Computer Science & Engineering Syllabus

COURSE STRUCTURE OF
B. TECH IN
COMPUTER SCIENCE & ENGINEERING

THIRD SEMESTER

A. Theory							
Sl. No.	**Code**	Subject	**Contacts Periods/Week**				**Credits**
			L	**T**	**P**	**Total**	
1.	M 301	Mathematics	3	1	--	4	4
2.	CS 302	Data Structure & Algorithms	3	1	--	4	4
3.	EE 301	Circuit Theory & Networks	3	1	--	4	4
4.	CS 303	Computer Organisation	3	0	--	3	3
5.	EC 312	Digital Electronics & Logic Design	3	1	--	4	4
6.	CS 301	Principles of Programming Language	3	0	-	3	3
Total Theory						**22**	**22**
B. Practicals							
1.	CS 392	Data Structures Lab	--	--	3	3	2
2.	EC 382	Digital Electronics and Logic Design	--	--	3	3	2
3.	CS 391	Lab	--	--	3	3	2
4.	EE 391	Programming Practice Lab Circuits & Networks Lab			3	3	2
Total Practical						**12**	**8**
Total of Semester						**32**	**29**

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FOURTH SEMESTER

A.THEORY:

A. Theory							
Sl. No.	**Code**	**Theory**	**Contacts Periods/Week**				**Credits**
			L	**T**	**P**	**Total**	
1	M 401	Mathematics	3	1	0	4	4
2	CS 401	Formal Language & Automata Theory	3	1	0	4	4
3	CS 402	Operation Research & Optimization Techniques	3	1	0	4	4
4	EC 411	Principles of Communication Engg		0	0	3	3
5	CS 403	Advanced Computer Architecture	3	1	0	4	4
Total Theory						**19**	**19**

B.PRACTICAL:

B. Practical							
Sl. No.	**Code**	**Practical**	**Contacts Periods/Week**				**Credits**
			L	**T**	**P**	**Total**	
1	CS 492	Operation Research Lab	0	0	3	3	2
2	CS 493	Computer Architecture & Organization Lab	0	0	3	3	2
3	EC 481	Communication Engg. Lab	0	0	3	3	2
Total Practical						**9**	**6**

C. SESSIONAL :

HU 481	Technical Report writing & / Language Practice Lab	0	0	0	3	2
	TOTAL OF SESSIONAL				3	2
	TOTAL of Semester :				**31**	**27**

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FIFTH SEMESTER

A. THEORY

Sl. No.	Code	THEORY	Contact Periods/Week			Total	Credits
			L	T	P		
1.	CS501	Operating System	3	0	--	3	3
2.	CS 502	Database Management System Design & Analysis of Algorithm	3	0	-- --	3	3
3.	CS 503	Microprocessor & Microcontrollers	3	1	--	4	4
4.	EI 502	Control System	3	1	--	4	4
5.	EE 503		3	1		4	4
TOTAL THEORY						**18**	**18**

B. PRACTICAL

Sl. No.	Code	PRACTICAL	Contact Periods/Week			Total	Credits
			L	T	P		
1.	CS591	Operating System Lab	0	0	3	3	2
2.	CS 592	Database Management System Lab	0	0	3	3	2
3.	EI 592	Microprocessor & Microcontrollers Lab	0	0	3	3	2
4.	EE 593	Control System Lab	0	0	3	3	2
TOTAL PRACTICAL						**12**	**8**

C. SESSIONAL

Sl. No.	Code	SESSIONAL				Total	Credits
			0	**0**	**0**	**0**	**0**
TOTAL OF SESSIONAL						**0**	**0**

TOTAL OF SEMESTER **30 26**

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SIXTH SEMESTER

A. THEORY

Sl. No.	Code	THEORY	Contact Periods/Week			Total	Credits
			L	T	P		
1.	CS 601	Computer network	3	1	--	4	4
2.	CS 602	Software Engineering	3	1	--	4	4
3.	CS 603	Computer Graphics & Multimedia	3	0	--	3	3
4.	CS 604	System Software and Administration	3	0	--	3	3
5.	CS 605	Object Technology & UML	3	0	--	3	3
TOTAL THEORY						**17**	**17**

B. PRACTICAL

Sl. No.	Code	PRACTICAL	Contact Periods/Week			Total	Credits
			L	**T**	**P**		
1.	CS 691	Computer network Lab	0	0	3	3	2
2.	CS 693	Computer Graphics & Multimedia Lab	0	0	3	3	2
3.	CS 694	System Software & Administration Lab	0	0	3	3	2
4.	CS 695	Object Technology Lab	0	0	3	3	2
TOTAL PRACTICAL						12	8

C. SESSIONAL

Sl. No.	Code	SESSIONAL				Total	Credits
1.	CS 682	Gr. Discussion & seminar				3	2
TOTAL OF SESSIONAL						3	2
TOTAL OF SEMESTER						**32**	**27**

6-Week Industrial Training during Summer Vacation

Computer Science & Engineering Syllabus

SEVENTH SEMESTER

A. THEORY

Sl. No.	Code	THEORY	Contact Periods/Week			Total	Credits
			L	T	P		
1.	CS 701	Language Processor	3	0	--	3	3
2.	CS 702	Artificial Intelligence	3	0	--	3	3
3.	CS 703	Visual Programming and Web technology	3	0	--	3	3
4.	HU 701	Financial Management and accounts	3	0	--	3	3
5.	CS 704	Elective I	3	0	--	3	3
TOTAL THEORY						15	15

B. PRACTICAL

Sl. No.	Code	PRACTICAL	Contact Periods/Week			Total	Credits
			L	T	P		
1.	CS 792	Artificial Intelligence lab	0	0	3	3	2
2.	CS 793	Visual Programming and Web Technology Lab	0	0	3	3	2
3.	CS 795	Assigned Project				6	4
TOTAL PRACTICAL						12	8

C. SESSIONAL

Sl. No.	Code	SESSIONAL				Total	Credits
1.	CS 781	Practical Training Evaluation					2
2.	CS 782	Seminar on Assigned /Selected Topic		0	3	3	2
TOTAL OF SESSIONAL						3	5
TOTAL OF SEMESTER						**30**	**27**

ELECTIVE I

CS 704A Distributed Database
CS 704B Bio Informatics
CS 704C Parallel Programming
CS 704D Advanced Operating System
CS 704E Computational Geometry
CS 704F Modeling & Simulation
CS 704G Image Processing
CS 704 H Network Applications(For Ceramic Technology College only)

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EIGHTH SEMESTER

A. THEORY

Sl. No.	Code	THEORY	Contact Periods/Week			Total	Credits
			L	T	P		
1.	HU 801	Values & Ethics in profession	**3**	**0**	**--**	**3**	**3**
2.	HU 802	Industrial Management	**3**	**0**	**--**	**3**	**3**
3.	CS 801	Elective II	**3**	**0**	**--**	**3**	**3**
4.	CS 802	Elective III	**3**	**0**	**--**	**3**	**3**
TOTAL THEORY						12	12

B. PRACTICAL

Sl. No.	Code	PRACTICAL	Contact Periods/Week			Total	Credits
			L	T	P		
1.	CS 893	Assigned Project			12	12	8
TOTAL PRACTICAL						12	8

C. SESSIONAL

Sl. No.	Code	SESSIONAL				Total	Credits
1.	CS 881	Comprehensive Viva-Voce					4
2.	CS 882	Personality Development			3	3	2
TOTAL OF SESSIONAL						3	6

TOTAL OF SEMESTER **27 26**

ELECTIVE II

CS 801A Robotic Control
CS 801B Soft Computing
CS 801C Digital Signal Processing
CS 801D VLSI Design
CS 801E E-Commerce and ERP
CS 801F Pattern Recognition

ELECTIVE III

CS 802A Mobile Computing
CS 802B Real Time & Embedded System
CS 802C GIS & Remote Sensing
CS 802D Network Security
CS 802E Advanced Java Programming
CS 802F Natural Language Processing

Computer Science & Engineering Syllabus

Third Semester
DETAILED SYLLABUS

Mathematics
Code: M 301
Contact: 3L + IT
Credit: 4

Probability:

Random Experiment; Sample space; Random Events; Probability of events. Axiomatic definition of probability; Frequency Definition of probability; Finite sample spaces and equiprobable measure as special cases; Probability of Non-disjoint events (Theorems). Counting techniques applied to probability problems; Conditional probability; General Multiplication Theorem; Independent events; Bayes' theorem and related problems. *10L*

Random variables (discrete and continuous); Probability mass function; Probability density function and distribution function. Distributions: Binomial, Poisson, Uniform, Exponential, Normal, t and χ^2. Expectation and Variance (t and χ^2 excluded); Moment generating function; Reproductive Property of Binomal; Poisson and Normal Distribution (proof not required). Transformation of random variables (One variable); Chebychev inequality (statement) and problems. *10L*

Binomial approximation to Poisson distribution and Binomial approximation to Normal distribution (statement only); Central Limit Theorem (statement); Law of large numbers (Weak law); Simple applications. *6L*

Statistics:

Population; Sample; Statistic; Estimation of parameters (consistent and unbiased); Sampling distribution of sample mean and sample variance (proof not required). *18L*
Point estimate: Maximum likelihood estimate of statistical parameters (Binomial, Poisson and Normal distribution). Interval estimation.

Testing of Hypothesis:

Simple and Composite hypothesis; Critical Region; Level of Significance; Type I and Type II Errors; Best Critical Region; Neyman-Pearson Theorem (proof not required); Application to Normal Population; Likelihood Ratio Test (proof not required); Comparison of Binomial Populations; Normal Populations; Testing of Equality of Means; χ^2—Test of Goodness of Fit (application only).

Simple idea of Bivariate distribution; Correlation and Regression; and simple problems. *4L*
Total ***48L***

Data Structures and Algorithms
Code: CS 302
Contact: 3L + IT
Credit: 4

Overview of C language
Time and Space analysis of Algorithms - Order Notations.

Linear Data Structures - Sequential representations - Arrays and Lists, Stacks, Queues and Dequeues, strings, Application.

Linear Data Structures, Link Representation - Linear linked lists, circularly linked lists. Doubly linked lists, application.

Recursion - Design of recursive algorithms, Tail Recursion, When not to use recursion, Removal of recursion.

Non-linear Data Structure: Trees - Binary Trees, Traversals and Threads, Binary Search Trees, Insertion and Deletion algorithms, Height-balanced and weight-balanced trees, B-trees, B+ -trees, Application of trees; Graphs - Representations, Breadth-first and Depth-first Search.

Hashing - Hashing Functions, collision Resolution Techniques.

Sorting and Searching Algorithms- Bubble sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and Radix Sort.

File Structures - Sequential and Direct Access. Relative Files, Indexed Files - B+ tree as index. Multi-indexed Files, Inverted Files, Hashed Files.

Text book :

1. Data Structures and Algorithms – O.G. Kakde & U.A. Deshpandey, ISTE/EXCEL BOOKS
2. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., "Data Structures and Algorithms", Addison Wesley
3. Drozdek- Data Structures and Algorithms,Vikas

References :

1.Heileman:data structure algorithims &Oop Tata McGraw Hill
2. Data Structures Using C – M.Radhakrishnan and V.Srinivasan, ISTE/EXCEL BOOKS
3. Weiss Mark Allen, "Algorithms, Data Structures, and Problem Solving with C++", Addison Wesley.
4. Horowitz Ellis & Sartaj Sahni, "Fundamentals of Data Structures", Galgotria Pub.
5 Tanenbaum A. S. , "Data Structures using 'C' "
6 Ajay Agarwal: Data structure Through C.Cybertech

Circuit Theory & Networks
Code: EE 301
Contact: 3L + IT
Credit: 4

Different types of systems & networks: continuous & Discrete, Fixed and Time varying, Linear and Non-linear, Lumped and distributed, Passive & Active Networks & Systems
Laplace transform of impulse and sinusoidal steps waveforms for RL, RC, LC and RLC Circuits. Transient analysis of different electrical circuits with and without initial conditions, Fourier Series and Fourier Transform
Network theorems and their applications in circuit analysis, Formulation of network equations, Source transformations, Loop variable analysis and node variable analysis
Graph of network, concept of tree branch, tree link. Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials
Two port networks, Open circuit Impedance and Short circuit Admittance parameters, Transmission parameters, hybrid parameters, and their inter-relations
Indefinite admittance matrix- their applications to the analysis of active network
Active filter analysis and synthesis using operational amplifier

SPICE: How SPICE works. Model statement, models for passive and active device, D.C. circuits analysis, small signal analysis, capacitors and inductors in D.C. Circuits, steady state and transient, plotting and printing, input and output Impedance, D.C. sensitivity analysis, harmonic decomposition (Fourier Series), Harmonic re-composition, voltage controlled components

***Text books* :**

1. Sudhakar:Circuits & Networks:Analysis & Synthesis 2/e TMH New Delhi
2. Valkenburg M. E. Van, "Network Analysis", Prentice Hall.
3.Engineering circuit analysis with PSPICE and probe-Roger
1. Engg Circuit Analysis,: Hayt 6/e Tata Mcgraw-Hill
2. A. Chakravarty: Networks, Filters & Transmission Lines
3. D.Chattopadhyay and P.C.Rakshit: Electrical Circuits
4. A.V. Oppenheimer and A.S.Wilsky: Signals & Systems, PHI
5. R.V.Jalgaonkar.: Network Analysis & Synthasis.EPH.
6. Sivandam- Electric Circuits Analysis.,Vikas
    1.

