

**COMPUTER SCIENCE AND ENGINEERING  
DEPARTMENT**

**M.TECH. ADVANCED COMPUTING**

**Course of Study & Scheme of Examination  
2016-17**



**Maulana Azad National Institute of Technology,  
Bhopal**

**SCHEME**  
**M.Tech (Advance Computing)**  
***First Semester***

Course number	Subject	Schemes of Studies Periods per week			Credits
		L	T	P	
AC511	Mathematical foundations of Computer Science	3	-	-	3
AC512	Advanced Data Structures	3	-	-	3
AC513	Advanced Computer Architecture	3	-	-	3
AC 531 – AC 538	Elective 1	3	-	-	3
AC 531 – AC 538	Elective 2	3	-	-	3
AC 551- AC 555	Open Elective 1	3	-	-	3
AC514	Laboratory 1 (Advanced Data Structures)	-	-	2	1
AC515	Laboratory 2 (Based on Elective)			2	1
AC516	Seminar 1	-		4	2
Total credit 22					

***Second Semester***

Course number	Subject	Schemes of Studies Periods per week			Credits
		L	T	P	
AC521	High Performance Scientific Computing	3	-	-	3
AC522	Graph Theory and Algorithms	3	-	-	3
AC523	Soft Computing	3	-	-	3
AC 541-AC548	Elective 3	3	-	-	3
AC 541-AC548 Hum XXX	Elective 4	3	-	-	3
AC 556- AC560	Open Elective 2	3	-	-	3
AC524	Laboratory 3 (High Performance Scientific Computing)	-	-	2	1
AC525	Laboratory 4 (Based on Elective)			2	1
AC526	Seminar 2	-	-	4-	2
Total credit 22					

**Departmental Elective**

<b>Course Number Elective – 1/2 Sem – I</b>	<b>Elective 1 &amp; 2</b>	<b>Course Number Elective – 3/4 Sem – II</b>	<b>Elective 3 &amp; 4</b>
AC 531	Data Mining And Warehousing	AC 541	Advanced Software Engineering
AC 532	Computer and Network Security	AC 542	Cryptography
AC 533	Advanced Computer Networks	AC 543	Simulation and Modelling
AC 534	Operating System Design	AC 544	Distributed Database
AC 535	Wireless Network	AC 545	Web search and Information Retrieval
AC 536	Stochastic Process & Query Theory	AC 546	Parallel Algorithm
AC 537	Steganography and Digital Watermarking	AC 547	Embedded System
AC 538	Natural Language Processing	AC 548	Randomized Algorithms
		HUM XXX	Professional Communication

**Open Elective**

<b>Course number Open Elective-1 Sem-I</b>	<b>Open Elective 1</b>	<b>Course number OpenElective-2 Sem-II</b>	<b>Open Elective 2</b>
AC551	Distributed Computing	AC556	Cloud Computing
AC552	Information Theory and Coding	AC557	Digital Image Processing
AC553	Optimization Techniques	AC558	CAD of Digital Systems
AC554	Biometrics	AC559	Object – Oriented Design and Modeling
AC555	Cluster and Grid Computing	AC 560	Technical Foundation of E-commerce

## Third Semester

Course No.	Subject	Scheme of Studies Periods Per Week			No. of Duration of Theory Paper		Credits			Total
		L	T	P	No.	HR	L.	Tut.	Prac.	
	Dissertation I								23	23
TOTAL									23	23

## Fourth Semester

Course No.	Subject	Scheme of Studies Periods Per Week			No. of Duration of Theory Paper		Credits			Total
		L	T	P	No.	HR	L.	Tut.	Prac.	
	Dissertation II								23	23
TOTAL									23	23
GRAND TOTAL I TO IV SEMESTER										90

**Details of Core and Electives Offered:**

- TOTAL NUMBER OF SUBJECTS OFFERED BY CSE = 33
- NUMBER OF CORE SUBJECTS = 06
- NUMBER OF ELECTIVE SUBJECTS = 04/17
- NUMBER OF OPEN ELECTIVE SUBJECTS = 02/10

## **SYLLABUS**

### **AC511 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE**

Logic: Basics of propositional and first order logic, Completeness and compactness results;

TOC: Universal Turing Machines, undecidability, Rice's theorems for RE sets, Post machines, Basics of recursive function theory. Equivalence, Church's thesis, Computational complexity, Space and Time complexity of Turing Machines, Relationships, Savage's theorem, Complexity Classes, Complete problems, NP – completeness, Cook-Levin theorem.

#### **References:**

1. Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, J. D. Ullman.
2. First-Order Logic, Raymond M. Smullyan,
3. Structural Complexity, J.L. Balcazar, J. Diaz, J. Gabarro,

### **AC512 ADVANCED DATA STRUCTURES**

Review of algorithm analysis, Optimal Binary search trees, Balanced binary search trees, Binary heaps, Advanced heap structures, Binomial heaps, Fibonacci heaps, Amortized analysis, Splay trees. Dictionaries, Disjoint set structures. Data Structures for External Memory, External sorting, String matching. Introduction to Randomized Data structures and algorithms.

