B.E. II YEAR (COMPUTER SCIENCE & ENGINEERING)
SEMESTER III EXAMINATION SCHEME 2018

Subject Nomenclature			Lecture	Tutorial	Practical	Contact Hrs	Credit	Exam Hrs	Marks		
									Theory	Practical and Sessional	Total
A. THEORY PAPERS											
Ma	201A	Advanced Engineering Mathematics-I (CSE/IT)	3	1	-	4	4	3	100	-	100
CSE	211A	Discrete Structures (CSE/IT)	3	1	-	4	4	3	100	-	100
CSE	212A	Object Oriented Programming (CSE/IT)	2	1	-	3	3	3	100	-	100
CSE	213A	Data Structures and Algorithms (CSE/IT)	3	1	-	4	4	3	100	-	100
CSE	214A	Logic Design (CSE/IT)	2	1	-	3	3	3	100	-	100
CSE	215A	Computer Oriented Statistical Methods (CSE/IT)	2	1	-	3	3	3	100	-	100
TOTAL(A)			**15**	**6**	**-**	**21**	**21**		**600**	**-**	**600**
B. PRACTICALS AND SESSIONALS											
CSE	212B	Object Oriented Programming Laboratory (CSE/IT)	-	-	2	2	1	3	-	100	100
CSE	213B	Data Structures and Algorithm Laboratory (CSE/IT)	-	-	2	2	1	3	-	100	100
CSE	214B	Logic Design Laboratory (CSE/IT)	-	-	2	2	1	3	-	100	100
CSE	216B	Scripting Languages Laboratory (CSE/IT)	-	-	2	2	1	3	-	100	100
TOTAL(B)			**-**	**-**	**8**	**8**	**4**		**-**	**400**	**400**
TOTAL(A+B)			**15**	**6**	**8**	**29**	**25**		**600**	**400**	**1000**

To pass, a candidate must obtain:

(a) At least P Grade in each written paper.
(b) At least B Grade in each practical & sessional.
(c) At least 5.00 SGPA in a semester.

B.E. II YEAR (COMPUTER SCIENCE & ENGINEERING)
SEMESTER IV EXAMINATION SCHEME 2018

Subject Nomenclature			Lecture	Tutorial	Practical	Contact Hrs	Credit	Exam Hrs	Marks		
									Theory	Practical and Sessional	Total
A. THEORY PAPERS											
Ma	202A	Advanced Engineering Mathematics-II (CSE/IT)	3	1	-	4	4	3	100	-	100
CSE	221A	Principles of Programming Languages (CSE/IT)	3	1	-	4	4	3	100	-	100
CSE	222A	Computer Organization and Architecture (CSE)	3	1	-	4	4	3	100	-	100
CSE	223A	Database and File Systems (CSE/IT)	2	1	-	3	3	3	100	-	100
CSE	225A	Communication Engineering (CSE/IT)	3	0	-	3	3	3	100	-	100
A		Open Elective-I (Open)	3	0	-	3	3	3	100	-	100
TOTAL(A)			**17**	**4**	**-**	**21**	**21**		**600**	**-**	**600**
B. PRACTICALS AND SESSIONALS											
CSE	221B	Programming Laboratory (CSE/IT)	-	-	2	2	1	3	-	100	100
CSE	222B	Computer Organization & Architecture Laboratory (CSE)	-	-	2	2	1	3	-	100	100
CSE	223B	Database & File Systems Laboratory (CSE/IT)	-	-	2	2	1	3	-	100	100
CSE	226B	Unix/Linux Laboratory (CSE/IT)	-	-	2	2	1	3	-	100	100
TOTAL(B)			**-**	**-**	**8**	**8**	**4**		**-**	**400**	**400**
TOTAL(A+B)			**17**	**4**	**8**	**29**	**25**		**600**	**400**	**1000**
CSE	**200E**	**Co-curricular Activities**	**-**	**-**	**-**	**-**	**0**	**-**	**-**	**-**	**100**

List of Open Electives I: Enclosed with examination scheme of VIII Semester

To pass, a candidate must obtain:

(a) At least P Grade in each written paper.
(b) At least B Grade in each practical & sessional.
(c) At least 5.00 SGPA in a semester.

