L: 3	CS771 Artificial Intelligence
T: 1	*Theory: 100 marks*
P: 0	Sessional: 75marks
	Time: 3 hours

Fundamental issues in intelligent systems: History of artificial intelligence; philosophical questions; fundamental definitions; philosophical questions; modeling the world; the role of heuristics.

Search and constraint satisfaction: Problem spaces; brute-force search; best-first search; two-player games; constraint satisfaction.

Knowledge representation and reasoning: Review of propositional and predicate logic; resolution and theorem proving; non-monotonic inference; probabilistic reasoning; Bayes theorem.

Advanced search: Genetic algorithms; simulated annealing; local search.

Advanced knowledge representation and reasoning: Structured representation; non-monotonic reasoning; reasoning on action and change; temporal and spatial reasoning; uncertainty; knowledge representation for diagnosis, qualitative representation .

Agents: Definition of agents; successful applications and state-of-the-art agent-based systems; software agents, personal assistants, and information access; multi-agent systems.

Machine learning and neural networks: Definition and examples of machine learning; supervised learning; unsupervised learning; reinforcement learning; introduction to neural networks.

AI planning systems: Definition and examples of planning systems; planning as search; operator-based planning; propositional planning.

Books:

1. Nilsson, N. J, Principle of AI, Narosa Publ. House.
2. Pitterson, D.N, Introduction to AI & Expert Sys.
3. Jacson, P., Intro. To Ex. Sys., Addision Werley Publ. Co.
4. Clocksm & Mellish, Programming in PROLONG, Narosa Publ. House.
5. Norvig, Peter, Paradigms of AI Programming, Morgan Kauffman, 1992.
6. Rusell, Stuart & Norvig, Peter, Artificial Intelligence, Prentice Hall, 1995.

7. Rich & Knight, Artificial Intelligence, 2nd edition, TMH, 1991.

L: 3	CS772 Design and Analysis of Algorithms
T: 1	*Theory: 100 marks*
P: 0	Sessional: 75marks
	Time: 3 hours

Review of basic data structures such as stacks, queues, linked lists, trees and graphs.

Concepts in algorithm analysis, asymptotic complexity. Domain independent algorithm design techniques such as divide and conquer, greedy method, dynamic programming, backtracking, branch and bound.

Examples of above techniques from sets, graphs, text processing, internal and external sorting, height balanced trees, B-trees, hashing algorithms, dynamic storage allocation and garbage collection.

Lower Bound theory and NP-hard problems.

Books / references:

1. Introduction to Algorithms - T. H. Comer, C. E. Leiserson and R. L. Rivest.

2. The Design and Analysis of Computer Algorithms - A. V. Aho, J.E. Hopcroft and J. D. Ulman, Adison Wesley Publication Company

3. Fundamentals of Computer Algorithms - E. Horowitz and S. Sahni, Galgotia Publications.

L: 3	**CS 773 Cryptology and Security Systems**
T: 1	**Theory: 100 marks**
P: 0	***Sessional: 75marks***
	Time: 3 hours

Introduction

Introduction to OSI Network Security Architectures, Services, Mechanisms and Attacks, Classical Encryption Techniques, Symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Steganography.

Block Cipher and Data Encryption standards

Classical Encryption Techniques, Introduction to DES, differential and Linear Cryptanalysis, Block Cipher Cryptography, Triple DES Algorithm, International Data Encryption Algorithm (IDEA), Blowfish Algorithm, RC-x Algorithms, CAST-x Algorithms, Symmetric Block Cipher Schemes, Encryption Function Placement and Confidentiality problems.

Public-Key Cryptography and Message Authentication

The Key Distribution Problem, Random Number Generation, The Public-Key Cryptosystems, The RSA Algorithm, The Key Management riddle, The Diffie-Hellman Key Exchange, Elliptic Curve Cryptography. Introduction to Message Authentication, requirements and functions, Message Authentication Codes, Hash Functions, their Security and other considerations

Authentication Applications

The Message Digest (MD5) Algorithm, The Secure Hash Algorithm (SHA-1), RIPEMD-x and HMAC fundamentals, Digital Signature basics, Authentication Protocols, The Digital Signature Standard, Introduction to the Kerberos Authentication scheme, The X.319 Directory Authentication scheme.

