**Department of Computer Science**
**Assam University, Silchar**
M. Sc. (Computer Science)
A Five Year Integrated Degree Course
Under CBCS Pattern
2010-11

Course Structure and syllabus for M.Sc. (Computer Science) - A 5 year Integrated Course under CBCS

SEMESTER I

| Course Code | Course Name | L | T | P | C | Sessional Marks | End Semester Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|
| MCS 101 | Communicative English | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 102 | Mathematics – 1 | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 103 | Digital Logic and Switching Theory | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 104 | Electronics Devices and Circuits | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 105 | Laboratory – 1: | | | 8 | 5 | 25 | 75 | 100 |
| | (a) Digital Electronics | .. | .. | 4 | | 13 | 37 | |
| | (b) Electronic Devices and Circuits | .. | .. | 4 | | 12 | 38 | |

SEMESTER II

| Course Code | Course Name | L | T | P | C | Sessional Marks | End Semester Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|
| MCS 201 | Programming in C | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 202 | Statistical Methods and Applications | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 203 | Computer Organization & Architecture | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 204 | Scientific Computation | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 205 | Laboratory – 2: | | | 8 | 5 | 25 | 75 | 100 |
| | (a) Programming in C | .. | .. | 4 | | 13 | 37 | |
| | (b) Scientific Computation | .. | .. | 4 | | 12 | 38 | |

SEMESTER III

| Course Code | Course Name | L | T | P | C | Sessional Marks | End Semester Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|
| MCS 301 | Environmental Studies | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 302 | Mathematics – 2 | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 303 | Data & File Structure | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 304 | Microprocessor and Assembly Language Programming | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 305 | Laboratory – 3: | | | | 5 | 25 | 75 | 100 |
| | (a) Data & File Structure | .. | .. | 4 | | 13 | 37 | |
| | (b) Microprocessor and Assembly Language Programming | .. | .. | 4 | | 12 | 38 | |

SEMESTER IV

| Course Code | Course Name | L | T | P | C | Sessional Marks | End Semester Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|
| MCS 401 | Computer Graphics | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 402 | Object Oriented Programming with C++ | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 403 | Data Base Management Systems | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 404 | Discrete Mathematics | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 405 | Laboratory – 4:<br>(a) Data Base Management Systems<br>(b) Programming with C++ and Computer Graphics | <br>..<br>.. | <br>..<br>.. | <br>4<br>4 | 5 | 25<br>13<br>12 | 75<br>37<br>38 | 100 |

SEMESTER V

| Course Code | Course Name | L | T | P | C | Sessional Marks | End Semester Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|
| MCS 501 | Programming in Java | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 502 | Data Communication | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 503 | Operating System and Architecture | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 504 | Elective -1 | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 505 | Laboratory – 5:<br>(a) Programming in Java<br>(b) Operating System and Architecture | <br>..<br>.. | <br>..<br>.. | <br>4<br>4 | 5 | 25<br>13<br>12 | 75<br>37<br>38 | 100 |

SEMESTER VI

| Course Code | Course Name | L | T | P | C | Sessional Marks | End Semester Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|
| MCS 601 | System Analysis and Design | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 602 | Computer Networks | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 603 | System Software | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 604 | Elective –II | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 605 | Laboratory – 6:<br>(a) Computer Networks<br>(b) Elective | <br>..<br>.. | <br>..<br>.. | <br>4<br>4 | 5 | 25<br>13<br>12 | 75<br>37<br>38 | 100 |

SEMESTER VII

| Course Code | Course Name | L | T | P | C | Sessional Marks | End Semester Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|
| MCS 701 | Theory of Computation | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 702 | Design and Analysis of Computer Algorithms | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 703 | Artificial Intelligence | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 704 | Wireless and Mobile Computing | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 705 | Laboratory – 7:<br>(a) Design and Analysis of Computer Algorithms<br>(b) Artificial Intelligence (Lisp/Prolog) | <br>..<br>.. | <br>..<br>.. | | 5<br>4<br>4 | 25<br>13<br>12 | 75<br>37<br>38 | 100 |

SEMESTER VIII

| Course Code | Course Name | L | T | P | C | Sessional Marks | End Semester Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|
| MCS 801 | Software Engineering | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 802 | Principles of Compiler Design | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 803 | Modeling and Simulation | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 804 | Digital Image Processing | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 805 | Laboratory – 8:<br>(a) Principles of Compiler Design<br>(b) Image Processing, Modeling and Simulation | <br>..<br>.. | <br>..<br>.. | <br>4<br>4 | 5 | 25<br>13<br>12 | 75<br>37<br>38 | 100 |

SEMESTER IX

| Course Code | Course Name | L | T | P | C | Sessional Marks | End Semester Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|
| MCS 901 | Data Mining and Knowledge Discovery | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 902 | Term Paper and Grand Viva | .. | .. | .. | 5 | 25 | 75 | 100 |
| MCS 903 | Neural Network | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 904 | Elective –III | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 905 | Laboratory – 9:<br>(a) Data Mining and Knowledge Discovery<br>(b) Neural Network | <br>..<br>.. | <br>..<br>.. | <br>4<br>4 | 5 | 25<br>13<br>12 | 75<br>37<br>38 | 100 |

SEMESTER X

| Course Code | Course Name | L | T | P | C | Sessional Marks | End Semester Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|
| MCS 1001 | Distributed Computing | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 1002 | Fuzzy Set Theory and Applications | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 1003 | Cryptography | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 1004 | Elective –IV | 4 | 1 | .. | 5 | 25 | 75 | 100 |
| MCS 1005 | Project work | | | 8 | 5 | 25 | 75 | 100 |

List of Electives:

*The students are required to choose one option for each of the courses from the list below. However, offering of a particular subject depends on the availability of concerned faculty*

| Course Code | Options (Any one of the following) |
|---|---|
| MCS 504: Elective - 1 | a) Advance Database Management Systems<br>b) Internet Technologies and Applications |
| MCS 604: Elective - II | a) Advance Java Programming<br>b) Web Technologies and Applications |
| MCS 904: Elective - III | a) Advanced Operating System<br>b) Computer Vision<br>c) Advanced Computer Architecture and Parallel Computing<br>d) Operations Research<br>e) VLSI Design<br>f) Natural Language Processing<br>g) Distributed Data Base Systems |
| MCS 1004: Elective - IV | a) Evolutionary Computation<br>b) Machine Learning<br>c) Computational Geometry<br>d) Clustering and Grid Computing<br>e) Pattern Recognition<br>f) Quantum Computation<br>g) Embedded Real Time Systems<br>h) Digital Signal Processing |

*L: Lecturer Hrs/Week T: Tutorial P: Practical Hrs/Week C: Credits S: Sessional Marks*
*E: End Semester Marks TM: Total Marks*

*Total Marks / Semester* – 500

## *Semester I*

### MCS 101: Communicative English

As prescribed in Assam University undergraduate courses in the P.G Department

*Text/References:*

As prescribed in Assam University undergraduate courses in the P.G Department

### MCS 102: Mathematics-1

**Unit I**

**Algebra:** Relation between the roots and coefficients of $n^{th}$ degree with special reference to cubic equations, symmetric function of roots; Transformation of equations: Cardan's Method of solution of cubic equation of the form $(ax^3+bx+c) =0$ $(a\neq0)$; Inequalities involving arithmetic and geometric means. Sequence and their convergence and divergence, monotonic and Bounded sequence and the theorems involving them. Infinite series of constant term. Convergence and Divergence of the series of positive terms, Test of Convergence-comparison tests, d' Alemberts ratio test; Raabe's test, Cauchy's root test (without proof)

**Unit II**

**Vector Analysis:** Introduction; Vector Equations of Lines, plans and spheres, Scalar triple product, Vector triple product, Differentiation and Partial Differentiation of Vector functions. Properties and Applications; Derivative of Sum, Directional Derivative, Gardient. Divergence and Curl; their identities and application. Vector Integration

**Unit III**

**Coordinate Geometry:** Change of axes, pair of straight lines, general equation of second degree reduction to standard form, tangent, normal. System of circles, standard equations and properties of parabola, ellipse and hyperbola. Equations of tangent, normal. General equations of second degree in two variables, tracing of conic section. Three dimensions – Direction cosines, Planes, lines and sphere.

**Unit IV**

**Matrix Algebra:** Materices and Linear systems of equations: Elementary transformations of matrix. Echelon and Normal form. Rank of a matrix, Solution of a system of Linear Equations by Matrix Methods – LU Decomposition – LU Decomposition from Gauss Elimination - Solution of Tridiagonal Systems-Solution of Linear Systems, Eigen values and eigen vectors of matrices

De' Moivres' theorem (for rational indices), Expansion of sin ø, cos ø in ascending power of ø, Hyperbolic functions.

**Unit V**

**Modern Algebra:** Mapping, Equivalence Relations, Groups, Permutation Groups, Cyclic Groups, Subgroups, Cosests and their properties, Lagrange's theorem for order of a subgroup, Normal subgroup, quotient Group .

Rings: Definitions, examples and simple properties of Rings, Internal Domains, Skew Fields, Fields Vector Space, Subspace, Linear Independence, Basis and dimensions.

*Text Books/References*


1. Vector Algebra – Shanti Narayan and PK Mittal, S. Chand & Co. Ltd, 2005
2. Analytical Geometry and Vector Analysis- B. Das, Orient Book Co, Calcutta, 1998
3. Vector Analysis – Schaum Series, Spiegel, 2dn Edition, Tata McGraw-Hill Education (India), 2009
4. Higher Algebra: Abstract & Linear - S. K. Mapa, Sarat Book House, 2003
5. Coordinate Geometry- S. L. Loney, 1st Edition, G. K. Publishers, 2008
6. Modern algebra- A. R. Vasishtha, 5th Edition, Krishna Prakashan Media, 2008

## MCS 103: Digital Logic and Switching Theory

**Unit I**

**Number Systems & Codes:** Philosophy of number systems – complement representation of negative numbers-binary arithmetic-binary codes-error detecting & error correcting codes –hamming codes.

**Boolean algebra And Switching Functions:** Fundamental postulates of Boolean Algebra - Basic theorems and properties - switching functions–Canonical and Standard forms-Algebraic simplification digital logic gates, properties of XOR gates –universal gates-Multilevel NAND/NOR realizations.

**Minimization of Switching Functions:** Map method, Prime implicants, Don't care combinations, Minimal SOP and POS forms, Tabular Method, Prime – Implicant chart, simplification rules.

**Unit II**

**Combinational Logic Design:** Design using conventional logic gates, Encoder, Decoder, Adders, Substractors Multiplexer, De-Multiplexer, Modular design using IC chips, MUX Realization of switching functions Parity bit generator, Code-converters, Hazards and hazard free realizations.

**Unit III**

**Sequential Circuits - I:** Classification of sequential circuits (Synchronous, Asynchronous, Pulse mode, Level mode with examples) Basic flip-flops-Triggering and excitation tables. Steps in synchronous sequential circuit design. Design of modulo-N Ring & Shift counters, Serial binary adder,sequence detector. Finite state machine-capabilities and limitations, Mealy and Moore models-minimization of completely specified and incompletely specified sequential machines, Partition techniques and Merger chart methods-concept of minimal cover table.

**Unit IV**

**Programmable Logic Devices, Threshold Logic:** Basic PLD's-ROM, PROM, PLA, PLD Realization of Switching functions using PLD's. Capabilities and limitations of Threshold gate, Synthesis of Threshold functions, Multigate Synthesis.

**Unit V**

**Algorothimic State Machines:** Salient features of the ASM chart-Simple examples-System design using data path and control subsystems-control implementations-examples of Weighing machine and Binary multiplier.

*Text Books***:**


1. Switching and Finite Automata theory – Zvi Kohavi, Tata McGraw Hill, 2nd Edition.
2. Digital Design – Morris Mano, PHI, 3rd Edition, 2006.


*References***:**


1. An Engineering Approach to Digital Design – Fletcher, PHI, 2009.
2. Fundamentals of Logic Design – Charles H. Roth, Thomson Publications, 5th Edition, 2009.
3. Digital Logic Applications and Design – John M. Yarbrough, Thomson Publications, 2006.
4. Malvino, A.P, Digital Principles and Applications, 4th Edition, Tata McGraw Hill, 1986.

## MCS 104: Electronic Devices and Circuits

**Unit I**

**Junction Diode Characteristics:** Review of semi conductor Physics – n and p –type semi conductors, Mass Action Law, Continuity Equation, Hall Effect, Fermi level in intrinsic and extrinsic semiconductors, Open-circuited p-n junction, The p-n junction Energy band diagram of PN diode, PN diode as a rectifier (forward bias and reverse bias), The current components in p-n diode, Law of junction, Diode equation, Volt-ampere characteristics of p-n diode, Temperature dependence of VI characteristic, Transition and Diffusion capacitances, Step graded junction, Breakdown Mechanisms in Semi Conductor (Avalanche and Zener breakdown) Diodes, Zener diode characteristics, Characteristics of Tunnel Diode with the help of energy band diagrams, Varactar Diode, LED, LCD. And photo diode

**Unit II**

**Rectifiers, Filters And Regulators:** Half wave rectifier, ripple factor, full wave rectifier, Harmonic components in a rectifier circuit, Inductor filter, Capacitor filter, L- section filter, - section filter, Multiple L- section and Multiple section filters, comparison of various filter circuits in terms of ripple factors, Simple circuit of a regulator using zener diode, Series and Shunt voltage regulators

**Unit III**

**Transistor and FET Characteristics:** Junction transistor, Transistor current components, Transistor as an amplifier, Transistor construction, Detailed study of currents in a transistor, Transistor alpha, Input and Output characteristics of transistor in Common Base, Common Emitter, and Common collector configurations, Relation between Alpha and Beta, typical transistor junction voltage values, JFET characteristics (Qualitative and Quantitative discussion), Small signal model of JFET, MOSFET characterisitics (Enhancement and depletion mode), Symbols of MOSFET, Comparison of Transistors, Introduction to SCR and UJT.

**Unit IV**

**Biasing and Stabilisation:** BJT biasing, DC equivalent model, criteria for fixing operating point, Fixed bias, Collector to base bias, Self bias techniques for stabilization, Stabilization factors, ($S$, $S'$, $S''$), Compensation techniques, (Compensation against variation in $V_{BE}$, $I_{co}$,) Thermal run away, Thermal stability,

**Amplifiers:** Small signal low frequency transistor amplifier circuits: h-parameter representation of a transistor, Analysis of single stage transistor amplifier using h-parameters: voltage gain, current gain, Input impedance and Output impedance. Comparison of transistor configurations in terms of $A_I$, $R_{i,}$ $A_v$, $R_{o,}$

**Unit V**

**Feedback Amplifiers:** Concept of feedback, Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of Feedback on input and output characteristics, Voltage series, voltage shunt, current series, and current shunt feedback amplifiers with discrete components and their analysis

**Oscillators:** Condition for oscillations. RC-phase shift oscillators with Transistor and FET, Hartley and Colpitts oscillators, Wein bridge oscillator, Crystal oscillators, Frequency and amplitude stability of oscillators, Multivibraters.