***References* :**

a. Reza F. M. and Seely S., "Modern Network Analysis", Mc.Graw Hill Book Company
b. Roy Choudhury D., "Networks and Systems", New Age International Publishers.
c. Kuo F. F., "Network Analysis & Synthesis", John Wiley & Sons.

Computer Science & Engineering Syllabus

Computer Organization
Code: CS 303
Contact: 3L
Credit: 3

Concepts and Terminology: Digital computer components Hardware & Software and their dual nature, Role of Operating Systems (OS).

The ALU: ALU organization, Integer representation, Serial and Parallel Adders, is 1s and 2s complement arithmetic, Multiplication of signed binary numbers, Floating point number arithmetic, Overflow detection, Status flags.

Memory Unit: Memory classification, Bipolar and MOS storage cells. Organization of RAM, address decoding, Registers and stack, ROM and PROM-basic cell. Organization and erasing schemes, Magnetic memories-recording formats and methods. Disk and tape Units. Concept of memory map. Timing diagrams, T-States, Timing diagram Controlling arithmetic and logic instructions. Instruction sequencing with examples. Introduction to Micro-programming, Variations in Micro-programming configuration.

General Organization: Instruction work formats, Addressing modes registers, Von-Neumann concept, Interconnecting system components, Interfacing buses, Timing diagrams, Examples from popular machines.

Text books **:**

1 Hayes J. P., "Computer Architecture & Organisation", McGraw Hill,
2 Hamacher, "Computer Organisation",
3 Computer Organization and System Software, EXCEL BOOKS
4. Chaudhuri P. Pal, "Computer Organisation & Design", PHI,
5. Mano, M.M., "Computer System Architecture", PHI.
6. Burd- System Architecture,Vikas
7. Computer Organization & Architecture (TMH WBUT Series), Ghosh & Pal, TMH

Digital Electronics & Logic Design
Code : EC 312
Contacts : 3L + 1T
Credits :3

Data and number systems, Binary representation, Codes and their conversions: BCD, Octal, Hexadecimal, ASCII, EBDIC, Gray, Signed binary number representation with 1's and 2's complement methods, Binary arithmetic
Boolean algebra, Venn diagram, logic gates and circuits, Minimization of logic expressions by algebraic method, K-map method and Quine Mc Clauskey method
Combinational circuits- adder, subtractor, encoder, decoder, comparator, multiplexer, de-multiplexer, parity generator, etc
Design of combinational circuits-Programming logic devices and gate arrays
Sequential Circuits- Flip Flops, various types of Registers and counters and their design, Irregular counter, State table and state transition diagram, sequential circuits design methodology
Memory devices- ROM, RAM, EPROM, EEPROM, etc
Different types of A/D and D/A conversion techniques
Different Logic families- TTL, ECL, MOS and CMOS, their operation, design and specifications

Text books:

1. Givone: digital Principles &design ,TMH
2. Digital Electronics – Dr. Saroj Rangnekar , ISTE/EXCEL BOOKS
3. Malvino:Digital Principles &application TMH
4. Jain :Modern Digital Electronics 2/e TMH
5. Marcovitz:Intro to logic Design Tata Mcgraw-hill
6. Digital Integrated Electronics- H.Taub & D.Shilling, Mc Graw Hill
7. Digital Technology- Virendra Kumar, New Age
8. Digital Logic Design- Morries Mano, PHI
9. Yarbrough- Digital Logic,Vikas
10. Salivahan- Digital Circuits and Design, Vikas

Principals of Programming Languages
Code : CS 301
Contacts : 3L
Credits :3

Concepts of structural program development; concept of data types; precedence and associatively of operators; conditional transfer; deterministic and in-deterministic loops; recursions; functions and procedures - call by value, call by reference and their differences; programming for numerical methods; records.

Data-type handling and various constructs (conditional, loop, functions etc); pointers: concept of pointers and passing parameters using pointers, non-numeric processing, concept of arrays of pointers and pointers to pointers; structures and unions – advantage of using structures, concept of information hiding, pointers to structures; files - basic concept of various types of file access methods: sequential, indexed sequential, random, various statements for file handling

Advanced Programming Languages like C++, ADA, LISP, PROLOG, and PASCAL. Comparison of various languages

Text books:

1. Tennence W.Pratt, "Programming languages design and implementation", Prentice Hall of India.
2. Allen B. Tucker, "Programming Languages", Tata McGraw Hill.
3. Gottfried BS – Programming with C, TMH pub.
4. Balagurusamy:ANSI C TMH
5. Kanetkar, Yashvant – Understanding Pointers in C- 2nd Edn. BPB
5. Kanetkar, Yashvant - Let us C. - 3rd revised Edn. BPB
6. Roosta- Foundation of Programming Languages,Vikas
7. Jeyapoovan- A First Course in Prog with C, Vikas
8. Programming In C++, Y.I. Shah and M.H. Thaker, ISTE/EXCEL BOOKS
9. Fundamentals of Programming Languages, R. Bangia,Cyber Tech

Data Structure Lab
Code: CS 392
Contact: 3P
Credit: 2

Experiments should include but not limited to :
Implementation of array operations:
Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem : Evaluation of expressions operations on Multiple stacks & queues :
Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queues using linked lists:
Polynomial addition, Polynomial multiplication
Sparse Matrices : Multiplication, addition.
Recursive and Nonrecursive traversal of Trees
Threaded binary tree traversal. AVL tree implementation
Application of Trees. Application of sorting and searching algorithms
Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

Digital Electronics & Logic Design Lab
Code: EC 382
Contact: 3P
Credit: 2

List of Experiments:

1. Realization of NOT, OR, AND, XOR, XNOR gates using universal gates
2. A. Gray to Binary conversion & vice-versa.
   B. Code conversion between BCD and EXCESS-3

3. A. ODD and even parity generation and checking.
   B. 4-bit comparator circuit
4. Design of combinational circuit to drive seven-segment display
5. Design of combinational circuits using multiplexer
6. A. Adder/Subtractor circuits using Full-Adder using IC and/ or logic gates. B. BCD Adder circuit using IC and/ or logic gates
7. Realization of RS, JK, and D flip flops using Universal logic gates
8. Realization of Asynchronous up/down counter
9. Realization of Synchronous Mod-N counter
10. Digital to Analog conversion

Programming Practice Lab
Code: CS 391
Contacts: 3P
Credits: 2

Concepts of flow charts and decision tables, Examples and practice problems
Introduction to Digital Computers and its components, Introduction to DOS and UNIX Operating System

Development of Computer Program using C language- Roots of quadratic and Cubic equations; Summation of N Natural numbers; Arranging numbers in ascending and descending orders; Separation of odd and even numbers, problems on recursion, Arrays, Pointers, and File handling, etc.

Circuits & Networks Lab
Code: EE 391
Contact: 3P
Credit: 2

List of Experiments:

1. Transient response in R-L and R-C Network: Simulation/hardware
2. Transient response in R-L-C Series & Parallel circuits Network: Simulation/hardware
3. Determination of Impedance (Z) and Admittance(Y) parameters of two port network
4. Frequency response of LP and HP filters
5. Frequency response of BP and BR filters
6. Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse, Ramp signals using MATLAB in both discrete and analog form
7. Evaluation of convolution integral, Discrete Fourier transform for periodic & non-periodic signals and simulation of difference equations using MATLAB
8. Representation of poles and zeros in z-plane, determination of partial fraction expansion in z-domain and cascade connection of second order system using MATLAB
9. Determination of Laplace transform and inverse Laplace transformation using MATLAB
10. Spectrum analysis of different signals

Note: An Institution/College may opt for some other software or hardware simulation wherever possible in place of MATLAB

Fourth Semester
COMPUTER SCIENCE

Mathematics
M 401
Contact: 3L + IT
Credit: 4

Sets and functions: Groups, Semigroups and monoids, Cyclic semigroups and submonoids, Subgroups and Cosets, Congruence relations on Semigroups. Morphisms, Normal subgroups. Structure of cyclic groups, permutation groups, dihedral groups. Elementary applications in coding theory.

Rings and Boolean algebra: Rings, Subrings, morphism of rings, ideals and quotient rings. Euclidean domains. Integral domains and fields. Boolean Algebra - direct product, Morphisms. Boolean sub-algebra. Boolean Rings. Applications of Boolean algebra in logic circuits and switching functions.
Recursion and Recurrence Relation: Basic idea, Sequence and discrete function. Generating functions and applications.
Graph Thoery: Graphs, Digraphs, Isomorphism, Walks, Paths, Circuits, Shortest Path Problem, Dijkstra's Algorithm, Trees, Properties of Trees, Cotrees and Fundamental Circuits, Shortest Spanning Trees - Kruskal's Algorithm,Prim's Algorithm,DFS,BFS, Cut Sets, Fundamental Cut Sets and Cut Vertices, Planar and Dual Graphs, Metric Representation of Graphs, Networks, Flow Augmenting Path, Ford-Fulkerson Algorithm for Maximum Flow.

***Text*:**

1. Liu C. L., "Introduction to combinatorial mathematics", McGraw Hill, 1968.
2 Mott J. L., Kandel A. and Baker T. P., "Discrete mathematics for Computer Scientists and Mathematicians", PH, 1986.
3 Rosen—Discrete Mathematics, 2/e,TMH
4 S.K. Mapa—Higher Algebra (Abstract & Modern)
5 Robert J. McElice , Robert B. Ash & Carol Ash, "Introduction to discrete Mathematics", Tata McGraw Hill
6 Deo N., "Graph Theory with Applications to Engineering and Computer Science", PHI, 1980
7 Tremblay and Manohar, "Discrete mathematical structures with applications to computer science", McGraw Hill, 1975
8 Kolamn, Busby and Ross, "Discrete mathematical structures", 3/ed, PHI, 1996.
9 Fraleigh J. B., "A first course in abstract algebra Narosa", 1990
10 Smullyan R. M., "First Order Logic Springer Verlag", 1968

Reference:

1.Lipschutz—2000 Solved Problems in Discrete Mathematics, TMH
2.Balakrishnan—Graph Theory (Schaum),MH
3.Hararay—Graph Theory

Formal Language and Automata Theory
Code: CS 401
Contact: 3L + IT
Credit: 4

Finite State Machines : Definition, concept of sequential circuits, state table & state assignments, concept of synchronous, asynchronous and liner sequential machines.
Finite State Models : Basic definition, mathematical representation, Moore versus Mealy m/c, capability & limitations of FSM, state equivalence & minimization, machine equivalence, incompletely specified machines, merger graph & compatibility graph, merger table, Finite memory, definite, information loss less & inverse machines : testing table & testing graph.
Structure of Sequential Machines : Concept of partitions, closed partitions, lattice of closed partitions, decomposition : serial & parallel.
Finite Automation : Preliminaries (strings, alphabets & languages, graphs & trees, set & relations), definition, recognition of a language by an automata - idea of grammar, DFA, NFA, equivalence of DFA and NFA, NFA with e-moves, regular sets & regular expressions : equivalence with finite automata, NFA from regular expressions, regular expressions from DFA, two way finite automata equivalence with one way, equivalence of Moore & Mealy machines, applications of finite automata.
Closure Properties of Regular Sets : Pumping lemma & its application, closure properties minimization of finite automata : minimization by distinguishable pair, Myhill-Nerode theorem.

Context Free Grammars : Introduction, definition, derivation trees, simplification, CNF & GNF.

Pushdown Automata : Definition, moves, Instantaneous Descriptions, language recognised by PDA, deterministic PDA, acceptance by final state & empty stack, equivalence of PDA and CFL.

Closure Properties of CFLs : Pumping lemma & its applications, ogden's lemma, closure properties, decision algorithms.

