D A Y A L B A G H E D U C A T I O N A L I N S T I T U T E
DEPARTMENT OF PHYSICS & COMPUTER SCIENCE (FACULTY OF SCIENCE)
COMPUTER SCIENCE COURSES
SESSION 2018-19

Course Number	Course Title	Credits	End Sem. Exam. Exists	Theory/ Practical
CSM101	INT. TO COMPUTER SC. & APPLICATIONS	3.0	Yes	T
CSM102	COMPUTER PROGRAMMING 1	3.0	Yes	T
CSM103	PROGRAMMING LAB I	2.0	Yes	P
CSM104	SEMINAR & GROUP DISCUSSION	0.5	No	P
CSM201	COMPUTER PROGRAMMING II	3.0	Yes	T
CSM202	DATA STRUCTURES	3.0	Yes	T
CSM203	PROGRAMMING LAB II	2.0	Yes	P
CSM204	ACTIVE LEARNING/TUTORIAL	0.5	No	P
CSM301	DIGITAL PRINCIPLES AND APPLICATIONS	3.0	Yes	T
CSM302	SIGNALS AND SYSTEMS	3.0	Yes	T
CSM303	DATABASE MANAGEMENT SYSTEMS	3.0	Yes	T
CSM304	PROGRAMMING LAB III	3.0	Yes	P
CSM305	SEMINAR & GROUP DISCUSSION	0.5	No	P
CSM401	INTERNET TECHNOLOGIES	3.0	Yes	T
CSM402	SEMICONDUCTOR DEVICES AND CIRCUITS	3.0	Yes	T
CSM403	OBJECT ORIENTED MODELLING & DESIGN	3.0	Yes	T
CSM404	PROGRAMMING LAB IV	3.0	Yes	P
CSM405	ACTIVE LEARNING/TUTORIAL	0.5	No	P
CSM501	COMPUTER GRAPHICS	4.0	Yes	T
CSM502	COMPUTER NETWORKS	4.0	Yes	T
CSM503	COMPUTER SYSTEMS ARCHITECTURE	4.0	Yes	T
CSM504	NETWORK THEORY	4.0	Yes	T
CSM505	PROGRAMMING LAB V	6.0	Yes	P
CSM511	COMPUTATIONAL SCIENCE	4.0	Yes	T
CSM601	SOFTWARE ENGINEERING	4.0	Yes	T
CSM603	CRYPTOGRAPHY AND SECURITY	4.0	Yes	T
CSM604	OPERATING SYSTEMS	4.0	Yes	T
CSM605	PROJECT	4.0	Yes	P
CSM606	PROGRAMMING LAB VI	6.0	Yes	P
CSM701	AUTOMATA THEORY & FORMAL LANGUAGES	4.0	Yes	T
CSM702	ADVANCED COMPUTER NETWORKS	4.0	Yes	T
CSM703	LOGIC & FUNCTIONAL PROGG. PARADIGMS	4.0	Yes	T
CSM704	COMPUTER SYSTEMS LAB I	4.0	Yes	P
CSM801	COMPILER DESIGN	4.0	Yes	T
CSM802	INTELLIGENT INFORMATION PROCESSING	4.0	No	T
CSM803	COMPUTER SYSTEMS LAB II	4.0	Yes	P
CSM001	BASIC RES. METH., SC.COMPUT. & ANAL.	4.0	Yes	T
CSM002	PRE-DISSERTATION	4.0	No	P
CSM003	TECHNICAL WRITING & PRESENT. SKILLS	1.0	No	P
CSM902	DISSERTATION I	6.0	Yes	P
CSM903	DISSERTATION II	6.0	Yes	P
CSM951	ADVANCED ALGORITHMS	4.0	Yes	T
CSM952	ADVANCED COMPUTER ARCHITECTURE	4.0	Yes	T
CSM961	SELF STUDY COURSE	4.0	Yes	P
CSM962	MINOR PROJECT	4.0	Yes	T
CSM963	MAJOR PROJECT I	8.0	Yes	T
CSM964	MAJOR PROJECT II	16.0	Yes	T
CSM965	MAJOR PROJECT I	8.0	Yes	T
CSM966	MAJOR PROJECT II	8.0	Yes	T
CSM996	DISSERTATION	12.0	Yes	P

CSM011	MEDIA PROCESSING	4.0	No	T
CSM014	DATA COMPRESSION	4.0	Yes	T
CSM015	PARALLEL COMPUTING	4.0	Yes	T
PEE316	DIGITAL IMAGE PROCESSING	4.0	Yes	T
CSM023	PATTERN RECOGNITION	4.0	Yes	T
CSM024	COMPUTATIONAL GEOMETRY	4.0	Yes	T
CSM026	EVOLUTIONARY COMPUTING	4.0	Yes	T
CSM031	INFORMATION THEORY	4.0	Yes	T
CSM032	DATA MINING	4.0	Yes	T
CSM033	COMBINATORIAL OPTIMIZATION	4.0	Yes	T
CSM034	COMPLEXITY THEORY	4.0	Yes	T
CSM035	BIOMETRICS	4.0	Yes	T
CSM042	MACHINE INTELLIGENCE	4.0	Yes	T
CSM043	COMPUTER VISION	4.0	Yes	T
CSM044	ENGG. ENTERPRISE SOFTWARE SYSTEMS	4.0	Yes	T
CSM045	MOBILE COMPUTING	4.0	Yes	T
CSM046	REAL TIME SYSTEMS	4.0	Yes	T

COURSES OFFERED BY FACULTY OF ENGINEERING

CSM302	SIGNALS AND SYSTEMS	3.0	Yes	T
PEE101	APPLIED SYSTEMS ENGINEERING	4.0	Yes	T
PEE202	MODELLING & SIMULATION	4.0	Yes	T
PEE212	DIGITAL SIGNAL PROCESSING	4.0	Yes	T
PEE316	DIGITAL IMAGE PROCESSING	4.0	Yes	T
PEE415	QUANTUM COMPUTING	4.0	Yes	T
PME214	NANO-TECHNOLOGY & NANO-COMPUTING	4.0	Yes	T
MAM811	DESIGN & ANALYSIS OF ALGORITHMS	4.0	Yes	T

Course Number: CSM101, Course Title: INT. TO COMPUTER SC. & APPLICATIONS
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 3, Periods(55 mts. each) per week: 3 (L: 3 + T: 0 + P: 0) Min. Periods/Sem.: 42

UNIT 1
Introduction to computers, processors (basic architecture and examples), primary and secondary memories, I/O devices, peripheral devices. Information and its representation in computers, storage of binary information, stored-program concept.
UNIT 2
Operating systems, user interface, file management, input and output of information, memory concerns. Windows and Linux OS, multitasking, multithreading, system and application software. Open source software.
UNIT 3
Computer languages, algorithms, programs: specification, top-down development and stepwise refinement. Sequential vs. parallel programming.
UNIT 4
Computer networks, topologies, data transmission, protocols , hardware. Internet and World Wide Web, applications, cluster computing.
UNIT 5
Databases: Storage and retrieval of data, simple examples of queries and implementation platforms. Data compression, compression standards for audio, image, and video. Audio and video streaming applications.

SUGGESTED READING:
KF Lauckner, MD Lintner: The COMPUTER CONTINUUM,QUE/E&T.
SL Mandell, S Sakthivel: COMPUTERS AND INFORMATION PROCESSING, SWE Publ.
K Abernethy, T Allen: EXPLORING THE DIGITAL DOMAIN, Brooks/Cole Publ.
P Norton: INTRODUCTION TO COMPUTERS, TMH

Course Number: CSM102, Course Title: COMPUTER PROGRAMMING I
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 3, Periods(55 mts. each) per week: 3 (L: 3 + T: 0 + P: 0) Min. Periods/Sem.: 42

UNIT 1
Algorithm / pseudo code, flowchart, program development steps, structure of C program, A Simple C program, identifiers, basic data types and sizes, Constants, variables, arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, type conversions, conditional expressions, precedence and order of evaluation.
Input-output statements, statements and blocks, if and switch statements, loops- while, do-while and for statements, break, continue, goto and labels.
UNIT 2
Designing structured programs, Functions, basics, parameter passing, storage classes- extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions, header files, C preprocessor.
UNIT 3
Arrays- concepts, declaration, definition, accessing elements, storing elements, arrays and functions, two-dimensional and multi-dimensional arrays, applications of arrays. pointers- concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointers to pointers, pointers and multidimensional arrays, dynamic memory managements functions, command line arguments.
UNIT 4
Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bitfields.
UNIT 5
Input and output - concept of a file, text files and binary files, streams, standard I/o, Formatted I/o, file I/o operations, error handling.

SUGGESTED READINGS:
Schildt, H.,Borland C: The Complete Reference, McGraw Hill Inc.
Rajaraman,V., Computer programming in C, Prentice Hall of India.
Turbo C, Schaum series.

Course Number: CSM103, Course Title: PROGRAMMING LAB I
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 2, Periods(55 mts. each) per week: 4 (L: 0 + T: 0 + P: 4) Min. Periods/Sem.: 56

Experiments supporting the Course No.: CSM102: Computer Programming I.

Course Number: CSM104, Course Title: SEMINAR & GROUP DISCUSSION
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 20
Credits: 0.5, Periods(55 mts. each) per week: (L:0+T:1+P:0) Min. Periods/Sem.: 13

Course Number: CSM201, Course Title: COMPUTER PROGRAMMING II
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 2013-14
Credits: 3, Periods(55 mts. each) per week: 3 (L: 3 + T: 0 + P: 0) Min. Periods/Sem.: 42
[Same as CSD201]
UNIT 1
Genesis of Java, applicability, data types, variables, arrays, operators, control statements, Overview of object-oriented programming, Classes: fundamentals, constructors, overloading, and argument passing.
Unit 2
Recursion, access control, inheritance, Packages, interfaces, Overview of Java Class Library, string handling, I/O streams, exception handling.
UNIT 3
Multi-threaded programming, Generics, Wrapper Classes, Collections, Inner Class.
UNIT 4
Graphics Programming I: Applets & Applications, Working with AWT: windows, graphics and Text, AWT controls, Layout Managers, Menus, Images.
UNIT 5
Graphics Programming II: Event Handling, Working with Swing: Lightweight vs. Heavyweight containers, AWT Replacement Components, Additional Swing Components: Tables, Trees, custom dialogs, Swing MVC

SUGGESTED READINGS:
Dietel&Dietel, Java How to Program, Pearson
Schildt,H., Java: The Complete Reference, Tata-McGraw Hill.
Geary,D.M., graphic Java, Addison Wesley
Horstmann and Cornell, Core Java 2 Vol. I, II, Pearson Education.

Course Number: CSM202, Course Title: DATA STRUCTURES
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 3, Periods(55 mts. each) per week: 3 (L: 3 + T: 0 + P: 0) Min. Periods/Sem.: 42

UNIT 1
Introduction, Arrays and Strings, Introduction to algorithm development, introduction to complexity analysis, recursion, Sequential Representation, lists
UNIT 2
Stack, queue, linked representation, circular and doubly linked lists, binary trees: representation, insertion and deletion, traversal
UNIT 3
Graphs: Representation and traversal, Minimum Spanning tree, shortest path, all pairs shortest path and transitive closure; String Algorithms
UNIT 4
Searching and internal Sorting, binary search tree
UNIT 5
AVL tree, Hashing, Sets: Representation, union and find, program specification, pre and post conditions, program testing.

