



# **M. Tech.**

## **(CSE)**

**Scheme and Syllabus**  
**Department of Computer Science**  
**AKS University, Satna (MP)**

# M. Tech (Computer Science and Engineering)

Department of CSE, Faculty of Engineering and Technology

AKS University, SATNA

Semester 1

S.NO.	PAPER CODE	NAME OF PAPER	HOURS PER WEEK			TOTAL CREDIT
			LECTURE	TUTORIAL	PRACTICAL	
	THEORY					
1	20MS101	Advanced Mathematics	3	1	0	4
2	2ORM102	Research Methodology	4	0	0	4
3	20CS103	Advanced Computer Networks	4	0	0	4
4	20CS104	Advanced Computer Architecture	3	1	0	4
5	Elective-I		4	0	0	4
	20CS105-A	Network Security and Cryptography				
	20CS105-B	Soft Computing				
	LABORATORY					
1	20CS151	Computer Lab- I	0	0	2	1
2	20CS152	Computer Lab- II	0	0	2	1
		TOTAL CONTACT HOURS/CREDIT				22

## M.Tech. (CSE)

Semester II

S.NO.	PAPER CODE	NAME OF PAPER	HOURS PER WEEK			TOTAL CREDIT
			L	T	P	
	THEORY					
1	20CS201	Advanced Data Structures and Algorithm	3	1	0	4
2	20CS202	Wireless Network & Mobile Computing	4	0	0	4
3	20CS203	Advanced Software Engineering	3	1	0	4
4	20CS204	Advanced DBMS	4	0	0	4
	Elective (Choose any one of no 5)		4	0	0	4
5	20CS205-A	System Programming				
	20CS205-B	Information Theory Coding				
	LABORATORY					
1	20CS252	Seminar I	0	0	2	1
2	20CS251	Computer Lab III	0	0	2	1
		TOTAL CONTACT HOURS/CREDIT				22

**M. Tech. (CSE)  
Semester III**

S.NO.	PAPER CODE	NAME OF PAPER	HOURS PER WEEK			TOTAL CREDIT
			LECTURE	TUTORIAL	PRACTICAL	
		THEORY				
2	20CS302	Digital Image Processing	4	0	0	4
3	Elective-I		4	0	0	4
	20CS303-A	Data Warehouse and Data Mining				
	20CS303-B	Cloud Computing				
		LABORATORY				
1	20CS351	Dissertation Part-I- Seminar II (Review of Literature)	0	0		4
2	20CS352	Project Using Latest Technology	0	0		4
		TOTAL CONTACT HOURS/CREDIT				16

**M. Tech. (CSE)  
Semester IV**

S.NO.	PAPER CODE	NAME OF PAPER	HOURS PER WEEK			TOTAL CREDIT
			LECTURE	TUTORIAL	PRACTICAL	
		THEORY				
1	20CS251	Seminar III	0	0	04	04
2	20CS252	Dissertation (Stage II)	4	0	12	12
		TOTAL CONTACT HOURS/CREDIT				16

## Semester I

### Advanced Mathematics

**Unit – I Group Theory and Applications:** Basic concept of set theory, Relations, Partial order & total order relations, Lattices & Hasse diagram, Functions, Composition of functions and some special functions. Introduction to graph theory, Groups, Homomorphism and Isomorphism of groups, COSETS and Lagrange's Theorem, Elements of Coding theory, Group codes, Decoding, Hamming matrices, The Parity check and Generator Matrices. Channel models, Channel capacity, Channel Coding, Convolution Codes.

**Unit – II Number Theory and Applications:** Fundamental theorem of arithmetic, Euclid's algorithm, Modular arithmetic, Fermat little theorem, Euler's Theorem, Primality Testing. Introduction to Cryptography, Encryption, Decryption, Integer Factoring Problem, Discrete Logarithm Problem, Hash Function, Digital Signature, Symmetric key Cryptosystem, Public key Cryptosystem, Diffie-Hellman Key Exchange, RSA Cryptosystem, ElGamal Cryptosystem, Elliptic Curve Cryptosystem.

**Unit – III Transform Theory:** Fourier Series (Review), Fourier Transform, Laplace Transform, Z - Transform.

**Unit-IV Application of Transform Theory:** Solving Differential Equations by Transform Methods (ODE & PDE), Solving Integral Equations by Transform Methods, Solving Difference Equations, Linearity, Time Scaling, Time Shifting, Frequency Shifting (Amplitude Modulation), Time differentiation and Time Integration.

**Unit - V Optimization & Modeling:** Basics of Mathematical Modeling, Linear Programming Problem (Formulation & Solution), Transportation Problem, Assignment Problem, Non – Linear Programming Problem, Dynamic Programming Problem, Simulation.

