

**BARRACKPORE RASTRAGURU SURENDRANATH COLLEGE**  
 85 Middle Road & 6 Riverside Road, Barrackpore, North 24 Pgs-700120  
 NAAC Accredited (3<sup>rd</sup> Cycle) 'A' Grade College  
 Affiliated to West Bengal State University  
 Recognized by UGC as College with Potential for Excellence  
 Website: [www.brsnc.org](http://www.brsnc.org)



**MASTER OF SCIENCE (M.Sc.) IN COMPUTER SCIENCE**  
**CURRICULUM for Session 2016-2017**

Course Code	Topic	Lecture/ week	Tutorial/ week	Practical/ week	Credit	Marks
<b>SEMESTER I</b>						
<b>CMSMT1.1</b>	Discrete Mathematics	6	1		5	50
<b>CMSMT1.2</b>	Advanced Data Structure	6	1		5	50
<b>CMSMT1.3</b>	Analysis of Algorithms	6	1		5	50
<b>CMSMT1.4</b>	Data Communication	6	1		5	50
<b>CMSMP1.5</b>	Lab 1: Advanced Data Structure			6	3	50
<b>CMSMP1.6</b>	Lab 2: Web Programming 1			6	3	50
<b>Total</b>					<b>26</b>	<b>300</b>
<b>SEMESTER II</b>						
<b>CMSMT2.1</b>	Object-oriented Technology	6	1		5	50
<b>CMSMT2.2</b>	Computer Network	6	1		5	50
<b>CMSMT2.3</b>	Advanced Operating Systems	6	1		5	50
<b>CMSMT2.4</b>	Software Engineering	6	1		5	50
<b>CMSMP2.5</b>	Lab 3: Software Engineering			6	3	50
<b>CMSMP2.6</b>	Lab 4: Web Programming II			6	3	50
<b>Total</b>					<b>26</b>	<b>300</b>

Course Code	Topic	Lecture / week	Tutorial/ week	Practical/ week	Credit	Marks
<b>SEMESTER III</b>						
<b>CMSMT3.1</b>	Advanced Computer Architecture	6	1		5	50
<b>CMSMT3.2</b>	Advanced DBMS	6	1		5	50
<b>CMSMT3.3</b>	Compiler Design	6	1		5	50
<b>CMSMP3.4</b>	Lab 5: Advanced DBMS			6	3	50
<b>CMSMP3.5</b>	Seminar				3	50
<b>CMSMP3.6</b>	Design Work				4	50
<b>Total</b>					<b>25</b>	<b>300</b>
<b>SEMESTER IV</b>						
	Elective I	6	1		5	50
	Elective II	6	1		5	50
<b>CMSMP4.3</b>	General Viva-voce				3	50
<b>CMSMP4.4</b>	Dissertation Work				10	150
<b>Total</b>					<b>23</b>	<b>300</b>
<b>M.Sc. Course Total</b>					<b>100</b>	<b>1200</b>

### List of Elective Subjects

1. **CMSMT4.S1: Artificial Intelligence**
2. **CMSMT4.S2: Graphics and Multimedia**
3. **CMSMT4.S3: Image Processing**
4. **CMSMT4.S4: Mobile Computing**
5. **CMSMT4.S5: Pattern recognition**
6. **CMSMT4.S6: Remote Sensing and GIS**
7. **CMSMT4.S7: VLSI Design**

**Note 1:** Content and the list of books for each paper are given in the detail syllabi. Standard websites may be consulted for teaching purpose.

**Note 2:** Two elective subjects are to be taken from the above list. The subjects offered in a particular semester will depend on the availability of teachers and the number of students opting for the paper. Minimum number of students opting for a paper must be greater than or equal to the one-third of the total number of students in the class.

DETAIL SYLLABI (SEMESTER I)

**PAPER CMSMT1.1: DISCRETE MATHEMATICS**

- **Combinatorics and Generating function:** Permutations and Combinations, Multinomial theorem, Principle of Inclusion-Exclusion, Pigeon-hole Principle, Recurrence relation/difference equation, Generating functions, Solution of recurrence relations by Generating functions.
- **Graph Theory**
  - Brief Review, Paths and Cycles, Trees, Centre of graphs and trees. Bipartite graphs. Graph isomorphism. Labeled and unlabeled graphs. Sub-graph, Complement of a graph. Directed Graphs, Binary trees. Representation of graphs and digraphs. Planer Graphs: Planer representation, Euler's formula, Planarity-testing, Statement of Kuratowski's theorem, Dual of a planer graph.
  - Graph Coloring and related topics: Vertex-coloring, Chromatic number, Independence number and clique number, Ramsey Theorem, Coloring-algorithms.
  - Graph Algorithms: Spanning trees, All cycles, Cliques, Isomorphism.
- **Finite Fields,** Sets with two operations, Modular Arithmetic, Congruence and Galois fields, Vector and vector spaces with application in graphs.
- **Probability Theory**
  - Random variables: Discrete Probability Distributions, Concepts of Joint distribution and Independent variables, Expectation values, Variances
  - Special Probability Distributions and their properties: Binomial, Poisson, Exponential, selection of appropriate distribution
  - Normal distribution

**References**

1. K. H. Rosen, Discrete Mathematics and its applications, 5<sup>th</sup> Ed., McGraw Hill, New York, 2002.
2. J. L. Mott, A. Kandel and T. P. Baker, Discrete Mathematics for Computer Scientists, Reston Publishing Company, 1983.
3. C. L. Liu, Introduction to Combinatorial Mathematics, McGraw Hill, 1985
4. C. L. Liu, Elements of Discrete Mathematics, 2<sup>nd</sup> Ed., McGraw Hill, New Delhi, 1985.
5. Polya, G. R. E. Tarjan and D. R. Woods, Notes on Introductory Combinatorics, BirkHauser, 1983.
6. Daniel I. A. Cohen, Basic Techniques of Combinatorial Theory, John Wiley & Sons, 1978
7. D. E. Knuth, The art of Computer Programming, Vol 4, Fascicle 0, Addison Wesley, 2008.
8. N. Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall, 1974.
9. F. Harary, Graph Theory, Narosa Publishing House, New Delhi, 1988.
10. J. A. Bondy and U. S. R. Murty, Graph Theory with Applications, MacMillan Press, London, 1976.
11. Amritava Gupta, Probability & Statistics, academic Publishers, Revised reprint with corrections, 1995.
12. Sen, De, Bannerjee, Probability & Statistics, U. N. Dhar & Sons, Pvt. Ltd., Jan 1999.
13. N. G. Das, Statistical Methods, Vol 2, PHI

**Supplementary Reading**

1. R. M. Graham, D. E. Knuth and O. Patashnik, Concrete Mathematics, A Foundation for Computer Science, Addison Wesley, 1989.
2. Doglas B. West, Introduction to graph theory, PHI, New Delhi, 2003.
3. F. M. Reingold, J. Nivergelt and N. Deo, Combinational Algorithms (Theory and practice), Prentice Hall, Inc., Engiewood Cliffs, N. J., 1977.
4. V. Aho, J. E. Hopcroft, J. D. Ullman, The Design and Analysis of Computer Algorithms, Addison Wesley, Reading, Mass, 1974.
5. M. C. Golumbic, Algorithmic Graph Theory and Perfect Graphs, New York: Academic Press, 1980.

