

## Scheme of Teaching & Examination

### M.Tech In Computer Science & Engineering

Semester-1

Subject Code	Name of the subjects	Hrs/Week			Credits	Evaluation(marks)				
		Lecture	Tutorial	Practical		Theory		Practical		Total
						Int.	Ext.	Int.	Ext.	
PG-CSE1-01	High Performance Computer Architecture	4	0	0	4	30	70	0	0	100
PG-CSE1-02	Advances in Operating System Design	4	0	0	4	30	70	0	0	100
PG-CSE1-03	Object Oriented System	4	0	0	4	30	70	0	0	100
PG-CSE1-04	Elective-1	4	0	0	3/4	30	70	0	0	100
PG-CSE1-05	Elective-2	4	0	0	3/4	30	70	0	0	100
PG-CSE1-06	Computer System Lab-1	0	0	6	4	0	0	50	0	50
PG-CSE1-07	Seminar-1	0	0	2	1	50				50
	<b>TOTAL</b>				23/25					600

## Semester-2

Subject Code	Name of the subjects	Hrs/Week			Credits	Evaluation(marks)				Total
		Lecture	Tutorial	Practical		Theory		Practical		
						Int.	Ext.	Int.	Ext.	
PG-CSE1-01	Advances in Algorithm	4	0	0	4	30	70	0	0	100
PG-CSE1-02	TCP/IP & Internet	4	0	0	4	30	70	0	0	100
PG-CSE1-03	Advanced Digital Image Processing	4	0	0	4	30	70	0	0	100
PG-CSE1-04	Elective-3	4	0	0	3/4	30	70	0	0	100
PG-CSE1-05	Elective-4	4	0	0	3/4	30	70	0	0	100
PG-CSE1-06	Computer System Lab-II	0	0	6	4	0	0	50	0	50
PG-CSE1-07	Seminar-II	0	0	2	1	50				50
PG-CSE1-08	Comprehensive Viva-Voce	0	0	0	3	100				100
	<b>TOTAL</b>				23/25					700

Semester-3&4

Subject Code	Name of the subjects	Hrs/Week			Credits	Evaluation(marks)				
		Lecture	Tutorial	Practical		Theory		Practical		Total
						Int.	Ext.	Int.	Ext.	
PG-CSE1-34	Project	0	0	6	15	0	0	200	300	500

**Elective 1:-**

- i. AI & Expert System Design
- ii. Data Warehousing & Mining

**Elective-2:-**

- i. Neural Network & Fuzzy System
- ii. Real Time System
- iii. Mobile Computing

**Elective-3:-**

- i. Distributed System
- ii. Software Engineering
- iii. Pattern Recognition

**Elective-4:-**

- i. Embedded System
- ii. Cryptography & Network Security
- iii. Multimedia Systems

**Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur**  
**Syllabus**

**M. Tech in Computer Science & Engineering**

<b>PG-CSE1-01</b>	<b>High Performance Computer Architecture</b>	<b>4-0-0</b>	<b>4</b>
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Introduction: Review of basic computer architecture, quantitative techniques in computer design, measuring and reporting performance. CISC and RISC processors, Pipelining, Basic concepts, instruction and arithmetic pipeline, data hazards, Exception handling, Pipeline optimization techniques, Compiler techniques for improving performance, Hierarchical memory technology, Inclusion, Coherence and Locality Properties, Cache memory, Organizations, Techniques for reducing cache misses, Virtual memory organization, Mapping and management techniques, Memory replacement policies, Instruction-level parallelism, Basic concepts, Techniques for increasing ILP, Super scalar, Super pipelined and VLIW processor architectures, Array and vector processors, Multiprocessor architecture, Taxonomy of parallel architectures, Centralized shared-memory architecture, Synchronization, Memory consistency, Interconnection networks, Distributed shared-memory architecture. Cluster computers. Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures.

<b>PG-CSE1-02</b>	<b>Advances In Operating System Design</b>	<b>4-0-0</b>	<b>4</b>
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Theory and implementation aspects of distributed operating systems, Process synchronization in multiprocessing/multiprogramming systems, Inter-process communication and co-ordination in large distributed systems, Distributed resource management, Fundamentals of real time operating systems, Case studies, Information management in distributed systems, security, integrity and concurrency problems, Fault tolerance issues, OS issues related to the Internet, intranets, pervasive computing, embedded systems, mobile systems and wireless networks. Case studies of contemporary operating systems.