#### **References:**

1. Introduction to algorithms, Cormen and Rivest.
2. Randomized algorithms, R.Motwani and P. Raghavan.

### **AC513 ADVANCED COMPUTER ARCHITECTURE**

Pipeline processor principles and design, Instruction set architecture; Memory addressing; Instruction composition; Instruction-level parallelism. Hazards: dynamic scheduling, branch prediction; Memory hierarchy; Processor case studies; Multiprocessor introduction: Shared- memory architectures and their synchronisation and consistency issues, advanced multi-core topics; Transactional Memory; Interconnection networks.

#### **References:**

1. Computer Architecture: A Quantitative Approach, J. L. Hennessy and D. A
2. Parallel Computer Architecture: A Hardware/Software Approach, David Culler, J.P. Singh and Anoop Gupta
3. Advanced Computer Architecture: Parallelism, Scalability, Programmability, Kai Hwang.

### **AC516 SEMINAR**

Students have to collect a International Journal paper on the topics of their interest, prepare a write up and present with suitable demonstration by software or experimental work. Evaluation will be based on relevant topic student has studied, communication skill and reporting/documenting procedure

### **AC521 HIGH PERFORMANCE SCIENTIFIC COMPUTING**

Overview of parallel system organization; Introduction to message passing and MPI programming; Embarrassingly parallel problems; Problem decomposition, graph partitioning, and load balancing; Introduction to shared memory and OpenMP programming; Examples of scientific computing; Parallel Languages.

#### **References:**

1. Parallel Programming for Multicore and Cluster Systems by Thomas Rauber and Gudula Runger.
2. Scientific Parallel Computing by Scott, Clark, and Bagheri.
3. Using OpenMP: Portable Shared Memory Parallel Programming by Chapman, Jost, and van der Pas.

### **AC522 GRAPH THEORY AND ALGORITHM**

Graph Basics; Planner Graphs; Optimization and Matching; Connectivity of graphs; Graph Colouring; Graph representations.

Warshall's Algorithm; Depth-First and Breadth-First Searches; Dijkstra's Algorithm; Floyd's Algorithm; Kruskal's and Prim's Algorithms; Travelling Salesman's Problem; K shortest Path Algorithms.

Maximum Matching in Bipartite Graphs: The Hungarian Algorithm; Maximum Flow in a Transport Network: The Ford–Fulkerson Algorithm

#### **References**

1. Graph, Network and Algorithm Dieter Jungnickel
2. Graph Theory with applications J A Bondy and U S R Murty.

### **AC523 SOFT COMPUTING**

Introduction to neural networks, Working of an artificial neuron, Perceptron, Back propagation algorithm, Adalines and Madalines. Supervised and unsupervised learning, Counter-propagation networks, Adaptive Resonance Theory, Kohonen's Self Organizing Maps, Neocognitron, Associative memory, Bidirectional Associative Memory.

Introduction to fuzzy logic and fuzzy sets, fuzzy relations, fuzzy graphs, fuzzy arithmetic and fuzzy if-then rules, Process control using fuzzy logic, Decision-making fuzzy systems, Applications of fuzzy logic, Hybrid systems like neuro-fuzzy systems.

Evolutionary Computation: Population-based Search: genetic algorithms and evolutionary computation, Genetic Programming. Swarm optimization, Ant colony optimization. Search techniques like Simulated Annealing, Tabu search etc.

**References:**

1. Soft Computing and Intelligent Systems Design b, F.O.Karray and C.De Silva,
2. Neural Networks, Fuzzy Logic and Genetic Algorithms, Rajsekaran and Pai,

**AC526 SEMINAR**

Students have to collect a International Journal paper on the topics of their interest, prepare a write up and present with suitable demonstration by software or experimental work. Evaluation will be based on relevant topic student has studied, communication skill and reporting/documenting procedure.

**DEPARTMENT ELECTIVES**

**AC531 /IS /CN DATA MINING AND WAREHOUSING**

Basic concept of Data ware house, OLAP and Data mining. OLTP vs. OLAP. Data Warehouse Design - Identifying facts & dimensions, designing fact tables, dimension tables, star flake schema query redirection. OLAP operations Data ware house architecture, Multidimensional schemes:- partitioning strategy, aggregation, data marting, metadata. Capacity planning, tuning the data warehouse testing the data warehouse: developing test plan, testing operational environment Distributed and virtual data warehouses. Data Mining: Basic concept, A statistical perspective on Data Mining-point estimation, models based on summarization, Bayes theorem, Hypothesis Testing, Classification issues, statistical-based algorithms, distance-based algorithms, decision tree-based algorithms and rule based algorithms. Clustering - similarity and distance measures outlier's hierarchical algorithms, partition algorithms, clustering large databases. Association Rules, large item sets, Apriori algorithm, sampling algorithm, partitioning, parallel and distributed algorithms, data parallelism task parallelism. Web Mining- Web Content Mining, Web Structure Mining, Web Usage Mining. Spatial Mining, Special data overview, Special data mining primitives, generation and specialization, spatial rules, spatial classification algorithms. Temporal Mining modelling temporal events, time series, pattern detection Sequences, temporal association rules. Privacy issues with respect to invasive use.