B.E. III YEAR (COMPUTER SCIENCE & ENGINEERING)
SEMESTER V EXAMINATION SCHEME 2018

Subject Nomenclature			Lecture	Tutorial	Practical	Contact Hrs	Credit	Exam Hrs	Marks		
									Theory	Practical and Sessional	Total
A. THEORY PAPERS											
CSE	311A	Theory of Computation (CSE/IT)	3	1	-	4	4	3	100	-	100
CSE	312A	Database Management System (CSE/IT)	2	1	-	3	3	3	100	-	100
CSE	313A	System Programming (CSE/IT)	2	1	-	3	3	3	100	-	100
CSE	314A	Microprocessors (CSE)	3	1	-	4	4	3	100	-	100
CSE	316A	Computer Networks (CSE/IT)	3	1	-	4	4	3	100	-	100
		Open Elective -II	3	0	-	3	3	3	100	-	100
TOTAL(A)			**16**	**5**	**-**	**21**	**21**		**600**	**-**	**600**
B. PRACTICALS AND SESSIONALS											
CSE	312B	Database Management System Laboratory (CSE/IT)	-	-	2	2	1	3	-	100	100
CSE	313B	System Programming Laboratory (CSE/IT)	-	-	2	2	1	3	-	100	100
CSE	314B	Microprocessors Laboratory (CSE)	-	-	2	2	1	3	-	100	100
CSE	316B	Computer Networks Laboratory (CSE/IT)	-	-	2	2	1	3	-	100	100
TOTAL(B)			**-**	**-**	**8**	**8**	**4**		**-**	**400**	**400**
TOTAL(A+B)			**16**	**5**	**8**	**29**	**25**		**600**	**400**	**1000**

List of Open Electives II: Enclosed with examination scheme of VIII Semester

To pass, a candidate must obtain:

(a) At least P Grade in each written paper.
(b) At least B Grade in each practical & sessional.
(c) At least 5.00 SGPA in a semester.

B.E. III YEAR (COMPUTER SCIENCE & ENGINEERING)
SEMESTER VI EXAMINATION SCHEME 2018

Subject Nomenclature			Lecture	Tutorial	Practical	Contact Hrs	Credit	Exam Hrs	Marks		
									Theory	Practical and Sessional	Total
A. THEORY PAPERS											
CSE	321A	Computer Graphics & Visual Computing (CSE)	2	1	-	3	3	3	100	-	100
CSE	322A	Operating System Design (CSE/IT)	3	1	-	4	4	3	100	-	100
CSE	323A	Java Programming (CSE/IT)	2	0	-	2	2	3	100	-	100
CSE	325A	Artificial Intelligence (CSE/IT)	2	1	-	3	3	3	100	-	100
CSE	328A	Robotics (CSE/IT)	3	1	-	4	4	3	100	-	100
		Open Elective-III (CSE)	3	0	-	3	3	3	100	-	100
TOTAL(A)			**15**	**4**	**-**	**19**	**19**		**600**	**-**	**600**
B. PRACTICALS AND SESSIONALS											
CSE	321B	Computer Graphics & Visual Computing Laboratory (CSE)	-	-	2	2	1	3	-	100	100
CSE	322B	Operating System Design Laboratory (CSE/IT)	-	-	2	2	1	3	-	100	100
CSE	323B	Minor Project Laboratory(CSE/IT)	-	-	4	4	2	3	-	100	100
CSE	325B	Artificial Intelligence Laboratory (CSE/IT)	-	-	2	2	1	3	-	100	100
CSE	328B	Robotics Laboratory (CSE/IT)	-	-	2	2	1	3	-	100	100
TOTAL(B)			-	-	**12**	**12**	**6**		-	**500**	**500**
TOTAL(A+B)			**15**	**4**	**12**	**31**	**25**		**600**	**500**	**1100**
CSE	**300E**	**Co-curricular Activities**	-	-	-	-	**0**		-	-	**100**

List of Open Electives III: Enclosed with examination scheme of VIII Semester

To pass, a candidate must obtain:

(a) At least P Grade in each written paper.
(b) At least B Grade in each practical & sessional.
(c) At least 5.00 SGPA in a semester.

B.E. FINAL YEAR (COMPUTER SCIENCE & ENGINEERING)
SEMESTER VII EXAMINATION SCHEME 2018

A. THEORY PAPER											
Subject Nomenclature	**Subject**	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Contact**	**Credit**	**Unit**	**Exam. Hrs.**	**Marks**		
									Theory	**Practicals & sessionals**	**Total**
CSE 411A	Design & Analysis of Algorithms (CSE/IT)	3	1	-	4	4	1	3	60	--	60
CSE 412A	Big Data Analytics (CSE)	3	1	-	6	5	1	3	60	--	60
CSE 413A	Software Engineering (CSE/IT)	3	1	-	6	5	1	3	60	--	60
CSE 414A	Principles of Compiler Design (CSE/IT)	3	1	-	6	5	1	3	60	--	60
CSE A	Elective - I	3	1	-	6	5	1	3	60	--	60
Total (A)		**15**	**5**	**-**	**28**	**24**	**5**	**-**	**300**	**--**	**300**
B. PRACTICALS AND SESSIONALS											
CSE 412B	Big Data Analytics Laboratory (CSE)			**2**					**--**	**60**	**60**
CSE 413B	Software Engineering Laboratory (CSE/IT)			**2**					**--**	**60**	**60**
CSE 414B	Compiler Design Laboratory (CSE)			**2**					**--**	**60**	**60**
CSE B	Elective – I Laboratory			**2**					**--**	**60**	**60**
CSE 415 D	Seminar (CSE)			**2**	**2**	**1**	**½**	**-**	**--**	**60**	**60**
Total (B+D)		**-**	**-**	**10**	**-**	**-**	**-**	**-**	**--**	**300**	**300**
Total of Semester (A+B+D)		**15**	**5**	**10**	**30**	**25**	**5**	**-**	**300**	**300**	**600**