<b>PG-CSE1-03</b>	<b>Object Oriented System</b>	<b>4-0-0</b>	<b>4</b>
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Review of programming practices and code-reuse; Object model and object-oriented concepts; Object-oriented programming languages and implementation; Object oriented analyses and design using UML structural, behavioral and architectural modeling; Unified development process, Software reuse design patterns, components and framework; Distributed object computing, interoperability and middleware standards COM/DCOM and CORBA; Object-oriented database system data model, object definition and query language, object-relational system.

<b>PG-CSE1-04/1</b>	<b>Artificial intelligence and expert system design</b>	<b>4-0-0</b>	<b>4</b>
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Overview of history and goals of AI: Tentative definitions, Turing's test, Knowledge Vs Symbolic level, Relations with other disciplines from philosophy, To Linguistic to Engineering, Review of AL successes and failures.

State Spaces, Production System and Search; State Space representation of problems, Problem solving search, Constraints, Definition and examples of Production Systems, Heuristic search techniques, Two person games.

Knowledge representation Issues : Procedural Knowledge Representation Vs. Declarations Knowledge + reasoning, Facts, General Assertions, Meta Knowledge, The Frame Problem. Using First-Order logic: Semantic and Deduction. Unification, Resolution-based theorem proving. Using theorem proving to answer questions about the truth of sentences or to identify individuals that satisfy complex constrains, Logic programming.

Weak Slot-and-Filler Structure: Semantic nets and Frames, Scripts for representing prototypical combination of events and actions.

Rule-Based Systems: Pattern-matching algorithms, He problem of Control in Rule based Systems. The Rete Algorithm.

Statistical Reasoning: Use of Certainty factors in Rule Based Systems. Associating probabilities to assertion in first order logic, Bayesian networks, fuzzy logic.

Learning: Learning to classify concepts using features of their instances, learning a concept (introduction) form examples. Explanation- Based learning. Version, neural nets with back propagation.

Introduction to Expert system: definition why build an expert system, application areas of expert system and how expert systems are used. Characteristics of expert systems, structure of expert system, characteristics and phases and people involved in building an expert system inference techniques, types of reasoning deductive, inductive, abductive, analogical, common-scene and non-monotonic, types of inference forward and backward chaining, search techniques, depth-first search, breadth-first search and best-first search.

Rule –Based Expert Systems: Evolution, architecture of rule based system, examples of rule based system, backward chaining and forward chaining rule based system and task on designing backward chaining and forward chaining rule based system. Approach inexact reasoning, probability theory, Bayesian Theory: example, variation and prospector: an expert system application that employed Bayesian approach, Certainty Theory: Overview uncertain evidence, uncertain rules, uncertain inferencing certainty factor and certainty factor example program.

Fuzzy Logic: overview of fuzzy logic, forming fuzzy set representation, hedges, set operation, inference of fuzzy logic and building of fuzzy logic expert system. Rame-Based Expert systems: Overview, Anatomy of class, subclass, instance properties, inheritance, facts, methods, encapsulation, rules interaction with objects and design methodology for frame based system. Define problem, Analyze Domain, define classes, instances, rules and object communication, design interface, evaluate system and expand system.

<b>PG-CSE1-04/2</b>	<b>Data Warehousing &amp; Mining</b>	<b>4-0-0</b>	<b>4</b>
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Data Mining and Data Warehousing: Introduction to Data Mining, Data Warehousing, Introduction to KDD process, Classification and Algorithms, Data mining tasks, Machine Learning-Basic-concept, Data Warehouse Architecture, Data Modeling.

Data marts & Olap: Data Mart Designing, Data Mart Builder, Data Mart Discovery, On-Line Analytical Processing, OLTP VS. DW Environment.

Relationship of Data Mining and Data Warehousing: Application of Data Mining, Application of Warehousing, A Relation Between Data Mining and Data Warehousing according to need of business.