**References:**

1. Building the data warehouse, W.H Inmon
2. Data mining concepts and techniques, Jimali Han and Micheline Kamber
3. Data Mining Introduction and Advance Topic, Margaret H. Dunham and S. Sridhar

### **AC532 COMPUTER & NETWORK SECURITY**

Introduction to computer and network security. Basic concepts, threat models, common security goals,

Cryptography and cryptographic protocols, including encryption, authentication, message authentication codes, hash functions, one-way functions, public-key cryptography, secure channels, zero knowledge in practice, models and methods for security protocol analysis. Malicious code analysis and defense. Viruses, Worms, spyware, rootkits, botnets, etc. and defenses against them, Detecting Attackers. Software security. Secure software engineering, defensive programming, buffer overruns and other implementation flaws. Language-based security: analysis of code for security errors, safe languages, and sandboxing techniques. Operating system security. Memory protection, access control, authorization, authenticating users, enforcement of security, security evaluation, trusted devices, digital rights management. Network security. Network based attacks, Kerberos, X.509, firewalls, intrusion detection systems, DoS attacks and defense. Case studies: DNS, IPSec. Web security. Securing Internet Communication, XSS attacks and defenses, etc. Advanced topics. Security monitoring, surreptitious communication, data remanence, trusted devices, privacy and security of low-powered devices (RFID) electronic voting, quantum cryptography, penetration analysis, digital rights management and copy protection, security and the law.

#### **References:**

1. William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall, New Jersey.

### **AC533 ADVANCED COMPUTER NETWORKS**

Review of networking concepts: Network models, Addressing, Data rate limits, Bandwidth, throughput, Latency, Data link control, Multiple Access, Wired LAN, Wireless LAN, VLAN, SONET, ATM, QoS in ATM, ATM applications, IP addressing, forwarding, and routing, IPv4, IPv6, IP Security, Virtual Private Networks, Transport layer protocol, congestion control, Multimedia Networks: Voice/Video over IP, IP Telephony, Voice over ATM, AAL2, Network management, Optical Networks.

### **AC534 OPERATING SYSTEM DESIGN**

Computer system and operating system overview, Operating system functions and design issues, Design approaches, Types of advanced operating systems, Process abstraction, Process management, system calls, Threads, Symmetric multiprocessing and microkernels.

Scheduling: Uniprocessor, Multiprocessor and Real time systems, concurrency, classical problems, mechanisms for synchronization: semaphores, monitors, Process deadlock and deadlock handling strategies, Memory management, virtual memory concept, virtual machines, I/O management, File and disk management, Operating system security.

Distributed Operating system: architecture, Design issues, Distributed mutual exclusion, distributed deadlock detection, shared memory, Distributed scheduling.



Multiprocessor operating systems: architecture, operating system design issues, threads, process synchronization, process scheduling, memory management, reliability and fault tolerance.

**References:**

1. Advanced concept in operating system:M. Singhal, N.G Shivratri
2. Operating system internal and design principles: William Stallings

**AC535 WIRELESS NETWORK**

Introduction to wireless communication, and future trends, Wireless Generations and Standards, Wireless Physical Layer Concepts, fundamentals of antennas, Cellular Concept and Cellular System Fundamentals. Spread Spectrum Modulation Techniques, Coding and Error Control, Multiple Access Technique for Wireless Communications, OFDM. Wireless LAN Technologies, Wireless IEEE Standards, Mobile Network Layer (Mobile IP). Mobile Transport Layer (Mobile TCP), Mobile Data network (GPRS), WAP Model and architecture, Introduction to Ad hoc networks, Sensor networks, Bluetooth networks and Wireless Mesh networks.

**References:**

1. Wireless Communications and Networking , William Stallings
2. Wireless communication: Principles and Practice, T. S. Rappaport
3. Mobile Communications, Schiller
4. Principles of Wireless Networks: A Unified Approach, Pahalvan, K. and Krishnamurthy

**AC536 STOCHASTIC PROCESS AND QUEUING THEORY**

The objective of this course is to provide the students basic knowledge about probability and stochastic process with applications. The course will include permutation and combinations, probability theory, Random variable, probability mass function, Binomial, poisson, exponential, normal, uniform distributions ,stochastic process and Markov chains.

