APPROVED COURSE STRUCTURE AND SYLLABI

BACHELOR OF ENGINEERING DEGREE EXAMINATIONS

(CE, ME, MetE, MinE, EE, ETcE, CSTE, IT Branches)

AND

BACHELOR OF ARCHITECTURE DEGREE EXAMINATIONS

From July, 2005

Bengal Engineering and Science University, Shibpur
HOWRAH- 711 103

Dean, FEAT
Bengal Engineering and
Science University, Shibpur
Howrah- 711 103

	1st. Semester(common to EE, ETcE, CSTE, IT Branches)								
	Name of the subject	**Subject Code**	**L**	**T**	**S**	**Tot**	**Full**	**Marks**	**Total**
1	Mathematics-I	MA101	3	1	0		100		
2	Physics	PH1201	3	1	0		100		
3	Prof.Comm.in English	HU1201	2	1	0		50		
4	Environment & Ecology	CE101	2	0	0		50		
5	BasicElectronicsEngg.	ET1201	3	1	0		100		
6	Engineering Drawing-I	DR101	1	0	0		100		
7	Physics Lab.	PH1251	0	0	3			50	
8	Workshop Practice	WS1251	0	0	3			50	
9	BasicElectronicsEnggLab	ET1251	0	0	3			50	
10	Engineering Drawing Practice-I	DR151	0	0	6			100	
		Total:	14	4	15	33	500	250	750
	Additional Elective								
	NCC / Physical Training-I (for all the departments)	SA191	0	0	2			50	
		(Marks obtained more than the Pass Marks will be added to theTotal)							

	2nd. Semester(common to EE, ETcE, CSTE, IT Branches)								
	Name of the subject	**Subject Code**	**L**	**T**	**S**	**Tot**	**Full**	**Marks**	**Total**
1	Mathematics-II	MA201	3	1	0		100		
2	Chemistry	CH1201	3	1	0		100		
3	Intro to Computing	CS1201	2	1	0		50		
4	Engineering Mechanics	AM201	3	1	0		100		
5	BasicElectricalEngg.	EE1201	3	1	0		100		
6	Engineering Drawing-II	DR201	1	0	0		100		
7	Chemistry Lab.	CH1251	0	0	3			50	
8	Computing Practice	CS1251	0	0	3			50	
9	Engineering Mechanics Lab.	AM251	0	0	2			50	
10	Basic Electrical Engg Lab	EE1251	0	0	3			50	
11	Engineering Drawing Practice-II	DR251	0	0	3			100	
		Total:	15	5	14	34	550	300	850
	Additional Elective								
	NCC / Physical Training-II (for all the departments)	SA291	0	0	2			50	
		(Marks obtained more than the Pass Marks will be added to theTotal)							

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Computer Science and Technology

	3rd. Semester								
	Name of the subject	**Subject Code**	**L**	**T**	**S**	**Tot**	**Full**	**Marks**	**Total**
1	Mathematics IIIC	MA303	3	1	0		100		
2	Electrical Machines and Applications	EE305	3	0	0		100		
3	Elements of Mechanical Engg.	ME304	2	1	0		50		
4	Electronic Devices and Circuits	ET305	3	1	0		100		
5	Digital Logic	CS301	3	1	0		100		
6	Data Structures and Algorithms	CS302	3	1	0		100		
7	Electrical Machines & Applications Lab.	EE355	0	0	3			50	
8	Electronic Devices & Circuits Lab.	ET352	0	0	4			100	
9	Data Structures Algorithms Lab.	CS351	0	0	3			50	
10	Digital Logic Lab.	CS352	0	0	4			50	
		Total:	17	5	14	36	550	250	800
	4th. Semester								
	Name of the subject	**Subject Code**	**L**	**T**	**S**	**Tot**	**Full**	**Marks**	**Total**
1	Probability & Statistics	MA402	3	1	0		100		
2	Control & Instrumentation	EE406	4	0	0		100		
3	Discrete Structures	CS401	3	1	0		100		
4	Computer Organisation	CS402	3	1	0		100		
5	Object Oriented Technology	CS403	3	1	0		100		
6	Electronic Design Automation	CS404	2	1	0		50		
7	Object Oriented Technology Lab.	CS451	0	0	3			50	
8	Electronic Design Automation Lab.	CS452	0	0	3			50	
9	Computer Organisation Lab.	CS453	0	0	4			100	
10	Discrete Structures Lab.	CS454	0	0	3			50	
		Total:	18	5	13	36	550	250	800

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	5th. Semester								
	Name of the subject	**Subject Code**	**L**	**T**	**S**	**Tot**	**Full**	**Marks**	**Total**
1	Mathematics-V	MA501	3	1	0		100		
2	Operating Systems	CS501	3	1	0		100		
3	Computer Architecture	CS502	3	1	0		100		
5	Microprocessor based System design	CS503	3	1	0		100		
6	Design & Analysis of algorithm	CS504	3	1	0		100		
7	Digital Communication	ET501	3	1	0		100		
8	Operating Systems Lab.	CS551	0	0	3			100	
9	Algorithm Lab.	CS552	0	0	2			50	
10	Microprocessor based System design Lab.	CS553	0	0	4			100	
11	Digital Communication Lab	ET551	0	0	3			50	
		Total:	18	6	12	36	600	300	900
	6th. Semester								
	Name of the subject	**Subject Code**	**L**	**T**	**S**	**Tot**	**Full**	**Marks**	**Total**
1	Economics & Accountancy	HU5601	2	0	0		50		
1	Principles of Management	HU5602	2	0	0		50		
2	Analysis, Design & Mgmt.of Info. Systems	CS601	3	1	0		100		
3	Theory of Computation	CS602	3	1	0		100		
4	Computer Networks	CS603	3	1	0		100		
5	Database Management System (DBMS)	CS604	3	1	0		100		
6	System Programming	CS605	3	1	0		100		
7	Anal., Design & Mgmt.of Info. Systems Lab.	CS651	0	0	2			50	
8	Database Management System Lab	CS652	0	0	2			50	
9	Computer Networks Lab.	CS653	0	0	3			50	
10	System Programming Lab.	CS654	0	0	3			50	
11	Digital Systems Design Lab.	CS655	0	0	4			100	
12	Viva Voce-I	CS671	0	0	0			50	
		Total:	17	5	14	36	600	350	950

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	7th. Semester								
	Name of the subject	**Subject Code**	**L**	**T**	**S**	**Tot**	**Full**	**Marks**	**Total**
1	Professional values and ethics	HU7801	2	0	0		50		
2	Computer Graphics	CS701	3	1	0		100		
3	Comp.Control of Industrial Processes	CS702	3	1	0		100		
4	Compiler Design	CS703	3	1	0		100		
5	VLSI Design	CS704	3	1	0		100		
6	Elective I (Dept)	CS705/d	3	1	0		100		
7	Elective II (Dept)	CS706/d	3	1	0		100		
8	Computer Graphics Lab	CS751	0	0	3			100	
9	Comp. Control of Industrial Process Lab	CS752	0	0	3			50	
10	Compiler Design Lab	CS753	0	0	3			50	
11	Project Preliminary / Thesis	CS754	0	0	2			50	
12	Viva - Voce II	CS771	0	0	0			50	
		Total:	20	6	11	37	650	300	950
	8th. Semester								
	Name of the subject	**Subject Code**	**L**	**T**	**S**	**Tot**	**Full**	**Marks**	**Total**
1	Management in Industries	ME806	2	0	0		50		
2	Software Engineering	CS801	3	1	0		100		
3	Symbolic Logic & Artificial Intelligence	CS802	3	1	0		100		
4	Elective III (Non-Dept / Dept)	XX80n/d/CS803/d	2	0	0		50		
5	Elective IV	CS804/d	3	1	0		100		
6	Symbolic Logic & Algorithm Lab	CS851	0	0	3			50	
7	VLSI Lab	CS852	0	0	3			50	
8	Software Engineering Lab	CS853	0	0	3			50	
9	Project / Thesis	CS854	0	0	6			200	
10	Group Discussion / Seminar	CS855	0	0	2			50	
11	Viva Voce-III	CS871	0	0	0			100	
		Total:	13	3	17	33	400	500	900

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DEPARTMENT OF APPLIED MATHEMATICS

APPROVED SYLLABUS for UNDERGRADUATE (B.E.) COURSE

MA 101 MATHEMATICS-I (for all Engg. Branches)

SEMESTER EXAMINATION: **CONTRACT PERIODS: (3 L + I T)**
TIME – 3Hrs. **Continious Assessment :**
Full Marks -70 **Full Marks -30**

Calculus (First half : A and B ; Second half: C and D
Function of Single Variable:

Successive Differentiation, Rolle's Theorem (statement only). Geometrical Interpretation, MVT, Geometrical Interpretation, Taylor's Theorem, Cauchy & Lagrange's form of reminders, Taylor's and Maclaurin's series, expansion of function, Indeterminate forms.