Introduction to Z. Regular language properties and their grammars. Context sensitive languages.

***Text books* :**

1. Hopcroft JE. and Ullman JD., "Introduction to Automata Theory, Languages & Computation", Narosa.
2. K.L.P Mishra & N. Chandrasekharan – "Theory of Computer Science", PHI
3. Ash & Ash – "Discrete Mathematics",TMH
4. Martin—Introduction
5. Lewis H. R. and Papadimitrou C. H., "Elements of the theory of Computation", P.H.I.
6. Kain, "Theory of Automata & Formal Language", McGraw Hill.

References **:**

1. Kohavi ZVI, "Switching & Finite Automata", 2nd Edn., Tata McGraw Hill.

2. Linz Peter, "An Introduction to Formal Languages and Automata", Narosa
3. "Introduction to Formal Languages", Tata McGraw Hill, 1983.

Operation Research and Optimization Techniques
CS 402
Contact: 3L + IT
Credit: 4

Introduction to OR modelling approach and various real life situations
Linear programming problems and applications, Various components of LP problem formulation, Solving Linear Programming problem using simultaneous equations and Graphical Method, Simplex Method and extensions, Sensitivity analysis - Duality theory, Revised Simplex Transportation and assignment problems

Network Analysis-shortest Paths, Maximal Flow including PERT-CPM. Integer programming concepts, formulation, solution and applications.

Dynamic Programming—Modeling , Optimization, Replacement.

Game Theory—Introduction, Decisions under risk, Decisions under uncertainty

Queuing Theory—Introduction, basic definitions & notations, axiomatic derivation of the arrival & departure distributions for Poission Queue, Poission Queuing model, M/M/I queues in series , application.

Text:

1. Hamdy A. Taha, "Operations Research", Fifth edn. , Macmillan Publishing Company, 1992.
2. V.K. Kapoor-- Operations Research
3. Kanti Swaroop-- Operations Research
4. Hadley G., "Linear Programming", Narosa Publishers, 1987.
5. Hillier & Lieberman—Introduction to Operations Research, 7/e (with CD),TMH
6. Hiller F. and Leibermann G. J., "Operation Research", Holder Day Inc, 1974.

Reference:

1. Operations Research – Schaum outline series, MH

Principles of Communication Engineering
EC 411
Contact: 3L
Credit: 3

Amplitude and Frequency Modulation – their generation and detection Bandwidth requirements Low Power and High Modulators and Modulated amplifiers. Superheterodyne detection. Signal to Noise ratio of A.M. and P.M. transmission.

A/D, D/A Converters. Shannon's sampling Theorem. PAM, PWM, PPM and PCM. Their generation and detection.

Digital Modulation : ASK, FSK, PSK performance evaluation. Time Division Multiplexing and Demultiplexing. Modems, Error control and coding, Channel capacity.

Data Transmission Synchronization, Data protection, error detection and correlation.

Elements of Satellite Communication tracking and control.

Text :

1. Taub H. and Shilling D. L., "Principles of Communication Systems", 2/e,TMH
2. Carlson R. B., "Communication Systems ,4/e, Mc.Graw Hill
3. Haykin S. S., "An Introduction to Analog and Digital Communication Systems", Wiley Eastern.
4. Lathi B. P., "Communication Systems", John Wiley.

Reference:

1.Kennedy—Electronic Communication Systems, 4/e , TMH

Advanced Computer Architecture
CS 403
Contacts: 3L + 1T
Credits: 4

Review of Pipelining, Examples of some pipeline in modern processors, pipeline hazards, data hazards, control hazards. Techniques to handle hazards, performance improvement with pipelines and effect of hazards on the performance.

Vector processors- Use and effectiveness, memory to memory vector architectures, vector register architecture, vector length and stride issues, compiler effectiveness in vector processors.

SISD, MISD, MIMD, Single instruction multiple data stream (SIMD) architectures. Array processors, comparison with vector processors, example of array processors such as MMX Technology.

Memory hierarchy, Cache Introduction, Techniques to reduce cache misses, techniques to reduce cache penalties, technique to reduce cache hit times. Effect of main memory bandwidth, effect of bus-width, memory access time, virtual memory, etc.

RISC architectures, addressing modes, instructions formats, effect of simplification on the performance, example processors such as MIPS, PA-RISC, SPARC, Power PC, etc.

MIMID Multiprocessors, Centralized shared architectures, distributed shared memory architectures, synchronization and memory consistency models, message passing architectures, comelier issues. Data flow architectures, Interconnection networks.

Text Books:

1. Hwang, K. "Advanced Computer architecture with parallel programming", McGraw Hill, 1993
2. Carter—Computer Architecture (Schaum Series),TMH
3. Patterson D.A. and Hennessy , J.L. "Computer architecture a quantitative approach", 2nd ed., Morgan Kaufman, 1996
4. Hwang & Briggs—Computer Architecture & Parallel Processing, TMH
5. Stone, H.S., "Advanced Computerat", Addison Wesley, 1989
6. Siegel, H.J., "Interconnection Network for Large Scale parallel Processing", 2nd Ed., McGraw Hill, 1990
7. Computer Organization & Architecture (TMH WBUT Series), Ghosh & Pal,TMH

Reference:

Quinn—Parallel Processing

Operation Research Lab
CS-492
Contacts: 3P
Credits: 2

Software based lab using C & FORTRAN .

For FORTRAN:

1) Familiarization with FORTRAN. (3)

2) Linear Programming (Tranportation , Assignment , Duality , Simplex)

For C-Language:

1) Shortest Path(Dijkstra's , Floyd's Algorithm)
2) Maximal Flow.
3) PERT/CPM
4) Queueing Theory
5) Integer Programming Problem (Branch & Bound Problem)

N:B:-Familiarization with any O.R package.

Computer Architecture & Organisation Lab
Code: CS 493
Contacts: 3P
Credits: 2

1. Review of the different logic design ckts., e.g.
   a) Flip/Flop(RS, JK, D, T), b)Register,(4/8 bit Synchronized Data Transfer),
   c)Tri-state logic Gates

2. Familiarity with state of art IC-chips, e.g.
   a) Multiplexer , b) Decoder, c) Encoder, d) Counter, e)Shift-Register, f)adder
   Truth Table verification and clarification from Data-book.
3. Design a BCD adder.
4. Design an Adder/Subtracter composite unit .
5. Design a carry-look ahead Adder.
6. Design a ripple counter and carry-look ahead counter and assess the complexity of both the ckts.

7. Use a multiplexer unit to design a composite ALU .
8. Design a multiplex display unit using counter, multiplexer, decoder etc.
9. Design a keyboard Encoder unit in 2 Dimension.
10. Test a RAM chip and cascade two chips for vertical and horizontal expansion. Use wired OR tri-state output interconnection.
11. Use ALU chip for multibit arithmetic operation.

Communication Engg. Lab
EC 481
Contacts: 3P
Credits: 2

1. Study of Amplitude modulation & Demodulation technique.
2. Study of Double Side Band Suppressed Carrier (DSB-SC) & Demodulation technique.
3. Study of Single Side Band Suppressed Carrier (SSB-SC) & Demodulation technique.
4. Study of Frequency Modulation & Demodulation.
5. Study of Time Division Multiplexing (TDM) & Demultiplexing.
6. Study of Frequency Shift Keying (FSK).
7. Study of Pulse Amplitude Modulation (PAM).
8. Study of Pulse Width Modulation (PWM).
9. Study of VCO (Voltage controlled oscillator) & PLL (Phase Locked Loop).

TECHNICAL REPORT WRITING & / LANGUAGE PRACTICE LABORATORY

Code: HU 481
Contact: 3
Credits: 2

Topics to be covered and number of hours required for it:

1. Introductory lecture is to be given to the students so that they get a clear idea of the syllabus and understand the need for having such a practice lab in the first place (3 hours)

2. Conversion practice is done on given situation topics. The students are also made to listen to pre-recorded cassettes produced by British Council and also by the Universities of Oxford and Cambridge (6 hours)
3. Group Discussions:- The students are made to understand the difference between the language of conversion and group discussion. Strategies of such discussions are to teach to them. It is also helpful to use videocassettes produced by the U.G.C. on topics like group-discussion. After wards the class is divided into groups and the students have to discuss on given topics on current socio-economic-political-educational importance(12 hours)
4. Interview sessions-students are taught the do's and don'ts of facing a successful interview. They then have to face rigorous practices of mock-interviews. There simulations of real life interview sessions where students have to face an interview panel(12 hours)
5. Presentations: The secrets of an effective presentation are taught to the students. Then each and every student has to make lab presentations with the help of the Overhead projector/ using power point presentation and other audio-visual aids in the laboratory. They also have to face the question answer sessions at the end of their presentation (12 hours)
6. Classes are also allotted to prepare the students for competitive examinations like the T.O.E.F.L. by making the students listen to specially produced C.D. cassettes of such examinations (3 hours)

The overall aim of this course is to inculcate a sense of confidence in the students and help them to become good communicators in their social as well as professional lives.

Text:

1. Sharma—Business Correspondence & Report Writing, TMH
2. Prasad—Group Discussion & Interview (With Audio Cassette) , TMH

Reference:

1. Sashi Kumar—Spoken English (with Cassette) , TMH

Fifth Semester

Operating System
Code: **CS 501**
Contacts: **3L**
Credits: **3**
Allotted Hrs: **47L**

Introduction [4L]
Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed, time-sharing, real-time, distributed, parallel.

System Structure[3L]
Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

Process Management [17L]

Processes [3L]: Concept of processes, process scheduling, operations on processes, co-operating processes, inter-process communication.

Threads [2L]: overview, benefits of threads, user and kernel threads.

CPU scheduling [3L]: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.

Process Synchronization [5L]: background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.
Deadlocks [4L]: system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Storage Management [19L]

Memory Management [5L]: background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.

Virtual Memory [3L]: background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.

File Systems [4L]: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.

I/O Management [4L]: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and nonblocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Disk Management [3L]: disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN) , disk reliability, disk formatting, boot block, bad blocks.

Protection & Security [4L]

Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threat monitoring, encryption.

Text Books / References **:**

1. Milenkovie M., "Operating System : Concept & Design", McGraw Hill.
2. Tanenbaum A.S., "Operating System Design & Implementation", Practice Hall NJ.
3. Silbersehatz A. and Peterson J. L., "Operating System Concepts", Wiley.
4. Dhamdhere: Operating System TMH
5. Stalling, William, "Operating Systems", Maxwell McMillan International Editions, 1992.
6. Dietel H. N., "An Introduction to Operating Systems", Addison Wesley.

Database Management System

Code: **CS 502**
Contacts: **3L**
Credits: **3**
Allotted Hrs: **45L**

Introduction [4L]

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Entity-Relationship Model [6L]

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Relational Model [5L]

Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

SQL and Integrity Constraints [8L]

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Relational Database Design [9L]

Functional Dependency, Different anamolies in designing a Database., Normalization using funtional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Nomalization using multi-valued depedencies, 4NF, 5NF

Internals of RDBMS [7L]

Physical data structures, Query optimization : join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management : transaction model properties, state serializability, lock base protocols, two phase locking.

File Organization & Index Structures [6L]

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree .

Text Books:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System , McGraw-Hill

4. Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques", Moragan Kauffman Publishers.
5. Jain: Advanced Database Management System CyberTech
6. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
7. Ullman JD., "Principles of Database Systems", Galgottia Publication.

Reference:

1. James Martin, "Principles of Database Management Systems", 1985, Prentice Hall of India, New Delhi
2. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition
3. "Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

Design & Analysis of Algorithm
Code: CS 503
Contacts: 3L + 1T
Credits: 4
Allotted Hrs: 45L

Models of computation [4L]: RAM,TM etc. time and space complexity

Asymptotic Notation [3L] Big-O, omega, theta etc.; finding time complexity of well known algorithms like- heapsort, search algorithm etc.

Algorithm Design techniques [2L]
Recursion- Definition, Use, Limitations, Examples: Hanoi problem. Tail Recursion

Divide and Conquer [3L]
Basic method, use, Examples: Merge sort, Quick Sort, Binary Search

Dynamic Programming [4L]
Basic method, use, Examples: matrix-chain multiplication, All pair shortest paths, single-source shortest path, Travelling Salesman problem

Branch and Bound [2L] : Basic method, use, Examples: The 15-puzzle problem

Backtracking [3L]
Basic method, use, Examples: Eight queens problem, Graph coloring problem, Hamiltonian problem

Greedy Method [4L]
Basic method, use, Examples: Knapsack problem, Job sequencing with deadlines, minimum spanning tree(Prim's and Kruskal's algorithms)

Lower Bound Theory [2L]
Bounds on sorting and sorting techniques using partial and total orders.