## PAPER CMSMT1.2 : ADVANCED DATA STRUCTURE

- **Brief Review:** Time and Space complexity: Big-O,  $\Omega$ ,  $\Theta$ . Worst case & Average case complexity, ADT and basic linear and non-linear data-structures
- **Recursion:** Brief Review, Limitations, Converting a recursive algorithm to a non-recursive one, Illustration by familiar examples like Hanoi problem
- **Sorting and selection problems:** Review of heap-sort, quick sort, merge sort and their complexity, Other sorting algorithms (both recursive and non-recursive versions where applicable): Tournament sort, Radix sort, External Sorting (Polyphase Merging, Cascade Merging)
- **Searching and set manipulation**
  - Searching in static table: Interpolation search
  - Searching in dynamic table: Randomly grown binary search trees, AVL trees, (2, 3) trees, Red-black trees, B-trees, B<sup>+</sup> trees, B\* trees
  - Amortized Analysis, Binomial heaps and Fibonacci heaps
  - Disjoint set maintenance techniques: Set manipulation algorithm like UNION-FIND, Union by rank, Path-compression, Pseudo Ackermann function and its applications
- **Hashing techniques:** Review of basic techniques, Linear probing, Chaining, Coalesced Chaining, Load factor

### References

1. T. Cormen, C. Leiserson and R. Rivest, Introduction to Algorithms, McGraw Hill, New York, 1994.
2. G. Brassard, P. Bratley, Fundamentals of Algorithms, PHI, New Delhi, 2003.
3. Robert Sedgwick, Data Structure through C, Addison Wesley Publishing Company, New York, 2000.
4. Robert Sedgwick, Algorithms in C, Addison Wesley Publishing Company, New York, 1998.
5. E. Horowitz and Sahni, Fundamentals of Computer Algorithms

### Supplementary Reading

1. R. L. Cruse, Data Structure and Program Design in C, Prentice Hall of India, New Delhi, 1996.
2. E. Horowitz and S. Sahni, Fundamentals of Data Structures, CBS, New Delhi, 1977.
3. N. Wirth, Algorithms + Data Structures = Programs, PHI, New Delhi, 2000.
4. A. V. Aho, J. E. Hopcroft, J. D. Ullman, Data structure and Algorithms, Addison Wesley, Reading, Mass, 1983.

## PAPER CMSMT1.3: ANALYSIS OF ALGORITHMS

- **Paradigms for Algorithm-design**
  - **Divide and Conquer:** Basic method, use, examples
  - **Dynamic Programming:** Basic method, use, Examples: All pair shortest paths, single-source shortest path, Traveling Salesman problem
  - **Branch and Bound:** Basic method, use, Examples: The 15-puzzle problem
  - **Backtracking:** Basic method, use, Examples: Eight queens problem, Graph coloring problem, Hamiltonian problem
  - **Greedy Method:** General characteristic of greedy algorithms, Minimum spanning tree: Optimal greedy algorithms (Prim's and Kruskal's algorithms), Non-optimal greedy algorithms: Knapsack problem, Scheduling problem, Sequential vertex-coloring algorithms
  - **Heuristic approaches:** Vertex coloring of non-planer graphs, TSP, Approximate Algorithms: Knapsack problem, Planar graph coding, Bin-packing
- **NP-completeness:** Decision problems and Optimization problems, Polynomial-time algorithms, Intractable problems, Classes P and NP: NP-complete and NP-hard problems, Satisfiability problem, Cook's Theorem, Polynomial reducibility.

### References

1. T. Coreman, C. Leiserson and R. Rivest, Introduction to Algorithms, McGraw Hill, New York, 1994.
2. G. Brassard, P. Bratley, Fundamentals of Algorithms, PHI, New Delhi, 2003.
3. E. Horowitz and Sahni, Fundamentals of Computer Algorithms, Galgotia Publications, New Delhi, 2000.
4. Robert Sedgwick, Algorithms in C, Addison Wesley Publishing Company, New York, 1998.
5. A. V. Aho, J. E. Hopcroft, J. D. Ullman, The Design and Analysis of Computer Algorithms, Addison Wesley, Reading, Mass, 1974.
6. Clark and Holton, A First Look at Graph Theory, Allied Publishers Ltd., 1995

### Supplementary Reading

1. R. M. Graham, D. E. Knuth and O. Patashnik, Concrete Mathematics, A Foundation for Computer Science, Addison Wesley, 1989.
2. Sara Baase, Computer Algorithms, Addison Wesley, 1988.
3. F. M. Reingold, J. Nivergelt and N. Deo, Combinational Algorithms (Theory and Practice), Prentice Hall Inc., Engiewood Cliffs, N. J., 1977.
4. Knuth D, E., The Art of Computer Programming: Sorting & Searching, Vol. 1, 2, 3, Addison-Wesley: An Imprint of Pearson Education Asia, New Delhi, 2000.
5. Goodman & Hedetniemi, Introduction to Design and Analysis Of Algorithms, 5<sup>th</sup> Ed., Mc Graw Hill, Singapore, 1988.
6. M. R. Garey and D. S. Johnson, Computers and Intractability: A Guide to The theory of NP-Completeness, Freeman, New York, 1979.
7. Colin R. Reeves, Modern Heuristics Techniques for Combinatorial Problems, John Wiely & sons, NY, 1993.
8. Udi Manbar, Introduction to Algorithms: A Creative Approach

## PAPER CMSMT1.4: DATA COMMUNICATION

- **Introduction to communication systems:** Data, Signal and Transmission: analog & digital data, periodic & aperiodic signal, transmission (analog & digital, difference between them, Advantage of digital transmission), Transmission modes, Transmission Impairments: Performance criteria of a communication system, Attenuation, Delay distortion, noise, Hartley Theorem
- **Encoding & modulation:** Digital data to Digital signal (Unipolar, Polar: NRZ-L, NRZ-I, RZ, Bipolar: Manchester, differential Manchester, Bipolar: AMI), Analog to Digital (PAM, PCM, Delta modulation), Digital to Analog (ASK, PSK, FSK, QAM), Modem, Line and block coding, Types of errors, Error detection & correction methods (Detection: VRC, LRC, CRC, Checksum, Correction: Hamming code)
- **Basics of Signal Theory:** Fourier transform, Transform pairs, Standard function & their transform, Transform theorem. Bandwidth utilization techniques: TDM, FDM, WDM; Spread spectrum concepts, Switching (Circuit switching, Packet switching, Message switching), Application in Telephone network, Connection-oriented and connection-less approach in packet switching network
- **Transmission Media:** Guided and Unguided: Architecture, Transmission Characteristics and Applications
- **Introduction to computer networks:** Data representation (ASCII, ISO etc.), direction of data flow, Network: distributed processing, network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN), brief history of Internet and Intranet, Protocols and standards. OSI reference model, TCP/IP reference model, Overview of mail transfer: DNS, TELNET, SMTP, FTP, HTTP & WWW
- **Information Theory:** Measure of information, Entropy, Discrete and Continuous Channel, Shannon's Encoding Algorithms
- **Security:** Introduction, Cryptography, Firewalls
- **Introduction to mobile communication**

### References

1. B. A. Forouzan, Data Communications and Networking (4th Ed.), TMH
2. W. Stallings, Data and Computer Communications (5th Ed.), PHI / Pearson Education
3. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
4. Black, Data & Computer Communication, PHI

### Supplementary Reading

1. Miller, Data Communication & Network, Vikas
2. Miller, Digital & Data Communication, Jaico
3. Shay, Understanding Data Communication & Network, Vikas
4. Fred Halsall, Data Communications, Computer Networks and Open Systems, Pearson Education, Low Price Edition, 4th edition, 2001.