*Text Books*:


1. Electronic Devices and Circuits – J.Millman, C.C.Halkias, and Satyabratha Jit, TMH, 2nd Ed., 2007.
2. Electronic Devices and Circuits – R.L. Boylestad and L. Nashelsky, Pearson/Prentice Hall, 9th Ed, 2006.


*References*:

1. Electronic Devices and Circuits – T.F. Bogart Jr., J.S.Beasley and G.Rico, Pearson Education, 6th Ed, 2004.
2. Principles of Electronic Circuits – S. G.Burns and P.R.Bond, Galgotia Publications, 2nd Edn., 1998.
3. Microelectronics – Millman and Grabel, Tata McGraw Hill, 1988.
4. Electronic Devices and Circuits – Dr. K. Lal Kishore, B.S. Publications, 2nd Edition, 2005.
5. Electronic Devices and Circuits- Prof GS N Raju I K International Publishing House Pvt .Ltd 2006.

## MCS 105: Laboratory – 1

(a) Digital Electronics
(b) Electronic Devices and Circuits

**Part B: (For laboratory examination – Minimum of 16 experiments)**

1. PN Junction diode characteristics A. Forward bias B. Reverse bias.
2. Zener diode characteristics
3. Transistor CB characteristics (Input and Output)
4. Transistor CE characteristics (Input and Output)
5. Rectifier without filters (Full wave & Half wave)
6. Rectifier with filters (Full wave & Half wave)
7. FET characteristics
8. Measurement of h parameters of transistor in CB, CE, CC configurations
9. CE Amplifier
10. CC Amplifier (Emitter Follower).
11. Single stage R-C coupled Amplifier.
12. FET amplifier (Common Source)
13. Wien Bridge Oscillator
14. RC Phase Shift Oscillator
15. Feed back amplifier (Current Series).
16. Feed back amplifier (Voltage Series).
17. Hartley Oscillator.
18. Colpitts Oscillator.
19. SCR characteristics.

**Part C: Equipment required for Laboratories:**

1. Regulated Power supplies (RPS) - 0-30v
2. CROs - 0-20M Hz.
3. Function Generators - 0-1 M Hz.
4. Multimeters
5. Decade Resitance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Micro Ammeters (Analog or Digital) - 0-20 µA, 0-50µA, 0-100µA, 0-200µA
8. Voltmeters (Analog or Digital) - 0-50V, 0-100V, 0-250V
9. Electronic Components - Resistors, Capacitors, BJTs, LCDs, SCRs, UJTs, FETs, LEDs, MOSFETs, diodes (ge & sitype), transistors (npn & pnp type)

## *Semester II*

## MCS 201: Programming in C

**Unit I**

**Computer fundamentals, Introduction to C:** The C character set, identifiers and keywords, data types, constants, variables and arrays, declaration, expressions, statements, symbolic constants.

**Arithmetic operator:** Unary operators, library functions, data input/output, preparing and running complete C program. Control statements: preliminaries, the WHILE, DO-WHILE, FOR, IF-ELSE, SWITCH, BREAK, CONTINUE, GOTO STATEMENTS, nested loops, the COMMA operator.

**Unit II**

**Functions:** A brief overview, defining a function, accessing a function, passing arguments to a function, specifying arguments data types, function prototypes, recursion. Program structure, storage classes, automatic variables, external variables, static variables, multi file programs.

**Arrays:** Defining an array, processing an array, passing arrays to a function, multi dimensional arrays, arrays and strings.

**Unit III**

**Pointers:** Fundamental, pointer declarations, passing pointers to a function, pointers and one dimensional arrays, operations on pointers, pointer and multi dimensional arrays, array of pointers, passing functions to other functions, more about pointer declaration.

**Unit IV**

**Structures and Unions:** defining a structure, processing a structure, user defined data types, structures and pointers, passing structure to a function, self referential structure, union.

**Unit V**

**Data files:** Opening and closing a data file, creating a data file, processing a data file, programming with C unformatted data files.

Enumeration, command line parameters, macros, the C preprocessor.

*Text Books/References:*


1. Programming with C - E. Balaguruswamy, McGraw Hill (Latest Edition)
2. Programming with C - Gottfried, Schaum's Outline Series (Latest Edition)
3. Programming with C - Rajaraman R, PHI (Latest Edition)
4. Programming with ANSI C - B.T. Holmes, BPB (Latest Edition)
5. The C Programming Language - Kernighan & Ritchie, PHI (Latest Edition)


## MCS 202: Statistical Methods & Applications

**Unit I**

Measures of location, measures of dispersion, skewness, co-efficient of skewness, Theory of probability, Axiomatic approach to probability, concept of events, sets, Additional multiplication theorem on probability, conditional probabilities, independent, pair wise independent and mutual independent events and applications, Bay's theorems and applications, Laws of expectations, Moment Generating functions and variance-covariance matrix.

**Unit II**

Random variables, Discrete and continuous, Probability mass function, probability of function, Joint distribution, P.D.F., conditional distribution and marginal distribution.

**Unit III**
Theoretical discrete and continuous distributions, Binomial, Poisson, Normal, Beta, Exponential distribution, other discrete distributions (Derivations not necessary).

**Unit IV**
Correlation, simple, partial and multiple correlations, regression, simple and complex regression, lines of regression, regressive curves and coefficients, Curve fitting by the least squares, Possible solution to system of linear equations by Lagrange's principle squares.

**Unit V**
Sampling, sampling of attributes, standard errors, sampling distribution, Testing of signal unitizing X, T, F and Z-statics, analysis of variance - one way and two way classes, co-variance analysis.

*Text Books/References:*


1. Fundamentals of Mathematic Statistics- S. C. Gupta, V. K Kapoor and Saxena, 1996, S Chand & Co. New Delhi
2. Mathematical statistics - Kapoor and Saxena, 1996, S. Chand & Co. New Delhi
3. Statistical methods - S. P. Gupta
4. Statistics - C. B. Gupta, Vikas Publication House Pvt. Ltd, 23rd Revised Edition
5. Methods and Application - Sanchetti and Kapoor
6. Fundamentals of Applied Statistics - S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons


## MCS 203: Computer Organization & Architecture

**Unit I**
**Basic Structure of Computers:** Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers.

**Register Transfer Language and Microoperations:** Register Transfer language. Register Transfer, Bus and memory transfer, Arithmetic Mircro operatiaons, logic micro operations, shift micro operations, Arithmetic logic shift unit. Instruction codes. Computer Registers Computer instructions – Instruction cycle. Memory – Reference Instructions. Input – Output and Interrupt.

**Unit II**
**Central Processing Unit:** Stack organization. Instruction formats. Addressing modes. DATA Transfer and manipulation. Program control. Reduced Instruction set computer

**Micro Programmed Control:** Control memory, Address sequencing, micro program example, Design of control unit-Hard wired control. Micro programmed control

**Unit III**
**Computer Arithmetic:** Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.

**Unit IV**
**The Memory System:** Memory Hierarchy, Main memory, Auxiliary memory, Associative memory, Cache memory, Virtual memory, Memory management hardware

**Unit V**

**Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous data transfer Modes of Transfer, Priority Interrupt, Direct memory Access, Input-Output Processor (IOP), Serial communication;

*Text Books/References:*


1. Computer System Architecture – M. Morris Mano, 3rd Edition, PHI / Pearson, 2006.
2. Computer Organization – Car Hamacher, Zvonks Vranesic, Safwat Zaky, 5th Edition, McGraw Hill, 2002.
3. Computer Organization and Architecture – William Stallings Seventh Edition, PHI/Pearson, 2006.
4. Computer System Architecture -Morris Mano, Prentice Hall, 1998
5. Introduction to Computer Architecture - Stone S., Galgotia Publication Pvt. Ltd., 2nd Edition, 1990.
6. Computer Architecture and Organization - John. P. Hayes, McGraw Hill, 1998
7. Computer Organization and Architecture design for Performance, 4th edition - W. Stallings, PHI
8. Computer Engineering: Hardware Design - M. Morris Mano, PHI.
9. Computer Architecture and parallel processing - Kai Hwang & Faye Briggs, McGraw hill, 1985


## MCS 204: Scientific Computation

**Unit I**

Errors and precision, errors due to round off, Solution of Algebraic and Transcendental Equations: Introduction – The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method.

**Unit II**

**Interpolation:** Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences-Backward differences –Central differences – Symbolic relations and separation of symbols-Differences of a polynomial-Newton's formulae for interpolation – Central difference interpolation Formulae – Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

**Unit III**

**Curve fitting:** Fitting a straight line –Second degree curve-exponentional curve-power curve by method of least squares.

**Approximation:** Uniform, discrete, least square, polynomial, Fourier.

**Unit IV**

Numerical Differentiation and Integration– Trapezoidal rule – Simpson's 1/3 Rule –Simpson's 3/8 Rule.

**Unit V**

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Methods, Predictor-Corrector Methods, Adams-Moulton Method, Milne's Method.

*Text Books/References:*


1. Numerical Analysis -S.S. Sastry, PHI, 5th Edition 2010.
2. Computer Oriented Numerical Methods - Rajaraman, PHI
3. Numerical Computations - Venkataraman
4. Computer Oriented Numerical Methods - Stoer, Bullrich, Springer Verlag, 1980

**MCS 205: Laboratory – 2**

(a) Programming in C
(b) Scientific Computation

**(a) Practical on Programming with C**

Experiments should include but not limited to:

1. Write a program to produce ASCII equivalent of given number.
2. Write a program to find divisor or factorial of a given number.
3. Write a program to evaluate the following algebraic expressions after reading necessary values from the user.
    a) (ax+b)/ (ax-b)
    b) 2.5 log x-cos 30+$|x^2-y^2|$+sqrt (2xy)
    c) $(x^5+10x^4+8x^3+4x+2)$
4. Write a program to find sum of a geometric series.
5. Write a program to cipher a string.
6. Write a program to check whether a given string follows English capitalization rules.
7. Write a program to find sum of the following series 1+ ½ + $^1/_3$ +_____+$^1/_{20}$.
8. Write a program to search whether a given substring exist in an input string or not and then delete this string from input string.
9. Write a recursive program for tower of Hanoi problem.
10. The Fibonacci sequence of numbers is 1, 1, 2, 3, 5, 8……. Based on the recurrence relation F(n)=F(n-1)+F(n-2) for n>2, write a recursive program to print the first m Fibonacci number.
11. Write a menu driven program for matrices to do the following operation depending on whether the operation requires one or two matrices.
    a) Addition of two matrices
    b) Subtraction of two matrices
    c) Finding upper and lower triangular matrices
    d) Trace of a matrix
    e) Transpose of a matrix
    f) Check of matrix symmetry
    g) Product of two matrices.
12. Write a program that takes two operands and one operator from the user perform the operation and then print the answer.
13. Write a program to print the following outputs:

```
1                                   1
2 2                               2   2
3 3 3                           3   3   3
4 4 4 4                       4   4   4   4
5 5 5 5 5                   5   5   5   5   5
```

14. Write functions to add, subtract, multiply and divide two complex numbers (x+iy) and (a+ib) Also write the main program.
15. Write a menu driven program for searching an sorting with following options:-
    a) Searching: (1) Linear searching (2) Binary searching
    b) Sorting: (1) Insertion sort (2) Selection sort
16. Write a program to copy one file to other, use command line arguments.
17. Write a program to mask some bit of a number (using bit operations).
18. An array of record contains information of managers and workers of a company. Print all the data of managers and workers in separate files.

**(b) Practical on Scientific Computation:**

Problems related to scientific computation should be solved by using the high level programming language C (preferably on Unix/Linux/Solaris operating systems on a network). Following are some sample laboratory programming assignments but the assignments should not be limited to these only:

1. Algebric Equation: Bisection, Secant, Regular-falsi, Newton Raphson
2. Interpolation: Newton forward & backward, Lagrange
3. Numerical solution of a system of linear equation: Gauss elimination, Gauss Jacobi, Matrix Inversion, Gauss Seidal
4. Statistical Problem: Mean, Median, Mode, Standard deviation (for simple & frequency type data), Correlation & Regression
5. Ordinary Differential Equation: Taylor Series, Euler's method, Runga-Kutta
6. Numerical Integration: Trapezoidal Rule, Simson's 1/3 Rule, Weddle's Rule

## *Semester III*

### MCS 301: Environmental Studies

As prescribed in Assam University undergraduate courses in PG departments

### MCS 302: Mathematics – 2

**Unit I**

**Differential calculus:** Limit, Cauchy's criteria for existence of limits (without proof), problems on limit, Continuity: problems on continuity, Bounded functions- properties of continuous and bounded functions. Differentiability – problems on differentiability, relation between continuity and Differentiability. Rolle's theorem and mean value theorem.

**Unit II**

Successive differentiation- standard cases, Leibnitz theorem, partial differentiation, curvature, asymptotes, singular points, concativity points of inflection and tracing of Cartesian curves.

Maxima and minima for functions of one variable, necessary and sufficient conditions for maxima and minima. Functions of two or more variables - partial derivative, Euler's theorem.

**Unit III**

**Integral Calculus:** Integrals-definition and properties of definite integrals, Integration of irrational functions, Fundamental theorem, Reduction formulae. Rectification of plane curves, Area bounded by plane curves, quadrature, Volumes and surfaces of solid of revolution about axes.

**Unit IV**

**Differential equation:** Solution of first order and first degree differential equations – variable separable method, Homogenous equations, Exact equations. Linear equations (including Bernoulli's equation), Higher order differential equations with constant coefficients, Homogenous linear differential equations. Applications of differential equations.

**Unit V**

Integral Transforms, Fourier Transforms, Laplace Transforms.

*Text Books/References:*


1. Integral Calculus - Das & Mukherjee, U.N. Dhur Publishers, 1998
2. Differential Calculus - Das & Mukherjee, U.N. Dhur Publishers, 1975
3. Integral Calculus - Maity & Ghosh, New Central Book Agency (P) Limited, 2003


## MCS 303: Data and File Structure

**Unit I**

**Linear and List Structures:** Arrays: Multidimensional arrays, sequential allocation, address calculations, sparse arrays. Lists: sequential and linking structures, simple lists, circular lists, doubly linked lists, inverted lists, threaded lists, operations on all these structures and applications.

**Unit II**

**Stacks, Queues:** Operations on Stack and Queues and their implementations, Applications of Stacks: Polis Notation, Applications of Queues, and Types of Queues: Priority Queue, Circular queue, Double Ended Queue, Implementation of stacks & queues using linked lists.

**Unit III**

**Tree Structures:** Trees, binary trees, tree traversal algorithms, threaded trees, trees in search algorithms, B-trees, B+ trees and applications.

**Unit IV**

**Sorting and Searching:** Sorting: Sequential Sort, Insertion Sort, Bubble Sort, Quick Sort, Merge Sort, Heap Sort. Searching: Sequential Search, Binary Search, Binary Search trees.

**Unit V**

Introduction to Graph and Graph Search Techniques, File Organization: serial, sequential, indexed sequential, direct inverted, multi-list, hashing functions and collision handling methods.