Disjoint Set Manipulation [2L]
Set manipulation algorithm like UNION-FIND, union by rank, Path compression.

Properties of graphs and graph traversal algorithms [3L]: BFS and DFS

Matrix manipulation algorithms [5L]
Different types of algorithms and solution of simultaneous equations, DFT & FFT algorithm; integer multiplication schemes

Notion of NP-completeness [5L]
P class, NP-hard class, NP-complete class, Circuit Satisfiability problem, Clique Decision Problem.

Approximation algorithms [3L]
Necessity of approximation scheme, performance guarantee, Polynomial time approximation schemes: 0/1 knapsack problem

Text Books:

1. A.Aho, J.Hopcroft and J.Ullman "The Design and Analysis of algorithms"
2. D.E.Knuth "The Art of Computer Programming", Vol. I & Vol.2
3. Horowitz Ellis, Sahani Sartaz, R. Sanguthevar " Fundamentals of Computer Algorithms".
4. Goodman: Introduction to Design and Analysis Of Algorithms TMH

Reference:

1. K.Mehlhorn , "Data Structures and algorithms- Vol. I & Vol. 2 "
2. S.Baase "Computer algorithms"
3. E.Horowitz and Shani "Fundamentals of Computer algorithms"
4. E.M.Reingold, J.Nievergelt and N.Deo- "Combinational algorithms- Theory and Practice", Prentice Hall , 1997
5. A.Borodin and I.Munro, "The computational complexity of Algebraic and Numeric problems"

CONTROL SYSTEM
Code : EE 503
Contacts : 3L + 1T
Credits :4

Concept of feedback and Automatic Control, Electrical analogy of physical system. Transfer Function, Block diagram representation of Control Systems, Block Diagram Algebra, Signal Flow Graph, Mason's gain formula.

Control system components : Error sensing devices, potentiometer, synchros, D.C. and A.C. tachometers, servomotors, modulators and demodulators. Transient analysis of closed loop systems. Transient errors and their minimisation, steady state error and their minimisation, error coefficients, P, PI and P-I-D type controllers.

Stability of Control Systems : R-H criteria, Nyquist criteria, Bode Plots. Polar Plots, Nichols chart, measures of relative stability. Construction of Root Loci for simple system, effects of the movement of poles and zeros.

Improvement of system performance through compensation. Case studies on control voltage, current, frequency, position and speed. Control of liquid level, density, flow, temperature etc.

BOOKS ;

1. Kuo B.C. Automatic Control System, PHI
2. Das Gupta S : Control System Theory ; Khanna Pub.
3. Nagrath I J & Gopal M : Control Systems Engineering, New Age International Pub.
4. Ogata K : Modern Control Engg. PHI
5. Dorf R C & Bishop R.H.: Modern Control System ; Addison – Wisley
6. Bolton: Industrial Control & Instrumentation, Orient Longman
7. Nakra: Theory & Applications of Automatic Control, New Age International
8. Gopal: Modern Control System Theory, New Age International
9. Gopal: Digital Control Engineering, New Age International
10. Sinha: Control Systems, New Age International

Microprocessor and Microcontrollers
Code: EI 502
Contacts: 3L + 1T
Credits:4

Introduction to 8085A CPU architecture-register organization, addressing modes and their features. Software instruction set and Assembly Language Programming. Pin description and features.

Instruction cycle, machine cycle, Timing diagram.

Hardware Interfacing: Interfacing memory, peripheral chips (IO mapped IO & Memory mapped IO).

Interrupts and DMA.

Peripherals: 8279, 8255, 8251, 8253, 8237, 8259, A/D and D/A converters and interfacing of the same.

Typical applications of a microprocessor.

16 bit processors: 8086 and architecture, segmented memory has cycles, read/write cycle in min/max mode. Reset operation, wait state, Halt state, Hold state, Lock operation, interrupt processing. Addressing modes and their features.

Software instruction set (including specific instructions like string instructions, repeat, segment override, lock prefizers and their use) and Assembly Language programming with the same.

Brief overview of some other microprocessors (eg. 6800 Microprocessor).

References:

1. Microprocessor architecture, programming and applications with 8085/8085A, Wiley eastern Ltd, 1989 by Ramesh S. Gaonkar.
2. Intel Corp: The 8085 / 8085A. Microprocessor Book – Intel marketing communication, Wiley inter science publications, 1980.
3. An introduction to micro computers Vol. 2 – some real Microprocessor – Galgotia Book Source, New Delhi by Adam Osborne and J. Kane
4. Advanced Microprocessors by Ray and Bhurchandi - TMH
5. Intel Corp. Micro Controller Handbook – Intel Publications, 1994.
6. Microprocessors and Interfacing by Douglas V. Hall, McGraw Hill International Ed. 1992
7. Assembly Language Programming the IBM PC by Alan R. Miller, Subex Inc, 1987
8. The Intel Microprocessors: 8086/8088, 80186, 80286, 80386 & 80486, Bary B. Brey, Prentice Hall, India 1996.

Operating System Lab
Code: CS 591
Contacts: 3P
Credits: 2

1. **Shell programming [6P]:** creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands).
2. **Process [6P]:** starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
3. **Signal [9P]:** signal handling, sending signals, signal interface, signal sets.
4. **Semaphore [6P]:** programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).
5. **POSIX Threads [9P]:** programming with pthread functions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
6. **Inter-process communication [9P]:** pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO)

Database Management System Lab
Code: CS 592
Contacts: 3P
Credits: 2

Structured Query Language

1. **Creating Database**
   - Creating a Database
   - Creating a Table
   - Specifying Relational Data Types
   - 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

- Subqueries

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

CONTROL SYSTEM LAB (PSPICE & MAT LAB)

Code : EE 593
Contacts : 3 P
Credit : 2

List Of Experiments

1) Familarisation with MAT- Lab- control system tool box, MAT –Lab- simulink tool box & PSPICE.
2) DETERMINATION OF STEP RESPONSE FOR FIRST ORDER & SECOND ORDER SYSTEM WITH UNITY FEEDBACK ON CRO &CALCULATIONS OF CONTROL SYSTEM SPECIFICATIONS LIKE TIME CONSTANT , % PEAK OVERSHOOT, SETTLING TIME ETC., FROM THE RESPONSE.
3) SIMULATION OF STEP RESPONSE & IMPULSE RESPONSE FOR TYPE-0 , TYPE-1 & TYPE –2 SYSTEM WITH UNITY FEEDBACK USING MATLAB & PSPICE.
4) DETERMINATION OF ROOT LOCUS, BODE- PLOT, NYQUIST PLOT USING MATLAB- CONTROL SYSTEM TOOLBOX FOR 2^{ND} ORDER SYSTEM & DETERMINATION OF DIFFERERNT CONTROL SYSTEM SPECIFICATIONS FROM THE PLOT.
5) DETERMINATION OF PI, PD,PID CONTROLLER ACTION OF FIRST ORDER SIMULATED PROCESS.
6) DETERMINATION OF APPROXIMATE TRANSFER FUNCTION EXPERIMENTALLY FROM BODE PLOT.
7) EVALUATION OF STEADY STATE ERROR, SETTING TIME, PERCENTAGE PEAK OVERSHOOT, GAIN MARGIN, PHASE MARGIN WITH ADDITION OF LEAD COMPENSATOR & BY COMPENSATOR IN FORWARD PATH TRANSFER FUNCTION FOR UNITY FEED BACK CONTROL SYSTEM USING PSPICE OR OTHERWISE.
8) STUDY OF A PRACTICAL POSITION CONTROL SYSTEM & DETERMINATION OF CONTROL SYSTEM SPECIFICATIONS FOR VARIATION OF SYSTEM PARAMETERS.

Microprocessor and Micro-controller Lab
Code: **EI 592**
Contacts: **3P**
Credits: **2**

Sl. No.	Name of the Experiments	No. of hours
1.	Familiarization with 8085 register level architecture and trainer kit components, including the memory map. Familiarization with the process of storing and viewing the contents of memory as well as registers.	**3**
2.	a) Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical) b) Assignments based on above.	**3**
3.	a) Familiarization with 8085 simulator on PC. c) Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator. b) Assignments based on above	**3**
4.	Programming using kit/simulator for i) table look up ii) Copying a block of memory iii) Shifting a block of memory	**9**

iv) Packing and unpacking of BCD numbers
v) Addition of BCD numbers
vi) Binary to ASCII conversion
vii) String Matching
viii) Multiplication using Booth's Algorithm

5.	Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit eg, subroutine for delay, reading switch state & glowing LEDs accordingly, finding out the frequency of a pulse train etc	**3**
6.	Interfacing any 8-bit Latch (eg, 74LS373) with trainer kit as a peripheral mapped output port with absolute address decoding	**3**
7.	Interfacing with I/O modules: a) ADC b) Speed control of mini DC motor using DAC c) Keyboard d) Multi-digit Display with multiplexing e) Stepper motor	**12**
8.	Writing programs for 'Wait Loop (busy waiting)' and ISR for vectored interrupts (eg, counting number of pulses within specified time period)	**3**
9.	Study of 8051 Micro controller kit and writing programs for the following tasks using the kit a) Table look up b) Basic arithmetic and logical operations c) Interfacing of Keyboard and stepper motor	**6**
10.	Familiarization with EPROM programming and Erasing	**3**

Sixth Semester

Computer Network
Code: **CS 601**
Contact: **3L + 1T**
Credits: **4**
Allotted Hrs: **45L**

Note I: There will be one objective type question comprising 10 numbers spread over the entire syllabus and each carrying one mark.

Note II: Two questions are to be set from each module out of which five questions are to be answered taking at least one from each module. All questions carry equal marks.

Module I

Overview of data communication and Networking: [5L]

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.

Physical level: [5L]

Overview of data(analog & digital), signal(analog & digital), transmission (analog & digital)& transmission media (guided & non-guided); TDM, FDM, WDM; Circuit switching: time division & space division switch, TDM bus; Telephone network;

Module II

Data link layer: [6L]

Types of errors, framing(character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC;

Medium access sub layer: [5L]

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;

Module III

Network layer: [8L]

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.

Transport layer: [6L]

Process to process delivery; UDP; TCP; Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, choke packets; Quality of service: techniques to improve Qos.

Module IV

Application layer: [5L]

DNS; SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography, user authentication, security protocols in internet, Firewalls.

Modern topics: [5L]

ISDN services & ATM ; DSL technology, Cable modem, Sonet.
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 (3rd Ed.) " – TMH
2. A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas
7. Miller, Digital & Data Communication, Jaico
8. Shay, Understanding Data Communication & Network, Vikas

Reference Books:

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

Software Engineering

Code: **CS 602**
Contact: 3L
Credits: 3
Allotted Hrs: **45L**

Note I: There will be one objective type question comprising 10 numbers spread over the entire syllabus and each carrying one mark.

Note II: Two questions are to be set from each module out of which five questions are to be answered taking at least one from each module. All questions carry equal marks.

Module I

Overview of System Analysis & Design , Business System Concept, System Development Life Cycle, Waterfall Model , Spiral Model, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model. **[10L]**

Module II

System Requirement Specification – DFD, Data Dictionary, ER diagram, Process Organization & Interactions. **[5L]**

System Design – Problem Partitioning, Top-Down And Bottop-Up design ;Decision tree, decision table and structured English; Functional vs. Object- Oriented approach. **[5L]**

Module III

Coding & Documentation - Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation. **[4L]**

Testing – Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment . , Validation & Verification Metrics, Monitoring & Control. **[8L]**

Module IV

Software Project Management – Project Scheduling , Staffing, Software Configuration Management, Quality Assurance, Project Monitoring. **[7L]**

CASE TOOLS : Concepts, use and application. **[5L]**

Books:

Text:

1. R. G. Pressman – Software Engineering, TMH
2.Behforooz, Software Engineering Fundamentals,OUP
3. Ghezzi, Software Engineering, PHI
4.Pankaj Jalote – An Integrated Approach to Software Engineering, NAROSA.
5.Object Oriented & Classical Software Engineering(Fifth Edition), SCHACH,TMH
6.Vans Vlet, Software Engineering, SPD
7.Uma, Essentials of Software Engineering, Jaico
8.Sommerville, Ian – Software Engineering, Pearson Education
9.Benmenachen, Software Quality, Vikas

Reference:

1. IEEE Standards on Software Engineering.
2. Kane, Software Defect Prevention, SPD

Computer Graphics & Multimedia

Code: **CS 603**
Contact: 3L
Credits: 3
Allotted Hrs: **45L**

Note I: There will be one objective type question comprising 10 numbers spread over the entire syllabus and each carrying one mark.