## PAPER CMSMP1.5: LAB I: ADVANCED DATA STRUCTURE

- Write a C program to implement the following using an array.
  - a) Stack ADT
  - b) Queue ADT
- To implement the following using a singly linked list.
  - a) Stack ADT
  - b) Queue ADT
- Write a C program to implement the deque (double ended queue) ADT using a doubly linked list and an array.
- Write a C program to perform the following operations:
  - a) Insert an element into a binary search tree.
  - b) Delete an element from a binary search tree.
  - c) Search for a key element in a binary search tree.
- Write C programs that use non-recursive functions to traverse the given binary tree in
  - a) Preorder
  - b) inorder and
  - c) postorder.
- Write C programs for the implementation of bfs and dfs for a given graph.
- Write C programs for implementing the following sorting methods:
  - a) Merge sort
  - b) Heap sort
- Write a C program to perform the following operations
  - a) Insertion into a B-tree
  - b) Deletion from a B-tree
- Write a C program to perform the following operations
  - a) Insertion into an AVL-tree
  - b) Deletion from an AVL-tree
- Write a C program to implement hashing along with its collision resolution techniques.
- Write a C program to construct a Binomial tree.
- Write a C program to do the following on a binomial heap
  - a) Insert a new value.
  - b) Delete a value
  - c) Search a value.
- Write a C program to do the following on a fibonacci heap
  - d) Insert a new value.
  - e) Delete a value
  - f) Search a value.
  - g) Consolidate the heap.
- Write a C program to implement the Union and Find Algorithm for Disjoint Set manipulation.
- Write a C program to implement Prim's algorithm using the Union and Find approach.

## PAPER CMSMP1.6: LAB 2: WEB PROGRAMMING 1

- **Internet Technology:** Basic concept of Intranet and Internet; Server and Client Model; Access methods, LAN, WAN, Bluetooth, Mobile, Satellite; Proxy-server, Application areas like E-Commerce, Ports; Domain Name Server (DNS); Accounts, Internet Service Providers; Connections: Dial Up, ISDN, Cable, Modem; E-Mail: Account, Sending, Receiving, Mailing List, server, gateways, IRC, Voice and Video Conferencing, Browsers.
- **Process, Standards and Protocols:** TCP/IP protocol stack, IP addressing, Role of DNS, FTP, Remote logging (Telnet), HTTP, HTTPS, etc.
- **Introduction to Web Technology:** Client-Server Architecture, Web server, Web browser, Web Page, Web Site, URL, Web Page designing methodology, Basic assumptions, Story boarding, Interaction with Web Page, WWW, Role of W3C, Client-side Scripting, Server-side Scripting etc.
- **Introduction to Hypertext Markup Language (HTML):** Introduction to HTML, HTML Tags, Entities, Attributes, Headings, Paragraphs, Formatting, Styles, Links, Images, Tables, Lists, Forms, Frames, Colors, Color names, Color values, Quick List, DOM models, Style Sheets, CSS, Head, Meta, Scripts, HTML URLs, URL Encode, Webserver, HTML Controls: defined controls, user define controls, Sample examples and scripting.
- **Introduction to Java Script/VB Script:** Introduction to Java Script/VB Script, Object Based Scripting concepts, Basic concept of Client side scripting, Java Script/VB Script Operators, expressions, Arrays, Loops: for, nested for loops, for all, while, do while etc, Conditions, Objects, Methods, Windows, Frames, Forms and Regular Expressions, Events, validations, Cookies etc. Incorporating Java Script/VB Script into your HTML pages, HTML controls handing using Java Script/VB Script, Sample practice.
- **Dynamic Web Page Design Practice:** Hands on experience of dynamic web page design on different modules.



## DETAIL SYLLABI (SEMESTER II)

### **CMSMT2.1: OBJECT-ORIENTED TECHNOLOGY**

- **Introduction and Basics of Object-oriented Technology**  
Why object orientation- Program Design Concepts, Software evolution and crisis, Procedure-Oriented Approach Introduction to common PO- languages, Features of good programs and software quality, Advantages and disadvantages of PO-methodology. Basic concepts of OO approach, Evolution of OO methodology and its benefits, Comparison of OO and PO approaches, Introduction to common OO Language; Object-oriented paradigm, Benefits of OOP, Applications of OOP
- **Variables and data types, operators and Expressions and Array**  
Constants – Integer Constants, Real Constants, Single character Constants, String Constants, Backslash character Constants; Variables, Data types – Integer types, Floating point types, character type, Boolean types; Declaration of variables; Giving values to variables; Scope of variables; Symbolic constants; Type casting; Standard default values; One-dimensional arrays; Two-dimensional arrays; Strings; Vectors; Wrapper Class  
Arithmetic, Relational, Logical, Assignment, Increment and decrement, Bitwise, Special operators; Expressions; Type conversion in expression;
- **Control statements**  
Selection statements – if and switch; Iteration statements – while, do-while, for, for- each; nested loops; Jump statements – Using break, using continue, return
- **Introduction to classes and objects**  
Class fundamentals – the general form of a class; Declaring objects; Introducing methods; manager function- constructor; Introducing access controls; Introducing nested and inner classes; overloading methods;
- **Inheritance**  
Inheritance basics- member access and inheritance; Creating multilevel hierarchy; Method overriding; Abstract classes;  
Case study: interfaces and packages in JAVA
- **Exception handling**  
Exception-Handling fundamentals; Exception types; Uncaught exceptions; Using try and catch statements; Multiple catch clauses; Nested try statements; Chained exceptions; Using exceptions;
- **Files and Streams**  
Streams, the stream class hierarchy, stream classes, string I/O, writing strings, reading strings, detecting end-of-file, character I/O, object I/O writing an object to disk, binary versus character files, reading an object from disk, the stream class, the opening files, specifying the position, closing files, redirection, IOS flags, redirecting input and output, command-line arguments, overloading the extraction and insertion operators.  
Case study: file and I/O in JAVA.
- **Introduction to threads**  
Basics of thread, thread life cycle, synchronization, concept of multithreading  
Case study: multithreading in JAVA