Application of Calculus: Intrinsic and Pedal equation of curves, Curvature, Asymptote.

Test of Convergence of Infinite Series:
Comparison test, D Alenbert's Ratiotest, Gauss test and Cauchy's Root test, Power series.

Functions of Several variables:
Limit, Continuity, Differentiability (definition and sample examples only), Partial derivatives, Differentials & small errors, Euler's theorem, Taylor's theorem & series,Expansion of functions, Maxima &minima.

Complex Algebra:

De Moivre's theorem, Extraction of roots of complex numbers, complex functions, e.g., a^z and sin z, cos z, log z, $\sin^{-1}z$, $\cos^{-1}z$, $\tan^{-1}z$ etc.

MA 201 MATHEMATICS -II (for all Engg. Branches)

SEMESTER EXAMINATION: **CONTRACT PERIODS: (3 L + I T)**
TIME – 3Hrs. **Continious Assessment :**
Full Marks -70 **Full Marks -30**

First half : A and B ; Second half: C and D

Calculus:
Fundamental an MVT of Intigral Calculus,(sStatement only), Improper Integrals, Beta and Gamma Functions, MultipleIntegrals and Applications.

Vector Analysis
Sum and product of vectors, Vector equations of lines and planes, Derivative of a vector, Differential Geometry upto Serret – Frenet's formula, Directional Derivations, Gradient, divergence, Curl, Line integral and surface integral, Green, Gauss and Stokes'ems, Application of vector to Geometry and Mechanics

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Maxtrix and Determinant:
Definition and simple properties regarding sum and product of two matrices, Transpose, Symmetric, Skew-Symmetric and orthogonal matrics, Determinant of sq. matrics & their simple properties, co-factors & minors, Left and right inverse, Rank of matrics, Eigen-values and Eigen-vectors, similar matrics, Diagonalisation of matrics, Solution of simultaneous linear equations: Consistency & Inconsistency.

Differential Equations:
Higher order linear ODE with constant co-efficients, method of variation of parameters, Cauchy or Euler's equations, Frobenious method of solution in series of ODE, Singular points, Bassel and Legendre equations, Rodrigue's Formula, Recurrence relations and Orthogonality relations

MA 301 MATHEMATICS III A (for CE/ME/MN/MT)

Semester Examination : Contact Periods : (3L+ 1 T)
Time-3 hrs. **Internal Assessment :**
Full Marks – 70. **Full Marks – 30.**

Group I:

A. Complex variables: Function, Limit and continuity of complex functions, Differentiation of complex functions, Analytic function, Cancly-Riemann equations, Harmonic functions, Line Integrates, Canchy-Gourset theorem (No proof required). Cancly's Integral formula, Derivative of analytic functions, Taylor's and Laurent's series, Zeroes, Singular points: essential and removable, Poles, Residue, Residue Theorem, Contour Integration (simple cases only)

B. Fouries Series :

C. Boundary value and Initial value problems leading to partial differential Equation: Method of solution by separation of variables Technique.

Group II: L.P.P.

Vector and Euclidean spaces, Linea dependence, Bases, Vector space and subspaces, Rank, Point sets, Convex sets, Boundary Points, Extreme points, Linear system – Basic Solutions, Basic matrix, Feasible solution, Basic feasible solution, Linear programming problems, Slack surplus and artificial variables, Graphical method of solution, Simplex method, Charne's Big-M-method.

MA 302 MATHEMATICS III B (for EE/ET/IT)

Semester Examination : Contact Periods : (3L+ 1 T)
Time-3 hrs. **Internal Assessment :**
Full Marks – 70. **Full Marks – 30.**

A. Probability : Intuitive notion, Classical definition of probability, Combinatorial application, Axiomatic approach to probability theory, Univariate probabilities distributions – discrete and continuous. Standard distributions – Binomial, Poisson, Normal and Exponential. Bivariate distributions – concept of joint and conditional distributions. Mathematical expectation, Variance and Covariance. Correlation coefficients.

B. Statistics : Point estimation and interval estimation. Concept of statistics. Unbiasedness and mean square error. Minimum variance unbiased estimators. Testing of Hypothesis.

C. Queuing Theory : Homogeneous Poisson Process (HPP), Notion of a queuing system, Kendall's notation, M/M/1, M/M/C, M/M/ ∞ queues. Steady state distributions. M/G/ ∞ queue and related special cases.

D. Linear programming : concept of LPP and its dual formulation, basic solutions, feasible solutions and basic feasible solutions, convex sets. Notions of optimal solutions and relations and relation to corner points. Graphical approach. Basic theorems and complementary slackness conditions. Simplex method.

MA 303 MATHEMATICS III C (for CS)

Semester Examination : Contact Periods : (3L+ 1 T)
Time-3 hrs. **Internal Assessment :**
Full Marks – 70. **Full Marks – 30.**

Group – I

A. Complex variables

Function, limit and continuity of complex functions, differentiation of complex functions, analytic function, Cauchy – Riemann equations, Harmonic functions, Line integrals, Cauchy – Gourset Theorem, Derivative of analytic functions, Taylor's and Laurent's series, Zeroes, Singular points, essential and removable, Poles, Resudue, Residue Theorem, Contour Integration (Simple cases only).

B. Fourier series.

C. Boundary value and Initial value problems leading to partial differential equation, Method of solution by separation of variables Technique.

Group – II : Discrete Structures

A. Algebraic Structures: Monoids, Groups, Subgroups, Homomorphism, Isomorphism, Automorphism, Cosets, Lagrange's Thearem, Elementary ideas of Ring and Field.

Graph Theory: Graph, Incidence and Degree, Walks, Paths and circuits, Euler graph, Tree, Spanning tree, Fundamental circuit, cut sets and cut vertices.

MA 305: PROBABILITY, STATISTICS AND QUEING THEORY

FM – 100 Contact Period : 4L+1T per week

Probability
Random experiments, Events and Event space, Classical definition of probability, statistical regularity and frequency definition of probability, Axioms of probability and associated basic formulas, Conditional probability, Bayes' theorem.

Independent trials, Bernoulli trials, Poisson approximate, Random variables, Probability distributions for univariate random variables – discrete and continuous, Expectations, Moment generating function and Characteristic function, Bivariate random variable, marginal and conditional distributions, Expectation for a bivariate distribution, Correlation and regression.

Special Distributions e.g. χ^2, t, F – distributions.
Inequalities and Limited theorems including the Central Limit theorem (statement only).
Statistics
Random samples and Sample characteristics, Sampling distributions.
Estimation of parameters: point estimation – method of Maximum Likelihood, Interval estimation.
Testing of hypotheses: best critical region, Neyman – Pearson theorem (statement only), Applications to Normal (m, σ) population, - χ^2 test for goodness of fit.
Queing Theory
Classification of Stochastic Processes, Markov chains, Transition Probability matrices, Chapman-Kolmogorov equations and applications. Simple Random Walk-recurrence

and transience.
Poisson Process. Structures and Components of a Queing System, Kendall's notation.

Basic queing models: the M/M/I, M/M/c, M/M/∞ , $M^{(b)}$ /M/1 and M/G/∞ queues-

transient and steady state solutions.

MA401 Mathematical Techniques (for ETC)

Semester Examination : Contact Periods : (3L+ 1 T)
Time-3 hrs. **Internal Assessment :**
Full Marks – 70. **Full Marks – 30.**

A. **Matrix Theory** - Partition of a matrix, Eigen values, Eigen vectors of various types of matrices, Properties of matrices, Similarity and Orthogonal transformation. Diagonalization and triangularization. Quadratic form and reduction to orthogonal transformation and Applications.

B. Fourier transform, fourier sine and cosine transform.

C. Laplace Transform, Transform of elementary functions, Convolution Theorem, Inverse transform, z transform

D. Calculus of Variation: Euler lagrange differential equation for fixed end points, Application to Brachistochrone problem, Euler Lagrange equation for variable end points.