Note II: Two questions are to be set from each module out of which five questions are to be answered taking at least one from each module. All questions carry equal marks.

Module I

Introduction to computer graphics & graphics systems [6L]
Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.

Scan conversion: [6L]

Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

Module II

2D transformation & viewing [8L]
Basic transformations: translation , rotation, scaling ; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear;
Transformation of points, lines , parallel lines, intersecting lines. Viewing pipeline, Window to viewport co-ordinate transformation , clipping operations , point clipping , line clipping, clipping circles , polygons & ellipse.

3D transformation & viewing [7L]

3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.

Module III

Curves [3L]

Curve representation, surfaces , designs , Bezier curves , B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

Hidden surfaces [3L]

Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal - geometry.

Color & shading models [2L]

Light & color model; interpolative shading model; Texture;

Module IV

Multimedia [10L]

Introduction to Multimedia: Concepts, uses of multimedia, hypertext and hypermedia.; Image, video and audio standards.

Audio: digital audio, MIDI, processing sound, sampling, compression.

Video: MPEG compression standards, compression through spatial and temporal redundancy, inter-frame and intra-frame compression .

Animation: types, techniques, key frame animation, utility, morphing.

Virtual Reality concepts.

Text Books:

1. Hearn, Baker – " Computer Graphics (C version 2nd Ed.)" – Pearson education
2. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH
3. D. F. Rogers, J. A. Adams – " Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH
4. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI
5. Sanhker, Multimedia –A Practical Approach, Jaico
6. Buford J. K. – "Multimedia Systems" – Pearson Education
7. Andleigh & Thakrar, Multimedia, PHI
8. Mukherjee Arup, Introduction to Computer Graphics, Vikas
9. Hill,Computer Graphics using open GL, Pearson Education

Reference Books:

1. Foley, Vandam, Feiner, Hughes – "Computer Graphics principles (2nd Ed.) – Pearson Education.
2. W. M. Newman, R. F. Sproull – "Principles of Interactive computer Graphics" – TMH.
3. Elsom Cook – "Principles of Interactive Multimedia" – McGraw Hill

System Software and Administration

Code: **CS 604**
Contact: 3L + 1T
Credits: 4
Allotted Hrs: **45L**

Note I: There will be one objective type question comprising 10 numbers spread over the entire syllabus and each carrying one mark.

Note II: Two questions are to be set from each module out of which five questions are to be answered taking at least one from each module. All questions carry equal marks.

Computer Science & Engineering Syllabus

Module I

System Software [15]

Assemblers: General design procedures, Design of two pass assemblers, Cross Assemblers, Macro Processors – Features of a macro facility,(macro instruction arguments, conditional macro expansion, macro calls within macros), Implementation of a restricted facility : A two pass algorithm; Macro Assemblers.
Loader schemes: Compile and go loaders, absolute loaders, relocating loader, Linking, Reallocation- static & dynamic linking, Direct linking loaders, Binders, **Overlays**, dynamic binders; Working principle of Editors, Debuggers.

System Administration

Module II

Introduction: **[3L]**
Duties of the Administrator, Administration tools, Overview of permissions.
Processes: Process status, Killing processes, process priority. Starting up and Shut down:
Peripherals, Kernel loading, Console, The scheduler, init and the inittab file, Run-levels, Run level scripts.

Managing User Accounts: [2L]
Principles, password file, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users.

Managing Unix File Systems: **[2L]**
Partitions, Swap space, Device files, Raw and Block files, Formatting disks, Making filesystems, Superblock, I-nodes, Filesystem checker, Mounting filesystems, Logical Volumes, Network Filesystems, Boot disks

Configuring the TCP/IP Networking **: [4L]**
Kernel Configuration; Mounting the /proc Filesystem, Installing the Binaries, Setting the Hostname, Assigning IP Addresses, Creating Subnets, Writing hosts and networks Files, Interface Configuration for IP, ifconfig, netstat command, Checking the ARP Tables; Name service and resolver configuration.

Module III

TCP/IP Firewall : **[6L]**
Methods of Attack, What Is a Firewall? What Is IP Filtering? Setting Up Linux for Firewalling Testing a Firewall Configuration; A Sample Firewall Configuration:
IP Accounting, Configuring the Kernel for IP Accounting, Configuring IP Accounting, Using IP Accounting Results

IP Masquerade and Network Address Translation **: [4L]**
Side Effects and Fringe Benefits, Configuring the Kernel for IP Masquerade, Configuring IP Masquerade.

Module IV

The Network Information System : **[3L]**
Getting Acquainted with NIS, NIS Versus NIS+ , The Client Side of NIS, Running an NIS Server, NIS Server Security.

Network file system: **[3L]**
Preparing NFS, Mounting an NFS Volume, The NFS Daemons, The exports File.

System Backup & Recovery: **[3L]**
Log files for system and applications; Backup schedules and methods (manual and automated).

Text Books:

1. L.L. Beck – "System Software " (3rd Ed.)- Pearson Education
2. Michel Ticher – "PC System Programming" , Abacus.
3. Kirch – " Linux network Administrator's guide (2nd Ed.)" – O'Rielly
4. Maxwell – "Unix system administration" - TMH
5. Limoncelli –"The Practice of System & Network Administration"-Pearson
6. Wells, LINUX Installation & Administration, Vikas

Reference Books:

1. W. R. Stevens – "Unix network programming, vol. 1(2nd Ed.)" – Pearson Education/PHI
2. W. R. Stevens – "TCP/IP illustrated, vol. 1" – PHI/Pearson Education
3. Comer – "Internetworking with TCP/IP, vol. 1(4th Ed.)" – Pearson Education/PHI

4. E. Nemeth, G. Snyder, S. Seebass, T. R. Hein – " Unix system administration handbook" – Pearson Education

Object Technology & UML

Code: **CS 605**
Contact: 3L
Credits: 3
Allotted Hrs: **45L**

Module I

Introduction **[6 L]**
Why object orientation, History and development of Object Oriented Programming language, concepts of object oriented programming language.

Object oriented analysis **[4L]**
Usecase diagram; Major and minor elements, Object, Class.

Module II

Object oriented design **[10 L]**
Relationships among objects, aggregation, links, relationships among classes- association, aggregation, using, instantiation, meta-class, grouping constructs.

Module III

Basic concepts of object oriented programming using Java **[15 L]**
Object, class, message passing, encapsulation, polymorphism, aggregation, threading, applet programming, difference between OOP and other conventional programming-advantages and disadvantages.

Module IV

Fundamentals of Object Oriented design in UML **[12 L]**
Static and dynamic models, why modeling, UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, statechart diagram, activity diagram, implementation diagram, UML extensibility- model constraints and comments, Note, Stereotype.

Text Books :

1. Ali Bahrami, - "Object –Oriented System Development" - Mc Graw Hill.
2. Rambaugh, James Michael, Blaha - "Object Oriented Modelling and Design" - Prentice Hall India/ Pearson Education
3. Bruce, Foundations of Object Oriented Languages, PHI
4. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" - TMH
5. Priestley – " Practical Object Oriented Design using UML" - TMH
6. Jana, C++ & Object Oriented Programming, PHI
7. Alhir, learning UML, SPD/O'Reily

Reference Books:

1. Page Jones, Meiler - "Fundamentals of object oriented design in UML"
2. Roff: UML: A Beginner's Guide TMH
3. Rajaram: Object Oriented Programming and C++, New Age International
4. Mahapatra: Introduction to System Dynamic Modelling, Universities Press
5. Muller : Instant UML, Shroff Publishers / Wrox
6. Srimathi, Object Oriented Analysis & Design Using UML, Scitech
7. Alhir : UML in a Nutshell, Shroff Publishers / O'reilly
8. Olshevsky : Revolutionary guide to Object Oriented Programming using C++, Shroff / Wrox

Computer network Lab
Code: **CS 691**
Contact: **3P**
Credits: 2

- IPC (Message queue)
- NIC Installation & Configuration (Windows/Linux)

- Familiarization with
  - Networking cables (CAT5, UTP)
  - Connectors (RJ45, T-connector)
  - Hubs, Switches
- TCP/UDP Socket Programming
- Multicast & Broadcast Sockets
- Implementation of a Prototype Multithreaded Server
- Implementation of
  - Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
  - Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
  - Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

Computer Graphics Lab
Code: CS 693
Contact: 3P
Credits: 2

- Point plotting, line & regular figure algorithms
- Raster scan line & circle drawing algorithms
- Clipping & Windowing algorithms for points, lines & polygons
- 2-D / 3-D transformations
- Simple fractals representation
- Filling algorithms
- Web document creation using Dreamweaver.
- Creating Animation using Flash.

SYSTEM SOFTWARE & ADMINISTRATION LAB
Code: CS 694
Contact: 3P
Credits: 2

- Packet Monitoring software (**tcpdump, snort, ethereal**)
- Trace route, Ping, Finger, Nmap
- Server configuration (FTP, SMTP, DNS)
- NFS Configuration
- Firewall Configuration using **iptables/ipchains** (Linux only)
- Experiments using Turbo C Assembler

Note: All the above experiments may be performed in both Unix /Linux & Windows

Object Technology Lab
Code: CS 695
Contacts: 3P
Credits: 2

1. Assignments on class, constructor, overloading, inheritance, overriding
2. Assignments on wrapper class, vectors, arrays
3. Assignments on developing interfaces- multiple inheritance, extending interfaces
4. Assignments on creating and accessing packages
5. Assignments on multithreaded programming, handling errors and exceptions, applet programming and graphics programming
6. Use of CASE tools

Note: Use Java as programming language.

Language Processor
Code: CS 701
Contact: 3L
Credits: 3
Allotted Hrs: 45L

Introduction to Compiling [3L]

Compilers, Analysis of the source program, The phases of the compiler, Cousins of the compiler.

Lexical Analysis [6L]
The role of the lexical analyzer**,** Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

Syntax Analysis [9L]
The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.

Syntax directed translation [5L]
Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

Type checking [4L]
Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions

Run time environments [5L]
Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

Intermediate code generation [4L]
Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

Code optimization [5L]
Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.

Code generations [4L]
Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Text books:
1. Aho, Sethi, Ullman - “Compiler Principles, Techniques and Tools” - Pearson Education.
2. Holub - “Compiler Design in C” - PHI.

Artificial Intelligence
Code: CS-702
Contact: 3L
Credits: 3
Allotted Hrs: 45L

Introduction [2]

Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.

Intelligent Agents [2]

Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

Problem Solving [2]

Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

Search techniques [5]

Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

Heuristic search strategies [5]

Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Adversarial search [3]

Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Knowledge & reasoning [3]

Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Using predicate logic [2]

Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

Representing knowledge using rules [3]

Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Probabilistic reasoning [4]

Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.

Planning [2]

Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

Natural Language processing [2]

Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.

Learning [2]

Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Expert Systems [2]

Representing and using domain knowledge, expert system shells, knowledge acquisition.

Basic knowledge of programming language like Prolog & Lisp. [6]

Books:

1. Artificial Intelligence, Ritch & Knight, TMH

2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson

3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI

4. Poole, Computational Intelligence, OUP

5. Logic & Prolog Programming, Saroj Kaushik, New Age International

6. Expert Systems, Giarranto, VIKAS

7. Artificial Intelligence, Russel, Pearson

Visual Programming & Web Technology
Code: CS-703

Contact: 3L

Credits: 3

Allotted Hrs: 45L

Windows concepts and terminology, key elements **[11]**
Creating the look, communication via messages, windows resources and functions, adding multimedia and sound resources
Writing windows applications, taking control of windows, adding menus, dialog boxes,

Special controls. Concepts of X-Windows System & programming.
Introduction to Visual Basic & difference with BASIC. Concept about form Project, Application, Tools, Toolbox, Controls & Properties. Idea about Labels, Buttons, Text Boxes.
Data basics, Different type variables & their use in VB, sub-functions & Procedure details, Input box () & Msgbox (). Making decisions, looping
List boxes & Data lists, List Box control, Combo Boxes, data Arrays.
Frames, buttons, check boxes, timer control, Programming with data, built in functions, ODBC data base connectivity. Data form Wizard, query, and menus in VB Applications, Graphics.

Dynamic Web Pages [2L]
The need of dynamic web pages; an overview of DHTML, cascading style sheet (css), comparative studies of different technologies of dynamic page creation

Active Web Pages [2L]
Need of active web pages; java applet life cycle.