#### **References**

1. G. Booch, Object-Oriented Analysis and Design, Benjamin / Gunning Publishing co.
2. H. Schield, JAVA 2 - The Complete Reference, TMH
3. Horton, Beginning JAVA 2 SDK 1.4, SPD/WROX
4. Programming in JAVA, EXCEL
5. Samantha, Object Oriented Programming with C++ & JAVA, PHI
6. Doke, Object Oriented Application Development Using JAVA, VIKAS
7. Xavier, Programming with Java 2, Scitech

#### **Supplementary Reading**

1. Allamaraju and Buest, Professional JAVA Server Programming, SPD Publication.
2. Austin and Pawlan, Advanced Programming for JAVA 2 Platform, Pearson.
3. Bruce Eckel, Thinking in Java Vol 3 at <http://www.mindview.net/books/TIJ>

## PAPER CMSMT2.2: COMPUTER NETWORK

- **Review of basic concepts**
- **Data Link Control:** Line Discipline, ENQ/ACK; Poll/Select, Flow control: Stop & Wait, Sliding window; Error control: Stop & Wait ARQ, Sliding window ARQ: Go-Back- N ARQ, Selective repeat ARQ, Protocol: HDLC.
- **Virtual Circuit Switching:** Global Addressing, Virtual Circuit Identifier, Three Phases – Data transfer, Set up, Tear down phases, Frame Relay, Asynchronous Transfer Mode (ATM).
- **Protocol basics:** Error Control, Idle RQ, Continuous RQ, Link management. Data link control protocols: Application environments, Character-oriented protocols, Bit-oriented protocols.
- **Medium access protocols:** Point to point protocol, Ethernet, token bus, token ring, FDDI; Reservation, polling, concentration; Wireless LANs, Wireless Media, MAC Sub Layer Services, LLC Sub Layer, Network Layer, Bridges, Transparent Bridges, Source Routing Bridges, Internetworking With Different Types.
- **Multiple access protocols:** Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA, FDMA, TDMA, CDMA, LAN Interconnection Technologies and High Speed LANs, Virtual LANs, Virtual Circuit Approach in WANs.
- **Host to Host Communication:** Review of basic concepts and devices: Hubs, Bridges, Switches, Router, Gateway. Repeaters
- **Routing:** techniques, static vs. dynamic routing, routing table for classful address  
Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing, Hierarchical routing, Unicast and multicast routing protocols; Protocols: ARP, RARP, IP, IPV4.
- **Internetworking:** IP-Address – Subnetting, NAT, IP datagrams, Address mapping, Error reporting and multicasting in network layer.
- **Process to process delivery:** UDP; TCP; Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, chokes packets.
- **Advanced topics:** ISDN services; DSL technology, Introduction to blue-tooth, VLAN's.

### References

1. B. A. Forouzan, Data Communications and Networking (4th Ed.), TMH
2. A. S. Tanenbaum, Computer Networks (4th Ed.), Pearson Education/PHI
3. W. Stallings, Data and Computer Communications (5th Ed.), PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas
7. Miller, Digital & Data Communication, Jaico
8. Shay, Understanding Data Communication & Network, Vikas

### Supplementary Reading

1. Kurose and Rose, Computer Networking -A top down approach featuring the internet, Pearson Education
2. Leon, Garica and Widjaja, Communication Networks, TMH
3. Walrand, Communication Networks, TMH.
4. Comer, Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.), Pearson

## PAPER CMSMT2.3: ADVANCED OPERATING SYSTEMS

- **Review of OS:** Review of basic concepts of OS, Process Synchronization: Concept of process, Concurrent processes, Threads, Overview of different classical synchronization problem, Monitors, Communication Sequential processes (CSP), Process Deadlocks: Introduction, causes of deadlocks, Deadlock handling strategies, Models of deadlock
- **Message Passing:** Introduction, Features of a good Message-Passing System, Issues in IPC by Message Passing, Synchronization, Buffering, Process Addressing, Failure Handling, Group Communication.
- **Distributed Operating System:** Architectures, Issues in Distributed operating systems, Limitations of Distributed Systems, Lamport's logical clock, Global states, Chandy-Lampert's global state recording algorithm, Basic concepts of Distributed Mutual Exclusion, Lamport's Algorithm, Ricart -Agarwala Algorithm; Basic concepts of Distributed deadlock detection, Distributed File system, Architecture, Basic concepts of Distributed shared memory, Basic concepts of Distributed Scheduling, Load balancing, Load sharing
- **Distributed OS Implementation:** Models, Naming, Process migration, Remote Procedure Calls.
- **Security & Protection:** Security-threats & goals, Penetration attempts, Security Policies & mechanisms, Authentication, Protections & access control Formal models of protection, Cryptography, worms & viruses.
- **Kernel Programming (Linux):** Processes, Creating and Deleting Processes, The role of Interrupt signals, Interrupts and Exceptions, Nested Execution of Exception and Interrupt Handlers, Initializing the Interrupt Descriptor Table, Returning from Interrupts and Exceptions.
- **Kernel Synchronization:** Kernel control path, Necessity of Synchronization, Kernel Data Structures. System calls and Timing Measurement, Creating and deleting a process address space and Managing the Heap, System calls related to signal Handling, Page cache and buffer cache
- **Advanced topics:** Introduction to Real Time Operating System

### References

1. S. Tanenbaum, Distributed Operating Systems, Prentice Hall of India, New Delhi, 1996.
2. S. Tannenbaum, Modern Operating Systems, Prentice Hall, Englewood Cliffs, 1992.
3. Milan Milenkovic, TMH ,Operating System Concepts and Design
4. H. M. Deitel, Operating System, Addison-Wesley, Noida, 1999.

### Supplementary Reading

1. Mukesh Singhal and Niranjana G. Shivaratri, TMH, Advanced concepts in operating systems PK. Sinha, Distributed Operating Systems, IEEE Press.
2. Daniel P. Bovet & Marco Cesati, Understanding the Linux Kernel, O'Reilly.

## PAPER CMSMT2.4: SOFTWARE ENGINEERING

- **Brief review:** Software Crisis & Myths, System Development Life Cycle, Feasibility Assessment, Changeover, Software Life Cycle Models – Waterfall, Prototyping, Spiral, RAD etc. CMM, Project Management Concepts – Management, People, Product, Process, Project, W<sup>5</sup>HH Principle
- **Software Metrics :** Definition, Areas of application, Problems during implementation, LOC, Token Count, Function Count
- **Software Project Planning:** Cost estimation, Static single variable & multiple variable models, COCOMO, Putnam-Resource Allocation Model, Software Risk Management
- **Software Requirement Analysis and Specification:** Requirements Engineering, Problem Analysis – DFD, Data Dictionary, E-R Diagram, Decision Table, Software Requirement Specification
- **Software Design:** What is Software Design, Design Process, Design concepts, Modularity – Coupling and Cohesion, Dependence Matrix, Strategy of Design – Bottom-up, Top-down, Hybrid; User Interface Design
- **Software Testing:** Testing Process, Test Case Design, Verification & Validation, White Box Testing, Black Box Testing, Unit Testing, Integration Testing, Validation Testing, System Testing, Debugging
- **Software Project Management & Software Maintenance:** Project Scheduling, Software Configuration Management, SQA, Software Maintenance – categories of maintenance, problems during maintenance, maintenance process, maintenance models, concepts of documentation
- **Object Oriented Software Engineering:** Object Oriented concepts, Identifying the elements of an object model, Conventional vs. Object Oriented approach, Relationship diagrams: Class diagram, Use case diagram, State Transition Diagram