MA402 Probability & Statistics (for CS)

Semester Examination : Contact Periods : (3L+ 1 T)
Time-3 hrs. **Internal Assessment :**
Full Marks – 70. **Full Marks – 30.**

Group A

Probability : Intuitive notion, Classical definition of probability, Combinatorial applications, Axiomatic approach to probability theory.

(i) Probability distributions - Discrete and continuous, Bivariate distributions – concept of joint and conditional distributions, Standard distributions – Binomial, Poisson, Negative Binomial, Geometric, Hypergeometric, Uniform, Normal, Multivariate Normal, Exponential, Weibull. Chi-square distribution, t, F, Z distributions. Central Limit Theorem and its applications.

(ii) Mathematical expectation, Variance and Covariance. M.G.F and C.F. of standard distributions. Cauchy-Schwartz, Jenson, Chebychev's inequalities. WLLN, SLLN.

(iii) Correlation and Regression, Principle of least squares and curve fitting.

Group B

(i) Measures of Central Tendency, Dispersion, Skewness and Kurtosis.

(ii) Estimation: Point estimation and Interval estimation, Properties of good estimators- Unbiasedness, Consistency, Efficiency and sufficiency, Methods of estimation- MLE, Methods of Moments, Minimum variance unbiased estimators.

(iii) Testing of Hypothesis: Types of Hypothesis, Critical region, Types of Errors, Level and power of Test, MP test, likelihood test, Neymann-Person Lemma and its applications.

MA403 Operation Research (for IT)

Semester Examination : Contact Periods : (2L+ 1 T)

Time-2 hrs. **Internal Assessment :**

Full Marks – 35. **Full Marks – 15.**

1. Duality and dual-simplex method:- Concept of duality, Mathematical formulation of duals, Duality theorems, Complementary slackness duality and simplex method, Economic interpretation of duality. Computational procedure of the dual-simplex algorithm, Examples.
2. Sensitivity Analysis :- Introduction, Changes in the objective functions. Variation in the requirement vector. Addition and deletion of a variable. Addition of a constraint.
3. Integer linear Programming :- Introduction, Cutting plane algorithm for pure integer solution, The branch and bounds technique.
4. Assignment Problems :- Mathematical formulation of the problem solution of assignment problem, computational procedure. Variations in assignment problem, Travelling salesman problem.
5. Sequencing :- Introduction. Terminology, Notations and assumption, Problems with n-jobs and 2-machines. Problems with n jobs and 3 machines and problems with n-jobs and n-machines. Optimum sequencing algorithm.
6. Inventory Management :- Introduction, Techniques of inventory control with known demand, Economic lot size problem , Problems of EOQ with uniform demand, finite rate of replenishment with shortage etc.
7. Network scheduling by PERT/CPM :- Introduction basic concepts, Activities, Nodes, Network, Critical path time calculations in network, Critical path method (CPM) PERT calculations. Probability of meeting the schedule time.
8. Dynamic Programming :- Introduction, Bellman's optimality criteria. Recursive equation approach for solution of D.P.P. solution of L.P.P. by dynamic programming.

MA451 Operation Research Lab (for IT)

(Sessional Subject)

Full Marks – 50. Contact Periods : 3S

Experiments based on the subject Operation Research (MA403).

DEPARTMENT OF COMPUTER SCIENCE AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND TECHNOLOGY

APPROVED SYLLABUS for UNDERGRADUATE (B.E.) COURSE

1st & 2nd semester B.E.. Courses

CS 1201 **INTRODUCTION TO COMPUTING** **(for all Engg. Branches)**

SEMESTER EXAMINATION: **CONTRACT PERIODS: (2 L + I T)**
TIME – 2Hrs. **Continious Assessment :**
Full Marks -35 **Full Marks -15**

NUMBERSYSTEM & CODES

Positional & non positional number systems, Binary, Octal, Hexadecimal number system& Conversion, Representation of negative numbers & real numbers, Fixed and floating point numbers. Characteristics codes (ASCII, EBCDIC etc.) & others like Grey, Excess-3 etc.

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ARITHMETIC & LOGIC

Logic operations & gates, Half adder.
& full adder subtraction using add. Repetitive addition & subtraction to accomplish multiplication & division etc.

COMPUTER ORGANISATION

CPU, Memory & I/O devices – Commonly used peripherals.
Role of the CPU, Memory and I/O devices in the context of solving a problem.

PROBLEMSOLVING STEPS & PROGRAM DEVELOPMENT CYCLE

Systemetic decomposition, Flowchart, Algorithm, the three constructs (sequential, conditional and iterative). Edit, compilation, Debugging & execution.

INTRODUCTION TO PROGRAMMING IN C

Idea of High level, Assembly level & M/c level language.
Interpretation and compilation.
Variables and data types (basic), simple programs,
assignment, decision, loops, scope: Global & local,
control structure (if, if-else, switch, for, while, do while, break and continue)
Structural data type (Array, record, file, set etc.), Function, recursion, introduction to dynamic data structure.

CS 1251 **COMPUTING PRACTICE** **(for all Engg. Branches)**

Full Marks – 50 Contact Periods : (3S)

Following experiments are recommended based on the course **Introduction to Computing (CS 1201) :**

PROGRAM DEVELOPMENTIN UNIX ENVIRONMENT

Simple file handling and editing commands in suitable O.S (UNIX/ LINUX) environment & file structure. Batch files etc. servers/Clients and terminals in a Network environment. Edit, compile, link, debug and execute.

PROGRAMMING PROBLEMS

Programming problems covering all the aspects of C language and introductory numerical analysis problems.

ERROR PROPAGATION & COMPUTATION TIME

Rounding & truncation error. Execution time of a process. System time & user time etc.

DEBUGGING

Methods and tools.

3RD SEMESTER – COMPUTER SCIENCE AND TECHNOLOGY

CS 301 **DIGITAL LOGIC**

Semester Examination : Contact Periods : (3L+ 1 T)

Time-3 hrs. **Internal Assessment :**

Full Marks – 70. **Full Marks – 30.**

Diode as a switch. Use of diode in AND, OR circuits. Transistor as a switch. RTL,DTL,TTL logic gate circuits. MOS as a switch. Basic MOS inverter. MOS and CMOS logic gates. Fan in and Fan out capability of logic gate, propagation delay.

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Boolean Algebra - Postulates and axioms. Representation of truth table - POP and POS forms. Application in design of Adder, Parity generators, coda Converters. NAND/ NOR realisation. Exclusive OR functions. ALU combinatorial logic minimisation with K-map and Quine McCluskey method. Use of multiplexers and De-multiplexers in realisation of logic functions. Encoders and Decoders. Concept of Tristable logic and strobing

Sequential Network- Latch and flipflop. Systhesis of flipflop with combinatorial logic

gates, clocking methods. Synchronous and Asynchronous counter, Up and Down counting Resisters. Analysis and synthesis of sequential circuits - Moor and Mealy model description, state diagram and state table - Minimisation methods. Use of memory circuits. Racing and Logic hazards. Implementation of hazard free logic circuit.

CS 302 DATA STRUCTURES & ALGORITHMS

Semester Examination : Contact Periods : (3L+ 1 T)
Time-3 hrs. **Internal Assessment :**
Full Marks – 70. **Full Marks – 30.**

Concepts of data Structures – Information & Meaning, Abstract data Types.
Linear Data Structures – Sequential Representations :
Arrays and Lists, Stacks, Queues and Dequeues and their Applications; Linked Representations: Linear Linked List, Circular Linked List, Doubly Linked List and their Applications.

Nonlinear Data structures : Trees : Basic Terminologies; Binary trees: Properties, Traversals and Threads, Expression Tree, Binary search tree: Operations, Height Balanced Binary trees; M-Way Search Tree, B- Trees; Applications. Heaps & Priority Queues.
Graphs: Graph Terminologies, Representation of graphs, Graph Traversals, Application of Graphs.
Sets : Definition & Terminologies, Representation of Sets, Operations of sets, Applications.
Time & Space analysis of Algorithms – Order Notation.
Recursion – Design of Recursive Algorithms, Tail Recursion, When not to use recursion, Removal of Recursion.
Shorting Algorithms: Insertion sorts : Straight insertion sort, Binary insertion of sort, Shell sort; Exchange Sorts: Bubble sort, Quick sort, selection sorts: Straight Selection Sort, Heap Sort; Merge sort; Distribution Sorts : Bucket Sort, Radix Sort.
Searching: Sequential Search, Ordered Sequential Search, Binary Search, Interpolation Search.
Hashing,: Hashing Methods, Hash Function Implementations, Hash Tables, Scatter Tables, Scatter tables using Open Addressing.