SUGGESTED READING
Weiss N, DATA STRUCTURES USING C
Horowitz E & Sahani S, AN INTRODUCTION TO DATA STRUCTURES USING PASCAL

Course Number: CSM203, Course Title: PROGRAMMING LAB II
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 2, Periods(55 mts. each) per week: 4 (L: 0 + T: 0 + P: 4) Min. Periods/Sem.: 56

Part – 1: Experiments supporting the Course No.: CSM201: Digital Principles And Applications
Part – 2: Experiments supporting the Course No.: CSM202: Data Structures

Course Number: CSM204, Course Title: ACTIVE LEARNING/TUTORIAL
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 0.5, Periods(55 mts. each) per week: (L:0+T:1+P:0) Min. Periods/Sem.: 13

ACTIVE LEARNING/TUTORIAL

Course Number: CSM301, Course Title: DIGITAL PRINCIPLES AND APPLICATIONS
Class: B.Sc. Status of the Course No.: MAJOR, Approved Since Session: 2013-14
Credits: 3, Periods(55 mts.) per week: 03 (L:3 + T:0 + P:0), Min. periods per semester: 42
[SAME AS CSD103]

UNIT 1
Number systems, Logic gates, Boolean algebra, De Morgan's Theorem, algebraic simplification, canonical forms, K-map and Tabular minimization. Arithmetic circuits: signed magnitude representation, 2's complement representation, half adder, full adder circuits, subtraction, controlled adder-subtracter, carry look-ahead adder.

UNIT 2
Multiplexer, demultiplexer, encoder, decoder, seven segment display driver, parity checker, word comparator. Flip-flops: SR, D , T , JK, Master slave. Edge and level triggering. Clocks, timers, monostable and a stable multivibrators.

UNIT 3
Register: presettable, serial and parallel shift. Counters: Up, Down, Synchronous, Asynchronous, decoding gates, Mod-3, 5, ring etc. Memories. A/D and D/A conversion, Ladder circuit, Accuracy and resolution.

UNIT 4
Synchronous sequential systems, state transition diagram, state transition table, excitation tables, implementation. Counter design, sequence detection.

UNIT 5
Writing machine, Iterative networks. Minimization and transformation of Sequential machines, Simplification of incompletely specified machines.

SUGGESTED READINGS:
Kohavi, Z., Switching and Finite Automata Theory, Cambridge University Press.
Malvino, A.P.,Donald Leach, Digital Principles and Applications, TMH.
Bartee,T.C., Digital Computer Fundamentals, McGraw Hill.
Yarbrough, J.M., Digital Logic – Applications and Design, PWS Publ.

Course Number: CSM302, Course Title: SIGNALS AND SYSTEMS
Class: B.Sc., Status of Course No.: Major, Approved since session: 2012-13
Total Credits: 3, Total pds.(50 mts each)/week: 5(L:4+T:1+P:0+S:0) Min. pds./sem.:65

UNIT 1: MATHEMATICAL DESCRIPTION OF SIGNALS AND SYSTEMS
Introduction. Types of signals- continuos versus discrete , periodic, energy, power signals. Even and odd functions. Transformation of Independent Variable. Singularity functions. Continuous and Discrete Time Systems. Basic System characteristics such as Linearity, time invariance, Causality, Stability, Memory. Concept of correlation of signals.

UNIT 2: LTI SYSTEMS-TIME DOMAIN TECHNIQUES
Properties of LTI systems. Differential / Difference Equation representation of LTI. Zero-input and zero-state response. Impulse response and Unit step response. Convolution(discrete and continuos),its properties. LTI System Interconnections. Elgenfunctions of LTI systems.

UNIT 3: FREQUENCY DOMAIN TECHNIQUES
Signals and vectors, orthogonality. Fourier series, its convergence. Trigonometric and exponential Fourier series and their properties. Non-periodic signals and Fourier Transform- its convergence. Properties of Fourier Transform. Energy Density Spectrum, its relation with Auto correlation. Laplace Transform.

UNIT 4: FOURIER TRANSFORM ANALYSIS OF SIGNALS AND SYSTEMS(ANALOG)
Transfer Function of LTI systems. Frequency Response, Ideal fitters, Bandwidth. Impulse response and causality. Practical Passive Filters, RC and RLC fitters. Poles and Zeros. Log Magnitude Frequency Response Plots and Bode Diagrams. Distortionless transmission. Relationship between rise-time and bandwidth.

UNIT 5: SAMPLING, DISCRETE TIME FOURIER TRANSFORM AND Z- TRANSFORM.
Representing a continuous-time signal by its samples. Sampling Theorem. Frequency domain interpretation of sampling. Aliasing. Recovering original signal from its samples. Discrete Time Fourier Transform and its properties. Z-Transform, its properties. Application of Z-Transform to Discrete-Time system analysis.

REFERENCE BOOKS:
Signals and Systems: M.J.Roberts, Tata Mc Graw-Hill,2004
Signals and Systems: Oppenheim, Wilsky and Nawab
Communication Systems: B.P. Lathi

Course Number: CSM303, Course Title: DATABASE MANAGEMENT SYSTEMS
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 2010-11
Credits: 3, Periods(55 mts. each) per week: 3 (L: 3 + T: 0 + P: 0) Min. Periods/Sem.: 42
[SAME AS CSD104]
UNIT 1
Basic concepts: databases, database systems, data models, schemas, database systems architecture, data independence, database languages and interfaces, DBMS System Environment, classification, record storage and primary file organisation, index structures.
UNIT 2
Introduction to Microsoft Access for Windows 98/Microsoft SQL Server, Table creation, forms, data entry, creating and printing reports.
UNIT 3
Relational mode: Domains, relations, keys, relational algebra, calculus; SQL: data definition, queires, update statements, views; relational support for queries with MS Access/MS SQL Server.
UNIT 4
Database design: ER modelling, normalisation, relations and relaional algebra with MS Access/MS SQL Server.
UNIT 5
System implementation: transaction processing systems, concurrency, recovery, security, integrity, distributed databases, client-server architectures.

SUGGESTED READINGS:
CN Prague & MR Irwin: ACCESS FOR WINDOWS 95 BIBLE, 3/e, Comdex Publ.
Date CJ: AN INTRODUCTION TO DATABASE SYSTEMS, 6/e, Addison Wesley.
Elmasri & Navathe: FUNDAMENTALS OF DATABASE SYSTEMS, 3/e. Addison Wesley.
Soren V: SQL AND RELATIONAL DATABASE, Galgotia.
Kroenke DM: DATABASE PROCESSING: FUNDAMENTALS, DESIGN AND IMPLEMENTATION, Maxwell Publication.

Course Number: CSM304, Course Title: PROGRAMMING LAB III
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 2010-2011
Credits: 3, Periods(55 mts. each) per week: 6 (L: 0 + T: 0 + P: 6) Min. Periods/Sem.: 84

Based on THEORY courses.

Course Number: CSM305, Course Title: SEMINAR & GROUP DISCUSSION
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 0.5, Periods(55 mts. each) per week: 1 (L: 0 + T: 1 + P: 0) Min. Periods/Sem.: 13

Seminar & Group Discussion.

Course Number: CSM401, Course Title: INTERNET TECHNOLOGIES
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 3, Periods(55 mts. each) per week: 3 (L: 3 + T: 0 + P: 0) Min. Periods/Sem.: 42

UNIT 1
JDBC and RMI: Introduction to JDBC, JDBC Architecture, JDBC API, Communicating with Databases, JDBC Statement and ResultSet, Stored Procedures, Transactions, Batches.
Distributed Applications, RMI- Three Tier Layer, Client/Server Application using RMI, RMI packages.
UNIT 2
Java Server Pages (JSP) : JSP Lifecycle, Elements of JSP: Directives, TemplateData, Action, Scripting elements, Implicit objects, JSTL, custom tags
UNIT 3
Servlets: Introduction to Servlets and their utility; Servlet API, Servlet Lifecycle, Deployment Descriptor File, GenericServlet Class, Understanding Request processing and HTTP, Session Tracking
UNIT 4
Java Beans and EJB: Introduction to Java Bean, Elements of Java Bean, Types of Java Bean, Creation of Java Bean
EJB Overview, EJB Specification, Types of EJB: Entity Bean, Session Bean; Deploying EJB Technology
UNIT 5
Java & XML: Java & XML, XML syntax, Document type definition., Parsers, SAX parsers, DOM parsers, SAX vs. Dom, JAXP and JAXB

SUGGESTED READINGS:
Santosh Kumar k. "JDBC, Servlets and JSP Black book", dreamtech press
Chopra,V., "Beginning Java Server Pages", Wiley
Schildt,H., Java: The Complete Reference, Tata-McGraw Hill.
Dietel&Dietel, " XML how to program",Pearson

Course Number: CSM402, Course Title: SEMICONDUCTOR DEVICES AND CIRCUITS
Class: B.Sc., Status of the Course Number: MAJOR, Approved Since Session: 2015-16
Credits: 3, Periods (55 mts. each) per week: 3 (L:3 + T:0 + P:0) Min. Periods/Sem.: 39
[SAME AS PHM402]
UNIT 1 [8 pds]
Review: Historical developments, active passive components. Discrete components circuits, IC's, Logic, Semiconductors, n, p type on the basis of band theory, Semiconductors diodes: characteristics, diode equation, rectifier, clipper and clamper circuits, Zener diodes, Breakdown mechanism, use as a voltage regulator, regulated power supply, filter circuits. Synthesis of simple AND, OR, NOT gates from diode resistor networks
UNIT 2 [9 pds]
Transistors: pnp, npn transistors and their characteristics, current relationships, applications as an amplifier. Different configurations, Biasing, DC & AC load lines, Gain calculation
UNIT 3 [9 pds]
Operational Amplifiers: Ideal operational amplifier characteristics, concept of feedback, open/closed loop gain, inverting, non-inverting amplifier, Zero crossing detector, Applications:- mathematical operations and oscillators
UNIT 4 [8 pds]
Field Effect Transistor: Working and fabrication of JFET,MOS-C. Introduction to MESFETS and MOSFETs, Advantages of FETs over BUTs
UNIT 5 [8 pds]
Introduction to VLSI: Moore's Law and evolution of integrated circuits from SSI to VLSI, Crystal Growth, next generation lithographic methods, CMOS fabrication, Layout design- Rules, model and CADs (CMOS inverter as an example).

SUGGESTED READINGS:
1.Malvino, A.P. and Leach, D.: DIGITAL PRINCIPLES AND APPLICATIONS
2.Boylestadt and Nashelsky: ELECTRONIC DEVICES AND CIRCUIT THEORY
3.Streetmen, B.G.: SOLID STATE ELECTRONIC DEVICES
4.Weste and Eshragian: BASIC VLSI DESIGN

Course Number: CSM403, Course Title: OBJECT ORIENTED MODELLING & DESIGN
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 3, Periods(55 mts. each) per week: 3 (L: 3 + T: 0 + P: 0) Min. Periods/Sem.: 42

UNIT 1: CONCEPTS OF OOP IN C++
Classes and objects, operator overloading, inheritance, exception handling, templates, streams, Namespaces
UNIT 2: UML MODELLING LANGUAGE
Introduction, classes, relationships, class diagrams, interfaces, packages, object diagrams, use cases, sequence diagrams, state diagrams.
UNIT 3: UML MODELLING LANGUAGE
Collaboration diagrams, activity diagrams, component diagrams, deployment diagrams, Introduction to the unified software development process: The unified process, core workflows: analysis, design and implementation.
UNIT 4: THE C++ STANDARD LIBRARY
Standard containers like vector, map and string; iterator; algorithms and function objects. Introduction to design patterns: Basic concepts, importance and types of patterns. Creational patterns: abstract factory, factory method.
UNIT 5: DESIGN PATTERNS
Some more design patterns, adaptor, composite, iterator, observer, template method and strategy.