*Text Books/References:*


1. Data structures using C - Tanenbum, PHI, 1996.
2. Fundamentals of Data Structures - Horowitz and Sahani, Computer Science Press, 1978
3. Data Structures and Algorithms - Alfred V. Aho, J.E. Hopcroft and J.D. Ullman, Addison-Wesley, 1983
4. An introduction to data structures with applications - Jean Paul Trembley and Paul Sorenson, McGraw Hill, International Student Edition, 1985
5. Data Structures and Program design in C - R. Kurse, Leung & Tondo, PHI publication, 2nd edition.


## MCS 304: Microprocessor and Assembly Language Programming

**Unit I**

Architecture of 8086 Microprocessor. Special functions of General purpose registers. 8086 flag register and function of 8086 Flags. Addressing modes of 8086. Instruction set of 8086. Pin diagram of 8086-Minimum mode and maximum mode of operation. Timing diagram. Memory interfacing to 8086 (Static RAM & EPROM). Need for DMA. DMA data transfer Method. Interfacing with 8237/8257.

**Unit II**

Assembler directives, simple programs, procedures, and macros. Assembly language programs involving logical, Branch & Call instructions, sorting, evaluation of arithmetic expressions, string manipulation.

**Unit III**
8255 PPI – various modes of operation and interfacing to 8086. Interfacing Keyboard, Displays, 8279 Stepper Motor and actuators. D/A and A/D converter interfacing.

**Unit IV**
Interrupt structure of 8086. Vector interrupt table. Interrupt service routines. Introduction to DOS and BIOS interrupts. 8259 PIC Architecture and interfacing cascading of interrupt controller and its importance.

**Unit V**
Serial data transfer schemes. Asynchronous and Synchronous data transfer schemes. 8251 USART architecture and interfacing. TTL to RS 232C and RS232C to TTL conversion. Sample program of serial data transfer. Introduction to High-speed serial communications standards, USB.

*Text Books:*


1. Advanced microprocessor and Peripherals - A.K.Ray and K.M.Bhurchandi, TMH, 2000.
2. Microcontrollers: Theory and Applications, A.V. Deshmukh, Tata McGraw Hill, 2005.
3. Microprocessors Architecture, Programming and Applications -Ramesh S. Goanker, Wiley Eastern, 1994 or latest edition.


*References:*


1. Micro Processors & Interfacing – Douglas V. Hall, 2007.
2. The 8088 and 8086 Micro Processors – PHI, 4th Edition, 2003.
3. Micro Computer System 8086/8088 Family Architecture, Programming and Design - By Liu and GA Gibson, PHI, 2nd Ed.,
4. Introduction to microprocessors -Aditya P. Mathur, TMH, 1995


**MCS 305: Laboratory – 3**

(a) Data & File Structure
(b) Microprocessor and Assembly Language Programming

**(a) Practical on Data & File Structure:**

Problems related to Data and File Structure should be solved by using the high level programming language C (preferably on Unix/Linux/Solaris operating systems environment on a network).
Following are some sample laboratory programming assignments but the assignments should not be limited to these only:

1. Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements
2. Merging Problem: Evaluation of expressions operations on Multiple stacks & queues:
3. Implementation of linked lists: inserting, deleting, and inverting linked list. Implementation of stacks & queues using linked lists
4. Polynomial addition, Polynomial multiplication
5. Sparse Matrices: Multiplication, addition.
6. Recursive and Non-recursive traversal of Trees
7. Threaded binary tree traversal. AVL tree implementation.
8. Application of Trees, Application of sorting and searching algorithms
9. Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

**(b) Microprocessor and Assembly Language Programming**

## *Semester IV*

### MCS 401: Computer Graphics

**Unit I**
Development of computer graphics: basic graphics systems and standards, raster scan and random scan graphics, continual refresh and storage displays, displays processor and character generator, color display technique, frame buffer and bit operation, concept in raster graphics.

**Unit II**
Points, lines and curves, scan conversion, line drawing algorithm, circle and ellipse generation, polygon filling, conic section generation, antialiasing.

**Unit III**
Two-dimensional viewing: Basic transformations, co-ordinate systems, windowing and clipping, segments, interactive picture construction techniques, interactive input/output devices.

**Unit IV**
Three dimensional concepts: 3-D representation and transformation, spline curve and surfaces, fractals, quadtree and octree data structure.

**Unit V**
3-D viewing, algorithm for 3-D volumes, hidden lines and surface rendering, animation. Introduction to graphics packages and applications.

*Texts Books/References:*


1. Principles of Interactive Computer Graphics - Newman, W. Sproul, R.F., McGraw Hill,1980
2. Fundamentals of Interactive Computer Graphics - Foley J.D., Van Dome, Addison Wesley,1982
3. Computer Graphics - Hearn D., Baker, PHI, 1986
4. Procedural Elements for Computer Graphics - Rogers D. F., McGraw Hill, 1986


### MCS 402: Object Oriented Programming with C++

**Unit I**
Introduction to object oriented modeling, modeling techniques, Object Oriented Design, object design, comparison of methodologies (SA/SD, OMT, JSD)

**Unit II**
Principles of Object Programming, Beginning with C++, Tokens, Expressions and Control structures.

**Unit III**
Function in C++, Classes and Objects, Constructors, Destructors.

**Unit IV**
Operator Overloading and Type Conversions, Inheritance: Extending Classes.

**Unit V**
Pointers, Virtual Functions and polymorphism, working with Files.

*Text Books/References:*


1. Object-Oriented Programming with C++ - E. Balaguruswamy, TMH, 2008.
2. Teach yourself C++ - Herbert Schildt, Osborne McGraw Hill, 1998.
3. Object-Oriented Analysis and Design with applications - Grady Booch, Addison-Wesley, 2007.
4. C The Complete Reference - Herbert Schildt, Tata McGraw Hill, 4th Edition.
5. Object-Oriented programming in C++ - Nabajyoti Barkakati, PHI, 1995.
6. C++ Primer Plus - Stephen Prata, Galgotia Publications, 1996
7. C++ The Complete Reference - Herbert Schildt, Tata McGraw Hill, 4th Edition.


## MCS 403: Data Base Management Systems

**Unit I**

Data modeling for a database: records and files, abstraction and data integration, database management systems; the three levels architecture of a DBMS, components of a DBMS.

**Unit II**

Data models: Hierarchical, Network model, Relational; ER Diagrams, Extended ER Diagrams, Data base Schema, Keys, Relational Data base: manipulations; relational algebra.

**Unit III**

Relational calculus, SQL Queries, Relational database design.

**Unit IV**

Normalization and Functional dependencies, findings keys, decomposition computing closures of a FD's Query processing: general strategies for query processing and query optimization, query processor,

**Unit V**

Transactions and Transaction Processing, ACID Properties, Introduction to Concurrency and Serialization, Concepts of Security and Recovery.

*Text Books/References:*


1. Fundamentals of Database System - R. Elmasri & S. Navathe , Pearson Education, 5th Edition.
2. Data Base Management System - Henry F. Korth & Abraham Silberschats, McGraw hills, 1991.
3. An introduction to data base management system vol I &II - Date C.J., Addison Wesley, 1981, 1983
4. Principles of Database Systems - Ullman J.D., Galgotia Publications Pvt. Ltd., 3rd Edition, 2008.


## MCS 404: Discrete Mathematics

**Unit I**

Mathematical Logic: Statements and Notations, Connectives, Normal forms, The Theory of inference for the statement calculus, the propositional calculus, the Predicate calculus, Inference theory of the predicate calculus.

**Unit II**

Set Theory: Basic concept of set theory, Representation of Discrete Structures, Relations and ordering, Functions, Natural Numbers, Recursion, Recursion in Mechanical Theorem Proving.

**Unit III**

Algebraic Structures: Algebraic systems: Examples and General Properties, Semigroups and Groups, Grammars and Languages, Polish Expressions and their Compilation, The application of Residue Arithmetic to Computers Group Codes.

**Unit IV**

Lattices and Boolean Algebra with applications: Lattices and Partially Ordered Sets, Boolean Algebra, Boolean Functions, Representation and Minimization of Boolean functions, Design Examples using Boolean Algebra, Finite state Machines.

**Unit V**

Graph Theory with applications: Basic concepts of Graph Theory, Storage Representation and Manipulation of Graphs, Simple Precedence Grammars, Fault Detection in Combinational Switching Circuit, PERT and CPM Techniques.

*Text Books/References*


1. Discrete Mathematical structures with Applications to Computer Science, JP Trembly and R. Manohar, Tata McGraw-Hill International Edition (Latest Ed.)
2. Graph theory and its application to Engineering and Computer Science, Narsing Deo, PHI (Latest Ed.)
3. Discrete Mathematics, Seymour Lipshutz & Marc Lipson, McGraw Hill, 3rd Edition, 2009.
4. Discrete Mathematics and Its Applications, Kenneth. H. Rosen, McGraw Hill, 4th Edition.
5. Discrete Mathematics with Graph Theory, Goodaire and Parmenter, PHI EEE, 3rd Edition.


## MCS 405: Laboratory – 4

(a) Data Base Management Systems
(b) Programming with C++ and Computer Graphics

(a) **Practical on Database Management System:**

Database Management System design and implementation problems should form the laboratory assignments for this course. Students should solve assignments by using the standard principles and practices of relational data base design and then develop the appropriate schema for machine implementation on My SQL/SQL/SQLServer/PLSQL/Oracle etc. in Windows/Unix/Linux/Solaris operating systems environment on a network. Following are some samples for laboratory programming assignments but the assignments should not be limited to these only. These programming assignments must be preceded by corresponding database design assignments.

**Structured Query Language**

1. Creating Database
   Creating a Database, Creating a Table, Specifying Relational algebraic constructs, Specifying Constraints, Creating Indexes
2. Table and Record Handling
   INSERT statement, Using SELECT and INSERT together, DELETE, UPDATE, TRUNCATE statements, DROP, ALTER statements
3. Retrieving Data from a Database
   The SELECT statement, Using the WHERE clause, Using Logical Operators in the WHERE clause, Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING clause, Using Aggregate Functions, Combining Tables Using JOINS, Sub queries
4. Database Management
   Creating Views, Creating Column Aliases, Creating Database Users, Using GRANT and REVOKE, Cursors in Oracle PL / SQL, Writing Oracle PL / SQL Stored Procedures

(b) **Practical on Object Oriented Programming with C++:**

Programming problems should be solved by using the high level and Object Oriented Programming language C++ (preferably on Unix/Linux/Solaris operating systems environment on a network). Following are some areas of C++ for laboratory programming assignments but the assignments should not be limited to these only:

1. Class, constructor, overloading, inheritance, overriding
2. Wrapper class, vectors, arrays
3. Developing interfaces- multiple inheritance, extending interfaces
4. Creating and accessing packages
5. Multithreaded programming, handling errors and exceptions, applet programming and graphics programming

## *Semester V*

### MCS 501: Programming in Java

**Unit I**

Introduction To Java, Basic Features, Java Virtual Machine Concepts, A Simple Java Program, Primitive Data Type and Variables, Java Keywords, Integer and Floating Point Data Type, Character and Boolean Types, Declaring and Initialization Variables, Java Operators, Expressions, control statements, Arrays.

**Unit II**

Class Fundamentals, Creating objects, Assigning object reference variables, Introducing Methods, Method overloading, Static methods, Constructors, overloading constructors, This Keyword, Using Objects as Parameters, Argument passing, Returning objects, Method Overriding, Garbage Collection, The Finalize ( ) Method, Inheritance Basics, Access Control ,Multilevel Inheritance, Abstract Classes ,Polymorphism ,Final Keyword, Package, Defining Package, CLASSPATH, Package naming, Accessibility of Packages, Using Package Members, Interfaces, Implementing Interfaces, Interface and Abstract Classes.

**Unit III**

Exception Handling, Multithreaded Programming, I/O in Java, Text Streams, Stream Tokenizer, Buffered Stream, Print Stream, Random Access File, The String Class, String Buffer Class and Methods.

**Unit IV**

Applets Programming, Building User Interface with AWT, Swing-based GUI, Layouts and Layout Manager, Container.

**Unit V**

Java Database Connectivity, Establishing a Connection, Transactions with Database.

*Text Books:*


1. Timothy Budd, An Introduction to Object Oriented Programming, 3rd Ed., Pearson Education, 2008.
2. Herbert Schildt, Java2: The Complete Reference, 5th Edition, Tata McGraw Hill, 2008.
3. Patrick Naughton and Herbert Schildt, Java2: The Complete Reference, 3rd Ed., Tata McGraw-Hill, 1999.


*References:*


1. D. Samanta, Object Oriented Programming with C++ and Java, PHI, 2006

2. Cay Horstmann and Gary Cornell, Core Java 2, Volume I & II (The Sun Microsystems Press Java Series) 7th Edition, 2000.
3. Harvey M. Deitel and Paul J. Deitel, Java: How to Program, 2nd Edition, Prentice Hall, 1998.

## MCS 502: Data Communication:

**Unit I**

**Introduction to Data Communication Concept:** Fundamental of Digital Communication, Communication Channel, Measurement of Information, Shannon's Encoding Algorithm, Variable length Code, Shannon-Hartley Theorem, Host Computers & terminals, Parallel & serial transmission, Asynchronous & Synchronous transmission, Simplex, Duplex communication, Front end processor, Port-sharing device, Line splitters & remote intelligent controllers.

**Unit II**

**Data Integrity and Security:** Data Integrity, Source of error control approaches, Implementation of error control, Echo checking, parity checking and cyclical purity, Hammering code, Checksums, Cyclical Redundancy check, Security and security measuring.

**Unit III**

**Data Interfaces and transmission:** Digital interface standards: RS-232C standard, hand shaking, connecting a DTE in RS-232C, RS-449, RS-422A and RS-432A standards. High-speed desktop serial interfaces. Remote digital transmission: T carrier ISDN, Packet data networks, Digital access, Data Communication Efficiency, Modems, Multi-speed, high speed & Error Correcting modems Data compression in modems. Short-wave modems, Facsimile and Fax modems.

**Unit IV**

**Architectures and Protocols:** OSI model, Traditional communications architectures: Systems network, architecture and other communication architecture protocols: Polling and selecting, automatic repeat request, common link level protocols. Binary synchronous communications, characters in a BSC frame, Synchronous data link control, Protocols Converters and Code Converters TCP/IP protocols, UDP.

**Unit V:**

**Data transport layer:** Service provided to the upper layers, Element of transport protocol: Addressing, establishing and releasing connections. Flow control and buffering, Multiphase crash recovery.

*Text Books:*

1. William Stallings, Data & Computer Communications, 7th Edition, Pearson/Prentice Hall, 2004
2. Tanenbaum, Computer Network, 3rd Edition, Pearson Education India, 2006
3. Forouzan, Data Communications and Networking, 4rd edition, TMH, 2006

*References:*

1. Bertsekas & Gallanger, Data Network, 2nd Ed., PHI, 1992
2. Black, Computer Network: Protocols, Standards and Interface, 2nd Ed. , PHI, 1993
3. Wiliam A. Shay, Understanding Data Communication Network, 3rd Edition, Brooks/Cole, 2004.
4. Michael A. Miller, Data & Network Communication, Delmar Thompson Learning, 1999

## MCS 503: Operating System Architecture

**Unit I**

**Operating System Architecture:** Operating System as an extended machine and resource manager, Operating System classification, Operating System modes and system calls, Operating System architecture. Processor management functions: process model, hierarchies and implementation, process states and transitions, multiprogramming, multitasking, multithreading, levels of schedules and scheduling algorithms, micro kernel architecture.