Statistical Analysis and Cluster Analysis: What is Statistics? Difference between Statistics and Data Mining, Histograms, Statistics for predictions, clustering for clarity, Hierarchical and Non-Hierarchical Clusters, choosing classics.

Neural networks & mining complex: What are neural networks? Where to use these networks? Benefits and features of networks, Rule Induction, various mining complexities.

Next generation of informatics mining & knowledge discovery: Business Intelligence and Information mining, Text mining, Knowledge management, Benefits and products of text mining, Customer relationship management in the e-business world.

### **Books and References:**

1. Data Mining.  
By Pieter Adriaans
2. Data Mining Technology For Marketing, Sales And Customer Support  
By Michel Berry.
3. Data Warehousing & Data Mining For Telecommunication  
By Rob Maltison

4. Distributed Data Warehousing Using Web Technology  
By R.A.Moeller
5. Building Data Mining Application For CRM  
By Alex Berson

<b>PG-CSE1-05/1</b>	<b>Neural Network &amp; Fuzzy System</b>	<b>4-0-0</b>	<b>4</b>
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Introduction to Biological Neural Networks: Neuron physiology, Neuronal diversity, Specification of the brain, the eye's neural network.

Artificial Neural Networks Concepts: Neural attributes, Modeling learning in ANN, characteristics of ANN, ANN topologies, Learning algorithm, The stability-plasticity dilemma. Neural Networks Paradigm: McCulloch-Pitts, Model, the Perception, Winner-Take-All learning Algorithm, Back-propagation learning algorithm, Adaptive Resonance (ART) paradigm, Hopfield Model, Competitive learning Model, Memory-type Paradigm, Linear Associative Memory, Real-Time Models, LVQ, SOM, Probabilistic Neural Networks.

Introduction to Fuzzy sets: Fuzzy set theory Vs Probability theory, classical set theory, properties of Fuzzy sets, Operation in Fuzzy sets, Fuzzy relations, Operations of Fuzzy relations, the extension principle.

Fuzzy Arithmetic, Approximations reasoning: Introduction, Linguistic variables, Fuzzy propositions, Fuzzy if-then rules.

Representing a set Rule: Mamdani Vs Gödel, Properties of a set of rules.

Fuzzy Knowledge base control, Fuzzy Networks, Applications of Fuzzy logic & Neural Networks, Fuzzy Neural Networks.

<b>PG-CSE1-05/2</b>	<b>Real Time System</b>	<b>4-0-0</b>	<b>4</b>
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Introduction to real time system, embedded systems and reactive systems; Hard and Soft Real Time Systems; Handling real time; Specification and Modeling; Design methods; Real Time operating systems; Validation and Verification; Real time Process and Applications; Distributed Real Time Systems.

<b>PG-CSE1-05/3</b>	<b>Mobile Computing</b>	<b>4-0-0</b>	<b>4</b>
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Introduction: A short history of wireless communication, a market for mobile communication, A simplified reference model.

Wireless transmission: frequencies for radio transmission, single, antennas, signal propagation, Multiplexing, modulation, spread spectrum, cellular systems.

Medium access control: Motivation for a specialized MCA, SDMA, FDMA, TDMA, CDMA, Comparison of S/T//F/CDMA.

Telecommunication system: GSM, DECT, TETRA, UMTS and IMT-2000,

Satellite systems: History, application, basic, routing, localization.

Broadcast systems: overview, cyclical repetition of data, Digital audio broadcasting, Digital video broadcasting, convergence of broadcasting, and mobile communication.

Wireless LAN: intra red vs. radio transmission, infrastructure and ad-hoc network, IEEE 802, 11, HIPERLAN, Blue tooth.

Mobile network layer: Mobile IP, Dynamic host configuration protocol, mobile ad-hoc network.

Mobile transport layer: Traditional TCP, Classical TCP improvement, TCP over 2.5/3G wireless network, Performance enhancing proxies.

Support for mobility : file systems, world wide web, wireless application protocol(version 1.x),I-MODE,SYNCML,WAP 2.0.