To pass, a candidate must obtain:

(a) 35 percent in each of the written paper
(b) 50 percent in each of practical and sessionals, and
(c) 45 percent in the Grand Total

List of Elective –I:

CSE 451A – Soft Computing (CSE)
CSE 452A – Image Processing (CSE/IT)
CSE 453A – Client-Server Technology (CSE/IT)
CSE 454A – Multimedia Technology (CSE/IT)
CSE 455A – Computer Vision & Robotics (CSE)
CSE 456A – Web Technology (CSE/IT)
CSE 457A – Digital Signal Processing (CSE/IT)

B.E. FINAL YEAR (COMPUTER SCIENCE & ENGINEERING)
SEMESTER VIII EXAMINATION SCHEME 2018

A. THEORY PAPER											
Subject Nomenclature	**Subject**	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Contact**	**Credit**	**Unit**	**Exam. Hrs.**	**Marks**		
									Theory	**Practicals & Sessionals**	**Total**
CSE 421A	Advanced Computer Architecture (CSE)	**3**	**1**	**-**	**4**	**4**	**½**	**3**	**50**	**--**	**50**
CSE 422A	Embedded Systems (CSE)	**3**	**1**	**-**	**6**	**5**	**1**	**3**	**50**	**--**	**50**
CSE A	Elective – II	**3**	**1**	**-**	**6**	**5**	**1**	**3**	**50**	**--**	**50**
CSE A	Elective III	**3**	**1**	**-**	**6**	**5**	**1**	**3**	**50**	**--**	**50**
Total (A)		**12**	**4**	**-**	**22**	**19**	**3½**	**-**	**200**	**--**	**200**
B. PRACTICALS AND SESSIONALS											
CSE 422B	Embedded Systems Laboratory (CSE)			**2**					**--**	**50**	**50**
CSE B	Elective –II Laboratory			**2**					**--**	**50**	**50**
CSE B	Elective –III Laboratory			**2**					**--**	**50**	**50**
CSE 429D	Project (CSE)			**6**	**6**	**3**	**½**		**--**	**100**	**100**
CSE 435C	Practical Training (CSE)						**1½**		**--**	**75**	**75**
CSE 436C	Educational Tour (CSE)						**½**		**--**	**25**	**25**
	Total (B+C+D)			**12**						**350**	**350**
	Total of Semester (A+B+C+D)	**12**	**4**	**12**	**28**	**22**	**6**		**200**	**350**	**550**
Total of year									**500**	**650**	**1150**
Joint award for VII & VIII Semesters (Marks not counted for award of division / degree)											
FE 223E	Co-curricular Activities	**-**	**2**	**2**	**2**	**1**	**½**	**-**			**100**

To pass, a candidate must obtain:

(d) 35 percent in each of the written paper
(e) 50 percent in each of practical and sessionals, and
(f) 45 percent in the Grand Total

List of Elective – II
CSE 461A – Intelligent Database System (CSE/IT)
CSE 462A – Object Oriented DBMS (CSE/IT)
CSE 463A – Object Oriented Software Engineering (CSE/IT)
CSE 464A – Real-Time Systems (CSE)
CSE 466A – Graph Theory (CSE/IT)
CSE 470A- Computational Science

List of Elective – III
CSE 465A – Information Theory & Coding (CSE/IT)
CSE 467A – Simulation and Modeling (CSE)
CSE 468A – Mobile Computing (CSE/IT)
CSE 469A - Bioinformatics (CSE/IT)