**Unit II**

**Memory management functions:** memory management of a single user operating system, memory management for multi-user operating systems, partition, swapping, paging, segmentation, virtual memory.

**Unit III**

**Device management functions:** I/O Device and controllers, interrupt handlers, device independent I/O Software, user user/Space I/O software, Disk scheduling, clock hardware, software, software, Terminals I/O Software.

**Unit IV**

**File management functions :** File naming structure, type, access mechanism, attributes and operations, Hierarchical directory system, Directory structure and directory operations, File-space allocations, File sharing, file locking, symbolic links, file protection and security, distributed file system.

**Unit V**

Concurrent programming, Sequential and concurrent process, precedence graph, Bernstein's conditions, time dependency, critical node selection, mutual exclusion problem, classical coordination problem, deadlock handling, inter-process communication. This course can be taught with UNIX operating system as a prototype.

*Text Books/References:*


1. H. M. Dietal, An introduction to operating systems, Addition Wesley, 1990
2. Andrew S. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Prentice Hall, 2008
3. Peterson & Silberschatz, Operating System Concepts, 2nd Edition, Addison Wesley, 1985
4. Madnick and Donovan, Operating Systems, Tata McGraw Hill Edition, 1997
5. Lubomir F. Bic and Alan C. Shaw, Operating Systems Principles, 1st Edition, Prentice Hall, 2003
6. Galvino & Silberschatz, Operating System Concepts, 2nd Edition, Addison Wesley, Latest Edition


## MCS 504: Elective -1

| | |
|---|---|
| MCS 504: Elective – 1 | a) Advance Database Management Systems<br>b) Internet Technologies and Applications |

## MCS 504: Elective -1 (a) Advance Database Management Systems

**Unit I**

**Object Oriented Database:** Persistent Programming Language, Object identity and its implementation, Clustering Indexing, Client Server Object Bases Coherence.

**Unit II**

**Parallel database:** Parallel Architectures, Performance measures, shared nothing/shared disk/shared memory based architectures, Data partitioning, Intraoperator parallelism, Pipelining, Scheduling, Load balancing, query optimization with Volcano as a case study.

**Unit III**

**Distributed Database:** Query processing, semi-joins, query optimization, Concurrency Control Heterogeneity issues

**Unit IV**

**Advanced Transaction Models:** Save points, Sagas, Nested Transactions, Multilevel Transactions, recursive query processing: Top-down and bottom-up evaluation, Magic optimization

**Unit V**

**Recovery:** Multi-level recovery, Shared disk system, Distributed system 2PC, 3PC, replication and hot spares. Recursive query processing: Top-down and bottom-up evaluation, Magic optimization

*Text Books/References:*


1. A. Silberschatz, H.F. Korth and S. Sudarshan, Database System Concepts, 5th Edition, TMH, 2006
2. R. Elmasri & S. Navathe, Fundamentals of Database Systems, 5th Ed., Pearson Education India, 2008
3. A.K. Elmagarmid, Database Transaction Models for Advanced Applications, Morgan Kaufmann Publishers, 1992
4. J. Gray and A. Reuter, Transaction Processing Concepts and Techniques, Morgan Kaufmann Publishers, 1993
5. Won Kim, Introduction to Object-Oriented Databases, MIT Press, 2008
6. S. Zdonik and D. Maier, Readings in Object-Oriented Database Systems, Morgan Kaufmann, 1990
7. M. Stonebreaker, Reading in Database Systems, 4th Edition, MIT Press, 2005
8. S. Ceri and G. Pelagatti, Distributed Databases: Principles and Systems, Tata McGraw-Hill Ed., 1988


## MCS 504: Elective -1 (b) Internet Technologies and Applications

**Unit I**

Internet structure Protocols and Access, Router Technology, Internet and Internet Web Server Technology, Access and Protocols, JAVA Scripts and HTML Technology, Application and Example and Browsing System for the Web

**Unit II**

Building a Corporate Web Site- Practical Issues on Server and Application Software, On line Services-Technology, applications and Vendors, Broadband Communications for the Internet and Intranets, Virtual Reality Applications on the Internet and Intranets

**Unit III**

Hypertext, Markup Language (HTML), DHTML, XML, & introduction of WML

**Unit IV**

Scripting Language- Java Script & VB Script. Introduction to CGI & Perl

**Unit -V**

JAVA Servlet programming, Active Server Pages (ASP)

*Text Books:*

1. Daniel Minoli. Internet and Intranet Engineering, Tata McGraw-Hill Education (India) Pvt Limited, 1999 (for Unit I & II)
2. Keith and Jill, Active Server Pages, 1st Ed., Vikas Thomson Learning, 2000
3. Gosselin, JavaScript, 4th Edition, Vikas Thomson Learning, 2008
4. Cay Horstmann and Gary Cornell, Core Java 2, Volume I & II (The Sun Microsystems Press Java Series) 7th Edition, 2000

*References:*

1. David M. Geary, Graphic Java2: Mastering the JFC, Volume II: Swing, 3rd Ed., Prentice Hall, 1999
2. John Zukowski, Mastering Java2, BPB Publications 2002 (Chapters 18, 20, 21 and 22 for Unit-III Chapters 13 and 15 for Unit IV, Chapters 23, 25, 26 for Unit V)

## MCS 505: Laboratory – 5

(a) Programming in Java
(b) Operating System and Architecture

(a) **Practical on Programming in Java**

Programming problems should be solved by using the high level and Object Oriented Programming language JAVA (preferably on Unix/Linux/Solaris operating systems environment on a network). Following are some areas of JAVA for laboratory programming assignments but the assignments should not be limited to these only.

1. Class, constructor, overloading, inheritance, Method Overriding
2. Garbage Collection, vectors, arrays
3. Developing interfaces- Interfaces, Implementing Interfaces, Interface and Abstract Classes,
4. Multiple and multilevel inheritance, extending interfaces
5. Creating and accessing packages,
6. Multithreaded programming, Exception Handling, handling of errors
7. Applet programming, building user interface with AWT, Swing-based GUI, Layouts and Layout Manager, Container and graphics programming

(b) **Practical on Operating Systems and Architecture (with Unix/Linux/Solaris)**

Problems related to Operating Systems and Architecture (with Unix/Linux/Solaris) should be solved by using Programming languages C/C++/ JAVA (preferably on Unix/Linux/Solaris operating systems environment on a network). Further shell programming in UNIX/LINUX should be performed. Following are some areas of Operating Systems and Architecture (with Unix/Linux/Solaris) for laboratory programming assignments/experiments but the assignments should not be limited to these only:

1. Shell Programming
2. Packet Monitoring software (tcpdump, snort, ethereal)
3. Trace route, Ping, Finger, Nmap
4. Server configuration (FTP, SMTP, DNS)
5. NFS Configuration
6. Firewall Configuration using iptables/ipchains (Linux only)

# *Semester VI*

## MCS 601: System Analysis and Design

**Unit I**

**The system Concept:** Elements of a system, types of system. Introduction to system development life cycle, Recognition of need, prototyping, Roles of system Analyst, The analyst/ user interface.

**Unit II**

**Introduction to system analysis:** determining the user's information requirements, problem definition, Background analysis, fact-finding, fact analysis.
Introduction to structured analysis, the tools of structured analysis, Feasibility study; oral representation, Data analysis, Cost/ Benefit analysis, the system proposal

**Unit III**

**Introduction to system designs:** The process of design (logical and physical design), Design methodology, structured design, structured walkthrough, Major development activities, Data validation.
Introduction to input design, output design, forms design.
File structure, File organization, Data Base design, and the role of DBA.

**Unit IV**

**Introduction to system testing:** The Test Plan, Quality assurance, System Conversion, Post implementation review, Software maintenance.

**Unit V**

Procedure for Hardware/Software selection, Project Management and Control, Project Control, Gantt Chart, PERT and CPM, System Security.

*Text Books*:

1. Elias. M. Awad, System Analysis and Design, 2nd Ed., Galgotia Publication, 1997.

*References*:

1. Kendall and Kendall, System Analysis and Design, 8th Ed., PHI, 2008.
2. Igor Hawryszkiewycz, Introduction to System Analysis and Design, 4th Ed., PHI, 2000.

## MCS 602: Computer Networks

**Unit I**

**Overview of data communication and Networking:** Introduction; Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); Networks: distributed processing, network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, internet today; Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

**Unit II**

**Physical level:** Basics of Multiplexing - WDM; Circuit switching: time division & space division switch, TDM bus; Telephone network, Network Topology.

**Unit III**

**Data link layer:** Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC; Medium access sub layer: Point to point protocol, LCP, NCP, FDDI, token bus, token ring; Reservation, polling, concentration; Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, FDMA, TDMA, CDMA; Traditional Ethernet, fast Ethernet.

**Unit IV**

**Network layer:** Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : Internet address, classful address, subnetting; Routing : techniques, static vs. dynamic routing , routing table for classful address; Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP,RARP, IP, ICMP, IPV6; Unicast and multicast routing protocols.

**Unit V**

**Transport layer and Application layer:** Process to process delivery; UDP; TCP; Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, choke packets; Quality of service: techniques to improve QoS DNS; SMTP, SNMP, FTP, HTTP, Firewalls. Modern topics: Wireless LAN: IEEE 802.11; Introduction to blue-tooth, VLAN's, Cellular telephony & Satellite network.

*Text Books:*


1. B. A. Forouzan, Data Communications and Networking, 4th Ed., TMH, 2006
2. A. S. Tanenbaum, Computer Networks, 4th Ed., Pearson Education/PHI, 2003
3. W. Stallings, Data and Computer Communications, 5th Ed., Pearson Education/PHI, 1997
4. Zheng and Akhtar, Network for Computer Scientists & Engineers, 1st Ed., OUP, 2002
5. U. Black, Computer Networks: Protocols, Standards and Interfaces, 2nd Ed., PHI, 2009


*References:*


1. Kurose and Rose, Computer Networking - A top down approach featuring the internet, Pearson Education, 2000
2. Jean Walrand, Communication Networks (A first course), 2nd Ed., WCB McGraw Hill, 1998.
3. Comer, Internetworking with TCP/IP, Vol. 1, 2, 3, 4th Ed., Pearson Education/PHI, 2007


## MCS 603: Systems Software

**Unit I**

Introduction, System Software and Machine Architecture. Simplified instructional Computers (SIC)-SIC machine architecture, Data and instruction formats - addressing modes - instruction sets - I/O and programming, SIC /XE Machine Architecture, SIC programming Examples, Traditional (CISC) Machines.- VAX Architecture, Pentium Pro Architecture. RISC Machines-ULTRA SPARC Architecture, Cray T3E architecture. machine structure with special reference to IBM 360 and 370 system

**Unit II**

Assembler: Definition, general design procedures ,A simple SIC ssembler, Assembler Algorithm & Data Structures , Machine dependent assembler features - Instruction formats and addressing modes , Program relocation, Machine independent assembler features - Literals – Symbol-defining statements , Expressions, Program Blocks, Control Sections and Program Linking.One pass assemblers and Multi pass assembler, Implementation example - MASM assembler,SPARC Assembler.

**Unit III**

Basic macro processor functions - Macro Definition and Expansion, features of micro Facility, Macro Processor Algorithm and data structures , Machine-independent macro processor features - Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Macro Processor design Options- Recursive Macro Expansion. General purpose Macro Processors, Macro Processing within Language Translators, Macro-Implementation example - MASM Macro Processor – ANSI C Macro language.

**Unit IV**

Basic loader functions, Design of an Absolute Loader , A Simple Bootstrap Loader, Machine dependent loader features – Relocation, Program Linking, Algorithm and Data Structures for Direct Linking Loader, Machine-independent loader features - Automatic Library Search , Loader Options - Loader design options , Linkage Editors, Dynamic Linking, Bootstrap Loaders - Implementation example - MSDOS linker, SUN OS Linker, Cray MPP Linker.

**Unit V**

Compilers: Statement of Problem: Recognizing Basic Elements, Recognizing Syntactic Units and Interpreting Meaning, Intermediate form, Arithmetic statements, Non-Arithmetic statements, Non-executable statements, Storage Allocation, Code Generation, Optimisation (Machine-independent), Optimisation (Machine Dependent), Assembly Phase, General Model of the Compiler. Phases of the Compiler: Lexical Phase, Syntax Phase, Interpretation Phase, Optimisation, Storage Assignment, Code Generation, Assembly Phase, Passes of the Compiler. Interpreters: Use & Overview, Pure & Impure Interpreters .

Lex and Yacc- The Simplest Lex Program, Recognizing Words with LEX, Symbol Tables, Grammars, Parser –Lexer Communication, The Parts of Speech Lexer, A YACC Parser, The Rules Section, Running LEX and YACC. LEX and Hand – Written Lexers, Using YACC- Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse. A YACC Parser – The Definition Section , The Rules Section , Symbol Values and Actions, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity, Variables and Typed Tokens.

*Text Books/References:*


1. John J. Donovan, Systems Programming, 46th Reprint, Tata Mc Graw Hill, 2009
2. D. M. Dhamdhere, Introduction to Systems Software, Tata Mc Graw Hill, 1992
3. Leland L. Beck, System Software: An Introduction to Systems Programming, 3rd Ed., Pearson Education, 2009.


## MCS 604: Elective –II

| | |
|---|---|
| MCS 604: Elective – II | a) Advance Java Programming<br>b) Web Technologies and Applications |

## MCS 604: Elective –II (a) Advanced Java Programming

**Unit I**

Client & server side programming. Enterprise architecture styles: Single tier , 2-tier , 3-tier, n-tier; Relative comparison of the different layers of architectures. MVC Architecture: Explanation, Need, Drawbacks, J2EE WEB SERVICES, Different components & containers. Servlet: Introduction, Advantages over CGI, How it works?, Servlet life cycle, Servlet API (Different interfaces & classes of generic servlet & HTTP servlet), Accessing user information by means of Request & Response, Servlet session management techniques and relative comparison.

**Unit II**

JSP: Introduction, Comparison between JSP & servlet., Architecture/Life cycle, Different types of JSP architectures and relative comparison.; JSP tags ,Directives, Scripting elements, Actions; JSP implicit objects, Accessing user information using implicit objects. EJB :Introduction, Comparison of EJB & Java Beans , Applications, Drawbacks, Different types of enterprise beans ,Services provided by EJB container.

**Unit III**

RMI: Introduction and applications, Architecture ,Use of RMI Registry.
JNDI: Introduction and applications, Comparison between LDAP and JNDI
JDO (Java Data Objects): Introduction, Integration of EJB and JDO, JDO & RMI
JINI: Introduction, Applications.

**Unit IV**:
JDBC: Introduction, Database driver ,Different approaches to connect an application to a database server, Establishing a database connection and executing SQL statements, JDBC prepared statements, JDBC data sources.

**Unit V:**
XML: Java & XML, XML syntax, Document type definition., Parsers, SAX parsers, DOM parsers, SAX vs. Dom, JAXP and JAXB.