#### Books and References:

1. Mobile communication, 2<sup>nd</sup> edition, Jochen Schiller.
2. Mobile commerce & wireless computing systems, Geoffrey Elliott, Nigel [Phillips. @2004.](#)
3. Wireless communication and network, William Stallings, @ 2002, prentice hall.
4. The Essential guide to wireless communication application, 2/E, Andy Dornan, @20002,prentice hall PTR.
5. Principles of wireless network: A unified approach, Kaveh Pahlavan, Prashant Krishnamurthy, @2002,prentice hall PTR.



6. Ad hoc wireless network: architectures and protocols, C.siva ram murthy,B.S.manoj,@2004,prontice hall PTR.
7. Fixed and mobile telecommunication: Network system, and services, second edition, Jan Van Duuren, Peter Kastelein, Frits C.Schoute.
8. Real 802, 11 Security: Wi-Fi protected access and 802.11, Jon Edney William Arbaugh,2003.
9. Mobile commerce & wireless computing systems, Geoffrey Elliot, Nigel Phillips,@2004,Addison-Wesley.
10. Mobile ipv6, Hesham soliman,@2004,Addison Wesley professional.

<b>PG-CSE2-01</b>	<b>Advances in Algorithm</b>	<b>4-0-0</b>	<b>4</b>
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Algorithm Paradigms: Dynamic Programming Greedy, Branch-and-Bound, Asymptotic complexity, Amortized analysis, Graph Algorithms, Shortest paths, Flow networks, NP-completeness, Approximation algorithms(range searching, convex hulls, segment intersections, closet pairs), Numerical algorithms(integer, matrix and polynomial multiplication, FFT, extended Euclid's algorithm, modular exponentiation, primarily testing, cryptographic computations), Internet algorithms(text pattern matching, tries, information retrieval, data compression, Web caching).

<b>PG-CSE2-02</b>	<b>TCP/IP and Internet</b>	<b>4-0-0</b>	<b>4</b>
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The TCP/IP Architecture,

The Internet Protocol: IP Packet, IP Addressing Subnet Addressing, IP Routing, Classless Inter-Domain Routing (CIDR), Address Resolution, Reverse Address Resolution, Fragmentation and Reassembly, ICMP: Error and Control Messages.

IPv6: Header format, Network Addressing, Extension Headers

User Datagram Protocol

Transmission Control Protocol: TCP Reliable Stream Services, TCP Operation, TCP Protocol  
DHCP and Mobile IP: Dynamic Host Configuration Protocol, Mobile IP.

Internet Routing Protocols: Routing Information Protocol, Open Shortest Path First, Border Gateway Protocol

Multicast Routing: Reverse-Path Broadcasting, Internet Group Management Protocol (IGMP), Reverse-Path Multicasting, Distance-Vector Multicast Routing Protocol.

**Security Protocols:** Security and Cryptographic Algorithms: Applications of Cryptography to Security, Key Distribution. Security Protocols: IPSec, Secure Sockets Layer and Transport Layer Security Cryptographic Algorithms: DES, RSA.

**Multimedia Information and Networking:** Introduction to Digital Audio, Audio compression, Streaming Audio, Internet Radio, Voice over IP, Introduction to Video, Video compression, Video on demand the Real Time Transport Protocol: RTP Scenarios and terminology, RTP Packet format, RTP Control Protocol(RTCP) Session Control Protocols: Session initiation Protocol, H.323 Multimedia Communication Systems, Media Gateway Control Protocols.

**Networks applications:** Client-Server Interaction: The client-server paradigm, The socket interfaces. Naming with the domain system, electronic mail representation and transfer, file transfer and remote file access, world wide web pages browsing, dynamic web document technologies(CGI, ASP, JSP, PHP, ColdFusion), Active Web Document Technologies (Java, JavaScript), Network Management(SNMP).