Introduction of basic Queuing Theory, Markov Chains and Markov Processes, Birth-Death Processes, Simple Queuing Models (M/M/-/- Queues), Queues with Batch Arrivals, M/G/1 Queue with Residual Life and Imbedded Markov Chain Approach, Queues with Vacations, Bulk Arrivals and Priorities, Discrete Time Queues, Delay Analysis of Queues. Fundamental of Queuing Networks, Open and Closed Queuing Networks, Open Networks of M/M/m type queues. Approximate Models for Open and Closed Queuing Networks, Queuing System Applications, Simulation Modelling of Queuing Systems.

**References :**

1. Donald Gross, James M. Thompson, John F. Shortle and Carl W. Harris, Fundamentals of Queueing Theory, Wiley 2008.
2. Sanjay K. Bose, An Introduction to Queueing Systems, Springer 2002.

3. T.G. Robertazzi, Computer Networks and Systems - Queueing Theory and Performance Evaluation, Springer 2000.
4. L. Kleinrock, Queueing Systems Volume 1 : Theory, Wiley 1975.

### **AC537 STEGANOGRAPHY AND DIGITAL WATER MARKING**

Steganography: Overview, History, Methods for hiding (text, images, audio, video, speech etc.), Issues: Security, Capacity and Imperceptibility, Frameworks for secret communication (pure Steganography, secret key, public key steganography), Steganography algorithms (adaptive and non-adaptive), Steganography techniques: Substitution systems, Spatial Domain, Transform domain techniques, Spread spectrum, Statistical steganography, Cover Generation and cover selection, Tools : EzStego, FFEencode, Hide 4 PGP, Hide and Seek, S Tools etc.)

Steganalysis: Active and Malicious Attackers, Active and passive steganalysis, Detection, Distortion, Techniques: LSB Embedding, LSB Steganalysis using primary sets, Texture based.

Watermarking: Introduction, Difference between Watermarking and Steganography, History, Classification (Characteristics and Applications), Types and techniques (Spatial-domain, Frequency-domain, and Vector quantization based watermarking), Attacks and Tools (Attacks by Filtering, Remodulation, Distortion, Geometric Compression, Linear Compression etc.), Watermark security & authentication

#### **References:**

1. Peter Wayner, "Disappearing Cryptography – Information Hiding: Steganography & Watermarking", Morgan Kaufmann Publishers, New York, 2002.
2. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, Ton Kalker, "Digital Watermarking and Steganography", Morgan Kaufmann Publishers, New York, 2008.
3. Information Hiding: Steganography and Watermarking-Attacks and Countermeasures by Neil F. Johnson, Zoran Duric, Sushil Jajodia
4. Information Hiding Techniques for Steganography and Digital Watermarking by Stefan Katzenbeisser, Fabien A. P. Petitcolas

### **AC538 /IS /CN NATURAL LANGUAGE PROCESSING**

Regular Expressions and Automata, N-grams, Part-of-Speech Tagging, Hidden Markov and Maximum Entropy Models, Formal Grammars of English, Syntactic Parsing, Statistical Parsing, Features and Unification, Language and Complexity, The Representation of Meaning, Computational Semantics, Computational Lexical Semantics, Information Extraction, Question Answering and Summarization, Machine Translation

#### **References:**

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition D. Jurafsky and J. Martin
2. Foundations of Statistical Natural Language Processing Manning and H. Schutze

### **AC541 /IS /CN ADVANCED SOFTWARE ENGINEERING**

Software Project Management, Metrics and measurement, Software Configuration management, Software risk management, Requirements Engineering, Software quality assurance, software reliability models.

Object oriented design, object oriented programming (with C++), Formal specifications, Formal verification of programs, Jackson method for design, CASE tools and technology, Clean room method for software development, Information system design, Real-time software specification and design.

Enterprise architectures, Zachman's Framework, Architectural styles, Design Patterns, Architecture Description Languages, Product-Line architectures, Component Based Development.

#### **References:**

1. An integrated approach to Software Engineering, Pankaj Jalote.
2. Software Engineering: A Practitioner approach, Roger Pressman.
3. Software Architecture in Practice. Len Bass, Paul Clements, Rick Katzman, Ken Bass
4. Software Engineering, L. Pfleeger.
5. Pattern Oriented Software Architecture, Volumes 1 & 2, Stal, Douglas Schmidt

### **AC 542/IS /CN CRYPTOGRAPHY**

Introduction to cryptography, Security Attacks, mechanism and Services. Cryptosystems, Conventional

encryption model and techniques, classical encryption techniques- substitution ciphers and transposition

ciphers, cryptanalysis, stream and block ciphers. Block ciphers principals, fiestal structure, SPN, DES,

triple DES, AES,IDEA encryption and decryption, key distribution. finite field: Introduction to graph,

ring and field, modular arithmetic, Fermat's and Euler's theorem, Euclid's algorithm, Chinese remainder theorem, Entropy and Huffman's coding. Comparison of symmetric and public-key cryptographic systems, Principals of public key crypto systems, RSA algorithm, Diffie-Hellman key exchange algorithm, Message Authentication and Hash Function: security of hash functions and MACS, MD5 message digest algorithm, secure hash algorithm (SHA). Digital Signatures.