Electronic Mail and IP Security

Fundamentals of the E-mail security, PGP, The S/MIME Standard, The IP Security Framework, The Authentication Header scheme, The ESP scheme, Hybrid schemes and Key Management problems

Web Security and network management

Web-based Security frameworks, requirements, The SSL and TLS frameworks**,** A review of Web-security solutions, Introduction to Intrusion Detection, On the Virus, Worm and similar security threats, Introduction to Firewall Systems, On the Trusted Systems, A Case-study / Design of an Internet Security System.

Text Books/ References:

1. William Stallings, Cryptography and Network Security: Principles and Practice, Third Edition, Pearson Education, New Delhi, 2001.
2. C. Kaufman, R.Perlman and M. Spenser, Network Security, Second Edition, Prentice-Hall, Englewood Cliffs, 2002.

3. 3. S. Bellovin and W.Chesvick, Internet Security and Firewalls, Second Edition, Addison-Wesley, Reading, 1998

L: 3	**CS 774 Network Programming**
T: 1	**Theory: 100 marks**
P: 0	***Sessional: 75marks***
	Time: 3 hours

The client server model; an introduction to TCP socket function calls: socket(), connect(),bind(),listen() and accept().

Constructing messages for computer communication; byte manipulation functions; an example of a client-server program.

Introduction to multiple access in wireless networks; CDMA; 802.11 Wireless LANs; the 802.11 MAC protocol; the use of RTS/CTS frames.

The 802.11 frame format; addressing in 802.11; handling mobility within the same IP subnet; Bluetooth.

Using the Domain Name Service in programs; A review of SMTP and an example SMTP dialogue.

Writing a concurrent server program; using fork(), pipe() and wait() functions in C; using signals (asynchronous software interrupts); zombie processes.

Managing mobility in networks; addressing and routing under mobility; mobile IP; implications of wireless to higher layers.

Introduction to multimedia networking; the network service requirements of multimedia applications; RTSP; QoS on top of a best-effort service network; understanding jitter and playout delay; forward error correction and interleaving.

I/O multiplexing; using the select() and poll() functions; blocking and non-blocking sockets; socket options.

Review of HTTP; software architecture of web servers; event-driven, process-driven and hybrid servers; the Apache server as a case study;

Protocols for multimedia transmissions: RTP and RTCP; Session Initiation Protocol (SIP); communicating between circuit-switched telephone network and the Internet; H.323.

Scheduling and policing mechanisms for quality-of-service; fair queueing; leaky bucket.

Issues in buffering and TCP; understanding the TCP socket life cycle.

Content distribution networks; Integrated Services and Differentiated services for quality of service in the Internet; Resource reservation protocol.

Cellular Internet access and managing mobility in cellular networks.

Books / references:

J. F. Kurose and K. W. Ross, *Computer Networking: A Top-Down Approach Featuring the Internet*, Addison-Wesley Publishing, 2nd edition, 2002

W. R. Stevens, *UNIX Network Programming*, Prentice Hall PTR, 2nd edition, January 1998

L: 3	**CS 775 Integrated Circuit Technology**
T: 1	**Theory: 100 marks**
P: 0	***Sessional: 75marks***
	Time: 3 hours

Basic Outline of fabrication techniques; Silicon bipolar transistor as an example. Cost benefits of mass produced circuit blocks, reliability and performance considerations. Disadvantages. Exploiting the inherent component matching capabilities of I.C.s – example from linear and digital circuits.

Introductory ideas about crystal growth and wafer preparation. Short description of the Czochralski process.

The diffusion process. Simple diffusion theory and the evaluation of impurity diffused in silicon – determination of junction depth and sheet resistance. Oxidation and epitaxial growth of silicon. Pre-deposition and drive-in diffusions in junction devices. Fick's law, distribution of impurities and the calculation of emitter and base depths. Lateral diffusion. Diffusion related parameters for boron and phosphorous. Preparation of a simple process schedule.

Lithography. Optical lithography, minimum line-width consideration, layout fundamentals and mask making. Brief references to X-ray, electron beam and deep UV lithography.

Interconnection. Aluminum metallization – resistance heated evapovated and CVD methods. Brief mention about metallization failures – step covering and electromigration. Other method of interconnection.

Passive components. MOS capacitors and resistors. Calculation of area and the layout of capacitors and resistors.

MOSFET: NMOS and CMOS fabrication techniques. Polysilicon self aligned gate devices. Layout of simple Circuits. Introduction to VLSI processing and layout Stick diagrams and layout and simulation tools.

