hill,2002.

3. Alex Berson and Stephen J. Smith, “Data Warehousing, Data mining and OLAP”, Tata McGraw-Hill,13thed, 2008.

Pre Ph.D (CSE)

Subject Code	CS753	Subject Title	DISTRIBUTED SYSTEMS						
LTP	4 0 0	Credit	4	Subject Category	DE	Year	1st	Semester	I / II

OBJECTIVE

This course provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission.

Unit 1: **12 Hrs**

Fundamentals of Distributed Computing: Architectural models for distributed computing systems, Issues and challenges in Distributed systems, Basic concepts in distributed computing such as clocks, message ordering, consistent global states.
Distributed Environments
Current systems and developments (DCE, CORBA, JAVA).

Unit 2: **10 Hrs**

Coordination & Synchronization: Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication, Atomic transactions, Deadlocks in Distributed systems.
Message Passing & Remote Procedure Calls : Features of a good message-passing system, RPC model. Implementing RPC mechanism, Stub Generation, RPC Messages, Marshaling Arguments and Results, Server Management, Communication protocols for RPCs.

Unit 3: **10 Hrs**

Distributed File Systems: Features of Good DFS, File Models, File-Accessing models, File Service Architecture, File-sharing semantics, File Caching schemes, File replications.

Unit-4: **10 Hrs**

Distributed Shared Memory: Shared memory consistency models, Page based distributed shared memory, Shared variable distributed shared memory, Object based distributed shared memory.
Replication: Introduction, System Model & Group Communication, Fault Tolerant Services, Transactions with Replicated Data.

Unit-5: **10 Hrs**

Advanced Topics in Distributed Computing: High Performance Computing-HPF, Distributed and mobile multimedia systems.Adaptability in Mobile Computing.Grid Computing and applications. Fault tolerant Computing Systems.

COURSE OUTCOME:

At the end of the course, the student can:

CO1. The student will explain various architectures used to design distributed systems, such as client-server and peer-to-peer.

CO2. The student will have the knowledge about distributed systems using various interprocess communication techniques, such as remote method invocation, remote events, and tuple spaces.

TEXT BOOKS

1.Tannenbaum, A, Van Steen ,Distributed Systems, Principles and Paradigm,. Prentice Hall India,2ND ed, 2006
2. Tannenbaum,Distributed Operating Systems, A. Pearson Education. 2006
3.Attiya, Welch, “Distributed Computing”, Wiley India, 2006

REFERENCES

1. Singhal and Shivaratri, “Advanced Concepts in Operating Systems”, McGraw Hill, 2017

Pre Ph.D (CSE)

Subject Code	CS611	Subject Title	DATA STRUCTURES AND ALGORITHMS						
LTP	4 0 0	Credit	4	Subject Category	DE	Year	1st	Semester	I / II

OBJECTIVE

The course is aimed to provide the knowledge for target students to get the concept of advanced techniques for the designing of the algorithms including few contemporary algorithms**.**

Unit 1: **12 Hrs**

Introduction: Algorithms, The role of algorithms in computing, analysis of algorithms, Time and Space Complexity; Relation; Asymptotic notation, Growth of Functions, asymptotic analysis of recurrence relations, Recursion Tree; Master's Theorem, Medians and Order Statistics; Max-Min.Divide and conquer paradigm: Analysis of Divide-and-Conquer Algorithm; Quick Sort, Merge sort Analysis; Best Case, Worst Case and Average Case Analysis.

Unit 2: **10 Hrs**

Advanced Design and Analysis Techniques : Dynamic Programming : Longest Common subsequence, optimal binary search trees ;Greedy Algorithm :Activity Selection problem, Theoretical foundation of greedy algorithm, Task Scheduling problem, Comparison of dynamic programming and Greedy algorithm with Knapsack as case study ; Fractional Knapsack and 0/1 Knapsack ; Back Tracking: Queen Problem, BFS,DFS ; Amortized Analysis:

Unit 3: **10 Hrs**

Advanced Data Structure: Red-Black Trees, B Trees, Binomial Heaps, Fibonacci Heaps, Data Stricture for Disjoint Sets, Number–Theoretic Algorithm.