#### **References:**

1. Cryptography and Network Security: Principles and Practice William Stallings,
2. Cryptography Theory and Practice Douglas R. Stinson.

### **AC 543/IS/CN SIMULATION AND MODELLING**

Introduction: Systems, modelling, general systems theory, Concept of simulation, Simulation as a decision making tool, types of simulation. Random Numbers and Queuing Theory: Pseudo random numbers, methods of generating random variables, discrete and continuous distributions, testing of random numbers, Concepts of Queuing theory.

Design of Simulation Experiments :Problem formulation, data collection and reduction, time flow mechanism, key variables, logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation validation.

Simulation Languages: Comparison and selection of simulation languages, study of these simulation language.

Case studies: Development of simulation models using simulation language studied for systems like queuing systems, Production systems, Inventory systems, maintenance and replacement systems and Investment analysis.

**References:**

1. System Simulation, Geoffrey Gordon
- 2..System Simulation with Digital Computer, Narsingh Deo

**AC 544/IS /CN DISTRIBUTED DATABASES**

Introduction: Distributed Data processing, Distributed database system (DDBMSS), Promises of DDBMSs, Complicating factors and Problem areas in DDBMSs, Overview Of Relational DBMS Relational Database concepts, Normalization, Integrity rules, Relational Data Languages, Relational DBMS.

Distributed DBMS Architecture: DBMS Standardization, Architectural models for Distributed DBMS, Distributed DBMS Architecture.

Distributed Database Design: Alternative design Strategies, Distribution design issues, Fragmentation, Allocation.

Semantic Data Control: View Management, Data security, Semantic Integrity Control.

Overview of Query Processing: Query processing problem, Objectives of Query Processing, Complexity of Relational Algebra operations, characterization of Query processors, Layers of Query Processing.

Introduction to Transaction Management: Definition of Transaction, Properties of transaction, types of transaction.

Distributed Concurrency Control: Serializability theory, Taxonomy of concurrency control mechanisms, locking bases concurrency control algorithms.

Parallel Database Systems: Database servers, Parallel architecture, Parallel DBMS techniques, Parallel execution problems, Parallel execution for hierarchical architecture.

Distributed Object Database Management systems: Fundamental Object concepts and Object models, Object distribution design. Architectural issues, Object management, Distributed object storage, Object query processing. Transaction management.

Database Interoperability: Database Integration, Query processing.

**References:**

1. Principles of Distributed Database Systems, Second Edition, M.TamerOzsu Patrick Valduriez
2. Distributed Databases principles and systems, StefanoCeri,GiuseppePelagatti,TatamcGrawHill

### **AC545 /IS /CN WEB SEARCH AND INFORMATION RETRIEVAL**

Information retrieval model, Information retrieval evaluation, Searching the web, Document Representation, Query languages and query operation, Metadata search, Indexing and searching, Scoring and ranking feature vectors, Ontology, domain specific search, Parallel and distributed information retrieval, Text and multimedia languages, Social networks.

#### **References:**

1. An introduction to Information Retrieval Manning, C., Raghavan, P., and Schutze, H.
2. Mining the web: Mining the Web: Discovering knowledge from hypertext data. Morgankaufman Chakrabarti, S.

### **AC 546 /IS /CN PARALLEL ALGORITHMS**

Parallel algorithms: Introduction, Terminology, Pipelining & data parallelism, Control parallelism, scalability.

PRAM algorithms: Serial and Parallel computation; Processor arrays, Multiprocessors & Multi-computers, Flynn's taxonomy, Speedup Scaled Speedup and Parallelizability. Parallel Programming Languages, Mapping & Scheduling;

Matrix Multiplication Algorithm: Sequential, Processor arrays, Multi-computers.

Fourier transform: Introduction, Discrete, Inverse discrete, Fast Fourier transform. Sorting algorithms, Dictionary operation, Graph algorithm, Combinatorial Search.

#### **References:**

1. Parallel computing by Michael J. Quinn.
2. The Design of Parallel and Analysis Algorithms by Selim G. AkM.

### **AC547 /IS /CN EMBEDDED SYSTEMS**

Introduction, Hardware & electronics fundamentals, Peripherals, Program Design and Analysis, Processes and Operating system, Real time Operating system Memory, Interfacing, Examples of Embedded systems: Digital Camera Examples, Smart card application, Embedded database applications, etc State Machine and Concurrent Process Models, Control Systems Verilog programming, Programming of mobile and Hand-held devices. IC Technology Full-Custom (VLSI) IC Technology, Semi-Custom (ASIC) IC Technology, Programmable Logic Device (PLD) IC Technology, FPGA. Hardware Software Partitioning, Hardware/Software Co-Simulation, Intellectual Property Cores, Low Power design.