### Recommended Books:

1. Higher Engineering Mathematics – B. S. Grewal (42nd – Edition) – Khanna Publishers.
2. Advanced Engineering Mathematics – E. Kryzig (9th – Edition) – John Willy Publication.
3. Advanced Engineering Mathematics - Jain / Iynger – Narosa Publication.
4. J.P. Tremblay and R. Manohar, "Discrete Mathematical Structures with applications to Computer Science", TMH, 2000.Press, 2000.
5. Johannes A. Buchman, "Introduction to Cryptography", Springer-Verlag, 2005.
6. C.L. Liu, "Elements of Discrete Mathematics", Tata McGraw-Hill, 2002.
7. Bernard Kolman, Robert C. Busby and Sharon Cutler Ross, "Discrete Mathematical Structures", Pearson Education, 2004.
8. Narsingh Deo, "Graph theory with Applications to Engineering and Computer Science", Prentice Hall of India, 2003.
9. Mott, A. Kandel and T.P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", Prentice Hall of India, 2002.
10. Ranjan Bose, "Information theory: Coding and Cryptography", Tata McGraw Hill, 2002.
11. Viterbi, "Information Theory and Coding", McGraw Hill, 1982.
12. John G. Proakis, "Digital Communications", 2nd Edition, McGraw Hill, 1989.
13. H. A. Taha, "Operations Research: An Introduction", Pearson Education.
14. Gupta PK, PK Gupta, Kantiswaroop, "Operation Research" Sultan Chand & Sons.
15. Gareth A. Jones, Josephine Mary Jones, "Elementary Number Theory", Springer-Verlag, 2004.
16. Neal Koblitz, "A Course in Number Theory and Cryptography", Springer-Verlag, 2005.

## **Research Methodology**

### **Unit 1: Introduction to Research and Problem Definition**

Meaning, Objective and importance of research, Types of research, steps involved in research, defining research problem

### **Unit 2: Research Design**

Research design, Methods of research design, research process and steps involved, Literature Survey

### **Unit 3: Data Collection**

Classification of Data, Methods of Data Collection, Sampling, Sampling techniques procedure and methods, Ethical considerations in research

### **Unit 4: Data Analysis and interpretation**

Data analysis, Statistical techniques and choosing an appropriate statistical technique, Hypothesis, Hypothesis testing (T-test, Z- test, Chi Square, F-test, ANOVA), Data processing software (e.g. SPSS etc.), statistical inference, Interpretation of results

### **Unit 5: Technical Writing and reporting of research**

Types of research report: Dissertation and Thesis, research paper, review article, short communication, conference presentation etc., Referencing and referencing styles, Research Journals, Indexing and citation of Journals, Intellectual property, Plagiarism

### **Text Books:**

1. C. R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques, New Age International publishers, Third Edition.
2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, SAGE, 2005
3. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
4. Creswell, John W. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications, 2013.
5. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education New Delhi.

## Advanced Computer Networks

### UNIT-1

**Introduction:** Overview of computer networks, seven-layer architecture, TCP/IP suite of protocols, MAC protocols for high-speed LAN, MAN, and wireless LANs, (For example, FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless Ethernet, etc.), Fast access technologies (For example, ADSL, Cable Modem). IPv6: Why IPv6, basic protocol, extensions and options, support for QoS.

### UNIT-2

**Review of Networking Concepts:** (MAC layer issues, Ethernet 802.3, ARP, IP addressing and Subnetting, NAT and PAT, Variable Length Subnet Masking, CIDR

### UNIT-3

**End to End Protocols:** TCP connection establishment and termination, Sliding window concepts, other issues: wraparound, silly window syndrome, Nagle's algorithm, adaptive retransmission, TCP extensions. Congestion and flow control, Queuing theory, TCP flavors: Tahoe, Reno, New-Reno, TCP-SACK, TCP-RED and TCP-Vegas.

### UNIT-4:

**Routing and Multicast:** Structure of internet: Autonomous systems, Intra-domain routing: OSPF and RIP, Inter-domain routing: BGP. Multicasting: Group Management (IGMP), Internet scale multicasting: Reverse path broadcast, MOSPF, DVMRP, PIM. DNS (Domain Name System), E-mail (SMTP, POP, IMAP, MIME), World Wide Web (HTTP), Network Management (SNMP)

### UNIT-5:

Peer to peer and overlay networks: Concept of overlays, Unstructured Overlays: Gnutella, Concepts of Distributed Hash Table, Structured Overlays: Chord, CAN, Pastry  
Congestion Control and Resource Allocation: Congestion-avoidance mechanism, DEC bit, Random Early Detection (RED), Source based congestion avoidance.

### Text Books

1. Computer Networks: A Systems Approach, by Peterson and Davie, 5th Ed. Morgan Kaufman, 2011
2. Computer Networking: Top Down Approach, by Kurose and Ross, 6th Ed. Pearson, 2011

### Reading List

1. V. Paxson. "End-to-end Internet packet dynamics," in IEEE/ACM Transactions on Networking, Vol 7, No 3, June, 1999.
2. W. Stevens, "TCP Slow Start, Congestion Avoidance, Fast Retransmit, and Fast Recovery Algorithms," RFC2001.