### References

1. R. S. Pressman, Software Engineering: A Practitioner's Approach, 5th ed., McGraw Hill, College Div, Singapore, 2000.
2. Pankaj Jalote, An Integrated Approach to Software Engineering, 2nd ed. Narosa, New Delhi, 1997.
3. Ian Sommerville, Software Engineering, Pearson Education
4. Ghezzi, Software Engineering, PHI

### Supplementary Reading

1. G. Booch: Object-Oriented Analysis and Design, Benjamin / Gunning Publishing co., New York, 1994.
2. Behforooz, Software Engineering Fundamentals, OUP
3. Dick Hamlet, Joe Maybee, The Engineering of Software, Addison Wesley, 2001
4. Bob Huges & Mike Cotterell, Software Project Management, 2nd Edn., McGraw Hill, 1999
5. IEEE Standards on Software Engineering.
6. Kane, Software Defect Prevention, SPD

## PAPER CMSMP2.5: Lab 3: SOFTWARE ENGINEERING

This course introduces the students to

- Hands on Software Engineering principles
- Usage of Front-end and Back-end technologies and packages.

**1. Program Analysis and Project Planning:** Thorough study of the problem – Identify project scope, Objectives, Infrastructure.

**2. Software requirement Analysis:** Describe the individual Phases / Modules of the project, Identify deliverables.

### 3. Software Design

Plan a software engineering process to account for quality issues and non-functional requirements.

Employ a selection of concepts and techniques to complete a small-scale analysis and design of a project.

Data dictionary, DFD, ER diagrams, pert chart.

### 4. Software Development and Debugging using any Front end and Back end tool:

Employ group working skills - including general organization, planning and time management, inter-group negotiation, etc.

### 5. Software Verification and Validation procedures

## PAPER CMSMP2.6: Lab 4: WEB PROGRAMMING II

**Web Architecture:** The Way the Web works, The Asp.net difference, Client-Side Processing, How Asp.net Ties It Together

**Setting up and Installing ASP.NET:** Installing Internet Information Server, IIS Manager, Creating virtual/home directory, Folder Settings, Adding a virtual directory to your neighborhood, Installing .Net Framework SDK

**Overview of the ASP.NET Framework 2.0/3.5:** Introduction to Asp.net and the .NET Framework, Common Language Runtime (CLR), CLR Architecture, Just-in-time compiler, MISL, understanding IL with ILDASM,.Net Framework Class Library, Understanding Namespaces. The Structure of asp.net Page, Directives, Code Declaration Blocks, Code Render Block, Common Type System (CTS), Common Language Specification (CLS), Languages under .NET

**Working with Visual Studio 2005/2008:** Creating a project, Solution and Project, Exploring and Coding a project, Building a Project, debugging

**Introduction to C#:** Object-oriented programming system (OOPS) concept, Object, Class, Partial-Class, Polymorphism, Inheritance, Events and delegates, String handling, Exception handling, Working with Generics, File handling, Multi-threading, Memory Management Issues,

**GUI-Programming with Visual C#:** Introduction to Server side Scripting, Elements for GUI Programming, Controls, properties, Methods, events etc. Interact with Server Side Controls: Displaying information, Label Controls, Literal Controls, Accepting User Input, Textbox controls, RadioButton and RadioButtonList Controls, CheckBox and CheckBoxList Controls, Submitting Form Data, Button controls, DropDownList controls, LinkButton Control, ImageButton Control, displaying Images, Image Control, Using Panel Control, Using Hyperlink Control etc. Dialog controls: Color Dialog, Font Dialog, Open Dialog, Save File Dialog, Folder Browser Dialog etc. Creating Custom Controls. Validation Controls: Required Field Validator Control, RegularExpression Validator Control, Compare Field Validator Control, Range Validator Control, Validation Summary Control, and Custom Validator Control etc. Rich Controls.

**Introduction to XML:** Introduction to XML, XML usefulness, XML Tree, Syntax, Elements, Attributes, Validation, Validate, XML Viewing, XSL, XML Parser, XML DOM, XML to HTML, Applications, XML Examples

**Database Programming using ADO.NET:** Introduction to ADO technology, ADO vs. ADO.NET, ADO.NET operations and namespaces, ADO.NET Classes, Data retrieval methods, Working with Dataset, Data Binding; Using ConnectionString, Components of ConnectionString, Operations on Database. Database Query handling, using Parameter passing, using Stored Procedures etc.

**Web Programming using ASP.NET:** Introduction to Web Programming, Client-Server technology, cunderstanding Web Server IIS, How Internet and Intranet works, Creating Websites.

**Web Services:** Introduction to XML Web Services, Creating web services with Visual Studio .NET, Testing a Web Method, Consuming web services in client applications, Using Data with web service, WSDL, Proxy web services.

### **DETAIL SYLLABI (SEMESTER III)**

#### **PAPER CMSMT3.1: ADVANCED COMPUTER ARCHITECTURE**

- **Brief review:** Evolution of Computer Architecture, Desired Properties of the instruction set, Addressing Modes, Architectural Classification based on Multiplicity of Data and Instruction (SISD, SIMD, MISD, MIMD structures), CISC versus RISC architecture
- **Memory System:** Associative memory, Cache memory, Virtual memory.
- **Pipeline Architecture:** Basic Concepts, Performance of a static linear pipeline, Instruction pipelining Hazards (Structural, data & control hazards), Instruction level parallelism (ILP), Super pipelining, Super scalar processing, and Vector processing.
- **Array Processor:** Comparison with vector processors (examples of array processors)
- **Multiprocessors:** Centralized shared memory architecture, Distributed shared memory architecture Synchronization issues, models of memory consistency, Example systems.
- **Data Flow Architecture:** Static and Dynamic models, data flow graph.
- **Systolic Architecture:** Systolic array, systolic processors.
- **Interconnection network with examples:** Static network: Linear array, Ring, Star, Tree, Systolic Array, Completely connected network, Cube & 3-Cube network. Dynamic Network: Single-Stage network, Multi-stage network: Crossbar Switch, Blocking Network: Omega network, Non-blocking network, Mesh connected Illiac Network, Scuffle Exchange.
- **Case Study:** Microprocessor (8080, 8085, 8086, 80486 up to Pentium), Subroutine and delay, Interfacing using 8155, 8255 and 8279, Programming and interfacing using 8085.
- **Advanced topics:** Basic features of Current Architectural trends, DSP Processors, Dual Core processors, Grid computing

#### **References**

1. K. Hwang, Advanced Computer architecture with parallel programming, McGraw Hill, New York, 1993.
2. J. P. Hayes, Computer Architecture and Organization, 2nd ed., McGraw Hill, New York, 2002.
3. Patterson D. A., J. L. Hennessy, Computer architecture a quantitative approach, 2<sup>nd</sup> ed., Morgan Kaufman, 1996.
4. K. Hwang and F.A. Briggs, Computer Architecture & Parallel Processing, TMH, New Delhi, 1984.