Java Script [3L]
Data types, variables, operators, conditional statements, array object, date object, string object.

Java Servlet [4L]
Servlet environment and role, HTML support, Servlet API, The servlet life cycle, Cookies and Sessions.

JSP [15L]
JSP architecture, JSP servers, JSP tags, understanding the layout in JSP, Declaring variables, methods in JSP, inserting java expression in JSP, processing request from user and generating dynamic response for the user, inserting applets and java beans into JSP, using include and forward action, comparing JSP and CGI program, comparing JSP and ASP program; Creating ODBC data source name, introduction to JDBC, prepared statement and callable statement.

J2EE[7L]
An overview of J2EE web services, basics of Enterprise Java Beans, EJB vs. Java Beans, basics of RMI, JNI.

Books:
1. Win32 API Programming With VB , Roman,SPD/O'REILLY
2.Learn Microsoft VB 6.0 Now,Halvorson, PHI/MSP
3.Visual Basic 6 from the Ground Up, Cornell,TMH
4.Visual Basic 6, CDG, TMH
5. Visual Basic 6,Dietel, Pearson
6.Visual basic 6.0 in 30 days, Krishnan, Scitech
7.Beginning VB 6 ,Wright,SPD/WROX

8. Visual Basic Complete, Prasenjit Sinha, S. Chand
9. Web Technologies - Godbole A. S. & Kahate A., TMH.
10.Web Technology & Design - Xavier C., New Age Publication.
11. Java Server Programming, J2EE edition. (VOL I and VOL II); WROX publishers
11. X-Window System, R.W.Scheifler & J. Gettys, PHI.

Financial Management & Accounts
Code: HU 701
Contact: 3L
Credits: 3
Allotted Hrs: 45L

Introduction [3L]
Financial Management, Financial Planning and Capitalization- definitions, objectives, changing roles and functions, Financial Decision.

Capital Budgeting [7L]
Nature of Investment decision, Importance of Capital Budgeting, The Capital. Budgeting Process - Investment Criterion, Pay-back period, Accounting, ROR (Rate of Return) Method, Discounting Cash flow method, Net - present value method, IRR (Internal Rate of Return) method, The benefit-Cost Ratio method.

Management of Working Capital [7L]
Various concepts, Elements, Classification, Financing and importance of working capital, Investment analysis, Cash flow determination, cost of capital, capital budgeting methods.

Budgeting Control Technique [5L]
Concepts of Budget, budgeting and budgetary control, Objectives, Functions, Uses, Advantages, Limitations; Master Budget and Report.

Cost - Volume - Profit Analysis [8L]
Classification of costs, Allocation, apportionment and absorption, Cost centers, different costing systems, Cost analysis for managerial decisions, Meaning of Linear CVP analysis, Objectives, Assumptions, Break - Even analysis, determining the Break-Even point profit, Volume graph profit, Volume ratios margin of Safety.

Introduction to Accounting [8L]
Basic accounting concepts, important definitions, uses, limitations, advantages; types of Accounting, Financial statements, introduction to Journal Accounting; different types of Vouchers, double entry bookkeeping, different types of transactions related to Financial Accounting.

Financial Control [7L]
Posting of Ledgers and preparation of Trial Balance; preparation of Balance Sheet and Profit and Loss Accounts; Controlling other departments by Financial Accounting (A practical Approach).

Books:

1. Financial Management and Accounting - P. K. Jain, S. Chand & Co.
2. Management & Accounting: Principles and Practice - R. K. Sharma & Shashi Kumar Gupta, Kalyani Publishers.
3. Advanced Management Accounting - Kaplan & Atkinson, PHI.
4. Fundamentals of Financial Management - Van Home, PE.
5. Financial Mgmt Accounting, Gupta,Pearson
6. Financial Mgmt, I.M. Pandey, Vikas
7. Financial Mgmt., Khan & Jain, TMH
8. Financial Mgmt , Mcmenamin, OUP
9. Financial Mgmt & Policy, Van Horne, PHI
10. Financial Mgmt,Kulkarni & Satyaprasad, Himalaya

Elective I

Distributed Database
Code :CS 704A
Credits: 3

Module I [5]
Distributed DBMS features and needs. Reference architecture. Levels of distribution transparency, replication. Distributed database design - fragmentation, allocation criteria.

Module II [10]
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.

Module III [10]
Partitioned networks. Checkpoints and cold starts. Management of distributed transactions- 2 phase unit protocols. Architectural aspects. Node and link failure recoveries.

Module IV [10]
Distributed data dictionary management. Distributed database administration. Heterogeneous databases-federated database, reference architecture, loosely and tightly coupled.

Module V [10]
Alternative architecture. Development tasks, Operation- global task management. Client server databases-SQL server, open database connectivity. Constructing an application.

Books:
1. Database System Concepts, Silberschatz Korth, Sudarshan, MH
2. Distributed Database, Tannenbaum, Pearson
3. Principles of Distributed Database Systems, M. Tamerozsu Patrick Valduriez, Pearson
3. Database Management Systems,Ramakrishnan, MH
4. Beginning SQL Server 2000 programming, Dewson,SPD/WROX
6. Database Management Systems, Leon, VIKAS
7. My SQL :Enterprise Solutions, Alexender Pachev, Wiley Dreamtech

Bio Informatics
Code : CS 704B
Credits: 3

Module I: 12L

Introduction to Genomic data and Data Organization: Sequence Data Banks - Introduction to sequence date banks - protein sequence data bank. NBFR-PIR, SWISSPROT, Signal peptide data bank, Nucleic acid sequence data bank - GenBank, EMBL nucleotide sequence data bank, AIDS virus sequence data bank. RRNA data bank, structural data banks - protein Data Bank (PDB), The Cambridge Structural Database (CSD) : Genome data bank - Metabolic pathway data : Microbial and Cellular Data Banks.

Module II: 12L

Introduction to MSDN (Microbial Strain Data Network): Numerical Coding Systems of Microbes, Hibridoma Data Bank Structure, Virus Information System Cell line information system; other important Data banks in the area of Biotechnology/life sciences/biodiversity.

Sequence analysis: Analysis Tools for Sequence Data Banks; Pair wise alignment -NEEDLEMAN and Wunsch algorithm, Smith Waterman, BLAST, FASTA algorithms to analyze sequence data: Sequence patterns motifs and profiles.

Module III: 11L

Secondary Structure predictions; prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking.

Tertiary Structure predictions; prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking.

Module IV: 10L

Applications in Biotechnology: Protein classifications, Fold libraries, Protein structure prediction: Fold recognition (threading), Protein structure predictions : Comparative modeling (Homology), Advanced topics: Protein folding, Protein-ligand interactions, Molecular Modeling & Dynamics, Drug Designing.

Books:

1. Lesk, Introduction to Bio Informatics, OUP
2. Introduction to Bioinformatics, Atwood, Pearson Education
3. Developing Bioinformatics Computer Skills, Cynthia Gibas and Per Jambeck, 2001 SPD
4. Statistical Methods in Bioinformatics, Springer India
5. Beginning Perl for Bio-informatics, Tisdall, SPD
6. Biocomputing: Informatics and Genome Project, Smith, D.W., 1994, Academic Press, NY
7. Bioinformatics: A practical Guide to the Analysis of Genes and Proteins, Baxevanis, A.D., Quellette, B.F.F., John Wiely & Sons.
8. Murty CSV, Bioinfornmatics, Himalaya

Parallel Programming
Code: CS 704C
Credits : 3

Module I [10]
Introduction : Computational demands on modern science, advent of practical parallel processing, parallel processing terminology.
PRAM algorithms : model of serial computation, PRAM model of parallel computation, PRAM algorithms, reducing the number of processors.

Module II [10]
Processes and processors. Processor organizations, Processor arrays, Multiprocessors, Multicomputers, FLYNN's taxonomy, Shared memory. Fork. Join constructs. Basic parallel programming techniques- loop splitting, spin locks, contention barriers and row conditions.

Module III [10]
Variations in splitting, self and indirect scheduling. Data dependency-forward and backward block scheduling. Linear recurrence relations. Backward dependency. Performance tuning overhead with number of processes, effective use of cache.

Module IV [15]
Parallel programming examples: Average, mean squared deviation, curve fitting, numerical integration, Matrix multiplication, sorting, travelling salesman problem, Gaussian elimination. Discrete event time simulation.

Parallel Programming Languages :Fortran 90, C*,Sequent C, OCCAM,C- Linda,
Parallel programming under Unix.

Books:

1.Parallel Computing, Quinn,TMH
2.Introduction to Parallel Processing ,Sashi Kumar,PHI
3.Parallel Programming, Wilkinson, Pearson
4.Elements of Parallel Computing, Rajaraman,PHI
5.Fundamentals of Parallel Processing, Jordan, PHI
6. Advanced Computer Architecture, Hwang, TMH

Advanced Operating System
Code: CS 704D
Credits: 3

Process Synchronization [5]
Concepts of processes, Concurrent processes, Threads, Overview of different classical synchronization problems, Monitors, Communicating Sequential processes(CSP)

Process deadlocks [4]
Introduction, causes of deadlocks, Deadlock handling strategies, Models of deadlock

Distributed operating system [10]
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 Distrubuted Scheduling, Load balancing, Load sharing

Distributed OS Implementation [4]
Models, Naming, Process migration, Remote Procedure Calls.

Multiprocessor System [6]
Motivation, Classification, Multiprocessor Interconnections, Types, Multiprocessor OS functions & requirements; Design & Implementation Issue; Introduction to parallel programming; Multiprocessor Synchronization.

Performance, Coprocessors, RISC & data flow [5]

Introduction, Necessity, Measures, Techniques, Bottlenecks & Saturation, Feedback loops, Coprocessors, RISC.

Analytic Modeling [5]
Introductions, Queing Theory, Markov Process

Security & Protection [6]
Security-threats & goals, Penetration attempts, Security Policies & mechanisms, Authentication, Protections & access control Formal models of protection, Cryptography, worms & viruses.

Books:

1) Operating Systems Concepts & design - Milan Milenkovic, TMH
2) Operating System - H.M. Deitel, Pearsons **.**
3) Advanced Concepts in operating Systems - Mukesh Singhal and Niranjan G. Shivaratri, TMH

Computational Geometry
Code : CS 704E
Credits: 3

Module I [12]

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
-

Module II [18]

Polygon approximation
- triangular approximations
- k-gonal approximations
- restricted approximations
- other criteria of approximation

Geometric searching
- point-location problems
- range-searching problems
-

Module III [15]

Proximity
- Typical problems and lower bounds
- Closest pair problem
- Voronoi diagrams
- Minimum spanning trees
- Triangulations

Miscellaneous problems
- (More) Art gallery problems
- Intersections
- Pattern recognition
- Parallel computational geometry

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

Modeling & Simulation
Code: CS 704F
Credits: 3

Module I [12]

- The notion of system, model, simulation. Types of simulations. Illustrative examples. Conceptual and computer models. Verification and validation of models. Simulation experiment. Simulation project life cycle. Description of simulation models. Structure vs. behaviour models. Classification of tasks solved within the modeling and simulation process. Detailed example introduction: database server as a typical queuing system.

- Description of discrete-event systems behaviour. Modeling of time. The notion of status, event, activity, process and their interdependencies. Object-oriented model design. Simulation time, control of time advancement, event list. Event driven simulation algorithm. Detailed example: implementation of the database server as a queuing system.

- Random numbers in simulation. Random variables with discrete and continuous probability distribution. Pseudo-random generators. Multiplicative and additive congruential method. Nonuniform random numbers.

Module II [10]

- Testing of pseudo-random generators. Monte Carlo method. Precision. Queueing systems. Entities: queues, service facilities, storages. Properties of input and output stream. Kendall classification of queueing systems. Entity behaviour and statistical data sampling during the simulation run.

- Discrete and continuous Markov model. Birth -Death processes.

- Steady-state queueing systems of types M/M/1, M/M/? , M/M/m, M/Er/1, Er/M/1 and their variants.

Module III [10]

- Models M/G/1, G/M/1, G/M/m, G/G/1, G/D/1, M+D/D/1. Closed systems and queueing networks.
- Simulation languages for discrete-event systems. Case study and comparison: Simscript, GPSS, SOL,

Module IV [13]

- Case study and comparison: Simula 67. Object oriented design and implementation of simulation models. Persistence of objects in C++, case studies. Application in a simulation system.
- Simulation experiments. Preparation and pre-processing of input data. Statistical data collected during the simulation run. Time dependency of statistics. Histograms. Evaluation and interpretation of results. Model validation and verification.
- Simulation of digital systems. Abstractions levels of digital system description. Models of signals and functions. Structure vs. behaviour. Models of components. Models of delays.
- Digital systems simulators - methods of implementation. Flow of simulation time. Synchronous and asynchronous algorithm of digital systems simulation. Acceleration of simulation run.
- Register-transfer level simulation. Simulation languages of HDL type. VHDL language and tools. Implementation of concurrent statements and processes in VHDL. Modeling of time and event list.