## Advanced Computer Architecture

### Unit 1

**Introduction and Review:** Fundamentals of digital computer and organization. **Pipelining:** Linear pipeline processor: Nonlinear pipeline processor, Instruction pipeline design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch handling techniques, Arithmetic Pipeline design: Computer arithmetic principles, Static arithmetic pipelines, Multifunctional arithmetic pipelines

### Unit 2

**Storage and Memory Hierarchy:** Register file, Virtual memory, Cache memories, Cache memory working principles, Cache coherence issues, Cache performance analysis, High bandwidth memories. I/O Organization: High bandwidth I/O, Disk I/O, Bus specifications and Standards. Instruction Level Parallelism: Super-scalar processors, VLIW architecture

### Unit 3

**Parallel Computer Models and Program Parallelism:** Classifications of Machines, SISD and MIMD, condition of parallelism, data and resource dependencies, hardware and software parallelism program partitioning and scheduling, grain size latency, program flow mechanism, control flow versus data flow, data flow architecture, demand driven mechanisms, comparison of flow mechanisms.

### Unit 4

**Vector Processor and Synchronous Parallel Processing:** Vector instruction types, vector-access memory schemes, vector and symbolic processors, SIMD architecture and programming principles: SIMD parallel algorithms, SIMD computers and performance enhancement.

### Unit 5

**System Interconnect Architectures:** Network properties and routing, static interconnection networks, dynamic interconnection networks, multiprocessor system interconnects: Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

#### Main Reading:

1. Hennessy & D.A. Patterson, "Computer Architecture: A Quantitative approach", International Student Edition, 3rd Edition, 2002, Morgan Kaufmann Publisher.
2. Michael J. Flynn, "Computer Architecture: Pipelined and Parallel Processor Design" 1995, Jones and Barlett, Boston.

#### Supplementary Reading:

1. Kai Hwang, "Advanced computer architecture", 1993, TMH
2. R.K. Ghose, Rajan Moona & Phalguni Gupta, "Foundation of Parallel Processing"; Narosa Publication.
3. D. Sima, T. Fountain, P. Kasuk, "Advanced Computer Architecture-A Design space Approach", 1997, Addison Wesley
- 4.

**Elective I**  
**Introduction to Cryptography and Network Security**

**UNIT I- INTRODUCTION**

Services, Mechanisms and attacks-the OSI security architecture-Network security, model classical Encryption techniques (Symmetric cipher model, substitution, techniques, transposition Techniques, steganography).

**UNIT II- BLOCK CIPHERS**

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced. Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm.

**UNIT III- PUBLIC KEY CRYPTOGRAPHY**

Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key Exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

**UNIT - IV HASH FUNCTIONS AND DIGITAL SIGNATURES**

Authentication functions-Message authentication codes-Hash Functions-Hash Algorithms (MD5, Secure Hash Algorithm)-Digital signatures (Authentication protocols, Digital signature Standard).

**UNIT - V Network Security**

Basic Concepts, Dimensions, Parameter for Network Protection, Network Attacks, Need of Intrusion Monitoring and Detection, Intrusion Detection

Virtual Private Networks- Need, Use of Tunneling with VPN, Authentication Mechanisms, Types of VPNs and their Usage, Security, Concerns in VPN.

Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing, Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Securing Wireless Networks

**REFERENCE BOOKS:**

1. William Stallings, “*Cryptography and Network Security*”, Pearson Education, 6th Edition, SBN 10: 0133354695, 2013.
2. Atul Kahate, “*Cryptography and Network Security*”, McGraw Hill Education India (Pvt Ltd), 2<sup>nd</sup> edition, ISBN 10: 0070151458, 2009.
3. Charlie Kaufman, Radia Perlman, Mike Speciner, “*Network Security: Private Communication in a Public World*”, Prentice Hall, 2<sup>nd</sup> edition, ISBN 10: 0130460192, 2002.
4. Charles Pfleeger, Shari Lawrence Pfleeger “*Security in computing*”, Prentice Hall, 4th Edition, ISBN 10: 0132390779, 2006.

## Soft Computing

### Unit I:

**Introduction:** Introduction - soft computing, soft computing vs hard computing. Soft computing techniques. Computational Intelligence and applications, problem space and searching: Graph searching, different searching algorithms like breadth first search, depth first search techniques, heuristic searching Techniques like Best first Search, A\* algorithm, AO\* Algorithms.

**Game Playing:** Minimax search procedure, adding alpha-beta cutoffs, additional refinements, Iterative deepening,

**Statistical Reasoning:** Probability and Bayes theorem, Certainty factors and Rules based systems, Bayesian Networks, Dempster Shafer theorem

### Unit II:

**Neural Network:** Introduction, Biological neural network: Structure of a brain, Learning methodologies. Learning (Supervised & Unsupervised) and activation function, Architecture, Models, Hebbian learning, Single layer Perceptron, Perceptron learning, Windrow-Hoff/Delta learning rule, winner take all, linear Separability, Multilayer Perceptron, Adaline, Madaline, different activation functions Back propagation network, derivation of EBPA, momentum, limitation, Applications of Neural network.