List of Open Electives	
Name of subject	**Semester**
BCT 291 A Open Elective-I: Sustainable Architecture CE 291A Open Elective-I :Energy Efficient Building Design ChE 291 A Open Elective-I : Renewable Energy Sources EE 291 A Open Elective-I : Industrial Applications of Electrical Drives EE 292 A Open Elective-II: Engineering Economics Ma 291 A Open Elective-I :Mathematical Statistics For Engineers ME 291 A Open Elective-I:Renewable Energy Sources ME 292A Open Elective-I: Automobile Engineering MI 291A Open Elective-I: Tunneling For Engineering Projects PI 291A Open Elective-I: Manufacturing Science	Fourth Semester
BCT 341 A Open Elective-II: Traditional Indian Architecture CE 341A Open Elective-II: Non Urban Public Hygiene & Drinking Water ChE 341 A Open Elective-II : Petroleum Refining Technology EE 341 A Open Elective-II : Optimization Techniques Ma 341 A Open Elective-II :Mathematical Theory of Operations Research ME 341A Open Elective-II : Economics Analysis and Management of Operations ME 342A Open Elective-II: Systems Design And Analysis MI 341A Open Elective-II: Application of GIS & Remote Sensing in Engineering PI 341A Open Elective-II: Principles of Management & Economics SE 341A Open Elective-II :Structural Dynamics	Fifth Semester
BCT 391 A Open Elective-III: Climate Responsive Architecture CE 391A Open Elective-III: Ecosystem & Biodiversity ChE 391 A Open Elective-III : Nanotechnology EC 391 A Open Elective-III: Electronic Instrumentation EE 391 A Open Elective-III: Soft Computing Techniques EE 392 A Open Elective-III: Energy Conservation Ma 391 A Open Elective-III: Advanced Numerical Analysis ME 391A Open Elective-III: Design Planning And Control Of Production System ME 392A Open Elective-III: Finite Elements Method MI 391A Open Elective-III: Project Environment Clearance PI 391A Open Elective-III: Quality Management SE 391A Open Elective-III :Finite Element Method	Sixth Semester
BCT: Building Construction Technology, CE: Civil Engineering, ChE: Chemical Engineering, CSE: Computer Science and Engineering, EC: Electronics & Communication, EE: Electrical Engineering, ME: Mechanical Engineering, MI: Mining Engineering, PI: Production & Industrial Engineering, SE: Structural Engineering, Ma: Mathematics	

THIRD SEMESTER (CSE)

Ma 201 A – Advanced Engineering Mathematics – I (CSE/IT)

3L,1T **3 Hours, 100Marks**

Section A

Differential equations : Simultaneous differential equations, Total differential equations, Partial differential equations of first order, Charpit's method, Linear partial differential equations with constant coefficients, Second order partial differential equations, Monge's method for the equation of type $Rr + Ss + Tt = V$
Solution of Wave, Heat and Laplace equations using separation of variables method.

Section B

Complex Analysis : Analytic function, Harmonic function, Construction of an Analytic function, Cauchy-Riemann equations in Cartesian and Polar form.
Complex integration, Cauchy's integral theorem, Cauchy's integral formula, Derivative of Cauchy's integral formula.
Taylor's and Laurent's series expansion of complex functions.
Cauchy's residue theorem and its application for evaluation of the contour integrals of f(sinx ,cosx) from 0 to 2π and f(x)from $-\infty$to ∞
Transformations: shifting, rotating, conformal and bilinear transformations.

Section C

Probability and Statistics: Theorems of probability and their application, Binomial, Poisson and Normal probability distribution. Correlation and Regression analysis of two parameters.

Note: Candidates are required to attempt FIVE questions in all, selecting at least one from each Section.

CSE 211 A - DISCRETE STRUCTURES (CSE/IT)

3L, 1T **3 Hours, 100 Marks**

Introduction to Discrete Mathematical Structures, Formal Methods: Induction and Analogy, Abstraction.
Sets, sequences, empty set, power set, operations on sets, Venn diagram, ordered pair, principle of inclusion and exclusion. Counting and Combinatorics.

Introduction to mathematical logic, statements and notations, well-formed formulas, tautologies, tautological implications, normal forms, the theory of Inference for statement calculus, predicate logic.

Graph Terminology, Degrees of Nodes, Isomorphic Graphs, Dijkstra's Shortest Path Algorithm, Planar Graphs, Eulerian Graphs, Hamiltonian Graphs, Traveling Salesman Problem.

Trees, Introduction, Rooted and Other Trees, Representation of Prefix Codes, representation of Arithmetic Expression, Representation of Prefix Codes, Spanning Trees, Traversing Binary Trees, Binary Search Trees.

Relations, matrix and graph representation of relation, properties of relations, partitions. Equivalence Relations, Compatibility Relations, Composition of Binary Relations, Transitive and symmetric closures, partially ordered set, lattices. Recurrence relations.

Functions, Matrix representation of functions, composition of function, inverse function.

Algebraic Structures, General properties of algebraic systems, groupoids, semigroup, monoids, group, rings. Applications of algebra to control structure of a program. Homomorphism, congruences, admissible partitions. Groups and their graphs.