#### **Supplementary reading**

1. Stone, H. S., Advanced Computer architecture, Addison Wesley, 1989.
2. Siegel, H.J., Interconnection Network for Large Scale parallel Processing, McGraw Hill.
3. Quinn, M. J, Design of Efficient Algorithms for Parallel Computers, McGraw Hill, New York, 1988.
4. Quinn, M.J., Parallel Computing: Theory and Practice, McGraw Hill, 1994.
5. W. Stallings, Computer Organization and Architecture, Prentice Hall, New Jersey, 1999.
6. P. Pal Choudhury, Computer Organization and Design, PHI India, New Delhi, 1994.

## PAPER CMSMT3.2: ADVANCED DATABASE MANAGEMENT SYSTEM

- **Brief review:** Objectives and architecture of database design, Relational database design, Hash and inverted files, Extended E-R diagram
- **Query processing:** Query optimization – heuristic and rule based optimizers, cost estimates
- **Transaction Management:** Concurrency control, recovery mechanisms
- **Object oriented database design:** Objects, methods, query languages, implementations, Comparison with Relational systems, Object orientation in relational database systems, Object support in current relational database systems, complex object model, implementation techniques
- **Distributed database:** Client/server model, integrity, security & repositions, case study, Integrity, Views & Security, Integrity constraints, views management, data security
- **Parallel Databases:** Objectives of parallel DBMS, Architecture, parallelism (Intra-query, Inter-query, Intra-operation, Inter-operation)
- **Case Study with a DBMS package**
- **Advanced topics**
  - **Data warehousing & Data mining:** Definition and idea on Data Warehousing, Multidimensional data model, Data Warehouse architecture, Data Cube, Schemas ( like snow flake, star etc.), ROLAP, MOLAP, HOLAP, comparison between ROLAP, MOLAP & HOLAP
  - **Basic concepts of Multimedia Database**

### References

1. H. F. Korth, A. Silberschatz, Database System Concepts, McGraw Hill, NY, 2000.
2. Silberschatz, Korth, Sudershan, Database System Concepts, 5<sup>th</sup> Ed., McGraw Hill, NY, 2005.
3. Alexis Leon and Mathews Leon – Database Management Systems , Vikas Publishing Limited
4. J. D. Ullman, Principles of Database Systems Vol. I & Vol II, Rockville, MD: Computer Science Press, 1998.
5. R. A. Elmasri, S. B. Navathe, Fundamentals of Database Systems, 3rd ed., Addison-Wesley, 1998.
6. C. J. Date, An Introduction to Database Systems, Eighth Edition.

### Supplementary Reading

1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 2002.
2. R. Ramakrishnan, Database Management Systems, 2nd ed., McGraw Hill, New York.
3. Jiawei Han & Micheline Kamber : Data Mining – Concepts & Techniques : Morgan Kaufmann Publishers , San Francisco , USA , First Indian Reprint , 2002
4. Arun K. Pujari – Data Mining
5. Berson and Smith : Data Warehousing and OLAP

### PAPER CMSMT3.3: COMPILER DESIGN

- **Review:** Review of automata theory: finite state machine, push-down-automata, Turing machine, regular and context-free grammar, pumping lemma
- **Introduction:** Analysis of the source program, Compiler, Phases of compiler, Cousins of compiler
- **Lexical & Syntax Analysis:** The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, idea of LEX. The role of a parser, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC/JavaCC).
- **Syntax directed translation & Type checking:** Syntax director definitions, Construction of syntax trees; Type systems, Specification of a simple type checker
- **Run time environments:** Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.
- **Intermediate code generation:** Intermediate languages, Graphical representation, Three-address codes, Implementation of three address statements (Quadruples, Triples, Indirect triples).
- **Code optimization:** Introduction, Basic blocks & flow graphs, Transformation of basic blocks, DAG representation of basic blocks, Principle sources of optimization, Loops in flow graph, Peephole optimization.

#### References

1. Aho & Ullman, Principles of Compiler Design, Narosa.
2. Aho, Sethi, Ullman, Compiler Principles, Techniques and Tools, Pearson Education.
3. Holub, Compiler Design in C, PHI.



### **PAPER CMSMP3.4: Lab 5: ADVANCED DBMS LABORATORY**

- **Introduction** Structured Query Language (SQL) – What is SQL, Features of SQL and SQL \*Plus, rules for SQL, Components of SQL, Activating and deactivating Oracle Engine, Tablespace – System tablespace, creating tablespace, creating a user.
- **Interactive SQL I (Table fundamentals)** Table fundamentals, Basic data types, create table, Inserting data into tables, Viewing data of a table, Eliminating duplicate rows, Sorting data of a table, Creating a table from a table, Inserting data into a table from another table, Delete from a table, Updating a table, Modifying a table structure, Creating synonyms, Table deletion.
- **Interactive SQL II (Constraints)** Constraints – I/O Constraints: Primary key, Foreign Key constraints, Unique, Business rule constraints: NULL Value, Check constraint, Default value; Altering and dropping integrity constraints.
- **Interactive SQL III (Operations on table data)** Computation on table data – Arithmetic, Logical operators; Range Search; pattern matching; Table – Dual; Oracle functions – group function, aggregate functions, date functions.
- **Interactive SQL IV (Operations on multiple tables)** Grouping – Group By, Having, Having clause to find unique values; Sub-queries; Joins – Joining multiple tables, Self joins; Union, Intersect and Minus clause.
- **Interactive SQL V (Performance tuning)** Performance tuning – creating views, creating indexes.
- **Interactive PL/SQL (Basics of PL/SQL)** Generic PL/SQL block, Execution environment, Data types, Variables and Constants, Control structure, Introduction to cursor, Types of cursor, Procedures/ Functions, Triggers.

### **PAPER CMSMP3.5: SEMINAR**

Students have to deliver a presentation on some advanced topic assigned by the Department.

### **PAPER CMSMP3.6: DESIGN WORK**

- Design Work is an introductory work on the fourth-semester paper CMSMP4.4 Dissertation Work.
- It may be developmental work as well as research-oriented work.
- It is assigned in the beginning of third semester and is continued to the fourth semester.
- At the end of third semester, work done by the student will be evaluated by a presentation and a synopsis.
- At the of the fourth semester, final presentation and report is to be submitted.

## DETAIL SYLLABI (SEMESTER IV)

**Two electives are to be taken from the following list.**

The subjects offered in a particular semester will depend on the availability of teachers and the number of students opting for the paper. Minimum number of students opting for the paper must be greater than or equal to the one-third of the total number of students in the class.