**Artificial Neural Network (ANN):** Evolution of, Basic neuron modeling, Difference between ANN and human brain, characteristics, McCulloch-Pitts neuron models,

### Unit III:

**Unsupervised learning in Neural Network:** Counter propagation network, architecture, functioning & characteristics of counter propagation network, Associative memory, hopfield network and Bidirectional associative memory.

**Adaptive Resonance Theory:** Architecture, classifications, Implementation and training. Introduction to Support Vector machine, architecture and algorithms, Introduction to Kohanan's Self organization map, architecture and algorithms

### Unit – IV

**Fuzzy Systems:** Introduction, Need, Classical sets (crisp sets) and operations on classical sets Interval Arithmetic, Fuzzy set theory and operations, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Membership functions

**Fuzzy Rule-base System:** fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic, fuzzification and defuzzification. Fuzzy associative memory. Fuzzy Logic Theory, Modeling & Control Systems

## **Unit – V**

Genetic algorithm: Introduction, working principle, Basic operators and Terminologies like individual, gene, encoding, fitness function and reproduction

Genetic modeling: Significance of Genetic operators, Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, GA optimization problems, including JSPP (Job shop scheduling problem), TSP (Travelling salesman problem), Applications of GA, Differences & similarities between GA & other traditional methods.

Evolutionary Computing: Concepts & Applications. Swarm Intelligence.

### **References:**

1. S.N. Shivnandam, “Principle of soft computing”, Wiley India.
2. David Poole, Alan Mackworth “Computational Intelligence: A logical Approach” Oxford.
3. Russell & Yuhui, “Computational Intelligence: Concepts to Implementations”, Elsevier.
4. Eiben and Smith “Introduction to Evolutionary Computing” Springer
5. Janga Reddy Manne; "Swarm Intelligence and Evolutionary Computing"; Lap Lambert Academic Publishing
6. E. Sanchez, T. Shibata, and L. A. Zadeh, Eds., "Genetic Algorithms and Fuzzy Logic Systems: Soft Computing Perspectives, Advances in Fuzzy Systems - Applications and Theory", Vol. 7, River Edge, World Scientific, 1997.
7. Ajith Abraham et.al, “Soft computing as transdisciplinary science and technology: proceedings of 4th IEEE International Workshop WSTST’ 05” Springer.
8. D.E. Goldberg “Genetic algorithms, optimization and machine learning" Addison Wesley
9. De Jong, Kenneth "An Evolutionary Computation: A Unified Approach" Prentice-Hall of India Private Limited
10. Rich E and Knight K, Artificial Intelligence, TMH, New Delhi.

## **M. Tech (CSE) – Semester I - Lab Practice I**

### **Cryptography and Networks Practical Manual**

- 1.** Write a C/Java program to perform encryption and decryption for the Substitution Cipher algorithm.
- 2.** Write a C/Java program to implement RSA algorithm.
- 3.** Implement the Diffie-Hellman Key Exchange algorithm using C language.
- 4.** Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (using GnuPG).
- 5.** Configure DNS/FTP/DHCP Server and Client on Windows/Linux Server.
- 6.** Study of basic Network commands and Network Configuration commands like ping, pathping, nslookup, tracert commands
- 7.** Write procedure of Linux OS (Ubuntu/CentOS) installation, practice on basic Linux commands and Networking commands (ifconfig, tcpdump, netstat, dnsip, hostname, route...)
- 8.** Overview of IP Addressing and sub-netting, static IP setting on Linux/Windows machine.
- 9.** Explain the following –
  - a. Honeypot
  - b. Rootkit
- 10.** Configuration of TCP/IP Protocols in Windows/Linux.

## M. Tech (CSE) – Semester I - Lab Practice II

### Architecture and RM Practical Manual

- 1) Study of Linear and nonlinear pipeline with their performance?
- 2) Study of Signed binary representation?
- 3) Study of simultaneous and hierarchical memory organization?
- 4) Study of different Cache mapping techniques?
- 5) Study of Instruction set of 8085 microprocessors?
- 6) Write an assembly language program to add two 8-bit numbers stored at address 2050 and address 2051 in 8085 microprocessors. The starting address of the program is taken as 2000?
- 7) Multiply two 8-bit numbers stored at address 2050 and 2051. Result is stored at address 3050 and 3051. Starting address of program is taken as 2000?
- 8) Consider a direct mapped cache of size 16 KB with block size 256 bytes. The size of main memory is 128 KB. Find
  - a) Number of bits in tag
  - b) Tag directory size
  - c) Number of bits in block number
  - d) Number of bits in word offset
- 9) Consider a 2-way associative mapped cache of size 16 KB with block size 256 bytes. The size of main memory is 128 KB. Find
  - a) Number of bits in tag
  - b) Tag directory size
  - c) Number of bits in set number
  - d) Number of bits in word offset
- 10) Write an assembly language program to find maximum of two 8-bit numbers in 8085 microprocessors?
- 11) Write a program in assembly language to check whether a number is even or odd?
- 12) What is Case-study method of research?
- 13) What Do I Need to Consider When Doing Observational Research?
- 14) What is Qualitative Research Methodology?
- 15) What is Research Methodology?