#### **Books and References:**

11. Communication Network, Leon-Gracia, & Widjija, 2001, TMH.
12. An Engineering approach to computer networking , S. Keshav, Addison Wesley, 2001.
13. TCP/IP illustrated, Volume 1: The Protocols, 1/e—2000, Richard Stevens.
14. TCP/IP illustrated, Volume 2: The implementation,1/e—1996, Gary R. Wright.
15. TCP/IP illustrated, volume 3: TCP for transaction, HTTP, NNTP & the UNIX domain Protocol,1/e – 1999 W. Richard Stevens
16. Internetworking with TCP/IP vol.1 principles, protocols & architecture, 4/e—2000, DOUGLAS E. COMER,
17. Internetworking with TCP/IP vol.2 ANSI C Version : Design. Implementation, & Internal, 3/e—1999, DOUGLAS E. COMER
18. Internetworking with TCP/IP vol. 3 Client-Server Programming & Application, 2/e—1996, DOUGLAS E. COMER
19. Computer Networking with Internet Protocols & technology, 1/e – 2003 William Stallings
20. Computer Networking, 4/e—2002, Andrew S. Tanenbaum,
21. Computer Networking & Internet, 2/e—1998, Douglas E.Comer
22. High-Speed networking & Internet,2/e—2002, William Stallings
23. TCP/IP PROTOCOL SUITE, FOROUZAN, BEHROUS A. , Mc grew hill.
24. RFC's & Internet drafts available from IETF, Articles in various journals & conference Proceeding.

<b>PG-CSE2-03</b>	<b>Advanced Digital Image Processing</b>	<b>4-0-0</b>	<b>4</b>
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Image Enhancement in the Spatial Domain : spatial & frequency methods, Basic Grey Level Transformation, histogram Equalization, Histogram Proceeding, Local Enhancement, Image Subtraction, Image Averaging, Basics of Spatial Filtering, smoothing Spatial filters, sharpening spatial filters.

Transforms: Introduction to the Fourier Transformation, Discrete Fourier Transformation, Fast Fourier Transformation Fourier Properties ,2D FT, inverse Fourier transform, Wavelet transform & multi resolution proceeding

Image Enhancement in the frequency Domain: Filtering in the Frequency Domain, corresponding between filtering in the Spatial & Frequency-Domain, Smoothing Frequency-domain filters, Sharpening frequency –domain Filters, Homomorphic Filtering, Implementation.

Image Compression: Image compression models, lossy & loss less compression, image compression standards.

Image Restoration, color Image Proceeding,

Morphological Image Proceeding; Preliminaries, Dilation & Erosion, Opening & Closing, hit-or-miss Transformation, some Basic Morphological algorithms, Extension to Gray-Scale Image

Image segmentation: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking & Boundary Detection, Thresholding, Region-Oriented Segmentation.

Representation: Chain Codes, Polygonal Approximation, Signatures, Boundary Segments, Skeleton of a Region.

Description: Boundary Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors, Simple Descriptors, Topological Descriptors.

Object Recognition: Recognition based on decision theoretical methods, Structural methods.

Books:

1. Rafeal C. Gonzalel and Richard E. Woods, “Digital Image Processing”, 2<sup>nd</sup> edition, Prentice Hall,2002.
2. A. K. Jain, “Fundamental of Digital Image Processing”, Prentice Hall.
3. W. K. Pratt, “Digital Image Processing” 3<sup>rd</sup> Edition, John Wiely and Sons, New York
4. Chanda, Mazumdar, “Digital Image Processing”, Prentice Hall,India.

<b>PG-CSE2-04/1</b>	<b>Distributed System</b>	<b>4-0-0</b>	<b>4</b>
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Basic concepts, Models of computation: shared memory and message passing systems, synchronous and asynchronous systems. Logical time and event ordering. Global state and snapshot algorithms, mutual exclusion, clock synchronization, leader election, deadlock detection, termination detection, spanning tree construction. Programming models: remote procedure calls, distributed shared memory. Fault tolerance and recovery: basic concepts, fault models, agreement problems and its applications, commit protocols, voting protocols, check pointing and recovery, reliable communication. Security and Authentication: basic concepts, Kerberos. Resource sharing and load balancing, Special topics: distributed objects, distributed databases, directory services, web services.