### **List of Elective Subjects**

1. **CMSMT4.S1: Artificial Intelligence**
2. **CMSMT4.S2: Graphics and Multimedia**
3. **CMSMT4.S3: Image Processing**
4. **CMSMT4.S4: Mobile Computing**
5. **CMSMT4.S5: Pattern recognition**
6. **CMSMT4.S6: Remote Sensing and GIS**
7. **CMSMT4.S7: VLSI Design**

### **Detail syllabus of Elective subjects**

#### **CMSMT4.S1: ARTIFICIAL INTELLIGENCE**

- **Introduction to Artificial Intelligence:** Overview of AI – Definition of AI, Relationship between AI Systems and other computing systems, comparison between AI programming and other conventional programming; AI and related fields; Key Issues in AI Research, AI problems-Examples; problem spaces, production systems and characteristics; knowledge –general concepts.
- **Knowledge Representation:** Approaches to knowledge representation, Issues in knowledge representation, Formal systems – basic concepts, Symbolic logics - Syntax and semantics of FOPL, properties of w.f.f, clausal forms, Resolution principle, Examples of Resolution; Structural knowledge – graphs, frames, C.D's , Semantic Nets and scripts; probabilistic reasoning-Bayesean Networks, Dampster – Shafer theory; Non Monotonic Reasoning –TMS, Model and Temporal logics, Fuzzy sets & Fuzzy logics.
- **Knowledge organization and Manipulation:** Search and control strategies - State space representation of problems, bounding functions, breadth first, depth first, A, A\*, AO\*. etc. Performance comparison of various search techniques, Examples of research problems, uninformed search techniques, Informed and Heuristic search techniques; Matching Techniques –Structures used in Matching, Measures of matching, partial matching, Fuzzy Matching Algorithms and RETE Matching Algorithm. RTNs, ATNs, Parsing of Ambiguous, GFG's, Tree Adjoining Grammars (TAGs).
- **AI languages:** LISP – Basic list manipulation functions, predicates, Conditionals, Input, output and local variables, Iteration and Recursion in LISP, property lists and Arrays, Prolog –Introduction, facts, questions, variables, conjunctions, syntax of character ,Operators, equality, matching, arithmetic expressions; Goals; Back tracking, cut predicates; Input and output operations.
- **Expert system:** Components of an expert system, Knowledge representation and Acquisition techniques, Building expert system and Shell.
- **Artificial Neural Network:** Machine Learning: Connectionist; Foundations of Connectionist Network – Idea and McCulloch-Pitts Neurons; Perceptron Training algorithms; To use activation Perceptron Network to classify a system – Example; The Generalized Delta Rule; Back propagation Learning; Back propagation example – NETtalk; Competitive Learning-Winner-Take-All Learning for classification; Kohonen Network for Learning Prototypes; Outstar Networks and Counter Propagation; Hebbian Coincidence Learning – Introduction, Unsupervised Learning- illustration by example, Supervised Hebbian Learning; Associative Memory and Linear Associator; Attractor Networks or Memories–Introduction, BAM, Examples of BAM processing; Auto Associative Memory and Hopfield Nets

#### **Books**

1. George F. Luger: Artificial Intelligence : Pearson Education Asia
2. Artificial Intelligence by Elaine RICH and Kevin Knight – TMH
3. Introduction to AI & Expert systems by O.W. Patterson – PHI
4. Artificial Intelligence by N J Nilsson HARCOURT ASIA (Pvt) Ltd

## CMSMT4.S2: GRAPHICS AND MULTIMEDIA

- **Review of basic concepts:** Definition and Types, Display technologies, CG software, Scan Conversion algorithms: Point, line, circle, ellipse; Filling algorithms: Polygon fill, boundary fill, flood fill; 2D transformation: Translation, rotation, scaling reflection, shear; transformation between coordinate systems; Viewing: Viewing pipeline, window to viewport coordinate transformation; clipping: point, line, circle, polygons and ellipse
- **3D transformation and viewing:** Translation, rotation, scaling and other transformations; Rotation about an arbitrary axis in space, reflection through an arbitrary plane, general parallel projection transformation; clipping, viewport clipping, 3D viewing, perspectives and depth cueing
- **Curves and Fractals:** Curve Representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves.
- **Hidden Surfaces:** Depth comparison, Z- buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm, Hidden line elimination, wire frame methods, fractal – geometry.
- **Color & Shading Models:** Introduction, Modeling Light Intensities and sources, Diffuse Reflection , Lambert's Cosine Law, Specular Reflection, Halftoning , color models – RGB Color, CMY Color
- **Multimedia:** Introduction to Multimedia, Presentation Graphics, Desktop Publishing, Production Planning and Design, User Interface Design, Hypermedia, Authoring Concepts, Multimedia Sound, File Compression, JPEG, MPEG, Digital Video, Designing Web-based Multimedia, Multimedia Distribution.

### Books

1. Principles of Interactive Computer Graphics, Newman and Sproull (McGraw Hill)
2. Computer Graphics, Donald Hearn and M.Pauline Baker (PHI 2nd Edition)
3. Procedural Elements of Computer Graphics, Rogers (McGraw Hill)  
Mathematical Elements of Computer Graphics, Rogers (McGraw Hill)
4. Ze-Nian Li and Mark S Drew. "Fundamentals of Multimedia", Prentice Hall.
5. Nigel Chapman and Jenny Chapman, "Digital Multimedia 2nd ed", Wiley.
6. Tay Vaughan, "Multimedia: Making it Work, 7th ed", McGraw-Hill Osborne Media
7. Kyle Rankin, "Linux Multimedia Hacks: Tips & Tools for Taming Images, Audio, and Video 1<sup>st</sup> ed", O'Reilly Media, Inc

## CMSMT4.S3: IMAGE PROCESSING

- **Image Processing:** Introduction, image definition and its representation, neighborhood metrics, 2-D orthogonal transformations of images (DFT, DOT, HT, KLT), enhancement, contrast stretching, histogram specification, local contrast enhancement, smoothing and sharpening, spatial/ frequency domain filtering, segmentation, pixel classification, greylevel thresholding, global/local thresholding, edge detection operators, region growing, split/merge techniques, image feature/primitive extraction, Hough transform, medial axis transform, skeletonization/ thinning, shape properties, compression, Huffman coding, block truncation coding, run-length coding, some applications.

### Books

1. R. C. Gonzalez and R. E. Woods: Digital Image Processing, Addison-Wesley, California, 1993.
2. B. Chanda and D. Dutta Majumder: Digital Image Processing and Analysis, Prentice Hall of India, New Delhi, 2000.
3. Jain: Fundamentals of Digital Image Processing, Prentice Hall of India, New Delhi, 1989.

## **CMSMT4.S4: MOBILE COMPUTING**

### **Introduction to telecommunication systems**

**Introduction: Current Wireless Systems:** Overview of Paging Systems, Cordless Phones, Cellular Telephone Systems, Satellite Communication, Wireless LANs, Blue tooth. Medium access control, Telecommunication Systems – SDMA, TDMA, CDMA, GSM Satellite Systems - Basics, Routing Localization, Handover. Broadcast Systems Overview, Cyclic Repetition of Data, Digital Audio Broadcasting, Digital Video Broadcasting,

### **Wireless Standards**

Wireless LAN – IEEE 802.11 – Infrared vs Radio Transmission, Infrastructure Networks, Ad-hoc Networks, HIPERLAN, Bluetooth Wireless ATM – Working group, Services, Reference Model, Functions, Radio Access Layer, Handover, Location Management, Addressing Mobile Quality of Service, Access Point Control Protocol.