## Semester II

### Advanced Data Structures and Algorithm

#### Unit 1:

**Elementary Data Structures:** Arrays, stack, queues, linked list, sorting techniques, Hash Tables, Binary Search Trees, B-Trees, Binomial heaps, Graph

#### Unit 2:

**Mathematical Preliminaries:** Algorithm analysis, Complexity analysis: time and space complexity, average case, worse case, and best-case complexities, Order notations: big Oh, big omega, big theta and small Oh, Solving recurrences

**Greedy Algorithms:** Graphs and minimum spanning tree, Knapsack problem, Job Scheduling Problem

#### Unit 3:

**Divide and Conquer:** General Template, various algorithm implementation eg. Binary search, Heap sort, Quick Sort, Finding the median, matrix multiplication

**Branch and Bound:** Assignment problem, Travelling Salesman Problem

#### Unit 4:

**Backtracking:** Knapsack problem, Eight Queens problem

**Dynamic Programming:** Introduction of Dynamic Programming, Principle of Optimality, Comparison with divide and conquer, single source shortest paths, Chained matrix multiplication

#### Unit 5:

**String processing:** String searching and Pattern matching, Knuth-Morris-Pratt algorithm and its analysis.

**Computational Complexity and NP-Completeness:** The classes of P and NP, Polynomial reductions, NP-complete problems, NP completeness proofs, NP hard problems, Non-Deterministic algorithms

#### References:

1. Gilles Brassard and Paul Bratley, Fundamentals of Algorithmics, PHI
2. Thomas Cormen, Introduction to Algorithms, PHI
3. Trembly and Sorenson, Data Structure and Algorithms, PHI



## Wireless Network & Mobile Computing

### Unit – I Introduction

Wired Network vs. Wireless Network, Overview of Wireless Applications. Wireless Transmission: Path loss, Multi-path propagation, Doppler shift, Fading.

Time Division Multiplexing, Frequency Division Multiplexing, Code, Spread Spectrum Technique, Satellite Communication.

### Unit – II Cellular System

Cellular Network Organization, Cellular System Evolution. Cellular Fundamentals: Capacity, Topology, Operation of Cellular Systems, Handoff, Power control.

Case study: Global System for Mobile Communication (GSM) Network, General Packet Radio Service (GPRS). Code Division Multiple Access (CDMA 2000), Cordless System, Wireless Local Loop.

### Unit – III Mobility Management

Mobility Management, Location Management. HLR-VLR scheme, Hierarchical scheme, Predictive location management Schemes.

### Unit – IV Wireless Network

**Protocols:** Media Access Protocol, Mobile IP, Mobile Transport Layer Protocol, Wireless Access Protocol, Ad -Hoc Networks and Routing. Standards: IEEE 802.11, Wi -Fi, Wireless Broadband - Wi-MAX, Bluetooth, IEEE802.15, Security in Wireless Network, Hyper LAN.

### Unit – V Mobile Computing

Mobile Computing, Issues: Resource Management, Interference, Bandwidth, Cell Splitting, Frequency reuse. Mobile Data Transaction Models, File Systems, Security, Attacks and countermeasures.

Contemporary Research Topics:

Case Study of different topic: Wireless Network, VoLTE, EDGE, Mobile Computing, Security.

### References

5. William Stallings, “Wireless Communications & Networks”, 2/E, Pearson Education India, Reprint 2007.
6. Jochen Schiller, “Mobile Communications”, 2/E, Pearson Education India, reprint 2007.
7. Sandeep Singhal, “The Wireless Application Protocol”, Addison Wesley, India, reprint 2001
8. T S Rappaport, "Wireless Communications: Principles & Practice", 2/E, Pearson Education, 2002.
9. C E Perkins, “Ad Hoc Networking”, Addison Wesley, 2000.



## Advanced Software Engineering

### Unit1

**Introduction:** Software engineering, software process models, software engineering principles, agility and agile model, CMM, SRS, Reengineering and reverse engineering, structured coding techniques.

### Unit 2

**The Wider Software Engineering Context:** Embedded software and systems engineering: overview, examples and industrial realities, Project Management - Project Planning and Scheduling, Standards, e.g. PSS-05, Case studies

### Unit3

**Software Engineering Process:** Unified Software Development Process, Software Process Improvement, Software Economics, Software Quality, Software Metrics - Measurement, Estimation and Prediction, Requirements Management, Configuration Management, Risk Management, Testing and Inspection

### Unit4

**Software Architecture:** Architecture Description Languages, Pattern-Oriented Software Architecture Component-based Development, Distributed Software Architectures using Middleware, Enterprise Application Integration, Architectures for Mobile and Pervasive Systems, Model Driven Architecture

### Unit 5

**Software Testing and Maintenance:** Software quality, Testing-strategic approach to software testing, validating testing, system testing, art of debugging, software maintenance and software supportability