CS 351 DATA STRUCTURES ALGORITHMS LAB

Full Marks – 50 **Contact Periods : (3S)**

Programming Experiments based on: Arrays, Stacks, Queues, Linked lists, Trees, Recursion, Sorting, searching and Hashing data structures.

CS 352 DIGITAL LOGIC LAB

Full Marks : 50 **Contact Period : (4S)**

Laboratory works based on Theory papers CST 301.

4th Semester - COMPUTER SCIENCE AND TECHNOLOGY

CS401 Discrete Structures

Semester Examination : Contact Periods : (3L+ 1 T)
Time-3 hrs. **Internal Assessment :**
Full Marks – 70. **Full Marks – 30.**

Sets, Relations, Functions : Basic definition & operations, Countable & uncountable sets, Cantors Diagonal arguments, Different types of relation & functions etc.

Partially order sets: Basic Definition & relations, different types of lattices , Boolean Algebra.

Algebraic Structures: Semigroup, monoid, group, ring, integral domain, field.

Principle of mathematical induction, Partition of integers, Integer functions, Numeric Functions, Order notations, Generating Functions, Recurrence relations and it's application in analyzing algorithms

Graph theory: Introductory concepts, trees, Planarity, Connectivity and Separablity, Cut Space and Cycle Space, colouring & related problems, Graph Enumerations.

Logic :
Proof Techniques : Proof by Exhaustive checking, Conditional proof , Proving the Contrapositive, Proof by Contradiction, If and Only If Proof, On Constructive Existence.

Sets : Definitions of a Set, Operations on Sets, Counting Finite Sets, Bags (Multisets).

Ordered Structures : Tuples, Lists, Strings and Languages, Relations, Counting Tuples.

Inductively Defined Sets : Numbers, Strings, Lists, Binary Trees, Cartesian Products of Sets.

Equivalence, Order and Inductive Proof : Composition of Relations, Closures, Path Problems; Equivalence Relations – Definitions and Examples, Equivalence Class, Partitions, Generating Equivalence Relations; Order Relations – Partial Order, Topological Sorting, Well – Founded Orders; Inductive Proof; Proof by Mathematical Induction, Proof by Well – Founded Induction, A Variety of Examples.

Elementary Logic : The Origins of Mathematical Logic,
How Do We Reason ? ; Propositional Calculus : Boolean Operators, Well – Formed Formulas and Semantics, Interpretations, Logical Equivalence and Substitution, Satisfiability, Validity, Truth Functions and Normal Forms, Logical Consequence, Formal Reasoning : Inference Rules, Formal Proof.

Predicate Logic : First Order Predicate Calculus – Terms, Predicates and Quantifiers, Well – Formed Formulas, Semantics and Interpretations, Validity, The Validity Problem; Equivalent Formulas : Equivalence, Normal Forms, Formalizing English Sentences ; Formal Proofs in Predicate Calculus.

CS402 Computer Organization

Semester Examination : Contact Periods : (3L+ 1 T)
Time-3 hrs. **Internal Assessment :**
Full Marks – 70. **Full Marks – 30.**

Basic organization, block level description. Assembly language programming, instruction set, instruction cycles, registers and storage, addressing modes. Processor design, information representation, computer arithmetic and their implementation, design of ALD. Controller design. Memory and 10 access, memory maps, programmed 10, DMA. Interrupts. 10 subsystems, input-output devices, interfacing 10 devices. Memory organizations, static and dynamic memories; Cache memory and memory hierarchy; Virtual memory. Introduction to multiprogramming and multiprocessing. Pipeline architectures.

CS403 Object Oriented Technology

Semester Examination : Contact Periods : (2L+ 1 T)
Time-2hrs. **Internal Assessment :**
Full Marks – 35 **Full Marks – 15.**

Review of OOP. Importance of OOP over procedural languages and software crisis. Classes and methods – encapsulation, message passing, base and derived classes, virtual base class, constructor, multiple inheritance. Operator and function overloading. Runtime Polymorphism.

Case studies – Object Oriented Design, analysis, implementation. Introduction to UML(Unified Modeling Language)

Introduction to Java Programming, Introduction to OO technologies.

Lab – Using Object Oriented features using C++.

CS404 Electronic Design Automation

Semester Examination : Contact Periods : (3L+ 1 T)
Time-3hrs. **Internal Assessment :**
Full Marks – 70 **Full Marks – 30.**

Design of regulated power supply and switching mode power supply (SMPS).

Specification of analog circuit components. Design of analog and mixed signal circuits.

Review of Metal Oxide semiconductor (MOS) and Bipolar junction transistor (BJT) based circuits. Examples with standard TTL and CMOS packaged devices.

Simulation of logic circuits using P-SPICE and other related tools.
VHDL, VERILOG programming for verification of analog and digital circuits. Introduction to other computer aided design packages.

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CS451 Object Oriented Technology Lab

(Sessional Subject)

Full Marks – 50. Contact Periods : 3S

Sessional work based on the course "Object Oriented Technology" (CS 403)

CS452 Electronic Design Automation Lab

(Sessional Subject)

Full Marks – 50. Contact Periods : 3S

1.Experiments on various compiler directives in verilog.

2.Write verilog code to observe the difference between case equality and logical equality operator.

3.Observe the difference between blocking and non-blocking procedural assignment statement experimentally.

4.Verify the difference between task and function experimentally.

5.Write verilog code to verify the truth table of various combinational and sequential circuits.

6.Write the VHDL description of a 16:1 MUX.

7.Observe the difference between various wait statements in VHDL code.

8.Verify the difference between the following in VHDL code:
(i) Signal and Variable
(ii) Concurrent and Sequential assignment statement.

9.Verify the use of sensitivity list in VHDL code.

CS453 Computer Organisation Lab

(Sessional Subject)

Full Marks – 100. Contact Periods : 4S

Sessional work based on the course "Computer Organisation " (CS 402)

CS454 DISCRETE STRUCTURE LAB

(Sessional Subject)

Full Marks : 50 Contact Period : 3S

Programming for manipulation of Discrete Structures like Set, Relation, Function, Hashing and recursive Function, Minimization of Boolean Function, etc. Programming related to Graph

Representation, Path Reachability, Tree Traversal, etc. Implementation of Graph Algorithms under UNIX environment.

5th Semester - COMPUTER SCIENCE AND TECHNOLOGY

Operating Systems (CS501)

FM - 100 **Contact Periods: 3L + IT**

Overview of Operating Systems:
Batch Processing, Multi-programming, Time Sharing and real Systems.
Process Management:
Process Management and Control, Concept of a process, Process control, IPC.
Threads and Symmetric multiprocessing
Processes and Threads, Symmetric Multiprocessing, Solaris, Linux and Windows threads
Processor Scheduling
Uniprocessor Scheduling, Multiprocessor and Real time scheduling
Concurrency: Mutual Exclusion and Synchronization Critical Section Problem
Semaphores, Monitors, Classical Problems of Synchronization
Concurrency: Deadlock and Starvation: Principles of Deadlock, Deadlock avoidance, Deadlock Detection, Recovery from Deadlock, Thread synchronization, Combined approach to deadlock handling
Memory:
Memory Management, Logical and Physical address space Swapping, Paging, Segmentation.
Virtual Memory: Demand Paging, Page replacement algorithms Frame allocation
Thrashing
Device management.
Information management- File system, Security.
A case study of UNIX.

Computer Architecture(CS502)

FM - 100 **Contact Periods: 3L + IT**

Overview: Von Neumann *m/c* architecture, instruction sets and their design issues, optimal coding algorithms, high speed arithmetic units, ALU; Control Unit, hardware and microprogrammed control design, optimization; Memory and I/O device interfacing, data transfer schemes; CISC and RISC processors.

Pipelining: Basic concepts, linear and non-linear pipe, hazards, overcoming hazards.

Memory Subsystems: High speed memories, memory interleaving, associative memory; Memory hierarchy, cache memory organizations, reducing cache misses, coherence and locality properties; Virtual memory organization, mapping and management techniques

Instruction-level parallelism, concepts, techniques for increasing ILP; Superscalar, superpipelined and VLIW processor architectures; Multiprocessor architecture, parallel architectures, shared-memory architecture, synchronization, memory consistency, interconnection networks; Non Von Neumann

Microprocessor Based System Design (CS503)

FM - 100 **Contact Periods: 3L+1T**

Review of Digital logic and logic Devices. CPU Architecture,BUS and system concept.