Unit-4: **10 Hrs**

Approximation Algorithms- the vertex-cover problem, The set covering problem; Randomized Algorithms ; String Matching : Knuth - Morris-Pratt Algorithm ; Polynomial time, Polynomial time verification, NP-completeness and reducibility, NP-Completeness proofs.

Unit-5: **10 Hrs**

Introduction: Need for parallel computers, Models of computation, analyzing parallel algorithms, expressing parallel algorithms,

Dense Matrix algorithms: Matrix vector Multiplication, Matrix matrix multiplication
Sorting: Hyper quick sort, Merge sort, Bitonic merge sort

COURSE OUTCOME:

At the end of the coursethe student will learn:

CO1. Define basic static and dynamic data structures and relevant standard algorithms for them: stack, queue, dynamically linked lists, trees, graphs, heap, priority queue, hash tables, sorting algorithms, min-max algorithm,

CO2. Demonstrate advantages and disadvantages of specific algorithms and data structures,

CO3. Select basic data structures and algorithms for autonomous realization of simple programs or program parts

CO4. Determine and demonstrate bugs in program, recognize needed basic operations with data structures

TEXT BOOKS

1. 1.T.H. Cormen,C. E. Leiserson,R.L. Rivest, C. Stein, Introduction to Algorithms, 3rd Edition(2009), PHI.

2. Ellis Harwitz and SartazSahani, Fundamentals of Computer Algorithms, Galgotia. 3.Basse, "Computer Algorithms: Introduction to Design & Analysis", Addision Wesley
3. Basse,Computer Algorithms: Introduction to Design & Analysis, Addision Wesley(third edition)2000

REFERENCES

1. The Design & Analysis of Computer Algorithms, A.V. Aho, J. E. Hopcroft, J.D. Ulman, Addison Wesley, 1975
2. BehroozParhami: Introduction to parallel Processing :Plenum series in Computer Science,2002
3. F.T.Leighton, "Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes", MK Publishers, San Mateo California,1992.

Pre Ph.D (CSE)

Subject Code	CS612	Subject Title	FUZZY LOGIC AND GENETIC ALGORITHM						
LTP	4 0 0	Credit	4	Subject Category	DE	Year	1st	Semester	I / II

OBJECTIVE

The course has been designed with the purpose to teach the students the fundamentals of Reasoning under uncertain circumstances (covered through Probabilistic Reasoning) and the Reasoning with imprecise knowledge (covered through Fuzzy Sets and Fuzzy Logic). The objective of the course is also to teach the fundamentals and applications of Genetic Algorithms. These three major areas contribute to the study and design of Machine Learning.

Unit 1: **12 Hrs**

Fuzzy Sets (Introduction)

Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory, Basic operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

Unit 2:Fuzzy Logic (Fuzzy Membership, Rules): **10 Hrs**

Fuzzy Logic (Fuzzy Membership, Rules)

Membership functions, Propositional logic and predicate logic, Inference in fuzzy logic, Fuzzy if-then rules, Fuzzy mapping rules, Fuzzy implications, Min-Max Theorem, Resolution Rule under Fuzzy environment, Refutation method for theorem proving, Defuzzifications,

Unit 3:Reasoning with uncertain and incomplete information: **10 Hrs**

Reasoning with uncertain and incomplete information: The statistical approach to uncertainty, Introduction, Uncertain & incomplete knowledge. Review of Probability theory

Unit-4:Bayes Theorem: **10 Hrs**

Bayes Theorem, Bayesian Networks, Bayesian reasoning. Decision Making, Joint Probabilities, Relationships, Polytrees.,Dempster-Shafer theory of evidence, Certainty Factor, Non-monotonic systems.