**Advanced Modelling:** UML Extension Mechanisms, Object Constraint Language, Model Checking UML diagrams.



## References

1. F. Buschmann, R. Meunier, H. Rohnert, P. Sommerlad, M. Stal: Pattern-Oriented Software Architecture. John Wiley. 1996
2. I. Jacobson, J. Rumbaugh, G. Booch: The Unified Software Development Process. Addison Wesley. 1999
3. G. Booch, I. Jacobson, J. Rumbaugh: The Unified Modeling Language User Guide. Addison Wesley. 1999
4. J. B. Warmer, A. G. Kleppe: The Object Constraint Language: Precise Modeling with UML Addison Wesley. 1997
5. E. M. Clarke, O. Grumberg, D. Peled: Model Checking. MIT Press. 2000
6. A. Finkelstein (ed): The Future of Software Engineering. ACM Press. 2000
7. R. Hubert, D.A. Taylor: Convergent Architecture: Building Model Driven J2EE Systems with UML. Wiley 2002.
8. W. A. Ruh, F. X. Maginnis, W. J. Brown: Enterprise Application Integration. Wiley 2000
9. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Tata McGraw-Hill seventh edition, 2009.



## Advanced Database Management System

### UNIT-I:

**Database Systems:** Introduction, Concepts of Relational Models and Relational Algebra. E-R Models, DDL, DML, SQL: Introduction to SQL Queries, Integrity Constraints, Joins, Views, Intermediate and Advanced SQL features, Nested Queries, Complex Integrity Constraints in SQL Views and Triggers. Query processing algorithms, Query optimization.

### UNIT-II:

**Introduction to Schema Refinement** – Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decompositions - Properties of Decompositions, Lossless Decomposition ,1NF, 2NF, 3NF, Boyce-Codd Normal Form, Normalization using multi-valued dependencies, 4NF, 5NF.

### UNIT-III:

**Transaction Management:** The ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock Based Concurrency Control, Transaction Support in SQL. Concurrency Control: Serializability, and recoverability, Dealing with Deadlocks. Crash recovery: Introduction to Crash recovery, Introduction to ARIES, Write-Ahead Log Protocol, Check pointing, recovering from a System Crash, Media recovery.

### UNIT-IV:

**Overview of Storage and Indexing:** Data on External Storage, File Organization and Indexing, Clustered Indexes, Primary and Secondary Indexes

**Storing data:** Disks and Files: -The Memory Hierarchy, Redundant Arrays of Independent Disks.

**Tree Structured Indexing:** Intuitions for tree Indexes, Indexed Sequential Access Methods, B+ Trees Hash Based Indexing: Static Hashing, Extendable hashing, Linear Hashing, Extendable vs. Linear Hashing.

### UNIT-V:

**Distributed databases:** Introduction to distributed databases, Distributed DBMS architectures, Storing data in a distributed DBMS, Distributed catalog management, Distributed query processing, Updating distributed data, Distributed transactions, Distributed concurrency control, Distributed Recovery.

### REFERENCES:

1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, TMH, 3rd Edition, 2003.
2. Data base System Concepts, A.Silberschatz, H.F. Korth, S.Sudarshan, McGraw hill, VI edition, 2006.
3. Fundamentals of Database Systems 5th edition. Ramez Elmasri, Shamkant B.Navathe, Pearson Education, 2008.
4. Introduction to Database Systems, C.J.Date,Pearson Education.
5. Database Management System Oracle SQL and PL/SQL, P.K.Das Gupta, PHI.
6. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning, 2008.



## **Elective II**

### **System Programming**

#### **Unit-1**

Overview of language processors, Elements of assembly level programming, Design of assembler, Macro definition, Design of Macro preprocessor, Relocating and linking concepts, Design of linker, Programming Environments.

#### **Unit-II**

Aspects of Compilation, overview of the various phases of compiler, Scanning, Syntax error handling, Symbol table conceptual design, Intermediate Code conceptual Design, Intermediate code interfaces, Dynamic storage allocation techniques, Dynamic Programming code generation algorithm, Principal sources of optimization, Approaches to compiler development. Register allocation techniques. Concurrentisation and vectorisation of programs.

#### **Unit –III**

Motivation and overview, Structure of a Parallelizing compiler. Parallelism detection: data dependence, direction vectors, loop carried and loop independent dependences. Compilation for Distributed Machines Data partitioning, instruction scheduling, register allocation, machine optimization. Dynamic compilation. Introduction to code optimization. Classical theory of data flow analysis. Bi-directional data flows. Unified algorithms for data flow analysis. Program representation for optimisation - SSA form, etc. Efficient code generation for expressions. Code generator generators (CGGs). Code generation for pipelined machines.

#### **Unit-IV**

Design Issues in distributed operating system, Networking Issues, Communication Protocols, Message Passing, RPC in heterogeneous environment, Resource allocation, Algorithms for Distributed control. Distributed Deadlock detection, Mechanism for building Distributed File System, Distributed shared memory, Distributed scheduling.