SUGGESTED READINGS:
Stroustrup,The C++ Programming Language, Addison Wesley, 3e, 1999
Booch, Jacobson, Rumbaugh,User Guide To The UML, Pearson, 1999
Jacobson, Booch, Rumbaugh,The Unified Software Development Process, Pearson, '99
Gamma, Helm, Johnson, Vlissides,Design Patterns, Addision Wesley, 1995
Bruegge and Dutoit,Object-Oriented Software Engineering, PHI, 2000

Course Number: CSM404, Course Title: PROGRAMMING LAB IV
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 2010-2011
Credits: 3, Periods(55 mts. each) per week: 6 (L: 0 + T: 0 + P: 6) Min. Periods/Sem.: 84

Based on THEORY courses.

Course Number: CSM405, Course Title: ACTIVE LEARNING/TUTORIAL
Class: B.Sc., Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 0.5, Periods(55 mts. each) per week: 1 (L: 0 + T: 1 + P: 0) Min. Periods/Sem.: 13

ACTIVE LEARNING/TUTORIAL

Course Number: CSM501, Course Title: COMPUTER GRAPHICS
Class: B.Sc. Honours, Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 4, Periods(55 mts. each) per week: 4 (L: 4 + T: 0 + P: 0), Min. Periods/Sem.: 52

UNIT 1
Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; RGB color model, direct coding, lookup table; Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.;
UNIT 2
Scan conversion: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.
UNIT 3
2D transformation & viewing : Basic transformations: translation , rotation, scaling ; Matrix representations & homogeneous coordinates, transformations between coordinate systems;
Transformation of points, lines , parallel lines, intersecting lines. Viewing pipeline, Window to viewport co-ordinate transformation , clipping operations , point clipping , line clipping, clipping circles , polygons & ellipse.
UNIT 4
3D transformation & viewing: 3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.
UNIT 5
Curves : Curve representation, surfaces , designs , Bezier curves , B-spline curves.
Hidden surfaces : Depth comparison, Z-buffer algorithm, Back face detection, scan-line algorithm; Hidden line elimination

SUGGESTED READING:
Hearn, Baker – " Computer Graphics (C version 2nd Ed.)" – Pearson education
Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH
D. F. Rogers, J. A. Adams – " Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH

Course Number: CSM502, Course Title: COMPUTER NETWORKS
Class: B.Sc. Honours, Status of the Course No.: MAJOR, Approved Since Session: 2013-14
Credits: 4, Periods(55 mts. each) per week: 4 (L: 4 + T: 0 + P: 0), Min. Periods/Sem.: 52
[Same as CSD112, PHM904]
UNIT 1
Introduction to computer networks, internet, telephone network. Network edge, core, access and physical media. Transmission media: twisted pair, coaxial cables, optical fiber, terrestrial and satellite microwave radio. Concepts of data transmission, delay and loss, protocol layers and service models.
UNIT 2
Application Layer: Principles of application layer, Web, HTTP, FTP, Email (SMTP), DNS, etc. Socket programming with TCP/UDP, client-server implementation, simple web server implementation.
UNIT 3
Transport Layer: Transport layer services, multiplexing/ demultiplexing, UDP. Principles of reliable data transfer (stop and wait, sliding window: go-back-N, selective repeat.). TCP: Connection management, segment structure, flow control, RTT estimation. Congestion control: Causes and approaches to control, TCP congestion control. Numerical examples.
UNIT 4
Network Layer: Network service models, routing principles (distance vector, link state), hierarchical routing, IP, fragmentation, ICMP, routing in the Internet (RIP, OSPF, BGP), IPv6.
UNIT 5
Link Layer & Security: services, error detection and correction, multiple access protocols, LAN, ARP, ethernet, bridging, wireless LAN. Security issues in networks, tunneling VPNs, IPSec.

SUGGESTED READING
Kurose JF, Ross KW: a top down approach featuring the inernet, pearson educaton, 2nd edition, 2002
Peterson LL, Davie B: COMPUTER NETWORKS; A SYSTEMS APPROACH, MORGAN-KAUFMANN
Stallings William: Local Networks; An Introduction, Macmillan Pub. Co.

Course Number: CSM503, Course Title: COMPUTER SYSTEMS ARCHITECTURE
Class: B.Sc. Honours, Status of the Course No.: MAJOR, Approved Since Session: 2008-09
Credits: 4, Total Periods(55 mts. each) per week: 4 (L:4 + T: 0 + P: 0) Min. Pds/Term: 50

UNIT 1
Number Systems, Radix Conversion, Fixed and Floating point Arithmetic, Logic Gates, Boolean Algebra, Combinational Logic, Minimization, Implementation Examples- arithmetic/logic circuits. Sequential logic, flips-flops, finite state machines, registers, counters.
UNIT 2
General Purpose Machine, History, Programming–Architecture–Logic design Viewpoints, Machine Classifications, Instruction Formats, Computer Instruction Sets (Data Movement, ALU, Branch Instructions) Addressing Modes, Simple RISC Computers (SRC), Formal Description using Register Transfer Notation (RTN) Data path, Control Path.
UNIT 3
Processor Design, register transfers, single bus SRC microarchitecture, Data Path Implementation, Logic Design, Control Sequences, Control Unit, Clocks, Timing, multi-bus microarchitecture, exceptions.
UNIT 4
Pipelining, microprogramming, examples of CISC/RISC processors.
UNIT 5
Memory system design, RAM Structure, SRAM, DRAM, ROM, Memory hierarchy, cache design, cache policies. I/O Programmed, I/O Interrupts, DMA, Error Control, Peripheral Devices.

SUGGESTED READING:
Heuring & Jordan: COMPUTER SYSTEMS ARCHITECTURE
R.P. Jain: DIGITAL ELECTRONICS
M. Mano: DIGITAL ELECTRONICS AND COMPUTER DESIGN

Course Number: CSM504, Course Title: NETWORK THEORY
Class: B.Sc. Honours, Status of the Course No.: MAJOR, Approved Since Session: 2013-14
Credits: 4, Periods(55 mts. each) per week: 5 (L: 5 + T: 0 + P: 0), Min. Periods/Sem.: 70
[Same as PHM504]
UNIT 1 [14 pds]
Introduction: Review of ideal circuit elements, KVL, KCL, resistive networks, mesh and nodal analysis. Network Theorems: linearity and superposition, Thevenin and Norton theorems, maximum power transfer, Wye-delta transformation, Tellegens theorem.
UNIT 2 [14 pds]
Transient Analysis: Laplace transform approach to solution of networks, signals, transform impedances, first order systems, second order systems, state space techniques for formulation of equations and analysis.
UNIT 3 [14 pds]
Sinusoidal Steady state analysis: Phasers and phaser diagrams, voltage-current-phase calculations in RL, RC, and RLC networks, steady state power, Fourier approach to solution using superposition. Two Port Networks: Derivation of H, Y, Z, ABCD parameters, inter-parameter conversions.
UNIT 4 [14 pds]
Network Synthesis: Introduction to network synthesis, Test for positive real functions, Hurwitz polynomials, passive RL, RC, LC network synthesis: Cauer, Foster realizations.
UNIT 5 [14 pds]
Introductory graph theory, incidence matrix, f-cutset and f-circuit equations, sparse tableau analysis, modified nodal analysis.

SUGGESTED READINGS
Hayt and Kermerley: ENGINEERING CIRCUIT ANALYSIS
Chua, Desoer, Kuh : LINEAR AND NON-LINEAR CIRCUITS.
Van Valkenburg : NETWORK ANALYSIS
Van Valkenburg : INTRODUCTORY NETWORK SYNTHESIS

Course Number: CSM505, Course Title: PROGRAMMING LAB V
Class: B.Sc. Honours, Status of the Course No.: MAJOR, Approved Since Session: 2011-2012
Credits: 6, Periods(55 mts. each) per week: 8 (L: 0 + T: 0 + P:8), Min. Periods/Sem.: 104

Based on THEORY courses.

Course Number: CSM511, Course Title: COMPUTATIONAL SCIENCE
Class: B.Sc. Honours, Status of the Course Number: MAJOR, Approved Since Session: 2017-2018
Credits: 4, Periods (55 mts. each) per week: 4 (L:4 + T:0 + P:0), Min. Periods/Sem.: 52
[SAME AS PHM605]

UNIT 1 [12 pds]
MATLAB M-files, debugging, and profiling tools. MATLAB applications, polynomials, interpolation, integration, differentiation, ODE. Graphics, 2-D, 3-D, Graphical User Interface (GUI). Advanced graphics in MATLAB, 3-D representation and exportable animations

UNIT 2 [10 pds]
Accuracy, stability and convergence of numerical algorithms, error analysis of operations, interpolation for numerical differentiation and integration, stable solution algorithm for ordinary and partial differential equations [Exercises in MATLAB in all units]

UNIT 3 [10 pds]
Key ideas of linear algebra, special matrices, differential and difference equations, solving linear systems, inverses, delta function, eigenvalues, eigenvectors, positive definite matrices

UNIT 4 [10 pds]
Oscillations by Newton's law, least squares, finite differences in time, graph models, networks. Boundary conditions, splines, gradient, divergence, Laplace's equation

UNIT 5 [10 pds]
Fourier series, Chebyshev, Legendre, Bessel, Green's functions, discrete Fourier series, fast Fourier transform, convolution, filtering, sampling

Suggested Readings
Gilbert Strang: Computational Science and Engineering, Wellesley-Cambridge Press, 2007.
SS Sastry: Introductory Methods of Numerical Analysis, PHI
Burden Richard, L. and Douglas Faires: Numerical Analysis, 7th ed, Belmont, CA, Brooks Cole, 2000.
Cleve Moler: Numerical Computing with MATLAB, Mathworks, 2004.
Patrick Marchand and O. Thomas Holland: Graphics and GUIs with MATLAB, Chapman and Hall/CRC Press

Course Number: CSM601, Course Title: SOFTWARE ENGINEERING
Class: B.Sc. Honours, Status of the Course No.: MAJOR, Approved Since Session: 2013-14
Credits: 4, Periods(55 mts. each) per week: 4 (L: 4 + T: 0 + P: 0), Min. Periods/Sem.: 52
[Same as CSD222 & PHM807]

UNIT 1
Introduction: Software and Software Engineering, Phases in Software Engineering, Software Engineering Life-Cycle Paradigms; Software: its Nature and Qualities. Software Engineering Principles.

UNIT 2
Software Project Management: The Software Management Process; Software Measurement: Function Points and Code Size Estimation, Software Cost Estimation - COCOMO and Putnam models; Staffing and Personnel Planning; Team Structure; Risk Management - an overview; Software Configuration Management; Quality Assurance Planning; Project Monitoring Planning; Case Study.

UNIT 3
Software Requirements Specification: Analysis principles, Structured Analysis: Modelling Tools, Structured Analysis Methodology - Classical and Modern; Requirements Specification: Characteristics, and Components; Case Study.

UNIT 4
System Design: Objectives, Principles, Modular Design, Structured Design - Structure Charts, Transform Analysis, Transaction Analysis, Design Heuristics; Module Specification; Detailed Design; Case Study.

UNIT 5
Coding: Structured Programming, Programming Style; Validation; Verification: Static Analysis (Reviews and Inspections), Testing - Goals, Theoretical Foundations, Testing in the Small, Testing in the Large; Metrics: Metrics in Requirements Analysis and Design, Complexity Metrics-Halstead's Theory, and Cyclomatic Complexity.

SUGGESTED READINGS:
Jalote, P., AN INTEGRATED APPROACH TO SOFTWARE ENGINEERING, NAROSA.
Pressman, R.S., SOFTWARE ENGINEERING: A PRACTITIONER'S APPROACH, MCGRAW HILL.
Somerville, I., SOFTWARE ENGINEERING, ADDISON WESELEY.