Other related processes. Ion implantation, dry etching, sputtering, assembly and reliability related evaluation. Future trends.

Books / references:

1. Douglas J. Hamilton and William G. Howard - Basic Integrated Circuit Engineering, McGraw-Hill Book Company.

2. S M. Sze - Basic VLSI Technology. McGraw-Hill Book Company

3. Douglas A. Pucknell and Karman Eshraghain - Basic VLSI Design, Prentice Hall of India.

4. Andrew S. Grove - Physics and Technology of Semiconductor Devices, John Wiley and Sons.

5. R Jacob Baker, Harry W. Li and David E. Boyce - CMOS circuit design layout and simulation. Prentice Hall of India.

L: 3	**CS775 Fault Tolerant Systems**
T: 1	**Theory: 100 marks**
P: 0	***Sessional: 75marks***
	Time: 3 hours

Test generation for digital systems. Fault models & Different types of test generation. Design for testability, Scan paths.. Built-in self test etc. Fault simulation, circuit modeling and logic values. Delays and Timing. General algorithm. Deductive and concurrent fault simulation. Fault injection and comparison of fault simulation methods. Coding theory & techniques in fault tolerant, self checking fail-safe circuits. An overview of architecture of fault tolerant computers. System diagnosis. a brief idea of fault tolerant software.

Books / references:

1. D. K. Pradhan - Fault Tolerant Computing, Prentice Hall of India.

L: 3	**CS775 Optimization Techniques**
T: 1	**Theory: 100 marks**
P: 0	***Sessional: 75marks***
	Time: 3 hours

Introduction to optimization

Introduction and scope of optimization. Definitions: design vector, design constraint and objective function. Classification of optimization problems.

Classical optimization techniques

Local and global minima and maxima. Single and multi-variable optimization without constraints. Multivariable optimization with inequality constraints. Method of direct substitution and method of Lagrange's multipliers. Multivariable optimization with inequality constraints. Kuho-Tucker conditions.

Linear programming

Formulation of linear programming problems (LPP). Standard form of LPP. Geometry of LPP (graphical solution). Solution by the simplex method. Computer program. Duality in linear programming. Sensitivity or post-optimality analysis.

Non-linear programming

Uninodal functions. One dimensional minimization methods. A brief idea about elimination (search) method. Fibonacci and golden section methods. Quadratic interpolation method. Gradient methods. Method of steepest descent, conjugate gradient (Fletcher-Reeve) method.

A brief introduction to dynamic programmiry and solution to simple problems.

Text Books / references:

1. N. S Rao - Optimization: Theory and Application Wiley Eastern ltd.

2. H. Taw - Operations Research - An Introduction, Prentice Hall

3. K. V. Mittal and C. Mohan - Optimization Methods in Operations Research and System Analysis, New Age International.

L: 3	**CS775 Perasive Computing**
T: 1	**Theory: 100 marks**
P: 0	***Sessional: 75marks***
	Time: 3 hours

Introductory concepts, Brief History and Emerging Trends

Pervasive Computing Application Architectures, Pervasive Computing Devices. Interfaces and Biometrics.

Operating System issues in Pervasive Computing. Java in Pervasive Computing

Device Technology Trends in Pervasive Computing. Device Connectivity Issues and Protocols . Device Connectivity Security Issues. Device Management and Mechanisms

Web-based Applications. Protocols, Transcoding, Authentication of Clients over Web. Wireless Application Protocol (WAP). WAP Architecture, Infrastructure, Security. WAP Push Technology, I-Mode and Emerging Trends. Scalability and Availability Issues

Wireless Markup Language: Introduction.

Voice-enabling Pervasive Computing Systems: Introduction. Voice Standards. Speech applications and security issues.

Personal Digital Assistants: Introduction. PDA Operating Systems. PDA Device Characteristics. PDA Software Components, Standards. Applications.

User Interface Architectures. Implementation of User Interface Architectures. Smart Card-based Authentication Mechanisms over the Internet.

Books and References:

1. Jochen Burkhardt, Horst Henn, Stefan Hepper, Thomas Schaec & Klaus Rindtorff: Pervasive Computing: Technology and Architecture of Mobile Internet Applications, Pearson Education, 2004

2. Uwe Hansman, Lothar Merk, Martin S. Nicklous & Thomas Stober: Principles of Mobile Computing, Second Edition, Springer-Verlag, New Delhi, 2003.