Processor Programming Model, Assembly language programming. Cross assembly, downloading and object files. Machine Cycle and Timing, BUS Arbitration, Memory and I/O devices. Address decoding, Memory and I/O interface System Support devices e.g., PPI, DMA & Interrupt Controller, USART, Timer etc, DMA, Serial communication Microcontroller and their use in embedded applications. Small system design principles & case study (Design and development of a system development kit: Assembly of h/w modules and development of the monitor program). Architectures, data flow machines, systolic architectures.
RISC & advanced CISC processors- Enhanced instruction and architectural support, Memory management & Multiprocessing etc.

Design & Analysis of Algorithms (CS504)

FM : 100 **Contact Period : 3L + 1T**

Notion of Algorithm Complexities: Time and Space complexities; Worst, Average and Amortized Time Complexities: Techniques for Amortized analysis.
Standard Techniques: Divide and Conquer, Dynamic Programming, Greedy, Branch and Bound, Backtracking techniques
Standard Data Structures: Dictionary, Priority Queue, Mergable heaps, Concatenable Queues, Hashing.
Algorithms for: Sorting- Lower bound, Randomized Quicksort, Heap Sort, Linear time Algorithms for Special instances; Matrix Multiplication and related problems; FFT Algorithms and Polynomial Multiplications, Network Flow Algorithms, NP- Hardness, Notion of Approximation Algorithms

Operating System Lab (CS551)

FM : 100 **Contact Period : 3S**

Laboratory Work Based on the Theory Paper CS501

Algorithm Lab (CS552)

FM : 50 **Contact Period : 2S**

Implementation of the algorithms and experimentations on them as in the theory papers CS504. Emphasis on implementation of algorithms designed using suitable data structures so as to get most efficient implementation.

Microprocessor Based System Design Lab (CS553)

FM : 100 **Contact Period : 4S**

Section I:
Familiarization I - Idea and operation of system Development Kit (SDK), Executing hand coded simple programs.
Familiarization II : Hardware of SDK etc., Executing harder programs.
Debugging: Debugging techniques, Break points, Single step etc.

Simple I/O - Interfacing simple I/O devices, I/O instruction, Memory mapped and I/O mapped, I/O concept etc.
Serial I/O _- Interfacing Simple I/O Devices, I/O instruction, Memory mapped & I/O mapped, I/O concept etc.
Display - Different types of display with special emphasis

Keyboard: Different types of keys, Interfacing matrix keyboard.
Section II
Design and development of SDK - Hardware Design of SDK, Software Monitor routine for SDK.

6th Semester - COMPUTER SCIENCE AND TECHNOLOGY

Analysis, Design & Management of Information Systems (CS601)

FM: 100 **Contact Periods: 3L + 1T**

Systems concepts – Characteristics, types, boundaries, subsystems, organizational system, information system, systems approach to management, MIS and its role in organization;
Types and functions of MIS, tools of MIS; control and feed-back of information systems, feed-forward control; information quality, information value chain;
Various models used in information systems especially in MIS such as CSF model, strategic planning model, management control model etc.;
Basic concepts on design of information systems for MIS oriented applications;
Decision making process, structured and unstructured decisions, concepts on DSS, ES, KBS etc.;
Socio-technical aspects of MIS.

Theory of Computation (CS602)

FM: 100 **Contact periods :3L+1T**

- Review of Sets, Relations, Functions, Closures
- Alphabets and Languages, Finite representation of languages, regular expressions and languages.
- Deterministic and non-deterministic finite automata, regular expression versus automata, properties of the class of regular languages, pumping theorem for regular languages, language recognizer and language generator, regular grammar and derivation under regular grammars, finite automata versus regular grammars.
- Context free grammars and pushdown automata, Deterministic pushdown automata, Parse Trees, Properties of Context Free Languages, Pumping theorem for Context Free Languages, Parikh's theorem.
- Turing Machine and its extensions, Turing computability, Unrestricted Grammar, Grammatically Computable functions, Chomsky hierarchy of languages, Churches thesis" Primitive recursive functions. Cantor and Godel numbering. Ackennann's function, murecursive functions, Universal TM and Undecidable problems

Computer Networks (CS603)

FM : 100 **Contact Period : 3L+1T**

Introduction:
Goals and Applications, Layered Model and Protocol Issues,,Network Design issues,
OSI reference model and services, Protocols and Standards.
Data Communication Fundamentals:
Channel Characteristics, Various transmission media, Different Modulation techniques
Network Structure:
Concepts of subnets, backbones and local access Channel sharing: FDM and TDM
Message transport: Circuit, Message and Packet switching Topological design of a network
LANs and their interconnections:
Basic concepts, Architecture, Management and performance of Ethernet, Token Ring and Token Bus protocols, Repeaters, Bridges and Hubs
Data Link Layers:
Services and Design issues, Framing techniques, Error Handling, Flow control, Stop and Wait, Sliding Window, HDLC Protocol

Network Layer:

Design issues, Routing algorithms, Congestion Control Techniques, Network architecture and protocols, TCP/IP, UDP etc.

Issues in presentation Layer

Application Layer:

Network security, DNS, SNMP, Electronic Mail

Wireless and mobile communication:

MACA & MACAW, GSM, CDMA

Internet:

IP Protocol, Internet control protocols, ICMP, ARP and RARP. Internet routing protocols: OSPF, BGP and CIDR

Distributed Systems:

Introductory concepts and definitions, Distributed operating systems, Formal Protocol Models Network Management Methods Control mechanism, Distributing network s/w

Database Management Systems (CS604)

FM: 100 **Contact Periods: 3L+1T**

Basic Concepts; Schema architecture; Storage structure, Data models- Hierarchical, Network and relational; ER/EER diagram and informal table schema; Relational algebra and relational calculus, Query languages- SQL, PL/SQL etc.; Normalization theory and Database design methodologies; Issues in DBMS implementation- Security, Recovery and Concurrency control; Query processing and optimization. Introductory overview of distributed database and object relational database.

System Programming (CS605)

FM 50 **Contact Periods: 2L+1T**

Design of Assembler- Statement of the problem.
Algorithms for one pass and two pass assembler, Data structures and implementation details, reloccatable assembly etc.

Macro Processor- Definition, Expansion, Nested macro definition and call, Data Structure & Implementation, Conditional Macro.

Linker- Statement of the problem, Public and External Table, Linker algorithm, Relocation, Linking library module, Dynamic Linking etc.

Analysis, Design & Management of Information Systems Lab (CS651)

FM : 50 **Contact Period : 2S**

Laboratory exercises based on the theory subject CS601

DBMS Lab (CS652)

FM : 50 **Contact Period : 2S**

Laboratory work based on the theory paper CS604

Computer Network Lab (CS653)

FM : 50 **Contact Period : 3S**

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Laboratory work based on the theory paper CS603

Systems Programming Lab (CS654)

FM : 50 **Contact Period : 3S**

(Prerequisite – Preliminary idea of Assembly Language & C Programming language: Interrupt, User supervisor mode of operation etc.)

Assembly language programming to examine various aspects of DOS in the context of interrupt, TSR, Overlay etc.
DOS enhancement – HEX dump and other
Utilities, Process time measurement, Interprocess communication.

Design of a typical 2-pass assembler, relocatable assembler, Macro assembler, Design of EXE file, loader and Device Driver.

Digital Systems Design Lab (CS655)

FM : 100 **Contact Period : 3S**

Familiarisation and Experimentation with FPGA, DSP, Microcontrollers.

Implementation of projects in embedded system design environment.