#### **Unit-V**

Resource Security and Protection: The Access Matrix model, Advanced models of protection. Cryptography, Authentication, Multiprocessor System Architecture, Structure of multiprocessor operating systems, Process synchronization, scheduling, Memory management, Fault tolerance. Case studies: Unix Operating system, Amoeba, Andrew.

#### **References:**

1. Dhamdhare, Systems Programming and Operating systems, TMH
2. Keith Cooper, Engineering a Compiler, Elsevier Pub
3. Mak, Writing compilers and Interpreters, Wiley India
4. Singhal & Shivaratri, Advanced concepts in Operating Systems, TMH
5. Sinha, Distributed operating system, PHI



## **Information Theory Coding**

### **Unit- I SOURCE CODING**

Introduction to information theory, Uncertainty and information, Average Mutual information and entropy, Source Coding Theorem, Shannon-Fano Coding, Huffman Coding, Arithmetic Coding, Lempel-Ziv Algorithm, Run-length Encoding and Rate Distortion Function.

### **Unit-II CHANNEL CAPACITY AND CODING**

Channel models, Channel capacity, Channel coding, Information capacity theorem, Random selection of codes, Error control coding, Linear block codes and their properties, Decoding of linear block code, Perfect codes, Hamming codes, Optimal linear codes and MDS codes.

### **Unit-III CYCLIC CODES**

Polynomials, Division algorithm for polynomials, A method for generating cyclic codes, Matrix description of cyclic codes, Burst Error Correction, Fire codes, Golay codes, CRC codes, Circuit implementation of cyclic codes. BCH codes, Minimal polynomials, Generator polynomial for BCH codes, Decoding of BCH codes, Reed-Solomon codes and nested codes.

### **Unit-IV CONVOLUTION CODES**

Tree codes and trellis codes, Polynomial description of convolutional codes, Distance notions for convolutional codes, Generation function, Matrix description of convolutional codes, Viterbi decoding of convolutional codes, Distance bounds for convolutional codes, Turbo codes and Turbo decoding.

### **Unit-V TRELLIS CODED MODULATION**

Concept of coded modulation, Mapping by set partitioning, Gottfried Ungerboeck's TCM design rules, TCM decoder, Performance evaluation for Additive White Gaussian Noise (AWGN) channel, TCM for fading channels.

### **Recommended Books:**

1. Ranjan Bose, "Information theory: Coding and Cryptography", Tata McGraw Hill, 2002.
2. Viterbi, "Information Theory and Coding", McGraw Hill, 1982.
3. John G. Proakis, "Digital Communications", 2nd Edition, McGraw Hill, 1989



## M. Tech (Computer Science and Engineering)

### Department of CSE, Faculty of Engineering and Technology, AKS University, SATNA Semester II (Lab Practice III)

1. Write a program to implement Code Division Multiple Access (CDMA).
2. Design a scenario of wireless communication in NS2 (Network Simulator 2) & analyze it.
3. WAP for Binary Search Tree to implement following operations:
  - a. Insertion
  - b. Finding an element
  - c. Finding Min element
  - d. Deletion
4. WAP to perform string matching using Knuth-Morris-Pratt algorithm.

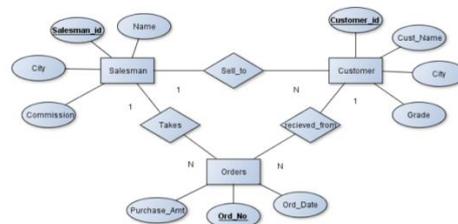
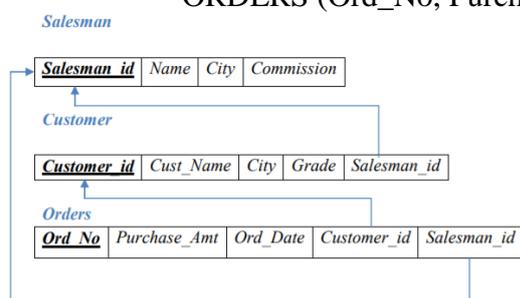
Find the product whose selling price is greater than 2000 and less than or equal to 5000.

5. Building Web Applications using PHP & MySQL showing the use of triggers
6. Consider the following schema for Order Database:

SALESMAN (Salesman\_id, Name, City, Commission)

CUSTOMER (Customer\_id, Cust\_Name, City, Grade, Salesman\_id)

ORDERS (Ord\_No, Purchase\_Amt, Ord\_Date, Customer\_id, Salesman\_id)



Write SQL queries to

- a) Count the customers with grades above Jabalpur's average.
  - b) Find the name and numbers of all salesmen who had more than one customer.
  - c) List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.)
  - d) Create a view that finds the salesman who has the customer with the highest order of a day.
  - e) Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
7. Draw ER Diagram, DFD for library management system.
  8. Draw UML diagrams of student database using Microsoft Visio or Rational rose software.
  9. Write a program to create single pass assembler.
  10. Write a program to create symbol table for a given assembly language program.