### **Mobile Network Layer**

Mobile IP Goals, Assumptions and Requirements, Entities, IP packet Delivery Agent Advertisement and Discovery, Registration. Tunneling and Encapsulation, Optimization Reverse Tunneling, IPv6, DHCP. Ad-hoc Networks - Characteristics, Performance Issues, Routing in mobile hosts.

### **Mobile Transport Layer & Wireless Application Protocol**

Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Transmission / Timeout Freezing Selective Retransmission, Transaction oriented TCP. Architecture, Datagram Protocol, Transport Layer Security, Transaction Protocol, Session Protocol , Application Environment , Wireless Telephony.

### **Application Issues**

Dynamic DNS File System, Synchronization Protocol, Context aware applications, Security, Analysis of existing wireless network, GSM Systems Overview: Architecture, Location tracking, and call setup. Security, Data Services N/W Signaling, GSM mobility management, Operations, Administration and maintenance.

### **Text Books**

1. J Schiller , 'Mobile Communication' , Addison Wesley, 2000
2. John Wiley, ' Mobile Communication Design Fundamentals', 1993.

### **Reference Books**

1. Wireless Communication and Networks, Pearson Education, 2003.
2. WAP-Wireless Application Protocol, Pearson Education, 2003

## **CMSMT4.S5: PATTERN RECOGNITION**

- **Pattern Recognition:** Introduction, decision boundaries, discriminant functions (linear and non-linear), Bayesian classification, training and test sets, parametric and non-parametric learning, minimum distance classifiers, k-NN rule, unsupervised learning, basic hierarchical and non-hierarchical clustering algorithms, dimensionality reduction, similarity measures, feature selection criteria and algorithms, principal components analysis, some applications.

### **Books**

1. R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification and Scene Analysis, 2nd ed., Wiley, New York, 2000.
2. J. T. Tou and R. C. Gonzalez: Pattern Recognition Principles, Addison-Wesley, London, 1974.

#### CMSMT4.S6: REMOTE SENSING & GIS

- **Introduction** – Perspectives and concept of remote sensing, special applications.
- **Geophysical Remote Sensing** – external fields, magnetics, geophysical remote sensing: Gravity, crust dynamics seismology. Electromagnetic spectrum; The photon, Distribution of Radiant energies, Sensor technology.
- **Spectral signatures**- Interpretation and classification. Multispectral images, colour and false colour composites ERTS-1, MSS histogram. Thematic mapper, SP07 & CCDS, Hyperspectral imaging; Meteorological, Oceanographic and Earth system Satellites, Systems approach to Remote sensing, military intelligence and medical applications.
- **Image Processing & Interpretation**: Morro Bay images– ground and Aerial photographs – analysis – mystery features and classification techniques.
- **Geologic application** – Strategy and Structure, Mineral and Petroleum explorations; Vegetation application – Agriculture, forestry and Ecology; Urban and Land use application, space flight.
- Radar and microwave remote sensing, thermal Remote sensing. Aerial photography as Primary and Ancillary data source; 3D Stereo system and Topographic mapping. Astronaut Photography-collection of surface data and geographic information system.
- **Earth system Science; Basic science study**- Mega Geomorphology, Impact cratering, Planetary remote sensing-Use in Astronomy and Cosmology. Future Prospects.

#### Books

1. Remote Sensing : George Joseph , Universal Press
2. Remote Sensing & Image Interpretation, LILLESAND,KIEFER,CHIPMAN, WEILEY-INDIA, 6<sup>th</sup>edition
3. Concepts & Techniques of GIS, C.P.LO. Albert K.W. Yeung, , PHI , 2<sup>nd</sup> edition
4. Remote Sensing of the environment: An earth Resource Perspective, John R. Jensen, Pearson, 2<sup>nd</sup> Edition

#### CMSMT4.S7: VLSI Design

- **Introduction**: Switching Circuits, Transistor based Logic Synthesis, Reduction of Energy demand through gradual development of transistor technology.
- **MOSFET**: Basic science, realization using poly-silicon conductor, SiO<sub>2</sub> insulator, diffusion layer, Synthesis rule: n-Complex, p-Complex, geometric dual, transmission gate, realization of circuit like  $(a-c + b-d + a-e-d + b-e-c)'$  ,  $(a + b-c + d-e)'$  , Physical layout, stick diagram.
- **Fabrication**: photolithographic resolution, parameter, design rules, Large Scale Integrations.
- **VLSI Design Cycle** :
  - **Partitioning**: Kernighan Lin Heuristics , Fiducia-Mattheyses heuristics
  - **Placement**: Rectangular Dual Graph Approach
  - **Floor Planning**: Channel Graph , Sliceable and inherently non-sliceable channel graph, Slicing Theorem, Four Cycle Theorem .
  - **Routing**: Interval Graph, Vertical Constraint Graph, Horizontal Constraint Graph, Constraint Graph, Zone – Margin, Chromatic Partitioning.
  - **Global Routing**: Lee’s Approach, Soukop’s Approach.
  - **Clocking**: Clock tree and its delay calculation, H-tree algorithm, Geometric-Matching based algorithm.
  - **Testing**: Fault, Error, Stuck-at-fault Model, Path-delay Model, Collapse of fault – universe using fault dominance and fault equivalence, Path-sensitization method, Fault activation, Fault Propagation and Fault justification, Boolean Difference Method, D- Algorithm.
  - **Design Tools**: ESPRESSO ( Two-level AND-OR Minimizer) , MAGIC (Layout editor), HOPE ( Test Pattern Generation Tool ), BENCHMARKS

#### Books

1. D. Pucknell and K. Eshraghian: Basic Principles of VLSI Design, Prentice Hall, Englewood Cliffs, 1985.

2. E. D. Fabricius: Introduction to VLSI Design, McGraw Hill, New York, 1990.
3. Mukherjee: Introduction to CMOS VLSI, Prentice Hall, Englewood Cliffs, 1993.
4. N. Weste and K. Eshraghian: Principles of CMOS Design, 2nd ed., Addison-Wesley, Reading, Mass., 1993.
5. Mead and L. Conway: Introduction to VLSI Systems, Addison-Wesley, Reading, Mass., 1980.
6. M. Sarrafzadeh and C. K. Wong: AN Introduction to VLSI Physical Design, McGraw Hill, New York, 1996.
7. N. Sherwani: Algorithms for VLSI Physical Design Automation, Kluwer Academic, Boston, 1999.

#### **CMSM P4.3: GENERAL VIVA-VOCE**

General viva-voce will be conducted by a panel of internal and external examiners.

#### **CMSM P4.4: DISSERTATION WORK**

- Dissertation Work is an illaborate work on the third-semester paper CMSMP3.6 Design Work.
  - It may be developmental work as well as research-oriented work.
  - It is assigned in the beginning of third semester and is continued to the fourth semester.
  - At the end of third semester, work done by the student will be evaluated by a presentation and a synopsis.
  - At the of the fourth semester, final presentation and report is to be submitted.
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