CSE 212 A - OBJECT ORIENTED PROGRAMMING (CSE/IT)

2L,1T 3 Hours, 100 Marks

A review of C. Concepts of object oriented programming using C++. Data types: elementary and derived data types, literals.
Operators and expressions: operators, association and precedence rules of operators, expressions using unary, binary and ternary operators.
Statements: declarations as statements, selection statements, iteration statements, goto statement, break statement, continue statement, return statement, try-catch block.
Functions: void functions, functions with return value, call by value and call by reference parameter passing, default parameters, recursive functions, inline functions.
Classes: classes, objects, friend functions, classes within a class, local classes, global classes, constructors, destructors.
Derived classes: single and multiple derivation of classes, multilevel and hybrid derivation of classes, constructors, destructors.
Polymorphism: function and operator overloading, virtual functions.
Streams: input and output of built-in data types, manipulators.
File streams: opening a file, accessing a file, closing a file.
Exceptions: catching exceptions, rethrowing the exception, standard exceptions.
Templates: defining a template, template instantiation, function templates, class templates.
Elementary case study of a object oriented database in C++.

CSE 213 A - DATA STRUCTURES AND ALGORITHMS (CSE/IT)

3L, 1T 3 Hours, 100 Marks

Introduction to data structure, String storage representation and manipulation. Markov algorithm and primitive data structures.

Concepts of non primitive data structures. Linear data structure. Array, stack, queue, their applications and implementations using sequential storage representation and linked representation.

Linear linked list, double linked list, circular linear linked list and generalised lists and applications.

Concept of non-linear data structures, Tree, graph, set and their representation, Binary Tree, Threaded tree, different techniques of tree traversal, breadth first search, depth first search, application of tree and graph such that Polish notation, concepts of heap.

Sorting, searching algorithms and comparative study of different sorting and searching techniques such that selection sort, heap sort, bubble sort, quick sort, merge sort and radix sort. Linear search and binary search, hashing. External sorting.

Time and space complexity of the algorithms – Big-O,θ,Ω, and small-o, Asymptotic complexity, Upper and Lower bound time and space trade offs.

CSE 214 A - LOGIC DESIGN (CSE/IT)

2L, 1T 3 Hours, 100 Marks

Introduction to number systems, concept of logic gates, boolean algebra and simplification of boolean expressions, K-map, tabular method, combinational circuits, half adder, full adder, flip flops, transfer circuits, clocks, shift registers and binary and BCD counters.

Multiplexer, demultiplexer, encoder, decoder.

Analysis and design of synchronous sequential systems, finite memory and flow chart method of design, State assignment, races and hazards, Introduction to threshold logic & relay circuits, sequential adder.

Introduction to switching devices, positive and negative logic. OR, AND, NOR, NAND, Exclusive OR and Exclusive NOR gates, RTL, DCL, DCTL, TTL, RCTL, ECL, HTL, MOS AND CMOS logic circuit and their realization. Fan-in and Fan-out capacity. Speed and delay in logic circuit.

CSE 215 A - COMPUTER ORIENTED STATISTICAL METHODS (CSE/IT)

2L, 1T 3 Hours, 100 Marks

Frequency distribution, Class interval, limit, boundaries, class mark, histograms and frequency polygon, relative frequency distribution, cumulative frequency distribution curves, Frequency curves.

Measure of central tendency, mean, arithmetic and weighted arithmetic and their properties, median, mode, the Empirical relation between mean, median and mode, geometric mean, harmonic mean. The root mean square (RSM). Quartiles, Deciles, and Percentiles.

Measures of Dispersions, range, mean deviation, standard deviation. Variance, properties of standard deviation , Empirical relation between measure of dispersions, Absolute and relative dispersion , coefficient of variation.

Moments for grouped data, relations between moments, computations. Skewness, Kurtosis, Population moments.

Probability theory, conditional probability, independent, dependent and mutually exclusive events. Probability distribution . Mathematical expectations. Combinations and permutations.

Sampling theory , random samples, random numbers, sampling distribution of means, preposition, differences and sums, Standard errors.

Decision theory, statistical decision, hypotheses, tests of hypotheses and significance. Decision rules, Type I, II, errors, level of significance. Special tests. Tests involving binomial and normal distribution, two tail and one tail test Curve fitting, equations of approximations curve, free hand method of curve fitting, the straight line.

Subject approach shall be algorithmic.

CSE 216B – SCRIPTING LANGUAGES LABORATORY (CSE/IT)

2P **100 Marks**

PEARL, PYTHON, AWK, SHELL. Data types, variables, and control structures. Basic introduction to PEARL, PYTHON, AWK, SHELL, simple application programme, followed by 200-300 LOC application development.