Unit-5Theoretical Foundation of Genetic Algorithms: **10 Hrs**

Theoretical Foundation of Genetic Algorithms

Introduction: Basic Operators: Reproduction, Crossover & Mutation. Fitness function. Search Space, Schemas & Two-Armed and k-armed problem, Exact mathematical models, Applications of Genetic Algorithms.

COURSE OUTCOME:

At the end of the coursethe student will learn:

- CO1. The Fuzzy Sets Fuzzy Systems and the reasoning using the Fuzzy Logic
- CO2. How to develop a decision support system using the fuzzy knowledge
- CO3. The Reasoning Techniques under uncertain circumstances
- CO4. The Bayesian Networks and the Bayesian Reasoning
- CO5. Dempsters- Shafers theory and Certainty theory as alternative to Bayesian reasoning uncer uncertain circumstances.
- CO6. Genetic Algorithms provide one of the best optimization techniques when the serch space is large. Starting from the very fundamentals the students shall learn as to how to find solutions to problems using Genetic Algorithms.

TEXT BOOKS

1. Timothy J Ross, “Fuzzy Logic with Engineering Applications”, 3rd Edition, John Wiley, 2004.

2. David E. Goldberg, “Genetic algorithms in search, optimization & Machine Learning” ,1st ed,Pearson Education, 2006

3. Stuart Russel, Peter Norvig, ”Artificial Intelligence A Modern Approach” Pearson, 2014 (3rd Ed.)

REFERENCES

1. John Yen, Reza Langari, “Fuzzy Logic Intelligence, Control and Information”, Pearson Education, 2006.

2. Timothy J Ross, “Fuzzy Logic with Engineering Applications”, 2nd Edition, John Wiley, 2004.

3. H. Zimmermann, “Fuzzy Set Theory and its applications”, 2nd Edition, Allied Publishers, 1996.

4. Melanle Mitchell, “An introduction to genetic algorithms”, Prentice Hall India, 2002.

5. SN Sivanandam, SN Deepa, Principals of Soft Computing,2nd Edition, Wiley India, 2008.

Pre Ph.D (CSE)

Subject Code	CS711	Subject Title	INFORMATION & CODING THEORY					
LTP	4 0 0	Credit	4	Subject Category	DE	Year	1st	Semester	I / II

OBJECTIVE

The participants will learn the basic concepts of information theory and coding, including information, source coding, channel model, channel capacity, channel coding and so on. The main purpose of this course is to help students to complete the understanding of the wireless communication system with other advanced courses in wireless communication.

Unit 1: INFORMATION THEORY: 12Hrs

Information-Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding -Joint and conditional entropies, Mutual information - Discrete memory less channels – BSC,BEC – Channel capacity, Shannon limit.

Unit 2: SOURCE CODING: TEXT, AUDIO AND SPEECH: 10Hrs

Text: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 Speech: Channel Vocoder, Linear Predictive Coding.

Unit 3:SOURCE CODING: IMAGE AND VIDEO: 10 Hrs

Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF Image compression: READ, JPEG.Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation,H.261, MPEG standard.

Unit-4: ERROR CONTROL CODING: BLOCK CODES: 10 Hrs

Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes ,Cyclic codes - Syndrome calculation, Encoder and decoder – CRC

Unit-5:ERROR CONTROL CODING: CONVOLUTIONAL CODES: 10 Hrs

Convolutional codes– code tree, trellis, state diagram - Encoding – Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding

COURSE OUTCOME:

At the end of the coursethe student will learn:

CO1. Understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them.

CO2. Describe the real life applications based on the fundamental theory.

CO3. Calculate entropy, channel capacity, bit error rate, code rate, steady-state probability and so on.

CO4. Implement the encoder and decoder of one block code or convolutional code using any program language.

TEXT BOOKS

1. R Bose, “Information Theory, Coding and Cryptography”,2nd ed. TMH 2007

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1. Steven Roman, “Introduction to Coding and Information Theory”.1st ed.1996.

2. T. M. Cover and J. A. Thomas, Elements of Information Theory, 2nd ed. Wiley interscience,2006 .