#### **References:**

1. Embedded system Design, Frank Vahid, Tony Givargis
2. Computer as Components, Wayne Wolf,
3. 8051 Microcontroller an Application Based introduction, Braithwaite Cowan, Parchizadeh

4. 8051 Microcontroller & Embedded Systems, Rajiv Kapadia
5. The 8051 Microcontroller & Embedded Systems, Mazidi & Mazida

### **AC548 /IS /CN RANDOMIZED ALGORITHMS**

Introduction to randomized algorithms. Game Theoretic Techniques. Probabilistic Method, Markov Chains and Random Walks. Randomized Data Structures: Treaps, skip lists, Hash tables. Geometric algorithms and linear programming, Graph algorithms, Approximate Counting, Online Algorithms.

#### **References:**

1. Randomized Algorithm Motwani and Raghavan.

### **HUM XXX PROFESSIONAL COMMUNICATION**

#### **OPEN ELECTIVES**

### **AC 551 /IS /CN DISTRIBUTED COMPUTING**

Introduction to Distributed System: Goals, Hardware concepts, Software concepts, and Client- Server model. Example of distributed systems. Communication: Layered protocols, Remote procedures call, Remote object invocation, Message-oriented communication, Stream oriented communication. Inter process communication in UNIX/LINUX. Processes: Threads, Clients, Servers, Code Migration, Software agent. Naming: Naming entities, locating mobile entities, removing un-referenced entities. Synchronization: Clock synchronization, Logical clocks, Global state, Election algorithms, Mutual exclusion, Distributed transactions.

Consistency and Replication: Introduction, Data centric consistency models, Client centric consistency models, Distribution protocols, Consistency protocols. Fault Tolerance: Introduction, Process resilience, Reliable client server communication, Reliable group communication. Distributed commit, Recovery. Security: Introduction, Secure channels, Access control, Security management. Distributed File System: Sun network file system, CODA files system, Google File System.

#### **References:**

1. Distributed Systems: Principles and Paradigms, Taunenbaum
2. Distributed Systems: Concepts and Design, G. Coulouris, J. Dollimore, and T. Kindberg,

### **AC552/IS /CN INFORMATION THEORY AND CODING**

Information and entropy information measures, Shannon's concept of information. Channel coding, channel mutual information capacity (BW) , theorem for discrete memory less channel, information capacity theorem , error detecting and error

correcting codes, Types of codes: block codes, hamming and Lee metrics, description of linear block codes , parity check codes ,cyclic code. Masking techniques.

Compression : loss less and lossy, Huffman codes, LZW algorithm, Binary image compression schemes, run length encoding, CCITT group 3 1-D compression, CCITT group 3 2D compression, CCITT group 4 2D Compression. Convolutional codes, sequential decoding. Video image compression: CITT H 261 Video coding algorithm, audio (speech) compression. Cryptography and cipher.

**References:**

1. Information Theory, Coding and Cryptography, R Bose
2. Multimedia system Design, Prabhat K Andleigh and Kiran Thakrar
3. Multimedia Communications, Fred Halsall

**AC553 OPTIMIZATION TECHNIQUES**

Introduction: Engineering application of Optimization, Formulation of design problems as mathematical programming problems, General Structure of Optimization Algorithms ,Constraints, The Feasible Region, Branches of Mathematical Programming ,Gradient Information, The Taylor Series, Types of Extrema, Necessary and Sufficient Conditions for Local Minima and Maxima, Classification of Stationary Points , Convex and Concave Functions, Optimization of Convex Functions, General Properties of Algorithms ,An Algorithm as a Point-to-Point Mapping, An Algorithm as a Point-to-Set Mapping Closed Algorithms , Descent Functions, Global Convergence, Rates of Convergence.

Unconstrained Optimization: One dimensional optimization techniques: Dichotomous Search, Fibonacci Search ,Golden-Section Search, Quadratic Interpolation Method ,Cubic Interpolation, The Algorithm of Davies, Swann, and Campey, Inexact Line Searches , Multidimensional Gradient Methods ,Steepest-Descent Method, Newton Method Gauss-Newton Method, Conjugate-Direction Methods: Conjugate Directions, Basic Conjugate-Directions Method, Conjugate-Gradient Method, Minimization of Non-quadratic Functions, Fletcher-Reeves Method, Powell's Method, Partan Method. Quasi-Newton Methods: The Basic Quasi-Newton Approach, Generation of Matrix  $S_k$  ,Rank-One Method, Davidon-Fletcher-Powell Method, Broyden-Fletcher-Goldfarb-Shanno Method, Hoshino Method, The Broyden Family, The Huang Family, Practical Quasi-Newton Algorithm, Applications of Unconstrained Optimization, Nonlinear Least Squares Problem and Algorithms.