Course Number: CSM603, Course Title: CRYPTOGRAPHY AND SECURITY
Class: B.Sc. Honours, Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 4, Total Periods(55 mts. each) per week: 4 (L:4 + T: 0 + P: 0) Min. Pds/Term: 52

UNIT 1

Private Key Cryptosystems: classical techniques, modern techniques, algorithms like DES, IDEA, RC5, Blowfish, etc, confidentiality using Conventional Encryption.
UNIT 2
Introduction to Number Theory: modular arithmetic, Fermat's and Euler's theorem, primality testing, Chinese remainder theorem, discrete logarithms; Basics of Finite fields.
UNIT 3
Public Key Encryption and Hash Functions: principles of public key cryptosystems, Diffie-Hellman key exchange, RSA, introduction to elliptic curve cryptography.
UNIT 4
Message Authentication and Hash function: MD5, SHa-1, HMAC etc.; Digital Signature and authentication protocols: Digital signature, DSS, Authentication protocols;
UNIT 5
Differential and Linear cryptanalysis; existing cryptosystems and their security. Cryptanalysis of existing systems. Zero-knowledge protocols, One-way functions. Advanced protocols for different applications, e.g. e-cheque, e-cash etc. Network and System level security issues.

SUGGESTED READING
William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall, New Jersy.
Johannes A. Buchmann, "Introduction to Cryptography", Springer-Verlag.
Bruce Schiener, "Applied Cryptography".

Course Number: CSM604, Course Title: OPERATING SYSTEMS
Class: B.Sc. Hons., Status of the Course No.: MAJOR, Approved Since Session: 2013-14
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 52
[Same as PHM810]
UNIT 1: BASICS
Functions of operating systems. Computer hardware review: processor and model of execution, interrupts and interrupt processing, storage structure, I/O structure, dual mode operation, clocks and timers. Evolution of operating systems, components. System calls, types of system calls (Linux system calls as examples). Operating system design and implementation.
UNIT 2: PROCESS MANAGEMENT
Process, Threads, IPC with shared memory and message passing. CPU scheduling: scheduling criteria, algorithms. Synchronisation: critical section problem, Peterson's solution, synchronization hardware, semaphores. Solving classic synchronization problems with semaphores. Monitors.
UNIT 3: DEADLOCKS AND MEMORY MANAGEMENT
Deadlocks: characterization, prevention and avoidance. Memory Management: contiguous allocation, paging, segmentation, demand paging, page replacement, frame allocation.
UNIT 4: FILE AND I/O MANAGEMENT
File Management: Files, directory structure, protection, file system structure, implementation, allocation methods, disk scheduling. I/O Management: Hardware, principles of I/O software, I/O software layers.
UNIT 5: LINUX OPERATING SYSTEM
Structure, scheduling, memory management and file system, shell and shell programming, signals and signal handling, pthreads, IPC: shared memory and pipes.

SUGGESTED READINGS:
Silberschatz A, Gagne G. and Galvin P.B.: OPERATING SYSTEM CONCEPTS, ADDISON - WESLEY PUBLISHING COMPANY, 7E,2005.
Tanenbaum A.S.: MODERN OPERATING SYSTEMS, 2E, PEARSON EDUCATION, 2001.
Linux Handouts

Course Number: CSM605, Course Title: PROJECT
Class: B.Sc. Honours, Status of the Course No.: MAJOR, Approved Since Session: 2011-12
Credits: 4
PROJECT based course.

Course Number: CSM606, Course Title: PROGRAMMING LAB VI
Class: B.Sc. Honours, Status of the Course No.: MAJOR, Approved Since Session: 2011-2012
Credits: 6, Periods(55 mts. each) per week: 4 (L: 4 + T: 0 + P:0), Min. Periods/Sem.: 52
Based on THEORY courses.

Course Number: CSM701, Course Title: AUTOMATA THEORY & FORMAL LANGUAGES
Class: M.Sc./M.Tech., Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 52

UNIT 1
Regular languages, Finite Automata, Nondeterminism, Equivalence of NFAs and DFAs, Regular Expressions, Equivalence with Finite Automata, Nonregular Languages
UNIT 2
Context free grammars, Chomsky normal form, Pushdown automata, equivalence, non-context-free languages
UNIT 3
Turing Machines, Turing Machines as Language Acceptors, Multitape Turing Machines, Nondeterministic Turing Machines, Enumerators, Decidable Languages
UNIT 4
The Church-Turing Thesis, The Halting Problem, Universal Turing Machines, Reducibility, Rice's Theorem, Basics of Recursive function theory
UNIT 5
Measuring Complexity, The Class P, The Class NP, NP Completeness, Introduction to Space Complexity

SUGGESTED READINGS:
Michael Sipser, Introduction to the Theory of Computation.
Thomas A Sudkamp, Languages and Machines

Course Number: CSM702, Course Title: ADVANCED COMPUTER NETWORKS
Class: M.Sc./M.Tech., Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1
Review of the internet architecture, layering; wired and wireless MAC.
UNIT 2
Intra- and inter-domain internet routing, BGP, MPLS, MANETs.
UNIT 3
Error control and reliable delivery, ARQ, FEC, TCP, congestion and flow control; QoS, scheduling.
UNIT 4
Mobility, mobile IP, TCP and MAC interactions, session persistence; multicast.
UNIT 5
Internet topology, economic models of ISPs/ CDNs /content providers; future directions.

SUGGESTED READINGS:
McConnell, J.,Internetworking Computer Systems: Interconnecting Networks And Systems, Springer
Aracil, J. and Callegati,F.,Enabling Optical Internet With Advanced Network Technologies, Springer

Course Number: CSM703, Course Title: LOGIC & FUNCTIONAL PROGG. PARADIGMS
Class: M.Sc./M.Tech., Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1
Introduction to programming languages, language description, lexical and syntax analysis, general syntactic criteria, syntactic elements of a language, regular expressions, syntax and parse trees, derivations, context-free grammar, scanners and parsers.
UNIT 2
Properties of types and objects, scalar, composite, derived and abstract data types, Data abstractions and control constructs; block-structure and scope, principles of abstraction. Assembly level computer architecture: Data representation, Instruction set architecture, The evolution of processor architecture, Compiling of modern processors.
UNIT 3
Fundamentals of subroutines/subprogram, subprogram control, static and dynamic scope rules, parameter passing methods, storage management.
UNIT 4
Functional programming in Python: Lists and Tuples, Conditionals, Loops, and Some Other Statements, Working with Strings, Abstraction, Exceptions, Magic Methods, Properties, and Iterators, Files and Graphical User Interfaces.
UNIT 5
Logic programming in Prolog: Prolog overview, Syntax and Unification, Lists, terms and arithmetic, Graphs, Trees, Non-determinism. knowledge representation, reasoning, searching, knowledge-based system, perception and action, unified systems.

SUGGESTED READINGS:
Scott, M.,Programming Language Pragmatics, Morgan Kaufmann.
Friedman, Wand and Haynes: Essentials Of Programming Languages, PHI.
Tennant: Principles Of Programming Languages, PHI.

Course Number: CSM704, Course Title: COMPUTER SYSTEMS LAB I
Class: M.Sc., Status of the Course No.: MAJOR, Approved Since Session:
Credits: 4, Periods(55 mts. each) per week : 8 (L: 0 + T: 0 + P: 8) Min. Periods/Sem: 112

Laboratory based on THEORY COURSES.

Course Number: CSM801, Course Title: COMPILER DESIGN
Class: M.Sc./M.Tech., Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1
Structure of a Compiler, Lexical Analysis: Input buffering, specificaiton and recognition of tokens, finite automata, from regular expressions to DFAs, The Parsing process, CFGs, Parse Trees and Abstract Syntax trees, EBNF.
UNIT 2
Top-down Parsing by recursive descent, LL parsing, Bottom up parsing, operator precedence grammars, LR Parsing: LR, SLR and LALR parsing
UNIT 3
Syntax directed definitions: inherited and synthesized attributes, dependency graph, evaluation order, bottom up and top down evaluation of attributes. The Symbol table, Data Types and Type Checking
UNIT 4
Run Time environments: storage organization, stack based allocation of space, heap management, Introduction to garbage collection, parameter passing. Intermediate code generation: intermediate representations and translations
UNIT 5
Code generation and instruction selection: issues, basic blocks and flow graphs, register allocation, DAG representation of programs, code generation from dags, peep hole optimization, Introduction to Code optimization

SUGGESTED READINGS:
Kenneth C Louden, Compiler Construction: Principles and Practice
Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers:Principles, Techniques, and Tools

Course Number: CSM802, Course Title: INTELLIGENT INFORMATION PROCESSING
Class: M.Sc., Status of the Course Number: MAJOR, Approved Since Session: 2011-2012
Credits: 04, Periods (55 mts. each) per week: 4 (L:4+T:0+P/S:0), Min. Periods/Sem:52
(INDIAN INSTITUTE OF TECHNOLOGY, DELHI: SIV 875)
[SAME AS PHM960]

UNIT 1
Soft Computing: neural networks, fuzzy logic, evolutionary computation, applications of soft computing technologies, simulation software.
UNIT 2
Pattern recognition, Bayesian Techniques, Bayes Theorem, Bayes classifier, neural network implementations, supervised learning with expectation maximization.
UNIT 3
Data Mining, models, methodologies, and processes. The KDD process. Generic tasks. Broad themes (search, induction, querying, approximation, and compression). Application areas.
UNIT 4 & UNIT 5
Special Topics (Invited lectures): Intelligent Software Agents, Multi-objective Evolutionary Optimization, Applications (Networks), Applications (Imaging), Hybrid Soft Computing Systems

SUGGESTED READINGS:
Material available from web sites.

Course Number: CSM803, Course Title: COMPUTER SYSTEMS LAB II
Class: M.Sc., Status of the Course No.: MAJOR, Approved Since Session:
Credits: 4, Periods(55 mts. each) per week : 8 (L: 0 + T: 0 + P: 8) Min. Periods/Sem: 112

Laboratory based on THEORY COURSES.

Course Number: CSM001, Course Title: BASIC RES. METH., SC.COMPUT.& ANAL.
Class: M.Sc./M.Tech., Status of Course: CORE COURSE, Approved since session: 2013-14
Total Credits:4

UNIT 1: INTRODUCTION
Meaning of research, types of research, research process, problem formulation and techniques, literature review. Research design, principles and types of experimental designs, controls in an experiment, types of controls.
UNIT 2: MEASUREMENT & DATA COLLECTION
Measurement & Scaling: Measurement in research, scales of measurement, sources of errors, tests of sound measurement, development of measurement tools, scaling, scale construction techniques. Methods of data collection: observation, interviews, questionnaire, rating scales, content analysis, case study, schedules.
UNIT 3: ANALYSIS
Quantitative analysis, Errors in Quantitative analysis- random and systematic errors, handling systematic errors, presentation of results, Quality Control and Quality Assurance, Figures of merit-accuracy, precision, limit of detection, limit of quantification, method of standard additions, internal and external standards, comparison of analytical methods.
UNIT 4: INTERPRETATION & REPORTING
Interpretation, techniques of Interpretation, precautions in Interpretation. Report writing: synopsis, project/dissertation report, abstract; reading and writing a research paper.
UNIT 5: SEARCH, REASONING & IPR
Part A: Patents, copyrights, trademarks, trade secrets, IPR. Ethical, legal and social issues associated with research. Research and the Internet: World Wide Web, search engines, search strategy, subject categories, specialized databases.
Part B: Mathematical and Logical Reasoning.

SUGGESTED READINGS:
Kothari C.R. & Gaurav Garg : RESEARCH METHODOLOGY-METHODS AND TECHNIQUES, 3RD Edition, New Age International
Chawla D. and Neena Sondhi : RESEARCH METHODOLOGY CONCEPTS AND CASES, Vikas Publishing House Pvt. Ltd.
Agarwal A.K.: MODERN APPROACH TO LOGICAL REASONING, 2012, S. Chand & Co. Delhi
R. Panneerselvam : RESEARCH METHODOLOGY, PHI, 2004

Course Number: CSM002, Course Title: PRE-DISSERTATION
Class: M.Sc., Status of Course No.: Summer Term Course, Approved since session: 1998-1999
Total Credits: 4
Pre-dissertation will include preparation and improvement of synopsis in consultation with concerning supervisor.