<b>PG-CSE2-04/2</b>	<b>Software Engineering</b>	<b>4-0-0</b>	<b>4</b>
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Introduction Life cycle models, Requirement analysis and specification, Formal requirement specification, Fundamental issues in software design, Goodness of design, Cohesion, Coupling, Function-oriented design, Structured analysis and design, Overview of object-oriented concepts, Unified Modeling Language (UML) Unified design process, User interface design, Coding standards and guidelines, Code walkthrough and reviews, Unit testing, Black box and White box testing, Software quality and reliability, SEI CMM and ISO 9001, PSP and Six Sigma, Cleanroom techniques software project management, Configuration management issues and techniques, Software reuse, Client-server software development.

<b>PG-CSE2-04/3</b>	<b>Pattern Recognition</b>	<b>4-0-0</b>	<b>4</b>
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**Introduction:** Examples: The nature of statistical pattern recognition; Three learning paradigms; The sub-problems recognition; The basic structure of a pattern recognition system; Comparing classifiers.

**Learning-Parametric Approaches:** Basic statistical issues; Source of classification error; Bias and variance; Three approaches to classification : density estimation, regression and discriminant analysis; Empirical error criteria; Optimization methods; Failure of MLE.

**Parametric Discriminant Function;** Linear and quadratic Discriminants; Shrinkage; Logistic Classification; Generalizes Liner Classifiers; Perceptrons; Maximum Margin; Error Correcting Codes.

**Error Assessment:** Sample error and truth error; Error rate estimation; Confidence intervals, Resampling methods; Regularization; Model selection, Minimum description length; Comparing classifiers.

**Nonparametric Classification:** Histogram rules; Nearest neighbor method, Kernel approaches, Local polynomial fitting; Flexible metrics, Autonomic Kernels methods.

**Feature Extraction:** Optimal features; Optimal liner transformations; Liner and nonlinear principal components; Feature subset selection.

<b>PG-CSE2-05/1</b>	<b>Embedded Systems</b>	<b>4-0-0</b>	<b>4</b>
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Introduction to Embedded Systems - definitions and constraints; hardware and processor requirements; special purpose processors; input-output design and I/O communication protocols; design space exploration for constraint satisfaction; co-design approach; example system design; Formal approach to specification; specification languages; specification refinement and design; design validation; Real Time operating system issues with respect to embedded system applications; time constraints and performance analysis.

<b>PG-CSE2-05/2</b>	<b>Cryptography and Network Security</b>	<b>4-0-0</b>	<b>4</b>
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Introduction: Basic objectives of cryptography, secret-key and public-key cryptography, one-way and trapdoor one-way functions, cryptanalysis, attack models, classical cryptography. Block ciphers: Modes of operation, DES and its variants, RCS, IDEA, SAFER, FEAL, BlowFish, AES, linear and differential cryptanalysis. Stream ciphers: Stream ciphers based on linear feedback shift registers, SEAL, unconditional security. Message digest: Properties of hash functions, MD2, MD5 and SHA-1, keyed hash functions, attacks on hash functions. Public-key parameters: Modular arithmetic, gcd, primality testing, Chinese remainder theorem, modular square roots, finite fields. Intractable problems: Integer factorization problem, RSA problem, modular square root problem, discrete logarithm problem, Diffie-Hellman problem, known algorithms for solving the intractable problems. Public-key encryption: RSA, Rabin and ElGamal schemes, side channel attacks. Key exchange: Diffie-Hellman and MQV algorithms. Digital signatures: RSA, DAS and NR signature schemes, blind and undeniable signatures. Entity authentication: Passwords, challenge-response algorithms, zero-knowledge protocols. Standards: IEEE, RSA and ISO standards. Network issues: Certification, public-key infrastructure (PKI), secured socket layer (SSL), Kerberos. Advanced topics: Elliptic and hyper-elliptic curve cryptography, number field sieve, lattices and their applications in cryptography, hidden monomial cryptosystems, cryptographically secure random number generators.

<b>PG-CSE2-05/3</b>	<b>Multimedia System</b>	<b>4-0-0</b>	<b>4</b>
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An overview of multimedia system and media streams; Source representation and compression techniques text, speech and audio, still image and video; Graphics and animation; Multi-modal communication; Multimedia communication, video conferencing, video-on-demand broadcasting issues, traffic shaping and networking support; Trans coding; Multimedia OS and middleware; Synchronization and OS; Multimedia servers, databases and content management; Multimedia information system and applications.