FOURTH SEMESTER

Ma 202 A – Advanced Engineering Mathematics – II (CSE/IT)

3L,1T **3 Hours, 100 Marks**

Section A

Transforms: Laplace Transform, Inverse Laplace Transform, Properties of Laplace Transforms, Application of Laplace Transform to solve differential equation with constant coefficients. Z- Transforms. Infinite Fourier Transforms.

Section B

Numerical Analysis : Interpolation with equal intervals: Newton-Gregory interpolation formulae, Lagrange's interpolation formula for unequal intervals. Central difference interpolation formulae: Gauss' forward and backward formulae, Stirling' s and Bessel's interpolation formulae. Numerical integration : Trapezoidal rule, Simpson' s 1/3 and 3/8 rule. Numerical solution of algebraic and transcendental equations : Bisection, regula falsi and Newton-Raphson methods. Numerical solution of linear simultaneous equations : Gauss' elimination, Gauss-Jordon, Jacobi and Gauss-Siedal methods. Numerical solution of ordinary differential equations : Euler's, Runge-Kutta Fourth order and Milne's methods.

Section C

Special function : Series solution of Bessel and Legendre's differential equations. Generating function of Bessel and Legendre's Polynomials. Orthogonal Property of Bessel and Legendre's function. Rodrigue's formula.

Note: Candidates are required to attempt FIVE questions in all, selecting at least one from each Section.

CSE 221 A - PRINCIPLES OF PROGRAMMING LANGUAGES (CSE/IT)

3L, 1T **3 Hours, 100 Marks**

Importance of programming languages, brief history , features of good programming language. Translators, Syntax, semantics, virtual computers. Binding and binding time.

Elementary and structured data types, their specifications and implementation. Type checking and type conversion, vectors arrays, records, character string, variable size data structures. Sets, input and output files.

Evolution of the concept of data type, abstraction, encapsulation and information binding, subprograms, type definition and abstract data types.

Implicit and explicit sequence control, sequence control within expression and between statements. Subprogram sequence control, Recursive subprograms, Exception and exception handlers, Coroutines and scheduled subprograms. Task and concurrency exception.

Names and referencing environments, Static, dynamic and block structure, Local data and local referencing environments.

Dynamic and static scope of shared data, Block structure, parameters and their transmission. Tasks and shared data. Storage requirement for major run-time elements. Program and system controlled storage management. Static and stack-based storage management. Fixed size and variable-size heap storage management.

CSE 222 A –COMPUTER ORGANIZATION AND ARCHITECTURE (CSE)

3L, 1T 3 Hours, 100 Marks

Organization of computer system, Basic Building blocks of CPU-ALU, Timing and Control Unit, Construction of ALU, integer representation, binary half and full adder. Parallel full adder. Addition and subtraction in a Parallel arithmetic element. BCD adder. Binary multiplication, Booth's algorithm. Binary division. Logical operations, implementation of logical instructions, floating point number system, and arithmetic operations on floating point numbers.

General instruction formats, addressing modes.

Concept of control unit, execution of instructions, Hardwired and Microprogrammed control unit, Microinstructions, Horizontal and vertical format, Microprogramming, Wilkes control .

Memory element , RAM, Static RAM, Dynamic RAM, dimension of memory access, ROM, PROM, EPROM, EEPROM, Magnetic, CCD and cache memories. Hierarchy of memories. Associative memory.

Interconnection of computer components, buses, bus formats and operations, isolated and memory-mapped input-output, interfacing of keyboards and printers. Interrupts in IO systems, DMA. Data transfer, DMA interrupts, polling, masking, nested interrupts. Control of data transfer, handshaking, bus scheduling, standard bus interfaces.
Introduction to printers, magnetic tapes, disks, floppy disks, optical disk.

CSE 223 A - DATABASE AND FILE SYSTEMS (CSE/IT)

2L, 1T **3 Hours, 100 Marks**

Introduction to database systems. A historical prespective, file systems v/s DBMS, advantages of a DBMS, Data abstraction , models, instances and schemes. Data independency. Data definition and manipulation languages. Database manager, administration and users. Overall system structure.

Entities and entity sets. Relationships and relationship sets. Attributes, mapping, keys, E-R diagram and its conversion to tables. Design of an E-R database scheme.

Structure of relational database. The relational algebra. The tuple and domain relational calculus. Modification of databases and views.

Query languages, SQL and query by examples. Security of databases against misuse. Domain

constraints, referential integrity, functional dependencies, assertions and triggers. Pitfall in relational database design. Normalization using functional, multi valued and join dependencies. Domain key normal form. Alternative approaches to database design.