Course Number: CSM003, Course Title: TECHNICAL WRITING & PRESENT. SKILLS
Class: M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 01

UNIT 1
Elementary rules of usage: possessive singular of nouns, conjunctions, commas, parenthetic expressions, independent clauses, use of hyphens, participial phrases.
UNIT 2
Elementary Principles of composition: paragraphing, active voice, positive form, tightening of sentences, expression or coordinate ideas, writing summaries, emphasis. Form: colloquialism, exclamation, headings, hyphen, margins, numerals, parentheses, quotations, references.
UNIT 3
Writing research papers: organization and sectioning, summary, conclusions, referencing style, diagrams, presentation, what goes into the paper, using the LaTeX typesetting system.
UNIT 4
Presentation: planning a presentation, slide layout, number of slides, content, styles of presentation, target audience, fielding questions. Practicing speaking skills.
UNIT 5
Vocabulary: ways to improve vocabulary. Improving listening comprehension skills, audio resources.

Suggested Readings:
Strunk and White: Elements of Style

Resources
http://bbclearningenglish.com/

Course Number: CSM996, Course Title: DISSERTATION
Class: M.Sc. Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 12
Dissertation for M.Sc.

Course Number: CSM902, Course Title: DISSERTATION I
Class: M.Sc. Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 6

Students will be required to select a topic of their choice in various fields of expertise available in the Institute: do extensive literature survey on the selected topic, and study and explore the possibility of some research oriented results.

Course Number: CSM903, Course Title: DISSERTATION II
Class: M.Sc. Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 6

Students will be required to select a topic of their choice in various fields of expertise available in the Institute: do extensive literature survey on the selected topic, and study and explore the possibility of some research oriented results.

Course Number: CSM011, Course Title: MEDIA PROCESSING
Class: M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 4, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50
[SAME AS PHM961]
(INDIAN INSTITUTE OF TECHNOLOGY, DELHI: SIV 864)

UNIT 1
Introduction to Multimedia and Data Compression: Digital representation of different media (Audio/Image/Video/Graphics), Tools and File formats for different media, Fundamentals of data compression: Compression ratio, Data redundancy, Lossy and Loss-less compression.
UNIT 2
Image and Video Compression: Variable length coding (Huffman coding), Run length coding, Predicitive coding, Transform coding, JPEG (Base Line). Motion JPEG, Temporal redundancy, Motion Compensation based prediction, Basics of video compresion in MPEG-1.
UNIT 3
Multimedia Communication: Real time media applications, An overview of multimedia communication and its protocols. Session Initiation Protocol (SIP).
UNIT 4
Multimedia Streaming: Streaming performance requirement, Real-time Transport Protocol (RTP), RTP-Control Protocol (RTCP),Real Time Streaming Protocol (RTSP).
UNIT 5
Special Topics through Guest Lectures in the related areas such as Speech processing, Mobile streaming, Video on Demand, etc.

SUGGESTED READINGS:
Material available from web sites.

Course Number: CSM014, Course Title: DATA COMPRESSION

Class: M.Sc./M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 4, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1

Compression Techniques: Loss less compression, Lossy Compression. Measures of performance, Modeling and coding, Mathematical *Preliminaries* for Lossless compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes.

UNIT 2

The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression.

UNIT 3

Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression-The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach. Image Compression: The Graphics Interchange Format (GIF), Compression over Modems: V.42 bits, Predictive Coding: Prediction with Partial match (ppm). Burrows- Wheeler Transform: Move-to-front coding, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding, Dynamic Markov Compression.

UNIT 4

Distortion criteria, Models, Scalar Ouantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization.

UNIT 5

Advantages of Vector Quantization *over* Scalar Quantization, The Linde-Buzo-Gray Algorithm, Tree structured Vector Quantizers. Structured *Vector* Quantizers.

SUGGESTED READINGS:

Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers.

Course Number: CSM015, Course Title: PARALLEL COMPUTING

Class: M.Sc./M.Tech., Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1: MOTIVATION AND HISTORY

Evolution of Supercomputing, Modern Parallel Computers, Seeking Concurrency, Data Clustering, Programming Parallel Computers.

Parallel Architectures: Interconnection Networks, Processor Arrays, Multiprocessors, Multicomputers, Flynn's Taxonomy.

UNIT 2: PARALLEL ALGORITHM DESIGN

Task Channel Model, Foster's Design Methodology, Example problems– Boundary value Problem, Finding the maximum, the n-body problem etc.

UNIT 3: MESSAGE PASSING PROGRAMMING

Basic MPI Functions, Introducing Collective Communication,Benchmarking Parallel Performance, Example problems – Circuit Satisfiability.Data Decomposition options in Parallel Programs, Example Problems - Sieve of Eratosthenes,Floyd's Algorithm. Matrix Vector Multiplication : Row-wise Block-Striped Decomposition, Column-wiseBlock-Striped Decomposition, Checkerboard Block-Striped Decomposition.

UNIT 4: PERFORMANCE ANALYSIS

Speedup and Efficiency, Amadahl's Law, Metrics for Performance. Non-blocking Communications, Document Classification- Parallel Algorithm Design with non-Blocking communication, Monte Carlo Methods, Parallelizing Matrix Multiplication, Solving Linear Systems, Sorting.

UNIT 5: SHARED MEMORY PROGRAMMING

Shared Memory Model, Parallel for Loops, Data and FunctionalParallelism.Introduction to OpenMP, Combining MPI and OpenMP.

SUGGESTED READINGS:

Quinn, M.,Parallel Programming, , Tata McGraw Hill.
Lin, C., and Snyder,L., Principles of Parallel Programming, Addison-Wesley.
Pacheco,P., An Introduction to Parallel Programming, Morgan Kaufmann.
MPICH2 User's Guide, Version 1.0.7, Mathematics and Computer Science Division,Argonne National Laboratory

Course Number: CSM023, Course Title: PATTERN RECOGNITION
Class: M.Sc./M.Tech./M.Phil., Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1
STATISTICAL PATTERN RECOGNITION: Introduction, Gaussian model, discriminant functions, classifier performance, risk and errors;
Supervised learning using parametric and nonparametric approaches: ML estimation, Bayesian parameter estimation approach, k-nn estimation;
UNIT 2
Clustering: Unsupervised learning and clustering: the clustering concept, c-means algorithm, learning vector quantization, clustering strategies, a hierarchical clustering procedure.
UNIT 3
Feature selection and extraction: Interclass distance measures, discirmanant analysis, Probabilistic distance measures, Principal Components.
UNIT 4
Segmentation: edge, region and texture; Boundary representation: projection, Fourier descriptors; Region representation: shape descriptors, mask and moments, thinning
UNIT 5
STRUCTURAL PATTERN RECOGNITION: Graphs and grid: fundamentals of graph theory, basic algorithms for graphs, connectivity and topology

Text Books:
R.Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, John Wiley& Sons, NY, 1992.
Reference Books:
Duda R O and P E Hart, Patten classification and scene analysis, John Wiley & Sons, NY 1973
T Pavlidis, Structural pattern recognition, Springer-Verlag, NY, 1977
DH Ballad & CM Brown, Algorithms for computer vision, Prentice Hall, 1982

Course Number: CSM024, Course Title: COMPUTATIONAL GEOMETRY
Class: M.Sc./ M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1
Visibility problems and triangulation. Line sweep and angle sweep: segment intersection, area, perimeter, diameter, width.
UNIT 2
Planar Point location: Kirkpatrick's hierarchy, Persistent data structure, Multidimensional data structures: Segment trees, range trees, orthogonal range searching.
UNIT 3
Convex hulls and Voronoi diagrams: 2d, 3d hulls, 2d Voronoi diagrams, dynamic maintenance, Duality between hulls and Voronoi diagrams, Duality between lines and points, higher order Voronoi diagrams.
UNIT 4
Arrangements: Construction and bounds, ksets, Zone theorem Algebraic lower bounds: Linear Decision model Ben-Or's theorem Randomized algorithms: Random sampling, Incremental construction.
UNIT 5
Backward analysis Optimization: Monge matrices, Fixed dimensional linear programming, Prune and Search Parametric search: kth intersection, k-th nearest neighbour.

SUGGESTED READING:
Computational Geometry: An Introduction by Franco P. Preparata and Michael Ian Shamos; SpringerVerlag, 1985.
Computational Geometry, Algorithms and Applications by Mark de Berg, Marc van Kreveld, Mark Overmars, and Otfried Schwarzkopf; Springer-Verlag, 1997. from Springer.
Algorithmische Geometrie (auf deutsch)by Rolf Klein Addison-Wesley, 1996
Computational Geometry and Computer Graphics in C++ by Michael J.Laszlo (Nova Southeastern University) Prentice-Hall, 1996.

Course Number: CSM026, Course Title: EVOLUTIONARY COMPUTING
Class: M.Sc./ M.Tech., Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1
Introduction to Optimization; Single Objective Optimization (SOP); Deterministic Optimization Methods (Gradient Descent, LP and QP); Stochastic Optimization Methods (random search, Simulated Annealing, Evolutionary Algorithms); Difficulties in Single Objective Optimization; Difficulties with Classical Optimization algorithms; Need for Evolutionary Algorithms.
UNIT 2
Evolutionary Algorithm; EA operators (Selection, Recombination and Mutation operators);
Single Objective Optimization (SOP) using EAs; Design & Parameterization for Single Objective Applications; Problem Formulation and representation issues for different real world engineering SOPs; some competent EAs.
UNIT 3
Constrained SOP;
Discovery of innovative knowledge through Optimization;
Difficulties in EAs; No Free Lunch Theorem; Enhancing efficiency of EAs through incorporation of domain specific information and hybridization with expressly designed algorithms.
UNIT 4
Introduction to Multi-objective Optimization (MOP); Concept of Pareto optimality; Issues in Multi-objective Optimization; Multi-objective Evolutionary Approaches; Design & Parameterization for Multi-objective Applications.
UNIT 5
Constrained Multi-objective Optimization;
Dynamic Optimization; Robust Optimization; some real-world MOPs and their solution using MOEAs.

SUGGESTED READINGS:
Deb, K.: Optimization for Engineering Design, PHI, India, 2000.
Goldberg, D.,E.:Genetic Algorithms in Search, Optimization and Machine Learning, Addison-Wesley, Massachusetts,1989.
AE Eiben, E Smith: Introduction to Evolutionary Computing (Natural Computing Series). Springer Verlag, Nov'03, 299 p., ISBN 3540401849.
Dasgupta, D., Michalewicz, Z.: Evolutionary algorithms in engineering applications. Springer Verlag, Berlin, 1997, ISBN 3-540-62021-4.
Back, J: Evolutionary algorithms, theory and practice, New York, 1996, ISBN 0-19-509971-0.
Deb, K.: Multi-objective Optimization using Evolutionary Algorithms, Wiley, Uk, 2001.

Course Number: CSM031, Course Title: INFORMATION THEORY
Class: M.Sc./ M.Tech., Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1
Entropy, relative entropy, and mutual information. Asymptotic equipartition property. Entropy rates of a stochastic process, Markov chains.
UNIT 2
Data compression: Kraft inequality, Huffman codes. Channel capacity: symmetric channels, channel coding theorem, Fano's inequality, feedback capacity. Differential entropy.
UNIT 3
The Gaussian channel: bandlimited channels, channels with coloured Gaussian noise, Gaussian channels with feedback.
UNIT 4
Rate distortion theory: rate distortion function, strongly typical sequences, computation of channel capacity.
UNIT 5
Network information theory: Gaussian multiple user channels, the multiple access channel, encoding of correlated sources, the broadcast channel, the relay channel, source coding and rate distortion with side information, multiterminal networks.