Viva-Voce I (CS671)

FM : 100 **Contact Periods: Nil**

Viva voce on all 2nd and 3rd year theoretical subjects

7th Semester - COMPUTER SCIENCE AND TECHNOLOGY

Computer Graphics (CS701)

FM : 100 **Contact Period : 3L + 1T**

INTRODUCTION:
Objectives, applications, implementations. Aspect Ratio. Object and Background, 4-neighborhood and 8-neighborhood. Storing Drawings (and Images) in 2-d Arrays and Files.
Programming in turbo-C in DOS vis-a-vis in C / Java in Linux and Unix. Chain Code Representation - Absolute & DifferenceChain Codes.
GEOMETRIC PRIMITIVES:
Digital Straight Line Segments (DSS) - Incremental Algorithm. Scan Line Algorithm by Bresenham. Dashed Lines, Dotted Lines, Thick Lines. Digital Circles - Bresenham Algorithm.
Thick Circles, Arcs, Pie Charts (Refer Filling). Curve Drawing - applications. Different Types of Curves and

Comparisons. Quadratic & Cubic Curves: Need for Cubic Curves. Conditions for Smooth Curves. Parametric Continuity and Geometric Continuity. Lagrange, Bezier, Hermite, and B-Spline Curves. Basis Matrix and Blending Function. 3-D Surface Generation.
FILLING:
Filling Simple Figures, viz. rectangles, triangles, convex polygons, circles, etc.
Recursive Flood Fill Algorithm and its Stack-based Improvement. Scan Line Fill Algorithm with IN/OUT Flag. Special Treatment for Vertex, Horizontal Edges, Slivers for Polygons. Scan Line Algorithm with Edge Tables. Filling With Patterns.
CLIPPING:
Clipping a Point, a Line, a Polygon, and Other Figures, w.r.t. a Window. Sutherland-Cohen Line Clipping Algorithm. Parametric Line Clipping Algorithm.
2D AND 3D TRANSFORMATIONS:
Translation T, Rotation R, Scaling S. Homogeneous Coordinate System. Rotation about an arbitrary point.
PLANAR PROJECTIONS:
Definitions, Conventions, Applications. Types of Projections and Examples. Parallel vs. Perspective Projections. Orthographic Projections and Multiviews. Isometric Projection. Vanishing Point: 1, 2, 3.
HIDDEN SURFACE REMOVAL:
Object Precision Algorithm vs. Image Precision Algorithm. Z-buffer Algorithm. Ray Tracing Algorithm.
RENDERING:
Illumination Models and Applications. Lambert's Cosine Law, Attenuation, Specular Reflection.
Phong Illumination Model. Goraud Shading (Linear Intensity Interpolation Model). Phong Shading (Normal Vector Interpolation Model).
ANIMATION:
Applications, Examples, Implementation Techniques. Tweening. Morphing. Color Dissolve.
ADVANCED TOPICS:
Detection of Straight Lines from a Point Set Using Hough Transform. Convex Hull: Applications and Algorithms. Fundamental Topics of Image Processing Related with Computer Graphics.

Computer Control of Industrial Processes (CS702)

FM : 100 **Contact Period : 3L + 1T**

Review of control system basics Modeling & Simulation of dynamical systems.Space methods of modern Control theory. Sampling process, discrete system modeling,State variable techniques of digital systems, Stability analysis for discrete systems. Digital controllers; Component in h/w controller Algorithms, Interfacing the systems with the Controller. Concepts of Controllability & Observer ability. Filtering, Estimation & Prediction Algorithms in Discrete Domain. Application Examples from the Domain of Aerodynamics, Biology, Process control Plants & other real life Systems.

Compiler Design (CST –703)

FM : 100 **Contact Period : 3L + 1T**

Review of languages and grammars, Compilers and Interpreters -- basic concepts Scanner -- The scanning process, Design using finite state m/cs, Scanner generator (LEX). Parsing -- Top-down and bottom-up strategies: general considerations, Top-down parsing--LL(1), Recursive descent. Bottom-up parsing -- Operator precedence and simple precedence. LR grammars -- LR(0), SLR(1), canonical LR(1) and LALR(1) parsers. Comparison of parsing methods. Symbol tables -- organisations for non-block structured languages (unordered/odered/tree/hash) and block structured languages (stack tables and stack implementations) Runtime storage management -- static allocation; dynamic allocation -- activation records and their usage, recursive procedures. Heap allocation -- storage request and release strategies.
Semantic analysis -- basic concepts; attributed translation; Intermediate codes; Syntax directed translation concepts. Code optimization -- basic blocks and optimization; loop optimization; flow graph analysis, machine dependent optimization.

Error handling -- Detection, reporting, recovery and repair. Compiler-compilers -- YACC; Code generation. Concepts of Compiler design for object-oriented languages

VLSI DESIGN (CS704)

FM – 100 **Contact Periods : 3L + 1T**

Introduction to CMOS Design; NMOS and CMOS transistor fractures. Operation of MOS transistor as a switch. Design and analysis of nMOS and CMOS ratioed and ratioless inverters, gates, latches and flip- flops.

Fabrication of MOS transistor, stick diagram, design rules and layout. Circuit Characterization and Performance estimation of MOS circuit (Delays, transition width) CMOS Circuit and Logic design, BiCMOS logic gates. Dynamic MOS structures, Registers, Counters and memory realization using MOS logic.

Design Structuring; Regular Structure Circuits, PLA and FSMs, system timing and clocking issues, scaling, CMOS subsystem design.
Low Power circuits and systems.

Elective-I (CS705/X)

FM: 100 **Contact Periods: 3L+1T**

One Subject from the following:

Principles of programming languages (CS705/1)

Language preliminaries, Chomsky hierarchy, Context free languages and push down acceptors; context sensitive language and Linear bounded acceptors;
Trios, Semi-AFl, AFl acceptors, verification of AFL axiom, Quasi-realtime acceptors; AFA characteristics, Substitution theorems, Generation of bounded languages, Non-bounded Language, Pumping Languages, Symbol loops;
Programming languages perspectives – use and comparison salient features of languages like PASCAL, 'C' LISP etc., case studies.

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Modelling and Simulation(CS705/2)

Theory of modeling and simulation -- concept of real system and model. Autonomous and non autonomous model, informal and formal model descriptions. Experimental frame, simplification of models. Formal specification of models -- discrete time, discrete event and cell space models. Model validation procedures. Test of simulation program correctness. Evaluation of computers -- benchmarks, work load, synthetic job, instruction mix. Throughput,. Address stream generation. Hardware and software monitors. Deterministic and stochastic models of memory, CPU, BUS, OS, compilers, etc. Petrinet models, modelling and evaluation of Pipeline and multiprocessing systems.

Parallel Algorithms (CS705/3)

Models of parallel computation, performance considerations and complexity issues. Basic techniques including balanced trees, pointer jumping, Divide and conquer, partitioning, pipelining, accelerated cascading, symmetry breaking. List tree algorithms, ranking, prefix sums, Euler's tour techniques, tree traversals, tree contraction and applications. Searching, sorting and merging techniques, Bitonic merge sort, odd-even transposition, Cole-Vishkin's merge sort. Graph algorithms for connected biconnected components, spanning trees, finding shortest path, Ear decomposition etc. Matrix manipulation algorithms and DFÔ algorithms. Notion of P-completeness, proving P-completeness of some basic problems.

Computational Geometry (CS705/4)

Basic Geometric Concepts: points, lines, polygons; subdivisions;
arrangements; polytopes; cell complexes; different applications of computational geometry.

Geometric Searching: in 1D, 2D, and higher dimensions: fractional cascading; Kd-tree; interval tree; range tree.
Point Location: slab method; trapezoid method; chain method; bridged chain method.

Plane-Sweep Algorithms: intersection of segments; intersection of rectangles; trapezoidation.

Arrangements and duality: computing the discrepancy; duality and dual transforms; arrangement of lines; zone theorem.

Convex Hulls: 2-dimensional convex hull; degeneracies and robustness; dynamic convex hull; Graham Scan algorithm, Jarvis March algorithm, Kirkpatrick-Seidel's algorithm; higher dimensional convex hulls.

Proximity: closest pair; furthest pair.

Linear Programming: half-plane intersection; incremental linear programming; randomized linear programming.

Voronoi diagrams: examples and applications, e.g. Post-Office problem; Doubly Connecetd Edge List; Fortune's Algorithm; Voronoi diagram in higher dimension.

Art Gallery Problem: monotone polygons; polygon triangulation.

Visibility Graphs: shortest paths; computing visibility graphs; robot motion planning.

Graph Algorithms (CS705/5)

Review: Connected Components, Minimum spanning tree,strongly connected components, Single source & All pair shortest path, Transitive closure

Planarity testing Algorithms, Polynomial time algorithms for planar graphs, Network flow algorithms, Algorithms for bipartite and general graph matching,

Perfect graphs: Notion of perfect graphs, Lovasz's theorem, Strong perfect graph conjecture, Polynomial time algorithms for elementary graph problems Interval, Chordal, Comparability Graphs.

Tree Structured graphs and algorithms for elementary graph problems on these graphs.

Elective-II (CS706/X)

FM: 100 **Contact Periods: 3L+1T**

One subject from the following:

Software Quality Assurance and Management (CS706/1)

Software development life cycle. Analysis & Design tools and techniques.

Verification and validation method, testing, concept of software quality, quality metrics and models. Performance Evaluation.