*Text Books:*


1. Allamaraju and Buest, Professional JAVA Server Programming J2EE 1.3, SPD Publication, 2001
2. Ivor Horton, Beginning J2EE 1.4, SPD Publication, 2005.
3. Austin and Pawlan, Advanced Programming for JAVA 2 Platform, Pearson, 2000


*References:*


1. Krishnamoorthy & S. Prabhu, Internet & Java Programming, 1st Ed., New Age Publication, 2002


## MCS 604: Elective – II (b) Web Technology and Applications

**Unit I**
Introduction: History of the WEB growth of the WEB, the past decade Protocols governing the web , web applications, security aspects on the web, computational features encompassing the web, development of web in India, creating of India International Cyber Laws.

**Unit II**
Web Development Strategies: Web project, writing Web project, identification of Objects, Target Users, Web Team, Assessment of Web Team, Team Dynamics, planning & Process development , Early Planning, Contents Technical & Production planning Communication issues

**Unit III**
Communication with client, communication breakdowns, Development of Multi developmental & large scale sites, Quality Assurance & Testing Study of Technological Advances and impact on Web teams. Planning Site Navigation, Creating Page templates, Web Typography etc

**Unit IV**
Design Strategies for E commerce Sites development: Basic foundations in E Commerce system Inventory management Profile management ordering management, Shipping management and reporting Systems, Creating forms, CGI, Web databases, Managing database through Web, system Design, credit card Verification, Security and performance issues of E Commerce site, adding functionally to E commerce site.

**Unit V**

Web Development tools: Common Gateway Interface (CGI), PERL, RML, COM/DCOM, Enterprise Web Development Tools, Net Dynamics, Security Features.

*Text Books:*


1. Sharma & Sharma, Developing E Commerce Sites: An Integrated Approach, Addison Wesley, 2000
2. Burdman, Collaborative Web Development: Strategies and Best Practices for Web Teams, Addison Wesley, 1999.
3. Joel Sklar, Principles of Web Design, 4th Ed., Vikas & Thomson Learning, 2009.
4. Maruyama, Tamura, Uramoto, XML & Java Developing Web Application, 2nd Ed., Addison Wesley, 2002
5. "Web Programming", Tech Media Series


*References:*


1. Keith and Jill, Active Server Pages, 1st Ed., Vikas Thomson Learning, 2000.
2. Gosselin, Java Script, 4th Ed., Vikas Thomson Learning, 2008
3. Horstmann, Core Java 2, Vol I & II, Addison Wesley, 2002
4. Holzner, Steven, Visual C++ Programming, PHI, 1997
5. Murry and Pappas, The Visual C++ handbook, 1995


### MCS 605: Laboratory – 6

(a) **Practical on Computer Networks:**

1. Threading concepts - single thread , multi thread
2. Socket programming - Client side socket, Server side socket.
3. Graphical user interface for client and server.
4. Session concepts for client and server

(b) **Elective**

## *Semester VII*

### MCS 701: Theory of Computation

**Unit I**

Sets, Relations and Functions, Fundamental Proof Techniques, Alphabets, Strings and languages, Finite and Infinite sets, Finite Representation of Languages, Regular Expressions, Deterministic and Nondeterministic Finite Automata (DFA and NFA), Equivalence of DFA and NFA.

**Unit II**

Properties of the languages Accepted by Finite Automata, State Minimization of a DFA, Pumping Lemma for Regular Sets, Regular and Non-regular languages.

**Unit III**

Context-free Grammars, Parse Trees, Regular Language and context free language, Chomsky's Normal Form, Pushdown Automata, Properties of Context Free Languages, Pumping Lemma for Context Free Languages, Determinism and Parsing.

**Unit IV**

The definition of a Turing Machine, Computing with TM, Recursive and Recursively Enumerable Language, Extensions of Turing Machines, Non Deterministic Turing Machines, Chomsky's Hierarchy.

**Unit V**
Primitive and *n*-Recursive Function, Church's thesis, The Halting problem, Unsolvability, Computational Complexity.

*Text Books/References:*


1. H. R. Lewis & C. H, Papadimitriou, Elements of the Theory of Computation, PHI, 1981.
2. J. E. Hopcroft, R. Motwani & J. D. Ullman, Introduction to Automata Theory, Language and Computation, 3rd Ed., Prentice Hall, 2007.
3. K. L. P. Mishra, N. Chandrasekaran, Theory of Computer Science: Automata, Languages and Computation, 3rd Ed., PHI, 2006.
4. John Martin, Introduction to languages and Theory of Computation, McGraw Hill, 2003.
5. D. A. Cohen, Introduction to Computer Theory, John Wiley and Sons, 1986.


## MCS 702: Design and Analysis of Computer Algorithms

**Unit I**
Definition of an Algorithm, writing structured programs, asymptotic notations (O, Θ, Ω), Solution of Recurrences: Substitution method, iteration method and the master method, stack and queues, heap and heap sort, hashing.

**Unit II**
Divide and conquer: the general method, binary search, finding the maximum and minimum, merge sort, quick sort, strassen's matrix multiplication, analysis of search, insertion and deletion in trees.

**Unit III**
Graph Algorithms: Representation of graphs, Breadth-first search, depth-first search, strongly connected components, topological sort, algorithms of Kruskal and Prim, single source shortest path algorithms and all pair shortest path algorithms, String matching algorithms, string matching with finite automata.

**Unit IV**
Dynamic programming: the general method, multistage graphs, optimal binary search trees, the traveling sales persons problem, Greedy method: Knapsack problem, Huffman codes, Lower bound theory.

**Unit V**
Computational geometry algorithms: Graham's scan algorithm, finding the closest pair of points, Backtracking, NP-HARD and NP complete problems.

*Text Books /References:*


1. Thomas H. Cormen *et al.,* Introduction to Algorithms, PHI, 2001
2. Ellis Horowitz, Sartraj Sahni, Fundamentals of Computer Algorithms, Galgotia Publication, 1984.
3. S.K.Basu, Design Methods and Analysis of Algorithms, PHI, 2005
4. Sahni, Data Structures, Algorithms and Applications in C++, McGraw Hill, 2000.
5. Aho A.V, Hopcroft, J.E. Ullman, Design and analysis of computer algorithms, Addison-Wesley, 1975.
6. Brassard and Bratley, Fundamentals of Algorithmics, PHI, 2001.
7. A. M. Tanenbaum, Data Structure using C, Pearson Prentice Hall, 1998.

## MCS 703: Artificial Intelligence

**Unit I**

Definition, Short History of Artificial Intelligence (AI), Brief Discussion of Major Topics (Expert System, Natural Language Processing, Speech and Pattern Recognition etc.) of AI. Problem Definition as a State Space Search, Production System, Control Strategies, Problem Characteristics.

**Unit II**

Forward Versus Backward Reasoning, Matching, Indexing, Search Techniques, Depth-First and Breadth-First Search Technique Best First Search, A*, AO* algorithms Adding Heuristics, Hill-Climbing, Search Technique, Problem Reduction, Constraint Satisfaction, Game Playing.

**Unit III**

Knowledge Representation in predicate and Prepositional Logic, Resolution in Predicate & Prepositional Logic, Deduction and theorem Proving, Question Answering, Structured Representation of knowledge declarative representation semantic networks conceptual dependencies frames and scripts procedural representation.

**Unit IV**

Overview of Expert System, Design of Rural-Based Expert System, Selecting a problem for expert system development. The knowledge Engineering Process, Conceptual models and their role in Knowledge acquisition.

**Unit V**

AI language & their important characteristics, Overview of LISP and PROLOG, Computer Architectures for AI Application, LISP Machines & Parallel Machines.
Note: Implementation in LISP or PROLOG.

*Text Books/References:*


1. E. Rich *et al*., Artificial Intelligence, Tata McGraw Hill, 2009.
2. P.H. Winston & B.P.Horn, Lisp, A.Wesley, 1984.
3. E. Charniak & D.Mc Dermott, Introduction to Artificial Intelligence, A.Wesley, 1985.
4. P.H. Winston, Articial Intelligence, 3rd Edition, A.Wesley, 1992.
5. S. Garavaglia, PROLOG Programming Techniques and Application, Harper and Row, 1987.
6. A.Barr & E.A.Feigenbaum, the Handbook of Artificial Intelligence, Los Altos, 1981.


## MCS 704: Wireless and Mobile Computing

**Unit I**

Introduction to Wireless Communication Systems: Evolution of wireless/mobile radio communications, mobile radio systems around the world, radio communication systems: paging systems, cordless telephone systems, cellular telephone systems; comparison of common wireless communications, trends in cellular radio and personal communication, second generation (2G) cellular networks, third generation (3G) wireless networks, introduction to radio wave propagation, Concepts of free space propagation model.

**Unit II**

Wireless networking: Wireless local area network standards, technology – RF and IR wireless LAN, diffuse, quasi-diffuse and point-to-point IR wireless LAN, advantages and applications of Wireless LAN, intro. to WI-FI, Bluetooth, 3G & 4G wireless systems.

**Unit III**

Basics of Mobile Technology, Brief history of Mobile Computing, Terrestrial cellular telephony: cellular concept, cell cluster, frequency reuse, mobile station (MS), base station (BS), Mobile switching center (MSC), Different cellular standards, digital cellular systems, TDMA and CDMA systems, global system for mobile communication (GSM) standard, GSM network, control function, call setup, call handling, mobility management.

**Unit IV**

Cellular digital packet data (CDPD) system: IP based mobile system, general packet radio service (GPRS). Switching and Traffic: intelligent cell concepts, intelligent network communication, and wireless local loop Antennas for cellular systems: multi-path and fading in signals, co-channel suppression, and GMSK modulation. Mobile Computing Complexities, Algorithms. Spread spectrum communication, Analysis of spread spectrum,

**Unit V**

Satellite mobile communication: Orbital mechanics: GEO, MEO, LEO system, Satellite links: direct broadcast satellite receiving system, earth station design, VSAT, analog and digital transmission of voice and TV signals, bandwidth compression, principles of FDMA, TDMA, CDMA, SPADE, DMAS, Global positioning system: basic principles of position fixing with GPS, errors in position fixing, DGPS, WAAS, GPS application. Case study on Google earth.

*Text Books:*


1. Talukder & Roopa Yavagal, Mobile Computing, Tata McGraw Hill, 2010.
2. Stallings, Wireless communication and Networks, 2nd Edition, Pearson Education, 2005.


*References:*


1. Comer, Computer Networks and Internets, 4th Edition, Pearson Education, 2004.
2. U. D. Black, Data Communications and Distributed Networks, 3rd Ed., PHI, 1992.


## MCS 705: Laboratory – 7

(a) Practical on Design and Analysis of Computer Algorithms
(b) Practical on Artificial Intelligence

(a) **Practical on Design and Analysis of Computer Algorithms**

Problems related to Design and Analysis of Computer Algorithms should be solved by using the Programming languages C/C++/JAVA (preferably on Unix/Linux/Solaris operating systems environment on a network). Following are some areas of Design and Analysis of Computer Algorithms for laboratory programming assignments but the assignments should not be limited to these only.

1. Stack and queues, tree, heap and heap sort, graphs and hashing.
2. Divide and conquer method: binary search, merge sort, quick sort, matrix multiplication, minimum spanning tree.
3. Dynamic programming: multistage graphs, all pair shortest paths, optimal binary search trees/I knapsack, travelling sales persons problem, flow shop scheduling.
4. Search and traversal techniques: AND/OR graphs, game trees, bi connected components and depth search.
5. Backtracking: Hamilton cycles, the fast Fourier transform, NP-HARD and NP complete problems.

(b) **Practical on Artificial Intelligence**

Problems related to Artificial Intelligence should be solved by using the Programming languages PROPOG/LISP. Following are some areas of Artificial Intelligence for laboratory programming assignments but the assignments should not be limited to these only:

1. State Space Search, Production System, Control Strategies
2. Search Technique: Depth-First and Breadth-First Search, First Search, A*, AO* algorithms, Adding Heuristics, Hill-Climbing, Constraint Satisfaction, Game Playing.
3. Knowledge Representation: Predicate and Prepositional Logic, Resolution in Predicate & Prepositional Logic, Deduction and theorem Proving, Question Answering, Knowledge representation, Semantic networks, Frames and scripts.
4. Expert System, Design of Rule-Based Expert System, Knowledge Engineering, Conceptual models and Knowledge acquisition.

Note: Implementation in LISP and/or PROLOG.

## *Semester VIII*

### MCS 801: Software Engineering

**Unit I**

Importance of software, Characteristics, Components, Applications of Software, Software Myths. Definition of the Classic Life Cycle, Prototyping, the Spiral Model, Fourth- Generation Techniques. Planning and Management of software Project : People, problem and process, measures, matrices and indicators, matrices for software quality, scooping, software project estimation, make-buy decision, software acquisition.

**Unit II**

Software risks: Identification, Projection assessment, monitoring, Project scheduling and tracking tasks/work breakdown structures, timeline chart, project plan, CASE tools. Requirement analysis: Communication techniques. FAST, quality development, analysis principles, modeling, partitioning, prototyping, specifications, SRS and SRS reviews, analysis models : data modeling, functional modeling and information flow, Data flow diagrams, extensions to real-time systems, behavioral models, mechanics of structured analysis, ER diagrams, control modeling, data dictionary CASE tools.

**Unit III**

Design Fundamentals: Software design and software design process, principles and concepts, abstraction, refinement and modularity, software architecture, control hierarchy, partitioning, data structure, information hiding, effective modular design, cohesion, coupling, design module, design document.

Design Method: Architectural design and design process, transform and transaction flow, design steps, Interface design, procedural design, graphical and tabular design notations.

**Unit IV**

Software testing and testing strategies : Software testing fundamentals, test case design, white-box, black-box testing, control structure testing, strategic approach to testing, strategic issues, unit testing, integrated testing, validation testing, system testing.

**Unit V**

Software quality concepts, Software quality assurance (SQA) and approaches, Software Reliability, SQA plan, ISO 9000 and SEI standards for software, software configuration management (SCM), base lines, scan process, version control, change control, SCM audits.

*Text Books/References:*


1. Roger Pressman, Software Engineering: A Practitioner's Approach, 7th Ed., TMH, 2009.
2. P. S. Pressman, Software Engineering, McGraw Hill, 2009.
3. Pankaj Jalote, An Integrated Approach of Software Engineering, Narosa, 1991.
4. M. Shooman, Software Engineering, 2nd Edition, McGraw Hill, 1983.


## MCS 802: Principles of Compiler Design

**Unit I**

Overview of process, some compiler structures, Regular expression, finite automata and Lexical Analysis, Syntax tress, ambiguity, context free grammar & derivation of parse trees, basic-parsing techniques, and deduction.

**Unit II**

Syntax – Direction Translation: Top-down and bottom-up parsing operator precedence parsing, LR parsers, syntax directed definition, translation schemes, L-attributed & S-attributed definition.

**Unit III**

Symbol Tables: The contents of a symbol table, Data structures for symbol table (ST), design of ST, ST for block structured languages.

Run-time storage administration: Storage allocation strategies, static dynamic & heap memory allocation, memory allocation in block structured languages, memory allocation in recursion, and memory allocation in FORTRAN.

**Unit IV**

Code optimization: Principal sources of Optimization, Loop Optimization, Global data Flow Analysis, Some other loop organizations.