SUGGESTED READING:
Thomas M. Cover, Joy A. Thomas: Elements of Information Theory 2ed, Wiley.

Course Number: CSM032, Course Title: DATA MINING

Class: M.Sc./ M.Tech., Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 04, Periods(55 mts.) per week: 04 (L: 4 + T: 0 + P: 0), Min. periods per semester: 50

UNIT 1: INTRODUCTION TO DATA MINING (DM)

Introduction, Kind of data, DM Functionalities, Classification of DM Systems, Issues in DM, What is Data warehousing (DW)? Multidimensional data model: Data cubes, Stars, snowflakes and fact constellations, defining schemas, concept hierarchies, OLAP, DW architecture: Steps for design and construction, Three-tier architecture, Types of OLAP servers, DW Implementation, back-end tools and utilities.

UNIT 2: DATA PREPROCESSING AND CONCEPT DESCRIPTION

Data cleaning: Missing Values, Noisy Data, Data Integration and transformation, Data Reduction Data Compression, Numerosity Reduction Discretization and Concept Hierarchy Generation Data Mining Primitives, System Architectures: Task relevant data, Kind of Knowledge to be mined, DM Query languages: Syntax, Designing GUI, architectures of DM Systems Data Generalization and summarization-based characterization, Attribute relevance, class comparisons Association Rule Mining: Market basket analysis, basic concepts, Finding frequent item sets: Apriori algorithm, generating rules, mining Multi-level Association rules from relational databases and Warehouses, Correlational analysis, constraint-based association mining.

UNIT 3: CLASSIFICATION AND PREDICTION

Issues in classification and prediction, Classification using Decision trees, Classification by Bayesian and Backpropagation, K-Nearest Neighbor classifiers, case-based reasoning, genetic algorithms, Rough and Fuzzy set approaches, Linear and nonlinear regression, classifier comparison, Introduction of OLE DB /DBMiner /ORACLE DM Tools, Combining Multiple Classification models: Bagging and Boosting.

UNIT 4: CLUSTERING

Introduction to clustering, types of data, partitioning methods: k-Means, Hierarchical clustering: and Model based clustering: Statistical and Neural network approach, Self Organizing Feature Maps Principle Components.

UNIT 5: MINING SPATIAL DATABASES

Spatial Data Cube and OLAP, Spatial Association, Clustering and classification Mining Text Databases: Text Data Analysis and Information Retrieval, Text Mining: Keyword-based Association and Document Classification Mining the WEB: Mining Web's link structure, Classification of Web pages, Web Usage Mining.

SUGGESTED READINGS:

Berson A & Stephen JS: Data Warehousing, Data Mining and OLAP, McGraw Hill, 1997.
Adriaans P & Zantinge D: Data Mining, Addison Wesley, 1996.
Hand, Mannila, & Smyth. Principles of Data Mining. Cambridge, MA: MIT Press, 2001. ISBN: 026208290X.
Berry & Linoff. Mastering Data Mining. New York, NY: Wiley, 2000. ISBN: 0471331236.
J. Han, M. Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann Publishers, 2001.
M. Kantardzic, "Data mining: Concepts, models, methods and algorithms, JohnWiley & Sons Inc., 2003.
M. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education, 2003.
H. Witten, E. Frank, "Data mining: Practical machine learning tools and techniques", 2nd ed., Morgan Kaufmann Publishers, 2005.

Course Number: CSM033, Course Title: COMBINATORIAL OPTIMIZATION
Class: M.Sc./M.Tech./M.Phil., Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1
Introduction: Optimization problems, neighborhoods, local and global optima, convex sets and functions, simplex method, degeneracy; duality and dual simplex algorithm, computational considerations for the simplex and dual simplex algorithms-Dantzig-Wolfe algorithms.
UNIT 2
Parametric Linear Programs, Sensitivity Analysis, Bounded Variable Linear Programs.
UNIT 3
Transportation problem and Network Algorithms.
UNIT 4
Formulation of Integer and Combinatorial, Cutting Plane Methods, Branch and Bound Approach, Complementarity Problems.
UNIT 5
Fractional Programming Problem. Mathematical Formulation, Charnes And Cooper Method Of FPP, Optimality Criteria Of FPP, Fractional Transportation Problem, Optimality Criteria, Real-Life Applications Of FPP.

SUGGESTED READINGS:
Linear and Combinatorial Programming, Katta G. Murty, By R.E. Krieger, 1985
Combinatorial Optimization, William J. Cook, William H. Cunningham, William R. Pulleyblank, Alexander Schrijver
Combinatorial Methods in the Theory of Stochastic Processes, Takacs, L., John Wiley, New York, 1967
C.H. Papadimitriou and K. Steiglitz, Combinatorial Optimization: Algorithms and Complexity, Prentice-Hall of India, 2006
K. Lange, Optimization, Springer, 2004
Mokhtar S.Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network Flows, John Wiley & Sons, 2004
H.A. Taha, Operations Research: An Introduction (8th ed.), Prentice Hall, 2006

Course Number: CSM034, Course Title: COMPLEXITY THEORY
Class: M.Sc./ M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2009-10
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1
Turing machines and non-determinism, models of computation like RAM and pointer machines.
UNIT 2
Relations between complexity classes, timespace tradeoffs for some fundamental problems.
UNIT 3
Reductions and completeness, Randomized complexity classes, Boolean circuit complexity.
UNIT 4
Cryptography and one-way functions. Polynomial hierarchy, P-space completeness.
UNIT 5
Interactive proofs and Hardness of approximation, Parallel complexity classes.

SUGGESTED READINGS:
Sanjeev Arora and Boaz Barak: Complexity Theory: A Modern Approach
Steven Homer, Alan L. Selman: Computability and Complexity Theory, Springer

Course Number: CSM035, Course Title: BIOMETRICS
Class: M.Sc./ M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2010-11
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1: INTRODUCTION
Review of digital image and signal processing, probability and pattern recognition; overview of biometrics; identification and verification; characteristics and performance parameters; limitations of biometric systems; privacy and other concerns.
UNIT 2: COMMON BIOMETRICS
Physiological and behavioral biometrics; fingerprint, face, hand geometry, palmprint, iris, voice, signature – features, algorithms and applications.
UNIT 3: ADDITIONAL BIOMETRICS
Soft biometrics; retina; keystroke dynamics; vein pattern; facial thermography; DNA; sweat pores; hand grip; fingernail bed; body odor; lip motion; ear; gait; skin luminescence; brain wave pattern; footprint and foot dynamics – distinguishing features, applications and limitations.
UNIT 4: MULTIBIOMETRICS
Fusion in biometrics; sources of multiple evidence; issues in designing multibiometric systems; levels of fusion – sensor level, feature level, rank level, decision level and score level; fusion incorporating ancillary information; quality based fusion.
UNIT 5: BIOMETRIC SYSTEM SECURITY AND STANDARDS
Vulnerabilties and attacks to biometric systems; liveness testing; securing biometric data; large scale and networked systems; authentication protocols; biometrics and cryptography; testing and evaluation of biometric systems; application programming interface standards; data structure and security standards.

SUGGESTED READING:
Anil K. Jain, Arun A. Ross: INTRODUCTION TO BIOMETRICS, Springer
John D. Woodward Jr., Nicholas M. Orlans, Peter T. Higgins: BIOMETRICS, McGraw Hill
Anil K. Jain, Patrick Flynn, Arun A. Ross: HANDBOOK OF BIOMETRICS, Springer
Ruud M. Bolle, Jonathan H. Connell, Sharath Pankanti, Nalini K. Ratha, Andrew W. Senior: GUIDE TO BIOMETRICS, Springer
Arun A. Ross, Karthik Nandakumar, Anil K. Jain: HANDBOOK OF MULTIBIOMETRICS, Springer

Course Number: CSM042, Course Title: MACHINE INTELLIGENCE
Class: M.Sc./ M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1
Introduction to Machine Learning; Review of Linear Algebra; Univariate linear regression; Multivariate linear regression. Practical aspects of implementation.
UNIT 2
Logistic regression; Multi-class classification; Regularization; Support Vector Machines; Naive Bayes; Decision trees; Boosting.
UNIT 3
Applying learning algorithms: development, debugging, feature and model design, experiment structure set up. Unsupervised learning: Agglomerative clustering, K-means, PCA, ICA.
UNIT 4
Anomaly detection. Combining supervised and unsupervised learning; Recommender systems. Learning to rank.
UNIT 5
Large-scale parallel machine learning and large data. System design; Practical methods. Team design of machine learning systems.

SUGGESTED READINGS:
Mitchell,T.,Machine Learning, McGraw Hill
Alpaydin,E.,Introduction To Machine Learning, MIT Press
Marsland,S.,Machine Learning: An Algorithmic Perspective, CRC Press
Rogers,S.,Girolami,M.,A First Course In Machine Learning, Taylor and Francis

Course Number: CSM043, Course Title: COMPUTER VISION
Class: M.Sc./ M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1: INTRODUCTION
Orthographic & Perspective Projection, Image Formation Models: Camera model and Camera calibration
UNIT 2: IMAGE PROCESSING AND FEATURE EXTRACTION
Image representations (continuous and discrete), Edge detection
UNIT 3: MOTION ESTIMATION
Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion
UNIT 4: SHAPE REPRESENTATION AND SEGMENTATION
Deformable curves and surfaces, Level set representations, Fourier and wavelet descriptors, Scene and activity interpretation.
UNIT 5: OBJECT RECOGNITION
Hough transforms Shape correspondence and shape matching, Principal Component analysis, Shape priors for recognition.

SUGGESTED READINGS:
Shapiro L.G., and Stockman,G.C.,Computer Vision, Prentice Hall Publication
Nalwa, V.S., A Guided Tour Of Computer Vision, Addison-Wesley Publication
Dana Harry Ballard,Computer Vision, Prentice Hall Publication
Wandell, B.A., Foundations Of Vision, Sinauer Associates

Course Number: CSM044, Course Title: ENGG. ENTERPRISE SOFTWARE SYSTEMS
Class: M.Sc./ M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1
Introduction: Enterprise information systems. Software architecture, systems and failure models, Middleware, Remote Procedure calls, Message oriented middleware, Web services and cloud computing.
UNIT 2
Introduction to Web services, SOAP, WSDL, UDDI, B2B integration with Webservices: Software as service, Middleware protocols, Standardization, Web service architecture.
UNIT 3
Representational State Transfer (REST): Plain old XML (POX) and RESTful Web services. Hypermedia network programming.
UNIT 4
Service-Oriented Architecture (SOA): Standardized service contract. Loose coupling, service abstraction, reusability and autonomy. Statelessness and Service discoverability
UNIT 5
Introduction to patterns, Domain logic patterns, Web presentation patterns, object related structural patterns, Session state patterns, Distributed patterns

SUGGESTED READINGS:
Duggan,D., Enterprise Software Architecture and Design, Wiley.
Fowler,M., Patterns of Enterprise Application Architecture
Alonso, G.,Casati,F.,Kuno,H., and Machiraju, V., Web Services: Concepts, Architectures and Applications

Course Number: CSM045, Course Title: MOBILE COMPUTING

Class: M.Sc./ M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1: INTRODUCTION TO NETWORK TECHNOLOGIES AND CELLULAR COMMUNICATIONS

HIPERLAN: Protocol architecture, physical layer, Channel access control sub-layer, MAC sub-layer, Information bases and networking WLAN: Infrared vs. radio transmission, Infrastructure and ad hoc networks, IEEE 802.11. Bluetooth: User scenarios, Physical layer, MAC layer, Networking, Security, Link management GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services. Mobile Computing (MC): Introduction to MC, novel applications, limitations, and architecture

UNIT 2

(Wireless) Medium Access Control: Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA.