Concepts of Software reliability, errors, faults, repair and availability.

Relevant Case studies.

Information and Coding Theory (CS706/2)

Definition of entropy. Information and entropy theorem of Shannon, binary symmetric channel, Un-uniform codes: source coding, Source without memory, Mixed entropy.

Introduction to various codes: linear codes and their properties, the Hamming code, the dual code, the perfect code, Golay code and their properties, cyclic codes and BCH codes, properties of BCH codes; Generator polynomial, minimal polynomials, check polynomials etc.

Multimedia Technology (CS706/3)

Introductory ideas on physics of sound and light, physiology and psychology of hearing and vision. Sound recording technology: microphones, loudness, tone control. Film and TV, video signals, computer video standards, graphics file formats, text and hypertext. Digital audio and video, standard interfaces, image processing and compression techniques.

Media production and hardware: audio production- tools and concepts, editing, MIDI. Video production: stages, preproduction planning, production show, post- production and use of computers, 2D and 3D graphics and animation, morphing. Multimedia authoring: windows, OLE; graphics browser, HTML files, Internet based multimedia.

Advanced Computer Architecture (CS706/4)

Introduction to basic computer architecture, reporting performance related issues; RISC processors; Limitations of Von Neumannic architectures; Advantages of multiprocessing; Pipelining, instruction and arithmetic pipeline, hazards, handling hazards, pipeline optimization, improving performance, compilers importance; Parallel processing, classification, interconnection, switching structures and algorithms. Instruction Level Parallelism (lLP), concepts, challenges, compiler support. Super scalar, superpipelined and VLlW processor architectures. Cluster computers. RISC processors, design motivation, hardware software features, pipeline scheduling algorithms, branching mechanisms, register organizations, data dependencies and addressing modes; Case study of RISC processor. Fault tolerant computing, motivation, reliability, redundancy, fault detection, design techniques, performance considerations. Quantum computing, algorithms, design issues, quantum computers

Data Mining (CS706/5)

Introduction : Knowledge Discovery in Database : The Origins, Purpose, Necessity and Challenges, Data Mining Tasks.
Fundamental Concepts : Types and Forms of Data : Concept, Example, Attribute, ARFF format, Spares Data, Missing Values.
Types and Forms of Knowledge : Contingency Tables, Subgroup Patterns, Rules, Decision Trees, Clusters, Taxonomies and Concept Hierarchies, Probabilistic and casual Networks, Neural Networks.
Data Processing and Exploration : Stages of Knowledge Discovery Processes.
Data Warehousing - data Cleaning and Loading, Warehouse Administration.
Data Reduction - Sampling, Aggregation, Dimensionality Reduction, Feature Subset Selection, Feature Creation, Discretization and Binarization.
Visualization - Motivation, General Concepts, Techniques.
OLAP and Multidimensional Data Analysis.
Classification : Decision Tree Induction - ID3 Decision Tree Learning Algorithm, Inductive Bias, C4.5 and CART Learning Algorithms, Over fitting and Pruning, Measures for Selecting the Best Split, Incorporating Continuous-Valued Attributes, Missing Value Handling.
Rule – Based Classifier - Learning Sets of Rules, Rule – Ordering Schemes, Sequential Covering Algorithms, Learning First – Order Rules and FOIL, Induction as Inverted Deduction, Inverting Resolution and PROGOL.
Nearest – Neighbor Classifier - Instance Based Learning, K- Nearest Neighbor Classifier, Case- Based Reasoning, Lazy and Eager Evaluation.
Bayesian Classifier - Bayes Theorem and Concept Learning, Minimum Description Length Principle, Using Bayes Theorem for Classification, Naïve Bayes Classifier, Belief Networks,
Artificial Neural Network - Perceptrons, Multilayer Artificial Neural Networks, Error Backpropagation, Role of Neural Networks in Data Mining, Rule Extraction, Rule Evaluation, Clustering and Self-Organization.
Association Analysis : Problem Definition, Association Rules, Apriori Principle, Rule Generation in Apriori Algorithm, FP- Growth Algorithm, Evaluation of Association Patterns.
Clustering : Numerical Clustering, Conceptual Clustering, K-means Clustering, Expectation – Maximization Algorithms, DBSCAN, Cluster Evaluation, EM Algorithm, Graph- Based Clustering.
Text Mining : Keyword-Based Search and Mining, Text Analysis and Retrieval, Mathematical Modeling of Documents, Similarity- Based Matching for Documents and Queries, Latent Semantic Analysis.
Web Mining : Web Content Mining- Crawlers, Harvest System, Virtual Web View, Personalization. Web Structure Mining – Page Rank, Clever.
Web Usage Mining – Preprocessing, Data Structures, Pattern Discovery, Pattern Analysis.
Case Studies with Data Mining Tools.

Computer Graphics Lab (CS751)

FM : 100 **Contact Period : 4S**

1. Grid: Construct a square grid with origin (0,0) at center of the display screen.
Use (0,0,0) as the background color and (200, 200, 200) as the grid color.
Show the x-axis and the y-axis with color (0,0,200).

2. Digital Straight Line
3. Digital Circle
4. Cubic Spline
5. Mini Project on Clipping / Filling / Digital Geometry / 3D Projections / Hidden Surface Removal / Rendering / Illumination / Animation.

Computer Control of Industrial Process Lab (CS752)

FM : 50 **Contact Period : 3S**

Laboratory work based on the theory paper CS702

Compiler Design Lab (CS753)

FM : 50 **Contact Period : 2S**

For the programming language and a specific m/c running under UNIX the following experiments are aimed at the design and implementation of a compiler.
1. Familiarization with Lex and development of the scanner for the language.
2. Familiarization with Yacc and development of a parser.
3. Incorporation of an effective error recovery scheme in the parser.
4. Incorporation of action routines for declaration processing and type analysis.
5. Incorporation of action routines for generation of a specific intermediate code.
6. Generation2 of target m/c code from intermediate code.
7. Formalization with optimization and retargetable code generation tools.

Project Preliminaries /Thesis (CS754)

FM-50 **Contact Periods:2S**

To work on a specific project and evaluation on the basis of submitted term paper

Viva-Voce II (CS771)

FM :50 **Contact Periods: Nil**

Viva voce on all theoretical subjects up to present semester

8th Semester - COMPUTER SCIENCE AND TECHNOLOGY

Software Engineering (CS801)

FM : 100 *Contact Period : 3L + 1T*

Introduction, life cycle models, software cost estimation;
Traditional approach to software system development, Requirements engineering, process analysis, macro and micro design, DFD, structure charts etc., system models, user interface design, formal specification;
Verification and validation, software testing and maintenance, software metrics;
Object oriented software design approach;
Project management;
CASE tools, Case study on software development process.
Software Quality Assurance.
Software Configuration Management.

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Symbolic Logic & Artificial Intelligence (CS802)

F M - 100. **Contact Periods : 3L + 1T**

Introduction : Overview and History of A.I..

Problem Solving : Problem Representation in State Space, Production System.

Uninformed Search Strategies – BFS, DFS, Iterative Deepening Search, Space & Time Complexities.

Informed Search – Heuristic Function , Hill Climbing Search, Simulated Annealing Search, Best – First Search, A* Algorithm, Admissibility of A* Algorithm, IDA* Algorithm, Problem Reduction and AO* Algorithm etc.

Constraint Satisfaction Problem.
Means Ends Analysis.

Adversarial Search – Games, The Minimax Algorithm, Evaluation Function, Alpha-Beta Pruning.

Knowledge and Reasoning :
Computational Logic -Review of PL & FOPL ,Automatic Reasoning using Resolution in PL , Skolem Standard Form in FOPL, Clauses and Clausal Forms, Substitution, Unification, General Resolution, Theorem Proving with Resolution, Answer Extraction.

Knowledge Representation – Categories and Objects, Actions, Situations and Events, Situation Calculus, Describing Actions in Situation Calculus, Solving Frame Problem, Knowledge and Belief, Semantic Networks, Reasoning with Default Logic, Open and Close Worlds, Circumscription and Default Logic, Truth Maintenance Systems.

Uncertain Knowledge and Reasoning – Uncertainty , Basic Probability Notation, The Axioms of Probability, Baye's Rule and Its Use, Rule-Based Expert System and Certainty Factor in MYCIN, Dempster- Shaffer Theory for Uncertainty Management.