Data storage, Physical storage media, files organization, organisation of records into blocks, sequential files , mapping relational data to files, data dictionary storage, buffer management,

Basic concept of indexing and hashing, properties of indexes, index specification in SQL,. B+ - Tree and B-Tree index files. Hash base indexing, static hash functions, dynamic hash function.

CSE 225A – COMMUNICATION ENGINEERING (CSE/IT)

3L 3 Hours, 100 Marks

Introduction to analog and digital techniques for electrical communication. Concept of baseband and carrier transmission. Elementary study of AM, DSBSC SSB, FM and PM.

Sampling theorem and principle of pulse analog modulation. Elements of PCM, fundamentals of digital carrier modulation techniques for data communication.

Concept of FDM and TDM. Meaning of synchronous and asynchronous transmission. Principle of models. Effects of noise in communication systems.

General structure of telecommunication networks. Simplex, duplex and half-duplex lines, concepts of centralized and common control switching in telephone networks.

Qualitative study of radio-wave propagation. Introductory study of microwave LOS tropospheric scatter, satellite and optical communications.

FIFTH SEMESTER

CSE 311 A – THEORY OF COMPUTATION (CSE/IT)

3L, 1T 3 Hours, 100 Marks

Introduction to Automata theory, description of finite automata, transition Systems. Properties of transition functions, acceptability of a string by a FA.

Non-deterministic finite state machine. Conversion from NDFA to DFA. The equivalence of DFA and NDFA. Finite automata. Mealy & Moore machine with outputs. Conversion from a Moore machine to Mealy machine and vice-versa. Minimization of finite automata.

Regular set and regular grammar. Regular expression, finite automata and regular expressions, transition system and regular expression. Equivalence of two finite automata. Equivalence of two regular expressions. Kleen's closure theorem. Construction of finite automata equivalence to a regular expression.

Context free languages and derivation trees. Left most and right most derivations. Normal forms of context free grammars (i) Chomsky-normal form (ii) Greibach-normal form.

Push down automata, acceptance by PDA, PDA and context free languages.

Introduction to Linear bounded automata, acceptance by LBA, LBA and context sensitive language.

Turing machine model, representation of TMs, languages acceptability by TMs, design of TMs, universal TMs and other modifications of TM, and Chomsky-Hierarchy grammar.

CSE 312 A – DATABASE MANAGEMENT SYSTEM (CSE/IT)

2L, 1T 3 Hours, 100 Marks

Review of Database Models. Basic concepts of object oriented model, New data base applications, object structure, class hierarchy, Multiple inheritance, object identity, object containment, physical organization, object oriented queries, scheme modification. Comparison between RDBMS and OODBMS, crash recovery. Failure classification, storage hierarchy.

Transaction model , log-based recovery, Buffer Management , check points, shadow paging , failure with loss of non-volatile storage, stable storage implementation, concurrency control schedule, Testing for serializability, lock-based protocols, Time stamp based protocols, validation techniques, multiple Granularity, Multiversion schemes, Insert and Delete operations.

Basics of XML, Schema, Syntax and Sementics, view, manipulation, query, design, constaints, translation from Relational database, application.

Security and Integrity violations, Authorizations and views, security specification in SQL, Encryption, statistical databases. Introduction to distributed databases, Internet data bases. Data base Design case study.

CSE 313 A - SYSTEM PROGRAMMING (CSE/IT)

2L, 1T 3 Hours, 100 Marks

System Software and Machine Architecture, General register level architecture, VAX, Pentium, RISC Machines – Power PC, instruction and data formats.
Assemblers: Basic functions, Algorithm and Data Structures.
Machine dependent assembler features: Instruction formats and addressing modes, program relocation.
Machine Independent features: Literals, symbol definitions.
Program blocks, control sections and Linking.
Assembler design, one pass and multi-pass assemblers, MASM, and SPARC assemblers.
Loaders and Linkers: Loaders functions, absolute loader, boot strap-loader, Machine dependent and independent features, relation and lining. Data structures and algorithm of loader, Library Search, Linkage editors, Dynamic and Static Linking. Specific examples.
Macroprocessors: Functions, algorithms and data astructures, macro-expansion. Macros of HLLs, specific examples and macroprocessors.
Basic idea of compilers, phases of compiler. Interpreters, compiler-compilers. Sun OS complier, lex, yacc, gcc.
Operating System, its functions, types of OS, User interface, run time environment, interrupt processing, process scheduling, memory management, file processing, job scheduling, protection.

CSE 314A - MICROPROCESSORS (CSE)

3L, 1T 3 Hours, 100 Marks

An introduction to 80x86 microprocessor family, Real and Protected mode Operation, S/W model of 80x86 family, processor registers, data organization, Instruction types, addressing modes, interrupts, a comparative study of 8086, 80286, 80386, and Pentium.