## Semester III

### Digital Image Processing

#### Unit 1

**Digital Image Fundamental** – Introduction, components of image processing systems, image sensing and acquisition, image sampling and quantization, pixel operation, Light, Brightness adaption and discrimination, Imaging Geometry, Perspective Projection, Spatial Domain Filtering

#### Unit 2

**IMAGE ENHANCEMENT TECHNIQUES:** Spatial Domain methods: Basic grey level transformation – Histogram equalization – Image subtraction – Image averaging – Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters: Smoothing – Sharpening filters – Homomorphic filtering, Color Image Enhancement

#### Unit 3

**Image Transformation** – Discrete fourier transformation, Walsh Transformation, Hadamard Transformation, Cosing transformation, HAAR transformation, Wavelet transformation, Slant – Karhunen – Loeve transforms

#### Unit 4

**Image Compression**-Encoder-Decoder model, Types of redundancies, Lossy and Lossless compression, Entropy of an information source, Shannon's 1st Theorem, Huffman Coding, Arithmetic Coding, Golomb Coding, LZW coding, Transform Coding, Sub-image size selection, blocking artifacts, DCT implementation using FFT, Run length coding, FAX compression (CCITT Group-3 and Group-4), Symbol-based coding, JBIG-2, Bit-plane encoding, Bit-allocation, Zonal Coding, Threshold Coding, JPEG, Lossless predictive coding, Lossy predictive coding, Motion Compensation

#### Unit 5

**IMAGE SEGMENTATION AND REPRESENTATION** Edge detection – Thresholding - Region Based segmentation – Boundary representation: chain codes- Polygonal approximation – Boundary segments – boundary descriptors: Simple descriptors-Fourier descriptors - Regional descriptors –Simple descriptors- Texture

#### Text Books

1. Fundamental of Image processing, Anil K. Jain, Prentice Hall
2. Digital Image processing, 3<sup>rd</sup> edition, Rafael C. Gonzalez and Richard E. Woods



## Cloud Computing

### Unit-1

**Introduction to Cloud Computing:** Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS, Cloud computing platforms: Infrastructure as service: Amazon EC2, Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing.

### Unit-2

**Introduction to Cloud Technologies:** Study of Hypervisors, Compare SOAP and REST, Web-services, AJAX and mashups-Web services: SOAP and REST, SOAP versus REST, AJAX: asynchronous 'rich' interfaces, Mashups: user interface services Virtualization Technology: Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization, Multitenant software: Multi-entity support, Multi-schema approach, Multi-tenancy using cloud data stores, Data access control for enterprise applications.

### Unit-3

**Data in the Cloud:** Relational databases Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Map-Reduce and extensions: Parallel computing, Map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Map-reduce, Features and comparisons among GFS, HDFS etc, Map-Reduce model.

### Unit-4

**Administrating the Clouds:** Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, Establishing Identity and Presence.

### Unit-5

**Issues in Cloud Computing:** Implementing real time application over cloud platform, Issues in Intercloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud Quality of Service (QoS) monitoring in a Cloud computing environment, Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud.

### Text Books:

1. Rajkumar Buyya, Christian Vecchiola, and S. ThamaraiSelvi, "Mastering Cloud Computing", McGraw Hill Education Pvt Ltd.
2. Gautam Shroff, "Enterprise Cloud Computing", Cambridge University Press.



## **Data Warehousing & Data Mining**

**UNIT-I: Data Warehousing and Business Analysis:** - Data warehousing Components, Building a Data warehouse, Mapping the Data Warehouse to a Multiprocessor Architecture, DBMS Schemas for Decision Support, Data Extraction, Cleanup, and Transformation Tools, Metadata reporting, Query tools and Applications, Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

**UNIT-II: Data Mining:** - Data Mining Functionalities – Data Preprocessing, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation. Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods, Mining Various Kinds of Association Rules, Association Mining to Correlation Analysis, Constraint Based Association Mining.

**UNIT-III: Classification and Prediction:** - Issues Regarding Classification and Prediction, Classification by Decision Tree Introduction, Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction Accuracy and Error Measures, Evaluating the Accuracy of a Classifier or Predictor, Ensemble Methods, Model Section.

**UNIT-IV: Cluster Analysis:** - Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical methods, Density-Based Methods. Grid-Based Methods, Model-Based Clustering Methods, Clustering High- Dimensional Data, Constraint Based Cluster Analysis, Outlier Analysis.

**UNIT-V: Text and Web Data:** Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.

**Case Study:** Bigdata, WEKA / R Tool

### **REFERENCES:**

1. Jiawei Han and Micheline Kamber “Data Mining Concepts and Techniques” Second Edition,
2. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Tenth Reprint 2007.
3. G. K. Gupta “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar “Introduction to Data Mining”, Pearson Education, 2007.
5. Soman K.P., Shyam Diwakar and V. Ajay, “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
6. Daniel T. Larose, “Data Mining Methods and Models”, Wile-Interscience, 2006.