Mobile Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).

UNIT 3: MOBILE TRANSPORT LAYER

Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

UNIT 4: DATABASE ISSUES

Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.

UNIT 5: DATA DISSEMINATION

Communications asymmetry, classification of new data delivery mechanisms, push- based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.

SUGGESTED READING:

Schiller, J.,Mobile Communications, Addison-Wesley. second edition, 2004.
Stojmenovic and Cacute,Handbook of Wireless Networks and Mobile Computing, Wiley, 2002, ISBN0471419028

Course Number: CSM046, Course Title: REAL TIME SYSTEMS

Class: M.Sc./ M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1: INTRODUCTION

Introduction, Applications of Real Time Systems, basic model if real time system, characteristics of real time system, safety and reliability, types of real time tasks, timing constraints, Modelling Timing constraints

UNIT 2: SCHEDULING REAL-TIME TASKS

Task scheduling, Types of Schedulers, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA).

UNIT 3

Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks, Handling Resource sharing among real-time tasks, Priority inversion.Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP).

Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization

UNIT 4: COMMERCIAL REAL-TIME OPERATING SYSTEMS

Features of a Real-time operating system, UNIX as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system, a survey of contemporary Real-time operating systems.

UNIT 5

Real-Time Communication: Examples of applications requiring real-time communication, Basic concepts, Real-time communication in a LAN, Real-time communication over packet switched networks. Real-Time Databases: Example applications of Real-time databases, Review of basic database concepts, Real-time databases, Characteristics of temporal data, Concurrency control in real-time databases.

SUGGESTED READINGS:

Mall, R., Real-Time Systems: Theory and Practice, Pearson, 2008.
Liu,J. W., Real-Time Systems, Pearson Education, 2001.
Krishna and Shin, Real-Time Systems, Tata McGraw Hill. 1999.

Course Number: CSM951, Course Title: ADVANCED ALGORITHMS
Class: M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2010-11
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1
Algorithms with advanced data structures: Self-adjustment, persistence and multidimensional trees, R-B tree, Splay tree, disjoint set forest, Binomial heap, Fibonacci heap, Interval tree.
UNIT 2
Randomized algorithms: Use of probabilistic inequalities in analysis, search trees, sorting, skip lists. String/vector matching algorithm: Rabin karp algorithm, string matching with FSA, KMP-algorithm, Boyce-Moore, Dynamic programming algorithms.
UNIT 3
Geometric algorithms: Point location, Convex hulls and Voronoi diagrams, Arrangements applications using examples. Graph algorithms: Graph matching algorithms, Network flows, Random Graphs.
UNIT 4
Approximation Algorithms: Vertex-color problems, set-covering problem, subset-sum problem. Use of Linear programming and primal dual, Local search heuristics. Parallel algorithms: Basic techniques for sorting, searching, merging, list ranking in PRAMs and Interconnection networks.
UNIT 5
NP completeness: Basic concepts, NP completeness and reducibility, Cook's theorem, Examples of NP-complete problems.

SUGGESTED READING
Cormen, Leiserson, Rivest : "INTRODUCTION TO ALGORITHMS", MIT Press.
Ahuja, Magnanti, and Orlin: NETWORK FLOWS, Prentice Hall.
Motwani and Raghavan: Randomized Algorithms, Cambridge University Press.
Dan Gusfield: ALGORITHMS ON STRINGS, TREES, AND SEQUENCES: COMPUTER SCIENCE AND COMPUTATIONAL BIOLOGY, Cambridge University Press.
Allan Borodin and Ran EI-Yaniv: ONLINE COMPUTATION AND COMPETITIVE ANALYSIS, Cambridge University Press.
Mark de Berg, Marc van Kreveld, Mark Overmars, Otfried Schwarzkopf: COMPUTATIONAL GEOMETRY: ALGORITHMS AND APPLICATIONS, Springer Verlag.
Dorit Hochbaum (ed.): APPROXIMATION ALGORITHMS FOR NP-HARD PROBLEMS, Broods Cole.

Course Number: CSM952, Course Title: ADVANCED COMPUTER ARCHITECTURE
Class: M.Tech., Status of the Course No.: MAJOR, Approved Since Session: 2010-11
Credits: 04, Periods(55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 50

UNIT 1
Processor & memory hierarchy, bus, cache and shared memory; Quantitative evaluation of performance gain using memory, cache miss/hits; High performance memory system; Shared memory multiprocessors and cache coherence.
UNIT 2
Introduction to Pipeline Processing; SIMD parallel processors; Arithmetic pipelines; Steady state analysis of pipeline; Pipelined instruction processing; Interlocks, hazards, hazards detections and resolution memory systems used in pipelines; Scheduling of dynamic pipelines.
UNIT 3
Instruction level parallelism; Improving branch performance; High performance instruction delivery; Limitations on Instruction level Parallelism for realizable processors; Software Approaches for Instruction Level Parallelism; Superscalar and VLIW processors.
UNIT 4
Introduction to Parallel Computing, Need for Parallel Computing, Parallel Architecture classification schemes – Flynn's, Shore's, Feng's classification; Introduction to Array Processors – their use for various applications.
UNIT 5
Multiprocessor interconnection networks; Elementary Permutations used in Interconnection Network, Network Classification Cross bar network, Commonly used Interconnection Network, Cross bar, Data Manipulator, Network Routing, Multistage Data Manipulator.

SUGGESTED READING:
John L. Hennessy, David A. patterson: COMPUTER ARCHITECTURE: A QUANTITATIVE APPROACH, Morgan Kaufmann.
Kai Hwang: ADVANCED COMPUTER ARCHITECTURE, McGraw Hill.
Kai Hwang, Fays Alaye Briggs: COMPUTER ARCHITECTURE AND PARALLEL PROCESSING, McGraw Hill.
Michael Jay Quinn: PARALLEL COMPUTING: THEORY AND PRACTICE, McGraw Hill.

Course Number: CSM961, Course Title: SELF STUDY COURSE
Class: M.Tech., M.Phil, Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 4

1. SOFT COMPUTING: Hybrid neuro-fuzzy-evolutionary computation, parallel implementations, rough-fuzzy integration, applications in bioinformatics.
2. ADVANCED MICROWAVE TECHNIQUES: Planar microwave devices, electronic band gap structures, negative refractive index structures, Smart antennas, MEMS
3. PHYSICS OF CONSCIOUSNESS: Concepts of consciousness, mind and matter, dualism, implications of new physics, interpretations, explaining biological phenomena through physics. Basic elements of emergence, chaos, complexity, and evolution, systems perspective, quantum consciousness theories, integral world view, unified theory of reality.
4. ADVANCES IN VLSI DESIGN: Adaptive electronics, physics of floating gate transistors, adaptive circuit design using FGMOS, field programmable architectures, neuromorphic circuits
5. SOLAR HYDROGEN PRODUCTION SYSTEMS: Hydrogen as a fuel, techniques of solar generation of hydrogen, role of materials in solar generation of hydrogen, applications of nano materials and nano structured thin films in PEC generation of hydrogen.
6. PHOTONICS: Nonlinear optical phenomena, characterization of optical properties of organic and bio- molecules, elements of biophotonics, nano photonics, photonics of components and devices, applications in communications, computing and sensing.
7. INTERNET TECHNOLOGIES AND PROGRAMMING WITH JAVA: Topics in Java relevant to Internet programming: JSP, Java Standard Tag Library, Custom tags, Database integration with web pages, Internationalization, Java Beans with JSP, XMLs sessions, servlets and other Java based technologies.

Course Number: CSM962, Course Title: MINOR PROJECT
Class: M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 4

Minor Project.

Course Number: CSM963, Course Title: MAJOR PROJECT I
Class: M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 8

Major Project I part.

Course Number: CSM964, Course Title: MAJOR PROJECT II
Class: M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 16

Major Project II part.

Course Number: CSM965, Course Title: MAJOR PROJECT I
Class: M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 8

Major Project I part.

Course Number: CSM966, Course Title: MAJOR PROJECT II
Class: M.Tech. Status of the Course No.: MAJOR, Approved Since Session: 2012-13
Credits: 8

Major Project II part.

Course Number: PEE101, Course Title: APPLIED SYSTEMS ENGINEERING
Class: M.Sc./M.Tech., Status of Course No.: MAJOR COURSE, Approved since session: 2007-08
Total Credits:4, Periods(55 mts. each)/week:4(L-4+T-0+P/S-0), Min.pds./sem.:52

UNIT 1
INTRODUCTION TO SYSTEMS PHILOSOPHY, THINKING: Need for systems approach and evolution of systems thinking. The nature of general systems, laws and theories.
INTRODUCTION TO SYSTEMS APPROACH AND CONCEPTS: Applied General Systems Theory and Physical Systems Theory. Definition, basic objectives, operational concepts, analysis and synthesis problems.
SYSTEMS, COMPONENTS AND INTERCONNECTIONS
Measurements and terminal representation of simple components; Axioms and Postulates.
UNIT 2: SYSTEMS MODELLING- CONTINUOUS TIME SYSTEMS
MODELLING OF LTI CONTINUOUS TIME SYSTEMS: Formulation techniques- Branch, Chord and Branch-chord formulations and their relative merits.
LARGE SCALE SYSTEMS MODELLING METHODOLOGY: Multi-terminal representations, tree transformations, Large scale systems modelling using subsystems-to-system approach.
Formulation of state variable equations for LTI systems and their solution.
UNIT 3: SYSTEMS MODELLING- DISCRETE TIME SYSTEMS
Preliminaries of signal processing, principles of discretization.
Time domain models for discrete time systems: state variable models, transfer function models.
z-Domain description of sampled continuous-time systems, z-Domain description of systems with dead-time.
Response of discrete time z-Domain system models.
UNIT 4: SYSTEM STABILITY
Concepts of Stability- BIBO, Liapunov Stability characteristics of linear continuous and discrete time systems (eigen value approach). Concepts of Sensitivity, First order differential sensitivity, Large-scale sensitivity and tolerance analysis. Concepts of Controllability and Observability.
UNIT 5
Preliminaries of probability theory: Venn diagrams, rules of combining probabilities. System reliability, reliability function, failure rate, Mean time failure. Reliability evaluation of simple systems. Reliability evaluation of complex systems: cut set method, tie set method. Event trees.

SUGGESTED READINGS:
PH Roe: NETWORK AND SYSTEMS
Koenig & Blackwell: ELECTROMECHANICAL SYSTEM THEORY
Koenig, Tokad Kesvan: ANALYSIS OF DISCRETE PHYSICAL SYSTEMS
AK Mahalanabis: INTRODUCTION TO SYSTEM ENGINEERING

Course Number: PEE202, Course Title: MODELLING & SIMULATION
Class: M.Sc./M.Tech., Status of Course No.: MAJOR COURSE, Approved since session: 2004-05
Total Credits:4, Periods(55 mts. each)/week:4(L-4+T-0+P/S-0), Min.pds./sem.:52

UNIT 1
Modelling theory of physical systems-Definition of physical and conceptual systems. Through and across variables. Generic Models of two terminal component like dissipaters. Delay, Accumulators, and drivers, Fundamental Axiom. First Postulate of physical system theory, Interconnection Postulates, concepts of QUASI power.
Coupling devices - Lumped models for diverse systems, Two port models for converters (Transformer, Transducers, ideal lever, gyrators, Electric motor-generators).
UNIT 2
Model development-Model determination from input-output observations, Formulation of state models for linear lumped and time invariant systems though NETAN, NETAN algorithm. Topological restrictions. In NETAN for two terminal and multi-terminal components, Modelling of large scale systems using computers.
Model Order Reduction Techniques-Introduction, Dominant Eigen Value approach, Aggregation method.
UNIT 3
Interpretive Structural modelling-Introduction, Definitions of loop, cycle, parallel lines, digraph, reachability. Model Exchange Isomorphism (MEI), Sequence of MEIs and intermediate models associated with each MEI. Develop Interpretive structural models.
System Dynamics Methodology for Modelling-Introduction, principles, features, Applications of System Dynamics for Modelling and Simulation of physical and conceptual systems.
UNIT 4
Simulation-Introduction. What is continuous and discrete simulation. Why simulation, Simulation Characteristics, Numerical Methods (Eulers and Rugga Kutta) for simulating various physical systems. Introduction of PC-BASED simulation packages (MATLAB, SPICE etc.) for simulation of Electrical, Mechanical, Hydraulic, Thermal Systems.
UNIT 5
Introduction of Non-linear system simulation. First order continuous system. Linearization, Second order and High order systems, discrete time systems, Simulation of chaotic systems, Simulation of systems with discontinuous nonlinearity, simulation of the time delay systems. Design of simulation experiments and validation of simulation models.