3. Rahul Banerjee: Internetworking Technologies: An Engineering Perspective, Prentice-Hall of India, New Delhi, 2003.

5. Yi-Bing Lin & Imrich Chlamtac: Wireless and Mobile Network Architectures, John Wiley & Sons, New Delhi, 2004.

6. P. Nicopolitidis, M. S. Obaidat, G. I. Papadimitriou & A. S. Pompportsis: Wireless Networks, John Wiley & Sons, New Delhi, 2003.

L: 3	**CS776 Multimedia Theory And Applications**
T: 1	**Theory: 100 marks**
P: 0	***Sessional: 75marks***
	Time: 3 hours

Introduction

History of Multimedia Systems, Hypermedia/Multimedia, HyperText/HyperMedia, Overview of Multimedia Software Tools, Music Sequencing and Notation, Graphics Image and Video Editing, Multimedia Authoring.

Issues in Multimedia authoring

Multimedia Authoring Metaphors, Content Design, Scripting(Writing), Graphics(Illustrating), Animation(Wiggling), Audio(Hearing), Interactivity (Interacting)

Multimedia Data Representations

Basics of Digital audio, Introduction to MIDI(Musical Instrument Digital Interface), Graphics/ Image File Formats, Standard System Independent Formats, System Dependent Formats, Color in Image and Video, Basics of Video, Types of Color Video Signals, Digital Video.

Video and Audio Compression

Basics of Information Theory, Lossless Compression Algorithms, Huffman Coding, Lempel-Ziv-Welch Algorithm, Image Compression-JPEG, 4 JPEG modes, JPEG 2000, Video Compression, H.261, H.263, MPEG, New MPEG Standards, Audio Compression, Simple Audio Compression Methods, Psychoacoustics.

Books/ References

1. Multimedia System Design by Adeleigh and Thakrar.
2. Multimedia at Work by T. Vaughan
3. Introduction to Data Compression by Khalid Sayood

L: 3	**CS776 Microprocessor Based System Design**
T: 1	**Theory: 100 marks**
P: 0	***Sessional: 75marks***
	Time: 3 hours

Small Systems Organization

Bus Architecture

Building blocks around a microprocessor

Memory Techniques, RAM discs

PAGED memory modules

Communication and data transfers

Monitors and Operating Systems

Engineering Applications of Microprocessors as device controllers

Concept of local and Central Control.

L: 3	**CS776 Graph Theory**
T: 1	**Theory: 100 marks**
P: 0	***Sessional: 75marks***
	Time: 3 hours

Graph : Incidence and degree; Handshaking Lemma; Isomorphism; Subgraphs and Union of graphs; Connectedness; Walks, Paths and Circuits; Components and Connectedness; Walks, Walks, Paths and Circuits; Components and Connectedness algorithms; Shortest Path Algorithms, Eulerian graph, Fleury's algorithm and Chinese postman problem; Hamiltonian graph - necessary and sufficient conditions; Traveling salesman; Bipartite graph.

Tree : Properties of trees; Pedant vertices in a tree; Center of a tree; Rooted binary trees; Spanning trees - Spanning tree algorithms; Fundamental circuits; Spanning trees of a weighted graph; cut-sets and cut-vertices; Fundamental cut-sets; Connectivity and separativity; network flow; max-flow min-cut theorem.

Planner graph: Combinatorial and geometric dual; Kuratowski's graph; detection of planarity; Thickness and crossings.

Matrix representations of graph: Incidence; Adjacency; matrices and their properties.

Colourings: Chromatic number : Chromatic polynomial; The six and five colour theorems; The four colour problem.

Directed graphs : Binary relations; Directed graphs and connectedness; directed trees; Aborecence; Polish method; Tournaments.

Counting of labeled trees : Cayley's theorem; Counting methods; Polya theory.

Books :

1. Deo, N.: Graph Theory with Applications to Engineering and Computer Science.
2. Harary : Graph Theory, PHI (EEE)

L: 0 **T: 0** **P: 2**	**CS777 Training** **Total marks: 50 marks**

Industrial training in recognized organizations.

L: 0	**CS778 Project I**
T: 0	**Total marks: 100 marks**
P: 8	

Project on any of the following topics:

1. Database Management system
2. Networking
3. Microprocessor
4. Microcontroller
5. Neural Network and Fuzzy logic
6. Network security