**Unit V**

Code Generation: Object programs, Problems in code generation, a machine model. A simple code generator, Register allocation and assignment, Peephole optimization

*TextBooks/References:*


1. D. M. Dhamdhere: Complier Construction – principles & practice (McMillan)
2. A. V. Aho, R. Sethi & J. D. Ullman : compiler-principles, techniques & tools (A.Wesley)
3. J. Trembley & P. G. Sorrenson : The theory and practice of compiler writing (McGraw)
4. W. A. Barrett et al: compiler construction theory & practice (Galgotia)
5. D. Gries : compiler construction for digital computer (JW)
6. A. V. Aho and J. D. Ullman : Principles of Computer Design, (Narosa Publishing House)


## MCS 803: Modeling and Simulation

**Unit I**

System models and role of simulation: Basic concept and nomenclature, Type of system – deterministic, stochastic, continuous and discrete system, System simulation – uses of simulation and its limitations, steps in simulation studies, Random variate generation for Uniform, Exponential, Normal and Poisson distributions, Sampling and estimation, Maximum ;likelihood estimation, Confidence interval estimation.

**Unit II**

Discrete Event Simulation : Representation of time, Approaches to discrete event simulation, Queuing models – single and multiserver queues, steady state behavior of queues, network of queues, Inventory system simulation, Programming languages for discrete event system simulation – GPSS,SIMSCRIPT (brief overview).

**Unit III**

Modeling and performance evaluation of computer system : Behavioral, data flow and structure modeling, overview of hardware modeling and simulation using VHDL, VHDL description for design reuse, test generation and fault simulation for behavioral model, Single server Centre models, central server models of interactive systems, use of VHDL in front-end and back-end system development, Evaluation of multiprocessor systems, workload characterization & benchmarks.

**Unit IV**

Continuous system simulation : Continuous system models- open and closed loop system, Models decribed by differential equations, System dynamics, Growth and decay models, Systems dynamics diagram, Simulation of aircraft models, Biological and sociological system simulation, Simulation languages overview – CSMP.

**Unit V**

Virtual reality modeling : Overview of Virtual reality modeling language VRML 2.0, creating dynamic worlds, Integrating Java scripts with VRML, Verification and validation of simulation models- Goals of model verification and validation, Input data analysis, Output analysis, Sensitivity analysis, Hypothesis testing, Performance measures and their estimation.

*Text Books/References:*


1. J. E. Banks and J. S. Carson II “Discrete System Simulation”, Prentice Hall, Englewood Cliff, NJ.
2. G. Gordon, System Simulation, Prentice Hall, Inc., Englewood Cliffs, NJ, 1969.
3. D. Ferrari, Computer System Performance Evaluation, Prentice Hall, NJ.
4. J. Bhasker, Computer System Performance Evaluation, Prentice Hall, NJ.
5. Glenn Vanderburg et al., Tricks of the Java Programming Gurus, Sams. Net Publishing, 1996.
6. Narsing Deo, System Simulation with Digital Computer, PHI, 1979.


## MCS 804: Digital Image Processing

**Unit I**

Digital image fundamentals - Concept of gray levels. Gray level to binary image conversion. Sampling and quantization. Relation ship between pixels. Imaging Geometry

Image Transforms 2-D FFT, Properties. Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform, Hotelling transform

**Unit II**

Image enhancement Point processing. Histogram processing. Spatial filtering. Enhancement in frequency domain, Image smoothing, Image sharpening

**Unit III**
Colour image processing : Psedo colour image processing, full colour image processing.
Image compression Redundancies and their removal methods, Fidelity criteria, Image compression models, Source encoder and decoder, Error free compression, Lossy compression.

**Unit IV**
Image Restoration Degradation model, Algebraic approach to restoration, Inverse filtering, Least mean square filters, Constrained Least Squares Restoration, Interactive Restoration.

**Unit V**
Image segmentation Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region oriented segmentation.

*Text Books:*

1. R. C. Gonzalez & R.E. Woods, Digital Image processing, Addison Wesley/ Pearson education, 2nd Education, 2002.

*References:*

1. A. K. Jain, Fundamentals of Digital Image processing, PHI, 1989.
2. Rafael C. Gonzalez, Richard E Woods and Steven L, Digital Image processing using MAT LAB , PEA, 2004.
3. William K. Pratt, Digital Image Processing, John Wiley, 3rd Edition, 2004.
4. Weeks Jr., Fundamentals of Electronic Image Processing, SPIC/IEEE Series, PHI.

## MCS 805: Laboratory – 8

(a) Principles of Compiler Design
(b) Digital Image Processing and Modeling and Simulation

**(a) Practical on Compiler Design**

Problems related to Compiler Design should be solved by using the Programming languages C/C++/JAVA as well as various tools for Compiler Construction and Design like LEX, YACC, BYSON etc. Following are some areas of Compiler Design for laboratory programming assignments but the assignments should not be limited to these only:

1. Construction of a lexical analyzer and LL(1) parser for a subset of FORTRAN/PASCAL/C/C++ (to be done without using any generator).
2. Construction of a lexical analyzer and LALR(1)/LR(1) parser for a subset of C/C++ (generators like LEX, YACC, BYSON to be used)
3. A construction of a translator from a high level to an intermediate language which is also a very simple subset of C (The correctness of this translation may be checked by compiling this intermediate program by a standard compiler)
4. Construction of a target code generator from the above intermediate language program to the assembly language of a suitable target machine (e. g. Intel 8088). Addition of rudimentary code optimization (like peep-hole)/jump optimization
5. Register optimization to the generated compiler. Experiments with incorporation of debugging features

(b) **Practical on Modeling & Simulation and Digital Image Processing**

Problems related to Modeling & Simulation should be solved by using the Programming languages C/C++/JAVA as well as various tools for Modeling & Simulation. Following are some areas of Modeling & Simulation for laboratory programming assignments but the assignments should not be limited to these only:

Discrete and continuous simulation procedures, Special purpose simulation languages (use of one language depending on the availability in detail) versus conventional general purpose programming language like C/C++/JAVA in simulation and modeling of large systems

## ***Semester IX***

### MCS 901: Data Mining and Knowledge Discovery

**Unit I**

Introduction to Data Mining and data Warehousing, What is Data ware house, Definition, Need for data Ware house, DBMS vs. Data Ware house, Multi dimensional data Model, Data Cubes, Ware house Schema, stars, snowflakes, and fact constellations, data ware housing architecture and process, Ware house server, Metadata, Data ware house back end process, Data ware house physical design – partitioning, indexing, integrity constraints, materialized views, Data ware house construction – data extraction, transformation, loading and refreshing.

**Unit II**

OLAP technique for data ware house, OLAP architecture, operations and OLAP engine, SQL extensions for OLAP, types of OLAP servers, 3-tier data ware house architecture, Data ware house implementation and data warehousing back end tools.

Fundamentals of Data Mining, Definitions, KDD vs Data Mining, Data Mining Functionalities, Data Mining techniques, DBMS vs Data Mining, Classification of data Mining problems, Major issues and challenges of data mining, Data Mining tools and Applications.

**Unit III**

Association rule mining in large data bases, Definition and types of Association rules, Association Rule Mining Algorithms: A priori, Partition, Pincer Search, Dynamic Item set Counting, FP Tree Growth Algorithms. Discussion on Different Algorithms, Incremental Algorithm, Border Algorithm, generalized Association Rule Mining, Association Rules with item set constraints. Recent trends in Association rule mining.

**Unit IV**

Clustering techniques: Introduction, clustering paradigms, Categorization of major clustering methods, partitioning algorithms, k-medoid algorithms, CLARA, CLARANS, Hierarchical Clustering, DBSCAN, BIRCH, CURE, Categorical Clustering Algorithms, STIRR, ROCK, CACTUS, Recent trends in Clustering

**Unit V**

Classification and prediction: Issues regarding classification and prediction, Classification by Decision tree Induction, Bayesian Classification, Classification by back propagation, Other Classification methods, Prediction, Classifier accuracy.

Overview of Advanced data mining techniques: WEB Mining, Spatial Mining, Spatial and Temporal data mining.

*Text Books/References*:


1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Elsevier, Morgan Kaufmann publishers, 2nd Edn, 2006
2. Arun Kumar Pujari, Data Mining Techniques, University press, 2001
3. Margaret H Dunham, Data Mining: Introductory and Advanced topics, Pearson Education, 2006.


## MCS 902: Term Paper and Grand Viva

**Term Paper** **Full Marks: 50**

For this course, each student is required to

(i) Select appropriate field of study under the supervision of a faculty of the Department.

(ii) Present a seminar in the beginning after the selection of the topic in presence of the Departmental Committee

(iii) Deliver a final seminar at the end of the semester course work in presence of the Departmental Committee

**Grand Viva** **Full Marks: 50**

Guide/Supervisor with the Departmental Committee shall evaluate the term paper and grand viva out of 100.

## MCS 903: Neural Network

**Unit I**

Introduction to Neural Networks: Biological and Artificial Neurons, Perceptrons, Classification and Linear Separability X-OR problem, Hopfield Networks, Overview of Neural Networks Architectures-Multilayered feed forward and Recurrent Networks, Learning-Supervised, Unsupervised and Reinforcement, Generalised Delta Rule.

**Unit II**

Multilayered Networks: Backpropagation (BP) Networks, BP Training Algorithm and Derivation for Adaption of weight, variations in Back propagation and Alternative cost function, Radial Basis function (RBF) Networks, Applications of BP and RBF Networks.

**Unit III**

Recurrent Networks and Unsupervised Learning : Counter Back propagation Networks, Boltzman Machine, Unsupervised learning methods, Hebbian learning Kohonen's Self Organizing feature maps, Adaptive Resonance Theory.

**Unit IV**

Associative Memories: Matrix, Auto, Hetero and Bidirectional Associative memories, Applications of Associative Memories. Neuro Fuzzy System: Relevance of Integration between Fuzzy Sets and Neural Networks-pros and cons, Fuzzy Neurons, Fuzzy Neuro Controllers.

**Unit V**

Neuro Computation : Domains of Application of Neural Networks – Expert System & Decision Making system, Pattern Recognition, Neuro Controllers and Fuzzy Neuro Controllers.

*Text/References:*


1. B. Yagnanarayana, Artificial Neural Networks, PHI, 2009.
2. S. Haykin, Neural Network: A Comprehensive Introduction, PHI, 2nd Edn, 1999.
3. Limin Fu, Neural Networks in Computer Intelligence, McGraw Hill International, 1994
4. John Hertz, Anders Krogh and Richard G. Palmer, Introduction to the Theory of Neural Computations, Addison Wesley, 1991
5. Yoh-Han Pao, Adaptive Pattern Recognition and Neural Networks, Addison Wesley 1989.
6. Mohammad Hassoun, Fundamentals of Artificial Neural Networks, PHI, New Delhi, 1998.


## MCS 904: Elective – III

| | |
|---|---|
| MCS 904: Elective – III | a) Advanced Operating System<br>b) Computer Vision<br>c) Robotics<br>d) Advanced Computer Architecture and Parallel Computing<br>e) Operations Research<br>f) VLSI Design<br>g) Natural language Processing<br>h) Distributed Data Base Systems |

## MCS 904: Elective – III (a) Advanced Operating System

**Unit I**

Process Synchronization: Concepts of processes, Concurrent processes, Threads, Overview of different classical synchronization problems, Monitors, Communicating Sequential processes (CSP)

Process deadlocks: Introduction, causes of deadlocks, Deadlock handling strategies, Models of deadlock

**Unit II**

Distributed operating system: Architectures, Issues in Distributed operating systems, Limitations of Distributed Systems, Lamport's logical clock, Global states, Chandy-Lampert's global state recording algorithm, Basic concepts of Distributed Mutual Exclusion, Lamport's Algorithm, Ricart-Agrawala Algorithm; Basic concepts of Distributed deadlock detection, Distributed File system, Architecture, Design issues, SUN Network File system

Basic concepts of Distributed shared memory, Basic concepts of Distributed Scheduling, Load balancing, Load sharing

**Unit III**

Distributed OS Implementation: Models, Naming, Process migration, Remote Procedure Calls

Multiprocessor System: Motivation, Classification, Multiprocessor Interconnections, Types, Multiprocessor OS functions & requirements; Design & Implementation Issue; Introduction to parallel programming; Multiprocessor Synchronization.

**Unit IV**
Performance, Coprocessors, RISC & data flow: Introduction, Necessity, Measures, Techniques, Bottlenecks & Saturation, Feedback loops, Coprocessors, RISC.
Analytic Modeling: Introductions, Queing Theory, Markov Process

**Unit V**
Security & Protection: Security-threats & goals, Penetration attempts, Security Policies & mechanisms, Authentication, Protections & access control Formal models of protection, Cryptography, worms & viruses.

*Text / Reference Books:*


1. Milan Milenkovic, Operating Systems: Concepts & design, TMH, 1987.
2. H. M. Deitel, Operating System, Prentice Hall, 2004.
3. Mukesh Singhal and Niranjan G. Shivaratri, Advanced Concepts in Operating Systems, TMH, 2001.


## MCS 904: Elective – III (b) Computer Vision

**Unit I**
Introduction: What is computer vision? The Marr paradigm and scene reconstruction. Other paradigms for image analysis. Image Formation. Image Geometry. Radiometry. Digitization

**Unit II**
Binary Image Analysis and Segmentation: Properties. Digital geometry. Segmentation.

**Unit III**
Image Processing for Feature: Detection and Image Synthesis. Edge detection, corner detection, Line and curve detection, SIFT operator, Image-based modeling and rendering, Mosaics, snakes

**Unit IV**
Stereo. Shape from X. Shape from shading. Photometric stereo. Texture. Occluding contour detection.
Motion Analysis: Motion detection and optical flow. Structure from motion.

**Unit V**
Object Recognition: Model-based methods, Appearance-based methods, Invariants

*Text Books:*


1. D. A. Forsyth and J. Ponce, Computer Vision: A Modern Approach, Prentice Hall, 2003.


*References:*


1. Shapiro, L. & Stockman, Computer Vision, G. Prentice Hall, 2001.
2. Trucco & Verri, Introductory technique for 3D computer vision, Prentice-Hall, 1998.


## MCS 904: Elective – III (c) Advanced Computer Architecture and Parallel Computing

**Unit I**
Advanced Computer Architecture: Introduction to Parallel Processing, Parallel Computer Structures, Pipeline and Array Computers, Multiprocessor Systems, Architectural Classification Scheme.
Interconnection network: Tree, Diamond Network, Mesh, Linear array, Ring, Star, Hypercube, Choral ring, Cube- connected cycles, perfect shuffle network, Torus, PM 21, Butterfly, Mesh of tree, Pyramid, Generalized

Hyperbus, Twisted cube, Folded Hypercube, Incomplete Hypercube, Enhanced Incomplete Hypercube, Cross Connection Cube, Banyan Hypercube. Amdahl's Law, Gustafson's Law.

**Unit II**

Principles of pipeline and Vector-Processing, Multification and Array Pipelines, Design of Pipelined Processors, Data buffering and busing System, Vector Processing Requirements, Pipeline Computers and Vectorization Methods, Architecture of Typical Vector Processors, Vectorization and Optimization Methods. Structures and Algorithms for Array Processors, SIMD Array Processors, SIMD Interconnection Networks, Typical Parallel Processors, Multiprocessor Architecture, Loosely and tightly coupled Multiprocessor.