Making Decisions – Combining Beliefs and Desire Under Uncertainty, The basic Utility Theory, Utility Functions, Multi-attribute Utility Functions, Decision Networks, Decision – Theoretic Expert System, Sequential Decision Problems Value Iteration, Policy Iteration, Decision Theoretic Agents, Game Theory and Nash Equilibrium.

Logic Programming & Prolog :

Conversion of a Clause into Clausal Representation, Logic Programming Concepts, Execution of a Query in Logic Program, General Syntax of Prolog, Prolog Program and Prolog Control Strategy, Relational and Arithmetic Operators, Recursion in Prolog, List Manipulation, Accumulators, The System Predicate 'CUT', Types of CUT, Fail Predicate, CUT and Fail Combination, Negation as Failure, Binary Tree, Binary Search Tree Representations and Operations in Prolog, Implementations of Sorting Algorithms, Representations of Graphs & Problems on Graph in Prolog, Solving A.I. Problems in Prolog.

Machine Learning :

Forms of Learning, Inductive Learning, Learning Decision Trees, Choosing Attribute Tests, Noise and Overfilling, Pruning, Missing Value Treatment, Cost – Sensitive Decision Trees.

Instance – Based Learning – k- Nearest Neighbor Learning, Distance-Weighted Nearest Neighbor Algorithm, Locally Weighted Regression, Radial Basis Functions, Case – Based Reasoning, Lazy and Eager Learning.

Evolutionary Algorithms – Representing Hypothesis, Genetic Operators, Fitness Function and Selection, Hypothesis Space Search, Evolutionary Programming, Models of Evolution and Learning.

Support Vector Machines (SVM) - Maximum Margin, Hyper-planes, Two- Class and Multi-Class SVM, Kernel – Based Methods.

Ensemble Methods - Rationale, Methods for Constructing on Ensemble Classifier, Bias-Variance Decomposition, Bagging, Boosting, etc.

Anamoly Detection - Causes of Anamolies, Approaches, to Anamoly detection.

Assessing and Comparing Learning Algorithms - Holdout Method, Cross- Validation and Re-sampling Methods, Measuring Errors, Interval Estimation, Paired t-test, McNemera's Test, Wilcoxson's Sign Rank Test.

Computational Learning Theory.

Elective III (CS803/X)
(For other departments)

FM: 50 **Contact Periods: 2L**

One of the subjects from the following:

Database Management Techniques in Engg (CS803/1)

Database, Database Management System, Basic Concept of 3-schema architecture, diagram, informal database design, relational data model, relation algebra, Query Language, Security, recovery

Application development : Case Studies

Introduction to Artificial Intellgence and Expert System (CS803/2)

Introduction and Overview,
Search : Production Systems; Concept of State Space; Blind Search: BFS and DFS ; Heuristic Search : Hill Climbing, Simlated Annealing, A* Algorithm, AND-OR Search; Adversary Search : Minimax, α-β Search,
Knowledge Presentation Using Logic : Propositional Logic:
Normal Forms, Resolution; First-Order Predicate Logic :
Terms, Predicates and Quantifiers, Prenex Normal Form,
Skolemization, Clause Form, Unification, Resolution.
Knowledge Representation using Other Techniques : Assumption-Based Truth Maintenance,
Nonmonotonic Reasoning, Semantic Nets and Frames.
Expert Systems : Advantages of Expert Systems, Characteristic of Expert System, Expert System Applications and Domains, Expert System Architecture and Expert System Shells, Design of Expert System
Introduction to PROLOG.

Soft Computing Techniques (CS803/3)

Fundamental Elements of Soft Computing, Fuzzy Sets and Relations, Fuzzy Logic and Approximate Reasoning, Fuzzy Pattern Recognition, Possibilistic Reasoning, Machine Learning Using Neural Nets, Supervised and Unsupervised Neural Learning Algorithms, Competitive Learning Using Neural Nets, Reinforcement Learning, Genetic Algorithms, GA in Optimization Problems, GA for Search and Machine Learning, Genetic Programming, Hybrid Systems : Neuro -Fuzzy, Neuro-GA, Fuzzy-GA, Neuro-Fuzzy-GA.

Design & Management of Information Systems (CS803/4)

Systems concepts – Characteristics, types, boundaries, subsystems, organizational system, information system, systems approach to management, MIS and its role in organization ;
Types and functions of MIS, tools of MIS ; control and feed-back of information systems, feed-forward control ; information quality, information value chain ;
Various models used in information systems especially in MIS such as CSF model, strategic planning model, management control model etc.;

Basic concepts on design of information systems for MIS oriented applications ;
Decision making process, structured and unstructured decisions, concepts on DSS, ES, KBS etc.;
Socio-technical aspects of MIS.

Elective IV (CS804/X)

FM:100 **Contact Periods: 3L+1T**

One of the subjects from the following:

Mobile Computing (CS804/1)

Infrastructured Wireless Network :

Cellular Network : Introduction, Frequency reuse, Cell design, Cellular architecture, Channel assignment, Hand offs, Location tracking, Load balancing, Query Processing.

Wireless LAN : Overview, Infrared LAN, Spread-spectrum LAN, Narrowband Microwave LAN, IEEE 802 protocol architecture, Medium Access Control, Physical layer.

Infrastructured –less Network : Mobile Ad-Hoc Network(MANET): Architecture, Self organization, Precomputed routing protocol, on-demand routing protocol, location assisted routing protocol.

Sensor Network : Overview, application areas, Sensor nodes, Architecture Data Aggregation, routing.

Image Processing and Analysis (CS804/2)

* Introduction
* Digital Image Definitions
  Common Values, Characteristics of Image Operations, Video Parameters.
* Tools
  Convolution, Properties of Convolution, Fourier Transforms, Properties of Fourier Transforms, Statistics, Contour Representations.
* Perception
  Brightness Sensitivity, Spatial Frequency Sensitivity, Color Sensitivity, Optical Illusions.
* Image Sampling
  Sampling Density for Image Processing, Sampling Density for Image Analysis.
* Noise
  Photon Noise, Thermal Noise, On-chip Electronic Noise, KTC Noise, Amplifier Noise, Quantization Noise.
* Cameras
  Linearity, Sensitivity, SNR, Shading, Pixel Form, Spectral Sensitivity, Shutter Speeds (Integration Time), Readout Rate.
* Displays
  Refresh Rate, Interlacing, Resolution.
* Algorithms
  Histogram-based Operations, Mathematics-based Operations, Convolution-based Operations, Smoothing Operations, Derivative-based Operations, Morphology-based Operations.
* Techniques
  Shading Correction, Basic Enhancement and Restoration Techniques, Segmentation.

Soft Computing Techniques and Applications (CS804/3)

Fundamental Elements of Soft Computing, Fuzzy Sets and Relations, Fuzzy Logic and Approximate Reasoning, Fuzzy Pattern Recognition, Possibilistic Reasoning, Machine Learning Using Neural Nets, Supervised and Unsupervised Neural Learning Algorithms, Competitive Learning Using Neural Nets, Reinforcement Learning, Genetic Algorithms, GA in Optimization Problems, GA for Search and Machine Learning, Genetic Programming, Hybrid Systems : Neuro -Fuzzy, Neuro-GA, Fuzzy-GA, Neuro-Fuzzy-GA.

Real Time Systems Design: (CS804/4)

1) Review of system analysis & Design techniques; State charts, petvi nets & other analysis tools for real time systems.
2) Concept of time, clock skew, delay etc.; Synchronization of clocks through h/w & s/w techniques.
3) Tasks & Their scheduling algorithms for real time environment ; optimality of RM & SDF algorithms, features of real time operating systems.
4) Basics of embedded system design; ASIP design philosophy, Processor architecture variations; memory customization; h/w – s/w partitioning & optimization issues; explorations of architecture; retargetable code generation issues. Micro controllers & other tiny Processors – examples & Application areas.

Symbolic Logic and AI Lab (CS851)

FM:50 **Contact Periods: 3S**

Laboratory exercises based on the theory paper CS802

VLSI Lab (CS852)

FM:50 **Contact Periods: 3S**

Laboratory work based on the theory paper CS704.

Software Engineering Lab (CS853)

FM : 50 **Contact Period : 3S**

Laboratory work based on the subject CS801

Project/Thesis (CS854)

FM:200 **Contact Periods: 6S**

Thesis is to be submitted on the basis of specific project work.

Group Discussion/Seminar (CS855)

FM:50 **Contact Periods: 2S**

Seminar on relevant topics to be delivered

Viva-Voce III (CS871)

FM:100 **Contact Periods: Nil**

Grand Viva voce on all subjects taught during the course.