Linear Programming: Graphical method, Simplex method, Duality in linear programming (LP),Sensitivity analysis, Interior-Point Methods, Primal-Dual Solutions and Central Path, Primal Affine-Scaling Method, Primal Newton Barrier Method, Primal-Dual Interior-Point Methods.

Nonlinear Constrained Optimization: Constrained Optimization, Constraints, Classification of Constrained Optimization Problems, Simple Transformation Methods ,Lagrange Multipliers , First-Order Necessary Conditions, Second-Order Conditions,

Convexity , Duality Quadratic And Convex Programming: Convex QP Problems with Equality Constraints, Active-Set Methods for Strictly Convex QP Problems , Interior-Point Methods for Convex QP Problems, Cutting-Plane Methods for CP Problems, Ellipsoid Methods.

Minimax Methods: Minimax Algorithms, Improved Minimax Algorithms,

#### References:

1. Practical Optimization Algorithms And Engineering Applications, by Andreas Antoniou, Springer publication.
2. An Introduction To Optimization by EDWIN K. P. CHONG & STANISLAW H. ZAK, Wiley publication.

#### AC 554 BIOMETRICS

Introduction: Definitions, biometric modalities, benefits of biometric versus traditional authenticated methods. Key biometric terms and processes. Authentication technologies: storage tokens, dynamic tokens, token usability. Design of a Biometric System: Building blocks, Modes of operation.

Biometric technologies: Passive & active biometric, user acceptance Ease of use, technology cost, deployability, Invasiveness of the technology, maturity of the technology. Fingerprint verification: Minutiae Based Fingerprint Matching, Non-minutiae Based Representations, finger print component, algorithms for interpretation .Fingerprint Enhancement, and Fingerprint Classification.

Face Recognition:- Introduction, Authentication vs. Identification, Challenges in Face recognition, Algorithms for face recognitions.

Iris Recognition: Introduction, devices for capturing Iris, Iris representation schemes, Iris recognition algorithms. Hand Geometry Recognition, Gait Recognition, The Ear as a Biometric, Voice Biometrics, A Palmprint Authentication System. On-Line Signature Verification.3D Face Recognition. Automatic Forensic Dental Identification, DNA.

Introduction to Multibiometrics.- Multispectral Face Recognition.- Multibiometrics Using Face and Ear.- Incorporating Ancillary Information in Multibiometric Systems. Multimodal Biometrics: Limitations of unimodal systems, multibiometric scenarios, levels of fusion, system design, score fusion techniques, score normalization, user-specific parameters, and soft biometrics. The Law and the Use of Biometrics.- Biometric System Security.- Spoof Detection Schemes.- Linkages between Biometrics and Forensic Science.- Biometrics in Government Sector.- Biometrics in the Commercial Sector.- Biometric Standards.- Biometrics Databases Case Study Presentations: Biometrics in Banking Industry, Biometrics in Computerized, Patient Records, Biometrics in Credit Cards, Biometrics in Mass Disaster Victim, Identification Forensic Odontology.



**Refences:**

1. Biometrics for network security, Paul Reid,
2. Handbook of Fingerprint Recognition , D. Maltoni, D. Maio, A. K. Jain, and S. Prabhakar,
3. BIOMETRICS: Personal Identification in Networked Society A. K. Jain, R. Bolle, S. Pankanti,
4. Biometric Systems: Technology, Design and Performance Evaluation, J. Wayman, A.K. Jain, D Maltoni, and D. Maio

**AC555/ IS /CN Cluster and Grid Computing**

Cluster Computing: Introduction, Hardware for cluster computing, Software architectures for cluster computing based on shared memory (OpenMP) and message-passing (MPI/PVM) models, Performance evaluation tools, Configuring and Tuning Clusters.

Grid Computing: The Evolution Grid Technologies, Programming models - A Look at a Grid Enabled Server and Parallelization Techniques, Grid applications, Grid architecture, Grid relationship to other Distributed Technologies, Computational and Data Grids, Semantic grids, Grid Management systems: Security, Grid-Enabling software and Grid enabling network services, Virtualization Services for Data Grids; Case Study, Setting up Grid, deployment of Grid software and tools.

**References:**

1. R. Buyya, High Performance Cluster Computing , Prentice Hall, USA, 1999.
2. Parallel Programming with MPI by Peter Pacheco, Morgan Kaufmann, 1998.
3. I. Foster and C. Kesselman, The Grid : Blueprint for a New Computing Infrastructure , Morgan Kaufmann Publishers , 1999.