Textbooks:

1.Law, A.M., Kelton, W.D.: Simulation Modeling and Analysis. McGraw-Hill, New York, 2-nd edition, 1991. ISBN 0-07-100803-9.
2. Basmadjian, Mathematical Modeling of Physical Systems, OUP
3. Brewmaud, Markov Chains; With Gibbs Field , Monte Carlo Simulation & Ques, Springer Verlag
4.Hoover,S.V., Perry,R.F.: Simulation: a Problem-Solving Approach. Addison - Wesley, 1990. ISBN 0-201-16880-4.
5.Zeigler,B.P.: Theory of Modeling and Simulation. John Wiley, New York,1976. Re-published Krieger Publ., Malabar, 1985.
6.Fishwick,P.A.: Simulation Model Design and Execution: Building Digital Worlds. Prentice Hall, Englewood Cliffs,1995.
7.Kleinrock, L.: Queuing Systems Vol.I, Vol.II, Wiley & Sons, London, 1975.
8. First Course in Mathematical Modeling, Giordano, Vikas

Image Processing
Code: CS 704G
Credits :3

Introduction [5L]
Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.

Digital Image Formation [6L]
A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.

Mathematical Preliminaries [7L]
Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.

Image Enhancement [8L]
Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.

Image Restoration [7L]
Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.

Image Segmentation [7L]
Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

An Overview of GIS [5L]
Definition of GIS, Features & Functions, GIS as an Information System, GIS & Cartography, GIS data feeds, Historical development of GIS.

Books:
1. Digital Image Processing, Gonzalves,Pearson
2. Digital Image Processing, Jahne, Springer India
3.Digital Image Processing & Analysis,Chanda & Majumder,PHI
4.Fundamentals of Digital Image Processing, Jain, PHI
5.Image Processing, Analysis & Machine Vision, Sonka, VIKAS
6. Getting Started with GIS- Clarke Keith. C; PE.
7. Concepts & Techniques of GIS - Lo C.P, Albert, Yeung K.W- PHI.

Artificial Intelligence Lab
CS-792

Programming Languages such as PROLOG & LISP

Visual Programming and Web Technology Lab
CS-793

Problems pertaining to CS-703

Values & Ethics in profession
Code: HU 801
Contact: 3L
Credits: 3

Allotted Hrs: 39L

Science, Technology and Engineering as Knowledge and as Social and Professional Activities **[2L**

Effects of Technological Growth: [15L

Rapid Technological growth and depletion of resources. Reports of the Club of Rome. Limits to growth; sustainable development. Energy Crisis; Renewable Energy Resources.
Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations. Environmental Ethics. Appropriate Technology Movement of Schumacher: later developments. Technology and developing nations. Problems of Technology transfer. Technology assessment/ impact analysis; Industrial hazards and safety, safety regulations safety engineering. Politics and technology, authorization versus democratic control of technology; Human Operator in Engineering projects and industries. Problems of man machine interaction. Impact of assembly line and automation. Human centred Technology

Ethics of Profession: [8L

Engineering profession: Ethical issues in engineering practice. Conflicts between business demands and professional ideals. Social and ethical Responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond. Case studies.

Profession and Human Values **[14L**

Value Crisis in contemporary society. Nature of values: Value Spectrum of a 'good' life
Psychological values: Integrated personality; mental health. Societal values: The modern search for a 'good' society, justice, democracy, secularism, rule of law; values in Indian Constitution. Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity
Moral and ethical values: Nature of moral judgments; canons of ethics; Ethics of virtue; ethics of duty; ethics of responsibility. Work ethics, professional ethics.

Books:
1.Blending the best of the East & West, Dr. Subir Chowdhury, EXCEL
2.Ethics & Mgmt. & Indian Ethos, Ghosh, VIKAS
3.Business Ethics,Pherwani,EPH
4.Ethics,Indian Ethos & Mgmt., Balachandran,Raja,Nair, Shroff Publishers
5.Business Ethics: concept and cases, Velasquez, Pearson

Industrial Management

Code: HU 802
Contact: 3L
Credits: 3
Allotted Hrs: 39L
Human Resource Management: **[8L**
Recruitment and selection, Performance appraisal, Industrial Relations, Trade Union, Collective Bargaining
Organizational Behaviour: **[8L**
Different Schools of Management Thought : Scientific Management, Administrative Theory, Theory of Bureaucracy, Human Relations Theory(Elton Mayo).
Motivation: Concept, Different Theories (Maslow, ERG, Herzberg,)
Communication: Purpose, process, Barriers to effective communication, Guidelines to make communication effective.
Perception: Process, Importance, Factors influencing perception, Shortcuts for judging people- Halo effect, Stereotyping, Projection.
Quality Management: **[6L**
Concept, Dimensions for goods and services, Cost of Quality, Statistical Quality Control, Control Charts, Acceptance Sampling (single).
Total Quality Management: Concept, benefits, Criticism.
New Quality Tools: Kaizen, Six Sigma, Quality Circles.
Productions Management: [5L
Concept. Difference from Operations Management, Types of Production(Mass, Batch, Project), Functions of Production Management.
Productivity: Concept, Different Inputs and Productivity Measures, Effeciency and Effectiveness, Measures to increase Productivity.
Marketing Management: **[6L**
Basic Concepts of Marketing, Difference between Selling and Marketing, Elements of Marketing Mix- the 4 P's.
Marketing Environment: Mega Environment, Micro Environment, Internal Environment, Relevant Environment.
Simple Marketing Strategies: SWOT Analysis, BCG Matrix, Industry Matrix.
Materials Management: [6L
Concept, Functions, EOQ Models- Wilson model, model with shortage, model with quantity discount, model without shortage , Selective Inventory Control—ABC, VED, FSN analysis

Books:

1. Industrial Management, Vol.1 L.C. Jhamb, EPH
2. Industrial Relations, Trade Unions & Labour Legislation - Sinha, Pearson Education Asia
3. Organizational Behaviour, S.P. Robbins, Prentice Hall
4. Productions and Operations Management, S. N. Chary, TMH
5. Marketing Management, Phillip Kotler, Prentice Hall/Pearson Education.
6. Productions and Operations Management, Joseph Monks,TMH

ELECTIVE II

Robotic Control
Code: CS 801A
Contact: 3L
Credits: 3

Allotted Hrs: 39L

Robot Anatomy Arm Geometry-Direct & Inverse Kinematics Problem.Arm Dynamics,D Alembert Equations of Motion, Synthesis of elements with movalulity constraints,manipulations-trajectory planning,joint interpolated trajectories. [15L]

Control of Robot Manipulation-computed torque technique sequencing & adaptive control, resolved motion control Moluie Robots. [6L]

Robot sensing-Range & Proximity & Higher-Level vision, illumination techniques,Imaging Geometry, Segmentation Recognition & Interpretation. [8L]

Robot Programming Language Characteristics of Robot Level & Task Level languages.Robot intelligence-State Space search, Robot learning,Robot Task Planning,Knowledge Engineering.
[10L]

References:

1. K.S Fu R.C . CSG Lee-Robotics Control,Sensing, Vision & Intelligence,McGraw-Hill.
2. M.P. Groover,M.Weins,R.N. Nagel,N.C. Odrey –Industrial Robotics,McGraw Hill
3. Andrew C.Straugard-Robotics & AI,PHI
4. S. Sitharama Iyengar,Alberto Elefes-Autonomous Mobile Robots Control,Planning & Achitecture,IEEE Computer Society Press

Soft Computing
Code: CS 801B
Contact: 3L
Credits: 3
Allotted Hrs: 39 L
Introduction to artificial neural network [10L
Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Applications of Artificial Neural Networks.
Competitive learning networks, Kohonen self organizing networks, Hebbian learning; Hopfield Networks, Associative Memories, The boltzman machine; Applications.
Fuzzy Logic [12L
Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.Fuzzy Logic: Classical Logic.
Genetic algorithms(Gas),Evolution strategies(Ess),Evolutionary programming(EP),Genetic Programming(GP),Selecting,crossover,mutation,schema analysis,analysis of selection algorithms;convergence;Markov & other stochastic models**.**
[10L]
Other Soft computing approaches [7L
Simulated Annealing, Tabu Search, Ant colony based optimisation, etc.

Text:

1. "Neuro-Fuzzy and Soft computing", Jang, Sun, Mizutani, Pearson
2. "Neural networks: a comprehensive foundation", Haykin, Pearson
3. "Genetic Algorithms", Goldberg, Pearson
4. "Fuzzy Sets & Fuzzy Logic", G.J. Klir & B. Yuan, PHI.

Reference:

1. "An Introduction to Neural Networks", Anderson J.A., PHI, 1999.

2. "Introduction to the Theory of Neural Computation", Hertz J. Krogh, R.G. Palmer, Addison-Wesley, California, 1991.
3. "An Introduction to Genetic Algorithm", Melanie Mitchell, PHI, 1998.
4. "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.
5. "Neural Networks: Algorithms, Applications and Programming Techniques", Freeman J.A. & D.M. Skapura, Addison Wesley, Reading, Mass, (1992).

Digital Signal Processing

Code: CS 801C
Contact: 3L
Credits: 3
Allotted Hrs: 39L

Introduction, Overview of digital signal processing **[2L**

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. **[4L]**

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. **[2L]**

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.
[7L

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.
[12L

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 . **[12L**

Text:

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

Reference:

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

VLSI Design
Code: CS 801D
Contact: 3L
Credits: 3
Note: Trace on Basic concepts only
Allotted Hrs: 39L

Introduction to CMOS circuits: MOS Transistors, MOS transistor switches, CMOS Logic, The inverter, Combinational Logic, NAND gate, NOT Gate, Compound Gates, Multiplexers, Memory-Latches and Registers.
[6L]

Processing Technology: Silicon Semiconductor Technology- An Overview, wafer processing, oxidation, epitaxy deposition, Ion-implantation and diffusion, The Silicon Gate Process- Basic CMOS Technology, basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator, CMOS process enhancement-Interconnect,

circuit elements, 3-D CMOS. Layout Design Rule: Layer Representations, CMOS n-well Rules, Design Rule of background scribe line, Layer Assignment, SOI Rule

[10L]

.Power Dissipation: Static dissipation, Dynamic dissipation, short-circuit dissipation, total power dissipation. Programmable Logic, Programmable Logic structure, Programmable interconnect, and Reprogramable Gate Array: Xilinx Programmable Gate Array, Design Methods: Behavioural Synthesis, RTL synthesis

[8L]

Placement: placement: Mincut based placement – Iterative improvement placement simulated annealing. Routing: Segmented channel routing – maze routing – routability and routing resources – net delays.

[5L]

Verification and Testing: Verification Versus Testing, Verification: logic simulation design validation – timing verification – Testing concepts: failures – mechanisms and faults – fault coverage – ATPG methods – types of tests – FPGAs – programmability failures – design for testability.

[5L]

Overview of VHDL **[5L]**

Text Book:

1."Digital Integrated Circuit", J.M.Rabaey, Chandrasan, Nicolic, Pearson
2. "CMOS Digital Integrated Circuit", S.M.Kang & Y.Leblebici, TMH
3."Modern VLSI Design" Wayne Wolf, Pearson
4."Algorithm for VLSI Design & Automation", N.Sherwani, Kluwer
5."VHDL", Bhaskar, PHI

References:

1. " Digital Integrated Circuits" Demassa & Ciccone, Willey Pub.
2. "Modern VLSI Design: system on silicon" Wayne Wolf; Addison Wesley Longman Publisher
3. "Basic VLSI Design" Douglas A. Pucknell & Kamran Eshranghian; PHI
4. "CMOS Circuit Design, Layout & Simulation", R.J.Baker, H.W.Lee, D.E. Boyee, PHI

E – Commerce & ERP

Code: CS801E

CONTACTS: 3L

CREDITS: 3

1. **Electronic Commerce** : Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws.
   [3 L]
2. **Technologies :** Relationship Between E – Commerce & Networking, Different Types of Networking For E – Commerce, Internet, Intranet & Extranet, EDI Systems
   Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce .
   [5 L]
3. **Business Models of e – commerce** : Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance. **[2 L]**
4. **E – strategy** : Overview, Strategic Methods for developing E – commerce. **[2 L]**
5. **Four C's** : (Convergence, Collaborative Computing, Content Management & Call Center).
   Convergence : Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce.
   Collaborative Computing : Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security.
   Content Management : Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management ; Content Marketing.
   Call Center : Definition, Need, Tasks Handled, Mode of Operation, Equipment , Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE).
   [6 L]
7. **Supply Chain Management** : E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power.
   [3 L]

8. **E – Payment Mechanism** : Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. **[1 L]**
9. **E – Marketing** :. Home –shopping, E-Marketing, Tele-marketing **[1 L]**
10. **Electronic Data Interchange (EDI)** : Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA). **[2 L]**
11. **Risk of E – Commerce** : Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures. **[4 L]**
12. **Enterprise Resource Planning (ERP)** : Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Process Redesign, Knowledge engineering and data warehouse .

Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials Management, QualityManagement, Sales&Distribution ERPPackage,
ERP Market: ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation
ERP-Present and Future: Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Future Directions in ERP [10]

Reference :

1. E-Commerce,M.M. Oka, EPH
2. Kalakotia, Whinston : Frontiers of Electronic Commerce , Pearson Education.
3. Bhaskar Bharat : Electronic Commerce - Technologies & Applications.TMH
4. Loshin Pete, Murphy P.A. : Electronic Commerce , Jaico Publishing Housing.
5. Murthy : E – Commerce , Himalaya Publishing.
6. E – Commerce : Strategy Technologies & Applications, Tata McGraw Hill.
7. Global E-Commerce, J. Christopher & T.H.K. Clerk, University Press
8. Beginning E-Commerce, Reynolds, SPD
9. Krishnamurthy, E-Commerce Mgmt, Vikas

Pattern Recognition
Code: CS 801F
Contact: 3L
Credits: 3
Allotted Hrs: 39L

Topic	Syllabus
1. Introduction (4L)	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.
2. Bayes Decision Theory (7L)	General framework; Optimal decisions; Classification; Simple performance bounds.
3. Learning - Parametric Approaches (4L)	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;
4. Parametric Discriminant Functions (4L)	Linear and quadratic discriminants; Shrinkage; Logistic classification; Generalized linear classifiers; Perceptrons; Maximum Margin; Error Correcting Codes;
5. Error Assessment (4L)	Sample error and true error; Error rate estimation; Confidence intervals; Resampling methods; Regularization; Model selection; Minimum description length; Comparing classifiers
6. Nonparametric Classification (4L)	Histograms rules; Nearest neighbor methods; Kernel approaches; Local polynomial fitting; Flexible metrics; Automatic kernels methods

7. Feature Extraction (6L)	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,
8. Margins and Kernel Based Algorithms (3L)	Advanced algorithms based on the notions of margins and kernels
9. Applications of PR (3L)	Speech and speaker recognition, Character recognition, Scene analysis.

Mobile Computing
Code: CS 802A
Contact: 3L
Credits: 3

Allotted Hrs: 45L

Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signalling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signalling. **[5L**

General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.
[5L
Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies. **[7L**

Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G.
[7L

Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.
[7L

Server-side programming in Java, Pervasive web application architecture, Device independent example application
[8L

Text :
1. "Pervasive Computing", Burkhardt, Pearson
2. "Mobile Communication", J. Schiller, Pearson
3. "Wireless and Mobile Networks Architectures", Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001
4. "Mobile and Personal Communication systems and services", Raj Pandya, Prentice Hall of India, 2001.

Reference :
1. "Guide to Designing and Implementing wireless LANs", Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.
2. "Wireless Web Development", Ray Rischpater, Springer Publishing,
3. "The Wireless Application Protocol", Sandeep Singhal, Pearson .
4. "Third Generation Mobile Telecommunication systems", by P.Stavronlakis, Springer Publishers,

Real Time & Embedded System
Code: CS 802B
Contact: 3L
Credits: 3

Allotted Hrs: 39L
Introduction-defining Real time systems,Embedded Real Time Systems,Special Characteristics of real time systems,a brief evolutionary history.

Hardware Architectures of Real Time systems. [12L]

Software architectures(concepts of interrupt driven activation,need for real time monitor,pseudo parallelism),meeting of dead lines & real time constraints.[5L]
Overview of WARD & MELLOR Methodology: Ward & Mellor Life Cycle,the essential model step,the implementation model,real time extensions of DFD[10L]

Real time languages: overview of ADA/Java Extension [4L]
Real time Operating Systems . [4L]
System Development Methodologies. [4L]

Text :

1. "Embedded System Design" Frank Vahid & Tony Givargis; John Wiley & sons, Inc.
2. "Real – Time Systems and software"Alan C. Shaw ; John Wiley & Sons Inc
3. "Fundamentals of embedded Software", Daniel W. Lewis, Pearson
4. "Real time Systems", J. W. S. Liu, Pearson
5. "Embedded Realtime System Programming", S. V. Iyer and P. Gupta, TMH

References:

1. "An Embedded System Primer" David E. Simon; Addison-Wesley Pub
2. "Embedded System Design" Steve Heath; Butterworth-Heinemann Pub.
3."Embedded System Computer Architecture" Graham Wilson, Butterworth-Heinemann,

GIS & Remote Sensing
Code: CS 802C
Contact: 3L
Credits: 3
Allotted Hrs: 39L

Introduction and Overview of Geographic Information Systems [3L
Definition of a GIS, features and functions; why GIS is important; how GIS is applied; GIS as an Information System; GIS and cartography; contributing and allied disciplines; GIS data feeds; historical development of GIS.

GIS and Maps, Map Projections and Coordinate Systems [4L
Maps and their characteristics (selection, abstraction, scale, etc.); automated cartography versus GIS; map projections; coordinate systems; precision and error.

Data Sources, Data Input , Data Quality and Database Concepts [3L
Major data feeds to GIS and their characteristics: maps, GPS, images, databases, commercial data; locating and evaluating data; data formats; data quality; metadata. Database concepts and components; flat files; relational database systems; data modeling; views of the database; normalization; databases and GIS.

Spatial Analysis [3L
Questions a GIS can answer; GIS analytical functions; vector analysis including topological overlay; raster analysis; statistics; integrated spatial analysis.

Making Maps [6L
Parts of a map; map functions in GIS; map design and map elements; choosing a map type; producing a map formats, plotters and media; online and CD-ROM distribution; interactive maps and the Web.

Implementing a GIS [4L
Planning a GIS; requirements; pilot projects; case studies; data management; personnel and skill sets; costs and benefits; selecting a GIS package; professional GIS packages; desktop GIS; embedded GIS; public domain and low-cost packages.

Technology & Instruments involved in GIS & Remote Sensing [8L]
GIS applications; GIS application areas and user segments; creating custom GIS software applications; user interfaces; case studies. Future data; future hardware; future software; Object-oriented concepts and GIS; future issues – data ownership, privacy, education; GIS career options and how to pursue them.

Remote Sensing [8L
Remote sensing of environment, E.M. Principle, Thermal infrared remote sensing, Remote sensing of Vegetation, Remote sensing of water, urban landscape

Text:

1. "Principles of geographical information systems", P. A. Burrough and R. A. Mcdonnel, Oxford.
2. "Remote sensing of the environment" , J. R. Jensen, Pearson

References:

1. "Exploring Geographic Information Systems", Nicholas Chrismas, John Wiley & Sons.
2. "Getting Started with Geographic Information Systems",Keith Clarke, PHI.
3. "An Introduction to Geographical Information Systems", Ian Heywood, Sarah Cornelius, and Steve Carver. Addison-Wesley Longman.

Network Security
Code: CS 802D
Contact: 3L
Credits: 3
Allotted Hrs: 39L

Introduction [3]
Attacks, Services, Mechanisms, Security Attacks, Security Services, Model for Network Security
Conventional Encryption and Message Confidentiality [8]
Conventional Encryption Principles, Conventional Encryption Algorithms, Location of Encryption Devices, Key Distribution
Public Key Cryptography and Message Authentication [8]
Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles, RSA, Digital Signatures, Key Management
Network Security Applications [4]
Kerberos Motivation, Kerberos Version 4, PGP Notation, PGP Operational Description
IP Security [2]
IP Security Overview, IP Security Architecture, Authentication Header
Web Security [7]
Web Security Threats, Web Traffic Security Approaches, Overview of Secure Socket Layer and Transport Layer Security, Overview of Secure Electronic Transaction
Intruders and Viruses [4]
Intruders, Intrusion Techniques, Password Protection, Password Selection Strategies, Intrusion Detection, Malicious Programs, Nature of Viruses, Types of Viruses, Macro Viruses, Antivirus Approaches
Firewalls [3]
Firewall Characteristics, Types of Firewalls, Firewall Configuration

Text :

1. "Network Security Essentials: Applications and Standards" by William Stallings, Pearson
2. "Network Security private communication in a public world", C. Kaufman, R. Perlman and M. Speciner, Pearson

Reference :

1. "Cryptography and Network Security", William Stallings, 2nd Edition, Pearson Education Asia
2. "Designing Network Security", Merike Kaeo, 2nd Edition, Pearson Books
3. "Building Internet Firewalls", Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition, Oreilly
4. "Practical Unix & Internet Security", Simson Garfinkel, Gene Spafford, Alan Schwartz, 3rd Edition, Oreilly

Advanced Java Programming
Code: CS 802E
Contact: 3L
Credits: 3
Allotted Hrs: 39L

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. [4L]
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. [4L]
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. [5L]
EJB :Introduction, Comparison of EJB & Java Beans , Applications, Drawbacks, Different types of enterprise beans ,Services provided by EJB container. [5L]
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 [5L]
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. [5L]
XML: Java & XML, XML syntax, Document type definition., Parsers, SAX parsers, DOM parsers, SAX vs. Dom, JAXP and JAXB. [8L]

Text :

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

Reference Books:

1. Internet & Java Programming by Krishnamoorthy & S. Prabhu(New Age Publication)

Natural Language Processing:
Code: CS 802F Contact: 3L Credits: 3
Allotted Hrs: 39L
Introduction to NLP [2L]:
Definition, issues and strategies, application domain, tools for NLP, Linguistic organisation of NLP, NLP vs PLP.
Word Classes [13L]:
Review of Regular Expressions, CFG and different parsing techniques 1L
Morphology: Inflectional, derivational, parsing and parsing with FST, Combinational Rules **3L**
Phonology: Speech sounds, phonetic transcription, phoneme and phonological rules, optimality theory, machine learning of phonological rules, phonological aspects of prosody and speech synthesis. **4L**
Pronunciation, Spelling and N-grams: Spelling errors, detection and elimination using probabilistic models, pronunciation variation (lexical, allophonic, dialect), decision tree model, counting words in Corpora, simple N-grams, smoothing (Add One, Written-Bell, Good-Turing), N-grams for spelling and pronunciation. **5L**
Syntax [7L]:
POS Tagging: Tagsets, concept of HMM tagger, rule based and stochastic POST, algorithm for HMM tagging, transformation based tagging **4L**
Sentence level construction & unification: Noun phrase, co-ordination, sub-categorization, concept of feature structure and unification. **3L**
Semantics [9L]:
Representing Meaning: Unambiguous representation, canonical form, expressiveness, meaning structure of language, basics of FOPC **2L**
Semantic Analysis: Syntax driven, attachment & integration, robustness **2L**
Lexical Semantics: Lexemes (homonymy, polysemy, synonymy, hyponymy), WordNet, internal structure of words, metaphor and metonymy and their computational approaches **3L**
Word Sense Disambiguation: Selectional restriction based, machine learning based and dictionary based approaches. **2L**
Pragmatics[8L]:
Discourse: Reference resolution and phenomena, syntactic and semantic constraints on Coreference, pronoun resolution algorithm, text coherence, discourse structure **4L**
Dialogues: Turns and utterances, grounding, dialogue acts and structures **1L**
Natural Language Generation: Introduction to language generation, architecture, dicourse planning (text schemata, rhetorical relations). **3L**
Text Book:

1. D. Jurafsky & J. H. Martin – "Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition", Pearson Education

Reference Books:

1. Allen, James. 1995. – "*Natural Language Understanding"*. Benjamin/Cummings, 2ed.
2. Bharathi, A., Vineet Chaitanya and Rajeev Sangal. 1995. *Natural Language Processing- "A Pananian Perspective"*. Prentice Hll India, Eastern Economy Edition.
3. Eugene Cherniak: "Statistical Language Learning", MIT Press, 1993.
4. Manning, Christopher and Heinrich Schütze. 1999. "*Foundations of Statistical Natural Language Processing"*. MIT Press.