**Unit III**

Principles of Parallel Computing: Message Passing Parallel Programming, PVM and MPI, Introduction to Pipelined Computations, Parallel Computation Models: PRAM, CRCW, CREW, EREW, Simulating CRCW on CREW & EREW. PRAM Algorithms: List Ranking, Parallel Prefix on a list, Finding Roots of trees in a Forest, Maximum of an Array, etc.

**Unit IV**

Parallel Sorting: Odd – Even transportation sort on Linear Array, Merge Splitting sorting, Quick Sort, Theorem of Odd-Even Merging, Zero- One Principle, Bitonic Sort. Matrix Multiplication: Sequential Matrix Multiplication: Row wise Block – Striped Parallel Algorithm, Cannon's Algorithm,

**Unit V**

Parallel Search Algorithms: Parallel Depth First Search, Parallel Breadth First Search, Parallel Branch and Bound Search, Parallel Best-First Search. Not smaller-than search, Distributed Real Time System, Data Flow Computer Architecture, Reduced Instruction Set Computer and Architecture Characteristics.

*Text Books/References:*


1. K. Hwang and F. A. Briggs, Computer Architecture and Parallel Processing, McGraw Hill, 1989.
2. K. Hwang, Super Computer Design and Application, Computer Society Press, 1984.
3. Kai Hwang, Advanced Computer Architecture – Parallelism, Scalability, Programmability, McGraw Hill Inc., 1993
4. V. Rajaraman, Elements of Parallel Computing, PHI, 1990.
5. Barry Wilkinson and Michael Allen, Parallel Programming: Techniques and Applications using Networked Workstations and Parallel Computers, 2nd Edition, Pearson Education, 2005.
6. Ananth Grama, Introduction to Parallel Computing, 2nd Edition, Addison-Wesley, 2003
7. M. J. Quinn, Parallel Programming in C with MPI and Open MP, Tata McGraw Hill, 2003.


## MCS 904: Elective – III (d) Operations Research

**Unit I**

Introduction, convexity and related results, linear programming problem, Solution by Graphical and Simplex method. Theory of simplex method, optimality condition, Duality, Fundamental Theorem of duality.

**Unit II**

Study of transportation Problem – Method for finding initial solutions (North-west corner method, Least cost method, Vogel's Approximation Method), Modi method for optimum solution, Assignment problems-

Mathematical formulation and solutions of assignment problems, Hurgerian method, Variations of Assignment problems, traveling salesman problem.

**Unit III**

Revised Simplex method, Sensitivity Analysis, Integer programming formulation- types of integer programming, concepts of a cutting plane, Gomory's all integer cutting plane method, Gomory's mixed integer cutting plane method, Branch and bound technique.

**Unit IV**

Introduction to game theory, Maximum-minimum Principle, games without saddle point, reduction to LPP, Networks Scheduling by PERT and CPM, Critical path analysis. Resource Analysis in Network Scheduling, Project cost, Time cost Optimization algorithm, Probability in PERT Analysis.

**Unit V**

Queuing Theory, Essential features of Queuing system, Operating characteristics of Queuing system, Probability Distribution in Queuing system, Classification of Queuing models, M/M/T etc. Sequencing problem: Introduction, Processing n jobs through m machines, Processing two jobs through m machines.

*Text Books/References:*


1. J.Medhi, Stochstic Process, New Age International Publisher, 1984.
2. H.M. Wagner, Principles of Operations Research, PHI, 1975.
3. H.A.Taha, Operations Research: An Introduction, PHI, 2004.
4. S. I. Gass, Linear programming: Methods and Applications, 5th Edition, Dover Publications, 2003.
5. J.K.Sharma, Operation Research: Theory and Applications, 4th Edition, Mcmillan, 2009.
6. W Feller, An introduction to Probability theory & its applications, 3rd Ed., Wiley Eastern, 1978.
7. M.R. Spiegel, Probability and Statistics, Schaum series, Mcgraw Hill, 2000.
8. C.W.Chrchman & EL Arnchoff : Introduction to Operation Research, Wiley and Sons, 1957.
9. E.Gillett : Introduction to Operations Research, Tata McGraw Hill, 1976.
10. D.Gross *et al.*, Fundamentals of Queuing theory, John Wiley and Sons, 2008.


## MCS 904: Elective – III (e) VLSI Design

**Unit I**

**Introduction:** Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS technologies-Oxidation, Lithography, Diffusion, Ion implantation, Metallisation, Encapsulation, Probe testing, Integrated Resistors and Capacitors.

**Basic Electrical Properties:** Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, figure of merit □o; Pa
Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

**Unit II**

**VLSI Circuit Design Processes:** VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 □m C
CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

**Unit III**

**Gate Level Design:** Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Basic circuit concepts, Sheet Resistance RS and its concept to MOS, Area Capacitance Units, Calculations - $\square\square$ Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out, Choice of layers

**Unit IV**

**Subsystem Design:** Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters, High Density Memory Elements.

**Semiconductor Integrated Circuit Design:** PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Design Approach.

**Unit V**

**VHDL Synthesis:** VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools, Test Principles.

**CMOS Testing :** CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques, System-level Test Techniques, Layout Design for improved Testability.

*TextBooks:*


1. Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, Essentials of VLSI circuits and systems, PHI, 2005.
2. Weste and Eshraghian, Principles of CMOS VLSI Design, Pearson Education, 1999.


*References:*


1. John P. Uyemura, Chip Design for Submicron VLSI: CMOS Layout & Simulation, Thomson Learning, 2006.
2. John .P. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley, 2003.
3. John M. Rabaey, Digital Integrated Circuits, PHI, EEE, 1997.
4. Wayne Wolf, Modern VLSI Design, Pearson Education, 3rd Edition, 1997.
5. S. M. SZE, VLSI Technology, 2nd Edition, TMH, 2003.


## MCS 904: Elective – III (f) Natural language Processing

**Unit I**

Introduction to NLP, Linguistic Background:An outline of English syntax, Grammars and sentence structure , Regular Expressions, Formal Languages,Finite State Automata, Non deterministic Finite State Automata(NFSA),Using an NFSA to accept strings, Relating deterministic and non deterministic FSA, Elementary probability theory and entropy.

**Unit II**

Morpholgy & Finite State Transducers: Survey of (mostly) English morphology,Inflectional morphology, derivational morphology, Introduction to shallow parsing and morphological analyzer:Rule based POS tagger, Stochastic POS tagger ,Chunking, Use of Morphological analyzer in POS tagging.

**Unit III**

Introduction to HMM Tagger:HMM for POS tagging,Viterbi algorithm,
, Parsing: Top Down Parsing, Bottom up Parsing, Earley Parsing, and Finite-State Parsing Methods.

**Unit IV**

Application of Bayes Theorem in Statistical NLP – (Spell Checker as a case study), Collocations, Probabilistic Context Free Grammar (PCFG), finding the most likely parse for a sentence, Training a PCFG

**Unit V**
Introduction to Word Sense Disambiguation: Supervised Disambiguation, Dictionary based disambiguation, Unsupervised disambiguation, clustering in statistical NLP

*Text Books/References:*


1. James Allan, Natural Language Understanding, Pearson Education, 1995.
2. Jurafsky and Martin, Speech and Language Processing, Pearson Education, 2000.
3. Manning and Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.
4. Bharati *et al*., Natural Language Processing, PHI, 1996


## MCS 904: Elective – III (g) Distributed Data Base Systems

**Unit I**
Distributed DBMS features and needs. Reference architecture. Levels of distribution transparency, replication. Distributed database design - fragmentation, allocation criteria.

**Unit II**
Storage mechanisms. Translation of global queries. / Global query optimisation. Query execution and access plan. Concurrency control - 2 phases locks. Distributed deadlocks. Time based and quorum based protocols. Comparison. Reliability- non-blocking commitment protocols.

**Unit III**
Partitioned networks. Checkpoints and cold starts. Management of distributed transactions- 2 phase unit protocols. Architectural aspects. Node and link failure recoveries.

**Unit IV**
Distributed data dictionary management. Distributed database administration. Heterogeneous databases-federated database, reference architecture, loosely and tightly coupled.

**Unit V**
Alternative architecture. Development tasks, Operation- global task management. Client server databases-SQL server, open database connectivity. Constructing an application.

*Text Books:*


1. Silberschatz, Korth, Sudarshan, Database System Concepts, McGraw Hill Education, 2010.
2. Ceri & Pelagatti, Distributed Databases: *Principles and Systems*, TMH, 1984.
3. Ozsu & Patrick, Principles of Distributed Database Systems, Pearson Education, 2006.
4. R. Elmasri & S. B. Navathe, Fundamentals of Database System, Pearson Education, 2008.


*References:*


1. Ramakrishnan, Database Management Systems, McGraw Hill Higher Education, 2003.
2. Vieira, Beginning SQL Server 2005 programming, John Wiley and Sons, 2006.
3. A. Leon and M. Leon, Database Management Systems, VIKAS, 2008.

## MCS 905: Laboratory – 9

(a) Practical on Data Ware Housing and Data Mining
(b) Practical on Artificial Neural Network and Expert Systems

(a) **Practical on Data Ware Housing and Data Mining**

Problems and various algorithms related to Data Ware Housing and Data Mining should be solved and implemented by using the Programming languages C/C++/JAVA/VB as well as various tools for Data Ware Housing and Data Mining.

(b) **Practical on Neural Network and Expert Systems**

Problems related to Neural Network and Expert Systems should be solved by using the Programming languages C/C++/JAVA as well as various tools for Neural Network and Expert Systems.

## ***Semester X***

## MCS 1001: Distributed Computing

**Unit I**
Fundamentals: Introduction, Models and Features, Concept of distributed operating system, Issues in design of a distributed operating system. Client Server Computing
Message Passing: Good message passing system, IPC, Synchronization, Buffering, Multi datagram messages, Encoding & decoding techniques, Process addressing, Failure handling, Group communication; Remote procedure calls (RPC) - Models, Communication protocols, RPC, Lightweight RPC.

**Unit II**
Distributed Shared Memory: Architecture, Thrashing, Granularity, Advantages
Synchronization: Introduction, Clock Synchronization, Event handling, Mutual Exclusion; Deadlock – Conditions, Avoidance, Prevention, Recovery.

**Unit III**
Resource & process Management: Features of a good scheduling algorithm, Task assignment approach, Load balancing & load sharing approach, Introduction to process management, Process migration, Threads.

**Unit IV**
Distributed Files Systems: Introduction, Features, Models, Accessing models; sharing Semantics & caching schemes, replication, Fault Tolerance, Atomic transactions. Distributed File Servers, Distributed Real Time System

**Unit V**
Distributed Database, Concurrency Control in Distributed Database, Naming: Introduction, Features, Fundamental Terminologies & concepts, System oriented names, Human oriented names, Name caches.
Security: Potential attacks to computer system, Cryptography, Authentication, digital signatures, Access Control.

*Text Books*:

1. Sinha Pradeep K., Distributed operating Systems, Concepts & design, PHI, 1998.
2. Tanenbaum Andrews S., Distributed Operating System, Pearson, 1995.

*References*:


1. Coulouris George, Dollimore Jean, Kindberg Tim, Distributed Systems, Concepts & design, Pearson.
2. Silberschatz, Galvin, Operating System Concepts, John Wiley, 5th Edition.


## MCS 1002: Fuzzy Set Theory and Applications

**Unit I**

Introduction, Basic concepts on fuzzy sets, Fuzzy sets versus crisp sets, Properties of alpha-cuts, Representation of fuzzy sets, Extension principle, Fuzzy arithmetic – Fuzzy numbers, Arithmetic operations on fuzzy numbers.

**Unit II**

Operation on fuzzy sets, Fuzzy union, intersection and complement, combinations of operations, Fuzzy relations, Projections & cylindric extentions, Binary fuzzy relations, Fuzzy equivalence and compatibility relations, Fuzzy ordering relations, Fuzzy morphism.

**Unit III**

Fuzzy measures, Belief and possibility measures, Evidence theory, Possibility theory versus Probability theory, Fuzzy logic, Multivalued logic, Fuzzy propositions, Fuzzy qualifiers.

**Unit IV**

Approximate reasoning – Fuzzy expert system (an overview), Fuzzy implications, Selection of fuzzy implication, Multiconditional approximate reasoning, Fuzzy system (general discussion), Fuzzy controllers (overview and example)

**Unit V**

Fuzzy system & neural network, Fuzzy automata, Pattern recognition (introduction), Fuzzy clustering, Fuzzy pattern recognition, Fuzzy image processing.

*Text Books/References*:


1. Fuzzy set theory & application – by G. J. Klir and Folger, Kluwer Academic Publishers, 2nd Ed., 1991.
2. Fuzzy sets and Fuzzy logic theory and application – by George J. Klir and Bo Yuan, PHI pub., 1997
3. Neural Networks and Fuzzy Systems: A Dynamic Systems Approch to Machine Intelligence – by B. Kosko, PHI publication, 1997
4. Neutral Networks in Computer Intelligence – by Limin Fu, McGraw Hill International, 1994
5. Introduction to the Theory of Neural Computations – by John Hertz, Addison Wesley, 1991


## MCS 1003: Cryptography

**Unit I**

Foundations of Cryptography and Security: Ciphers and Secret Messages, Security Attacks and Services.
Mathematical Tools for Cryptography: Substitutions and Permutations, Modular Arithmetic, Euclid's Algorithm, Finite Fields, Polynomial Arithmetic, Discrete Logarithms.

**Unit II**

Conventional Symmetric Encryption Algorithms: Theory of Block Cipher Design, Feistel Cipher Network Structures, DES and Triple DES, Modes of Operation (ECB, CBC, OFB, CFB), Strength (or Not) of DES.

**Unit III**

Modern Symmetric Encryption Algorithms: IDEA, CAST, Blowfish, Twofish, RC2, RC5, Rijndael (AES), Key Distribution.

Stream Ciphers and Pseudo Random Numbers: Pseudo random sequences, Linear Congruential Generators, Cryptographic Generators, Design of Stream Cipher, One Time Pad.

**Unit IV**

Public Key Cryptography: Prime Numbers and Testing for Primality, Factoring Large Numbers, RSA, Diffie-Hellman, ElGamal, Key Exchange Algorithms, Public-Key Cryptography Standards.

Hashes and Message Digests: Message Authentication, MD5, SHA, RIPEMD, HMAC.

**Unit V**

Digital Signatures, Certificates, User Authentication: Digital Signature Standard (DSS and DSA), Security Handshake Pitfalls, Elliptic Curve Cryptosystems.

Authentication of Systems: Kerberos V4 and V5, X.509 Authentication Service.

Digital Watermarking and Steganography

*Text Books*:


1. William Stallings, Cryptography and Network Security: Principles and Practice, 4th Edition, Prentice Hall Publisher, 2005.
2. Bruce Schneier, Applied Cryptography: protocols, algorithms, and source code in C, 2nd Edition, Wiley, 1996.
3. Alfred J. Menezes , Handbook of Applied Cryptography, CRC Press, 1996.
4. Michael Welschenbach , Cryptography in C and C++ , Apress, 2001.
5. Douglas R. Stinson, Cryptography: Theory and Practice, 3rd Edition, Chapman & Hall /CRC, 2005.