**AC 556/IS /CN CLOUD COMPUTING**

Cloud Computing: Introduction, Working of cloud computing, benefits;

Understanding Cloud Computing: Developing cloud computing services, Discovering cloud services; Cloud Computing for Everyone: Centralizing email communications, Cloud computing for community; Cloud Computing for the Corporation: Managing Schedules, Managing Projects; Using Cloud Services: Collaborating on Calendars, Schedules, and Task Management, Collaborating on Project Management. Outside the Cloud: Other Ways to Collaborate Online: Collaborating via Web-Based Communication Tools, Collaborating via Social Networks and Groupware.

**References:**

1. Michael Miller, "Cloud Computing", Pearson Education, New Delhi, 2009.
2. Implementing and Developing Cloud Computing Applications by DAVID E.Y. SARNA, CRC Press

### **AC557 /IS /CN DIGITAL IMAGE PROCESSING**

Introduction to Image Processing Systems, Digital Image Fundamentals:- Image model, Relationship between Pixels, Imaging geometry, Camera model. Image Sensing and Acquisition.

Sampling and quantization. Image Enhancement and in spatial Domain: Point processing, Neighbourhood Processing, High pass filtering, High boost filtering, zooming. Image Enhancement based on Histogram modelling. Image Enhancement in frequency domain: 1D & 2D Fourier transform, Low pass frequency domain filter, High pass frequency domain filters, Holomorphic filtering. Image Segmentation:- Detection of discontinuation by point detection, line detection, edge detection. Edge linking and boundary detection:- Local analysis, global by graph, theoretic techniques. Thresh-holding, Morphology, Representation and description. Discrete image transform. Image Compression. Wavelet transformation.

#### **References:**

1. Digital Image Processing, Gonzalez & Wood
2. Digital Image Processing, A.K.Jain
3. Image Processing, Dhananjay K. Techkedath

### **AC558 /IS /CN CAD OF DIGITAL SYSTEMS**

Basic Mathematical Concepts, Introduction to design methodologies, Design automation tools, Algorithmic graph theory and computational complexities, Computational Approaches and methods for combinatorial optimization, Design of digital hardware and HDLs, Introduction to logic circuits, Implementation technologies, Verilog Programming concepts, Gate level modelling, Data flow modelling, Behavioural modelling, Combinational circuit design, Flip-flops, registers, counters and processor, Sequential circuits design, Tasks and functions, Timing and Delays, Data Structure in VLSI design, Layout, placement and partition, floor planning, routing, Logic Synthesis, Model Optimization, Verification and Testing, Simple Microprocessor Design.

#### **References:**

1. Algorithm for VLSI Design automation, Sabih H. Gerez
2. Fundamental of Digital Logic with Verilog Design, Brown & Vranesic
3. Verilog HDL, Samir Palnitkar
4. Digital VLSI Design with Verilog, John Williams

### **AC559 /IS /CN OBJECT-ORIENTED DESIGN AND MODELLING**

Object Orientation, OMT Methodology, Object Modelling: Object and Class, Link and Association, Generalization, Aggregation Multiple Inheritance, Packages. Object Meta modeling, Metadata and Metamodels. Functional Modeling. UML, Interactive Modeling. Analysis: Object Model, Data Dictionary, Dynamic Model, Functional Model, System Design. Detailed Design, Evaluating the Quality of a Design Model. Object Oriented Languages.

**References:**

1. Object-Oriented Modeling and Design by James Rumbaugh, Michael Blaha, William Premerlani, Frederick Eddy, William Lorensen, Pearson Education.

**AC560 /IS /CN TECHNICAL FOUNDATION FOR E-COMMERCE**

Introduction: Electronic commerce, technology and prospects, forces behind e-commerce, advantages and disadvantages, architectural framework, e-commerce strategy, e-commerce emerging issues and implementation issues, e-commerce law, government policies and agenda. E-Commerce Infrastructure: Internet and Intranet based e-commerce- Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN,FRAME RELAY). Mobile Commerce: Introduction, Wireless Application Protocol, WAP technology, Mobile information device, mobile computing applications , security issues in m-commerce. Electronic Payment System: Overview, electronic payment mechanisms and protocols, SET protocol, payment gateway, certificate, digital tokens, smart card, credit card, magnetic strip card, electronic money, electronic contracts, micro-payments, e-checks, e-cash

Credit/Debit card based EPS, e-commerce payments security, online banking. electronic data interchange and its applications. Internet Advertising. Models of Internet advertising, sponsoring contents, corporate website, weaknesses in Internet advertising, web auctions and trading mechanism. Securing Business on Network. Security policies, procedures and practices, site security, firewalls, securing web service, transaction security, cryptology, cryptological algorithms, public key algorithms, authentication protocols, digital Signatures, virtual private network, security protocols for web commerce. Advanced Topics. Electronic commerce optimization algorithms, decision support systems for e-commerce, data mining for e-commerce, intelligent techniques for e-commerce.