SUGGESTED READING
MR Goodman: STUDY NOTES ON SYSTEM DYNAMICS M Marcus: MATRICES AND MATLAB A TUTORIAL
C Nelson Drony: UNDERSTANDING OF DYNAMIC SYSTEMS, APPROACH TO MODELLING ANALYSIS AND DESIGN
TT Hartley, GO Beale & SP Chicatelli: DIGITAL SIMULATION OF DYNAMIC SYSTEMS-A CONTROL THEORY APPROACH

Course Number: PEE212, Course Title: DIGITAL SIGNAL PROCESSING
Class: M.Sc./M.Tech., Status of Course No.: MAJOR COURSE, Approved since session: 2010-11
Total Credits:4, Periods(55 mts. each)/week:4(L-4+T-0+P/S-0), Min.pds./sem.:52

UNIT 1: INTRODUCTION
Digital Signal Processing Systems versus Analog Signal Processing Systems. Classification of Signals. Properties of Random Signals. Concept of Frequency in continuous time and discrete time signals. Sampling theorem for low pass & band pass signals discrete – time systems (DST) their classification. MATLAB implementation of simple DTS. LTI systems; Eigen-function, Impulse response, Linear convolution. Difference Equation representation. Zero-input & Zero-state response. Correlation of discrete time signals cross-correlation & autocorrelation sequences.
UNIT 2: DISCRETE-TIME SIGNALS IN THE TRANSFORM DOMAIN
Review of Fourier Transform, Review of Z-Transform. Discrete Time Fourier Transform(DTFT) & its properties; Discrete Fourier Transform (DFT) & its properties- Relation between DTFT & DFT. Circular convolution. Relation between linear & circular convolution, Block convolution overlap-add, overlap-save methods.
UNIT 3: LTI DISCRETE TIME SYSTEMS IN TRANSFORM DOMAIN
Transfer Function Description; Poles & zeros in z-plane; frequency response. Inverse Systems. Minimum Phase & Non-Minimum Phase Systems. All pass Transfer Functions. Linear Phase Systems. System Identification. Schur-Cohn Stability test.
UNIT 4: DIGITAL FILTER STRUCTURES
Basic building blocks, IIR Filter structures- direst, cascade & parallel. Delay-free-loop problem. Basic FIR Filter structures. Linear Phase structures. Realization of Basic structure using MATLAB. All pass filter structures. Lattice structure for FIR Filter.
UNIT 5: DIGITAL FILTER DESIGN
Basic approaches to digital filter design. Approximations – Butterworth, Chebyshev approximation. Estimation of Filter order. Scaling. IIR Filter design, techniques; derivative approximation, impulse invariance and bilinear transformation. FIR Filter design- window based design.

SUGGESTED READINGS:
SK Mitra: DIGITAL SIGNAL PROCESSING-A COMPUTER BASED APPROACH, Tata McGraw-Hill.
JG Proakis & DG Manolakis: DIGITAL SIGNAL PROCESSING PRINCIPLES, ALGORITHMS & APPLICATIONS, PHI
AV Oppenheim & RW Schafer: DISCRETE-TIME SIGNAL PROCESSING, PHI

Course Number: PEE316, Course Title: DIGITAL IMAGE PROCESSING
Class: M.Sc./M.Tech., Status of Course No.: Major Course, Approved since session: 2011-12
Total Credits:4, Total pds.(50 mts each)/week: 4(L:3+T:1+P:0+S:0)Min. pds./sem.:52

UNIT 1: IMAGE FUNDAMENTALS
Visual perception by human eye, Brightness Adaptation and Discrimination, Image Models, Sampling and quantization, Colour models, File formats.
UNIT 2: IMAGE ENHANCEMENT IN SPATIAL DOMAIN
Point Operations: Image negative, contrast stretching, Brightness, Grey level slicing, Bit plane slicing, Histogram Processing.
Spatial Operations: Smoothing filters, Median Filter, Sharpening filters, High boost filtering, derivative filtering, Robert, Previtt, Sobel operators, Second order derivatives, Laplacian Mask.
UNIT 3: IMAGE ENHANCEMENT IN FREQUENCY DOMAIN
Review of Fourier Transforms, Discrete Fourier Transforms, 2-dimensional DFT, Low pass (smoothing) filters, High pass filters.
UNIT 4: IMAGE SEGMENTATION
Point detection, line detection, edge detection, combined detection, Edge linking and boundary detection-Hough transforms, Thresholding.
UNIT 5: IMAGE COMPRESION
Fundamentals: Coding redundancy, Inter-pixel redundancy, Psycho-visual redundancey, Fedility criterion.
Compression Models: Source encoder and decoder, Channel encoder and decoder.
Lossless compression: Variable length coding, bit plane coding, lossless predictive coding.
Lossy compression: Lossy predictive coding, Transform coding.

SUGGESTED READINGS:
RC Gonzalez & RE Woods: DIGITAL IMAGE PROCESSING, Pearson Education
AK Jain: FUNDAMENTALS OF DIGITAL IMAGE PROCESSING, PHI
COMPUTER VISION HOME PAGE: Http://www.cs.cmu, edu/~cil/txtvision. html

Course Number: PEE415, Course Title: QUANTUM COMPUTING
Class: M.Sc./M.Tech., Status of Course No.: Major Course, Approved since session: 2004-05
Total Credits:4, Total pds.(55 mts each)/week: 4(L:3+T:1+P:0+S:0)Min. pds./sem.:52

UNIT 1: INTRODUCTION
Introduction to Quantum Computing, Quantum bits, Quantum Computation, Quantum algorithms, Experimental quantum information processing, Quantum information.
UNIT 2: QUANTUM MECHANICS AND COMPUTER SCIENCE
Introduction to quantum mechanics, linear algebra, postulates of quantum mechanics.
Introduction to computer science, models for computation, analysis of computational problems.
UNIT 3: QUANTUM CIRCUITS
Quantum circuits, single qubit operations, controlled operations, Quantum Simulation algorithms, examples.
UNIT 4: QUANTUM FOURIER TRANSFORM AND ITS APPLICATIONS
Quantum Fourier Transforms, phase estimation, applications to order-finding and factoring.
UNIT 5: PHYSICAL REALIZATION, QCL AND QCE
Quantum computers, physical realization, introduction to Quantum Computing Language (QCL) and Quantum Computing Emulator (QCE).

SUGGESTED READINGS:
Nielsen & Chuang: QUANTUM COMPUTATION AND QUANTUM INFORMATION, Cambridge.
Lomonaco: QUANTUM COMPUTATION, AMS Books.

Course Number: PME214, Course Title: NANOTECHNOLOGY & NANOCOMPUTING
Class: M.Sc./M.Tech., Status of Course No.: Major Course, Approved since session: 2007-08
Total Credits:4, Periods(55 mts. each)/week:4(L:3+T:1+P:0+S:0), Min.pds./sem.:52

UNIT 1
Nanotechnology: Nanosystems, Molecular machinery and Manufacturing, quantum mechanics mechanosynthesis, Ideas of Richard Feynman.
Nanocomputing: Introduction, Nanocomputing Technologies, Carbon nanotubes, Nano information processing, Silicon Nanoelectronics, Prospects and Challenges.
UNIT 2: CARBON NANOTUBES
Properties, Molecular Structure, Chiral Vector, Carbon nanotube Electronics, Carbon Nanotube Field-effect Transistors.
UNIT 3: IMPERFECTIONS AND RELIABILITY
Nanocomputing with Imperfections: Nanocomputing in presence of Defects and Faults, Redundancy, Error Control Coding, Reconfiguration, Fault Simulation, Defect Tolerance, Reconfigurable Hardware, Overcoming Manufacturing Defects.
Reliability of Nanocomputing: Markov Random Fields, Examples, Reliability Evaluation Strategies, Law of Large Numbers, NANOPRISM.
UNIT 4: NANOSCALE QUANTUM COMPUTING
Quantum Computers, Challenges to Physical Realization, Quantum-dot Cellular Automata (QCA), QCA Clocking, Design Rules, Placement, Basic QCA Circuits using QCA Designer Software and their implementation.
UNIT 5: MOLECULAR AND OPTICAL COMPUTING
Molecular Computing: Background of molecular electronics, Adleman's Experiment, DNA Computation, Bacteriorhodopsin, Challenges before Molecular Computing.
Optical Computing: Introduction, use of Optics for Computing, Optical Computing Paradigms, Ultrafast Pulse Shaping, Photonic Switches.

SUGGESTED READING:
NANO, QUANTUM AND MOLECULAR COMPUTING- IMPLICATIONS TO HIGH LEVEL DESIGN AND VALIDATION: SK Shukla & RI Bahar (Eds.), *Kluwer Academic Publishers*
NANOCOMPUTING- AN INTRODUCTION: V Sahni and D Goswami, *Tata McGraw Hill Publishers*
QUANTUM COMPUTING: V Sahni, *Tata McGraw Hill Publishers*
NATIONAL SCIENCE AND TECHNOLOGY INITIATIVE (NSTI), DST (INDIA), <http://dst.gov.in/scientific-programme/ser-nsti.htm
NATIONAL NANOTECHNOLOGY INITIATIVE, NSF (USA), <http://www.nsf.gov/home/crssprgm/nano/nni.htm>

Course Number: MAM811, Course Title: DESIGN & ANALYSIS OF ALGORITHMS
Class: M.Sc./ M.Tech., Status of Course: MAJOR, Approved since session: 2015-16
Total Credits:4, Total pds.(55 mts each)/week: 3(L:3+T:0+P:0+S:0) Min. pds./sem.: 39

UNIT 1: INTRODUCTION
Algorithms, analysis of algorithms, Growth of Functions, Master Theorem. Sorting and order Statistics: Heap sort, Quick sort, Sorting in Linear time, Medians and Order Statistics.
UNIT 2: ADVANCED DATA STRUCTURES
Red-Black Trees, Augmenting Data Structures. B-Trees, Binomial Heaps, Fibonacci Heaps, Data Structure for Disjoint Sets.
UNIT 3: ADVANCED DESIGN AND ANALYSIS TECHNIQUES
Dynamic Programming, Greedy Algorithms, Amortized Analysis.
UNIT 4: GRAPH ALGORITHMS
Elementary Graphs Algorithms, Minimum Spanning Trees, Single-source Shortest Paths, All-Pairs Shortest Paths, Maximum Flow, Travelling Salesman Problem.
UNIT 5: SELECTED TOPICS
Randomized Algorithms, String Matching, NP Completeness, Approximation Algorithms.

SUGGESTED READING:
Cormen, Leiserson, Rivest: "INTRODUCTION TO ALGORITHMS", PHI.
Basse, S.: "COMPUTER ALGORITHMS: INTRODUCTION TO DESIGN & ANALYSIS", Addison Wesley.
Horowitz & Sahani, "FUNDAMENTAL OF COMPUTER ALGORITHMS", Galgotia.

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