*References*:


1. William Stallings, Cryptography and Network Security, 4th.Ed, Prentice Hall PTR, Upper Saddle River, NJ, 2006
2. Wenbo Mao, Modern Cryptography: Theory and Practice, Prentice Hall, 2004
3. Richard A. Mollin, An Introduction to Cryptography, Chapman and Hall/CRC, 2001.
4. B. Schneier, Applied Cryptography, John Wiley and Sons, NY, 1996.
5. A. Menezes, P. Oorshcot, and S. Vanstone, Handbook of Applied Cryptography, CRC Press, Boca Raton, FL, 1997.
6. Thomas H. Barr, Invitation to Cryptography, Prentice Hall, 2002.
7. Richard J. Spillman, Classical and Contemporary Cryptology, Prentice Hall, 2005.


## MCS 1004: Elective –IV

| | |
|---|---|
| MCS 1004: Elective – IV | a) Evolutionary Computation<br>b) Machine Learning<br>c) Computational Geometry<br>d) Clustering and Grid Computing<br>e) Pattern Recognition<br>f) Quantum Computation |

| | |
|---|---|
| | g) Embedded Real Time Systems<br>h) Digital Signal Processing |

## MCS 1004: Elective –IV (a) Evolutionary Computation

**Unit I**
Genetic algorithms - the three main genetic operators, Schema theory, Schema theorem

**Unit II**
The building block hypothesis, implicit parallelism, Exploration versus exploitation, Stochastic models of GAs- reliability model, branching-process model, Markov models

**Unit III**
Convergence analysis, Analysis of Selection, Analysis of crossover, Analysis of mutation-crossover versus mutation

**Unit IV**
Non-canonical GAs. Deception, Evolution strategies, Evolutionary programming, Genetic programming

**Unit V**
Applications of EAs in diverse field - constrained optimization, combinatorial optimization, learning
Hybrid strategies and connections to other soft computing paradigms

*Text Books*:

1. David E. Goldberg: Genetic Algorithms in Search, Optimization and Machine Learning, Addision Wesley, MA, 1989.

*References*:

1. IEEE Transactions on Evolutionary Computation
2. Evolutionary Computation, MIT Press.

## MCS 1004: Elective –IV (b) Machine Learning

**Unit I**
Introduction-Objectives-Taxonomy, Review Basic Tasks, Methods and underlying problems of Machine Learning

**Unit II**
Learning methods such as role, analogical, EBG, EBL, Chunking. Learning form Examples - Version space algorithm, Inductive Concept Learning - Sequence Prediction - Effect of Noise in Input.

**Unit III**
Learning by Analogy- Concept formation - Derivational Analogy, Learning by Observation and Discovery Search for Regularity-Conceptual Clustering

**Unit IV**
ID3 algorithm, important systems and applications to the problem of knowledge acquisition for expert system

**Unit V**
Computational Learning Theory, Connectionist Learning

*Text Books/References*:

1. Michalsky, T. Mitchell, J.Corbonell, Machine Learning Springer-Verlag
2. T. M. Mitchell. Machine Learning, McGraw-Hill, 1997
3. Michalski, Carbonnel & Michel (Eds.): Machine Learning - An A. I. Approach, Vols. I, II & III, Morgan Kaufmann
4. C. J. Thornton: Techniques in Computational Learning, Chapman & Hall Computing

## MCS 1004: Elective –V (c) Computational Geometry

**Unit I**
Introduction: historical perspective, algorithmic background, geometric preliminaries, initial forays
Convex hulls, problem statement and lower bounds, convex hull algorithms, convex hulls in >2 dimensions, extensions and applications

**Unit II**
Polygon approximation: triangular approximations, k-gonal approximations, restricted approximations, other criteria of approximation

**Unit III**
Geometric searching: point-location problems, range-searching problems

**Unit IV**
Proximity: Typical problems and lower bounds, Closest pair problem, Voronoi diagrams, Minimum spanning trees, Triangulations

**Unit V**
Miscellaneous problems: (More) Art gallery problems, Intersections, Pattern recognition, Parallel computational geometry

*Text Books*:

1. Laszlo, Computational Geometry, PHI
2. M.de Berg, Computational Geometry-algorithms & applications, Springer India, 2008

## MCS 1004: Elective –V (d) Clustering and Grid Computing

**Unit I**
Introduction: Motivation, Definitions of Grid Computing, Evolution of the Grid, Differences with similar efforts (Meta, cluster, heterogeneous, Internet), Examples of usage, scope of Grid Computing.

**Unit II**
The Earliest Grid Motivations: High Performance computing across installation sites - the PACX-MPI example, High Throughput computing using non-dedicated workstations – Condor.

**Unit III**

The Building Blocks of Grid: The Globus toolkit, Security - Kherberos vs Globus GSI, Information Services – NWS, Projects over Globus - e.g. Condor-G.

**Unit IV**

HPC and Grids: Scheduling HPC applications in Grids- AppLeS, Scheduling Parameter sweep applications, Metascheduling; Grid RPC mechanisms; Rescheduling.

**Unit V**

Advanced Topics: Data Management in Grids, Grid simulation – MicroGrid, Grid Applications, Grid economy, Grid standards and forums - OGSA, GGF and Other topics

*Text Books:*


1. Ian Foster, Carl Kesselman, The Grid: Blueprint for a New Computing Infrastructure (2nd ed.), 2nd edition, Morgan Kaufmann, 2003.
2. Francine Berman, Geoffrey Fox, Hey, Grid Computing: Making the Global Infrastructure a Reality by John Wiley & Sons, 2003.


*References:*


1. Jarek Nabrzyski, Jennifer M. Schopf, Jon Weglarz, Grid Resource Management: State of the Art and Future Trends, Kluwer Academic Publishers, 2003.
2. Ian Foster, Carl Kesselman, The Grid 2: Blueprint for a New Computing Infrastructure, Morgan Kaufmann, 2003.


## MCS 1004: Elective –IV (e) Pattern Recognition

**Unit I**

Introduction: Examples; The nature of statistical pattern recognition; Three learning paradigms; The sub-problems of pattern recognition; The basic structure of a pattern recognition system; Comparing classifiers.
Bayes Decision Theory: General framework; Optimal decisions; Classification; Simple performance bounds.

**Unit II**

Learning - Parametric Approaches: Basic statistical issues; Sources of classification error; Bias and variance; Three approaches to classification: density estimation, regression and discriminant analysis; Empirical error criteria; Optimization methods; Failure of MLE;
Parametric Discriminant Functions : Linear and quadratic discriminants; Shrinkage; Logistic classification; Generalized linear classifiers; Perceptrons; Maximum Margin; Error Correcting Codes;

**Unit III**

Error Assessment: Sample error and true error; Error rate estimation; Confidence intervals; Resampling methods; Regularization; Model selection; Minimum description length; Comparing classifiers
Nonparametric Classification: Histograms rules; Nearest neighbor methods; Kernel approaches; Local polynomial fitting; Flexible metrics; Automatic kernels methods

**Unit IV**

Feature Extraction: Optimal features; Optimal linear transformations; Linear and nonlinear principal components; Feature subset selection; Feature Extraction and classification stages, Unsupervised learning and clustering, Syntactic pattern recognition, Fuzzy set Theoretic approach to PR,

**Unit V**

Margins and Kernel Based Algorithms: Advanced algorithms based on the notions of margins and kernels

Applications of PR: Speech and speaker recognition, Character recognition, Scene analysis.

*Text Book:*

1. Theodoridis & Koutroumbas, Pattern Recognition, 4th Edition, Academic Press, 2008.

## MCS 1004: Elective –IV (f) Quantum Computation

**Unit I**

Introduction to Quantum Computation, Concept and Fundamental Properties of Cbits and Qbits - Cbits and their states, Reversible Operations on Cbits, Qbits and their states. Reversible Operations on Qbits. The measurement of Qbits, Table: Cbits vs. Qbits Further Features of Dirac Notation. Structure of the general 1-Qbit unitary transformation Structure of the general 1-Qbit state. An application of the formalism: \Spooky action at a distance", A General Remark about the Figures

**Unit II**

Quantum Computation: General features and some simple examples, The general computational process, Deutsch's Problem; Why additional subroutine Qbits needn't mess things up; Some more substantial speed-ups with a quantum computer: Bernstein-Vazirani problem; Simon's problem.The importance of cNOT gates

**Unit III**

Breaking RSA Encryption with a Quantum Computer: Shor's Factoring Algorithm, Number theoretic preliminaries, RSA encryption, Quantum period-finding: setting things up, The Quantum Fourier Transform, Calculating the periodic function, The unimportance of unavoidable small phase errors, Period finding and factoring

**Unit IV**

Searching with a Quantum Computer The Grover iteration, How to construct W, Generalization to several special numbers. Quantum Error Correction.A simplified example of quantum error correction.The physics of error generation, Diagnosing error syndromes.Error correcting codes, The 7-Qbit code, Circuits that make the 7- and 5-Qbit codewords.

**Unit IV**

Quantum cryptography and some simple uses of entanglement, Quantum cryptography, Bit commitment, Quantum dense coding, Teleportation, The GHZ state.

## MCS 1004: Elective –IV (g) Embedded Real Time Systems

**Unit I**

Introduction: Embedded systems overview, design challenge, processor technology, IC technology, Design Technology, Trade-offs. Single purpose processors RT-level combinational logic, sequential logic (RT-level), custom single purpose processor design (RT-level), optimizing custom single purpose processors.
General purpose processors: Basic architecture, operation, Pipelining, Programmer's view, development environment, Application Specific Instruction-Set Processors (ASIPs) – Micro Controllers and Digital Signal Processors.

**Unit II**

State Machine And Concurrent Process Models: Introduction, models Vs. languages, finite state machines with data path model (FSMD), using state machines, program state machine model (PSM), concurrent process model, concurrent processes, communication among processes, synchronization among processes, implementation, data flow model, real-time systems.

**Unit III**

Communication Interface: Need for communication interfaces, RS232 / UART, RS422 / RS485, USB, Infrared, IEEE 1394 Firewire, Ethernet, IEEE 802.11, Blue tooth.

**Unit IV**

Embedded / RTOS Concepts – I: Architecture of the Kernel, Tasks and Task scheduler, Interrupt service routines, Semaphores, Mutex. Mailboxes, Message Queues, Event Registers, Pipes, Signals
Timers, Memory Management, Priority inversion problem, Embedded operating systems Embedded Linux, Real-time operating systems, RT Linux, Handheld operating systems, Windows CE.

**Unit V**

Design technology: Introduction, Automation, Synthesis, Parallel evolution of compilation and synthesis, Logic Synthesis, RT synthesis, Behavioral Synthesis, Systems Synthesis and Hardware/ Software Co-Design, Verification, Hardware/Software co-simulation, Reuse of intellectual property codes.

*Text Books*:


1. Frank Vahid, Tony D. Givargis, Embedded System Design – A Unified Hardware/Software Introduction, John Wiley, 2002.
2. KVKK Prasad, Embedded / Real Time Systems, Dreamtech Press, 2005.


*References*:


1. Jonathan W. Valvano, Embedded Microcomputer Systems, Brooks / Cole, 2000.
2. David E. Simon, An Embedded Software Primer, Pearson Ed., 2005.
3. Raj Kamal, Introduction to Embedded Systems, TMS, 2002.

4 Sri Ram V Iyer, Pankaj Gupta, Embedded Real Time Systems Programming, TMH, 2004.

## MCS 1004: Elective –IV (h) Digital Signal Processing

**Unit I**

Introduction, Overview of digital signal processing

Review of: Discrete – Time linear system, Sequences, arbitrary sequences, linear time invariant system, causality, stability. Difference equation, relation between continuous and discrete system, Classifications of sequence, recursive and non-recursive system

Review of: Mathematical operations on sequences: Convolution, graphical and analytical techniques, overlap and add methods, matrix method, some examples and solutions of LTI systems, MATLAB examples.

**Unit II**

Z-transform: Definition, relation between Z transform and Fourier transform of a sequence, properties of Z transform, mapping between S-plane and Z-plane. Unit circle, convergence and ROC, Inverse Z-transform, solution of difference equation using the one sided Z-transform MATLAB examples.

**Unit III**

Discrete Fourier transform: Definition, inverse discrete Fourier transform (IDFT) Twiddle factor, linear transformation, basic properties, circular convolution, multiplication of DFT, linear filtering using DFT, filtering of long data sequences, overlap add and save method. Computation of DFT, Fast Fourier transform (FFT), FFT algorithm, Radix 2 algorithm. Decimation-in-time and decimation-in- frequency algorithm, signal flow graph, butterflies, Chirp z-transform algorithm, MATLAB examples

**Unit IV & V**

Digital filter realization: Principle of digital filter realization, structures of All-zero filters. Design of FIR (Finite impulse response) filters, linear phase, windows-rectangular, Berlitt, Hanning, Hamming and Blackman. Design of infinite impulse response filters (IIR) from analog filters. Bilinear transformation, Butterworth, Chebyshev, Elliptic filters. Optimisation method of IIR filters. Some example of practical filter design. Computer aided filter design, MATLAB examples

*Text Books:*


1. Ifeachor, Digital Signal Processing, Pearson, 2nd Edition, 2002.
2. R. G. Lyons, Understanding Digital Signal Processing, Prentice Hall, 2010
3. L.R. Rabiner & B.Gold, Theory and Application of Digital Signal Processing, PHI, 2009.
4. J.G. Proakis & D.G. Manolakis, Digital Signal Processing, Principles, Algorithms and Applications, PHI , 2008.
5. S. Salivahanan et al., Digital Signal Processing, TMH


References:


1. Chen, Digital Signal Processing, OUP
2. Meyer-Basse U, Digital Signal Processing with FPGA, Spriger India, 2007.
3. Ingle, Digital Signal Processing using MATLAB, Vikas Publishing House, 2001.
4. Babu R, Digital Signal Processing, Scitech Publications, 2010.
5. S. K. Mitra, Digital Signal Processing - A Computer based approach, TMH, 2006.
6. Xavier, Digital Signal Processing, S. Chand, 2003
7. Pradhan, Digital Signal Processing Applications, Jaico

## MCS 1005: Laboratory – 10: Project work

The Project gives an opportunity to the student to use the methodologies/techniques taught in several courses in the curriculum. The topics for the project to be undertaken by the department, after deliberations among the faculty members, shall be notified to the students. The project is to be carried out under the guidance of a faculty member of the department. A student should submit 3 copies of dissertation for evaluation at the end of the semester and present his project as a seminar topic. The external examiner in consultation with the internal examiner shall carry out the adjudication, after giving due weightage to the work carried out in the project, the presentation of the project, and viva voice. The guide/supervisor will be the internal examiner and external shall be appointed from a panel of examiners.

**Marks Distribution:**

| | |
|---|---|
| **Internal Assessment:** | 25 marks |
| **Dissertation:** | 50 marks |
| **Presentation and Viva Voce:** | 25 marks |
| **Total:** | 100 marks |