Software Architecture, Addressing modes, Flags, Data transfer and string instructions, arithmetic, logical, bit manipulation, program transfer and processor control instructions.

Use of assembler directives, Using macros, instruction execution time, Interrupt Processing, working with interrupt vectors, Use of BIOS and DOS function calls, using disks and files.

Protected mode operation, Segmentation, Paging, Protection, Multitasking, Exceptions, Virtual- 8086 mode, Protected mode applications,

An introduction to supporting chips and interfacing - 8255, 8279,8253, 8259, 8257 (their advanced versions). Interfacing assembly with C- language.

CSE 316A- COMPUTER NETWORKS (CSE/IT)

3L, 1T 3 Hours, 100 Marks

Introduction to Computer Networks, advantages, LAN, MAN, WAN, Network topologies. OSI reference model, Basic concepts, services and layers of OSI model. Physical layer protocols- RS 232C,RS-449, X.21, X.24, Ethernet, Data link layer- basic link protocols, character and bit oriented protocols, Flow control, Error detection, Error control, High level Data Link control (HDLC).

Network layer- Virtual circuit, X.25 specification, Data grams, Transport, Session, Presentation and Application layers. Connection less and connection oriented protocols, circuit, message and packet switching.

Introductory study of TCP/IP protocol suit, LAN Topologies and transmission media, twisted pairs, coaxial, optical fibers. LAN access techniques, random access method, ALOHA, CSMA, CSMA/CD, Controlled access schemes.

Introduction to Network interconnections, Bridges and Routers.

INTERNET and WWW. Domain name system, E-mail, HTML, TELNET and file transfer protocol (FTP).

Introduction to Wireless Networks.

Basic idea of information and Network Security – Encryption, Decryption, DES, RSA, Digital Signatures, Firewalls, BGP.

SIXTH SEMESTER

CSE 321A COMPUTER GRAPHICS & VISUAL COMPUTING (CSE)

3L,1T **3 Hours, 100 Marks**

Introduction to computer graphics. Application areas, Display devices, raster scan, random scan, color monitor, display file, frame buffer, 3-D display techniques, Input devices, Hardcopy devices.

Points, line, plane and coordinates. Character, vector, circle generation algorithms, antialiasing techniques. Representation of polygons. Interfacing and filling polygon.2-D Transformations, translation, rotation, scaling, shearing, reflection, composite transformations, raster transformations.

Windows, multiple windowing, view-port, viewing transformation. Clipping algorithm for point, line using Sutherland and Cohen, polygon, text clipping. Segment and segment operation.

Interactive graphics, user dialogue, Input modes, Interactive picture construction technique, Curves and curved surface, interpolation and approximation curve, continuity of curve.

Concept of 3-D, representation of 3-D object, 3-D transformation, translation, rotation, reflection, scaling. Parallel, perspective, isometric projections. 3-D clipping Sutherland and Cohen algorithm. Hidden lines and surfaces removal technique. Back face, Z-buffer, painter algorithm.

Basic illumination models, halftone, dithering, color model RGB & CMY, Visualization of data set, representation, scalar, vector, tensor, multivariate data fields.
Introduction to Open GL.

CSE 322A – OPERATING SYSTEM DESIGN (CSE/IT)

3L,1T 3 Hours, 100 Marks

Introduction to operating system, operating system functions, batch processing systems, multiprogramming systems, time sharing systems, real time operating systems.
Process management, process concept, process scheduling, operation on processes, cooperating processes, interprocess communication.

CPU scheduling, scheduling algorithms – first come first served, shortest job first, priority based, round robin, multilevel queue, multilevel feedback queue.
Process synchronization, critical section problem, semaphores, monitors. Deadlocks, deadlock prevention, deadlock avoidance, deadlock detection.

Memory management, contiguous allocation, paging, segmentation, virtual memory, demand paging, page replacement, page replacement algorithms – first in first out algorithm, optimal algorithm, least recently used algorithm.

File concepts, directory structure, file protection, allocation of disk space.

I/O systems, I/O hardware – polling, interrupts, direct memory access. Disk scheduling, disk scheduling algorithms – first come first served algorithm, shortest seek time first algorithm, SCAN algorithm, C-SCAN algorithm, C-LOOK algorithm.

Protection and security in an operating system, access matrix, capabilities.

Case studies of Windows / LINUX operating System.

CSE 323 A - JAVA PROGRAMMING (CSE / IT)

3L, 0T 3 Hours, 100 Marks

Evolution of programming languages, generation of programming languages, type of programming languages. Basic feature of Java, flow control, classes, objects, interfaces, exception and packages.

Java classes and object, access control and inheritance, constructions, inheritance and overloading. Extension of classes.

Data type, control-flow, basics of exception handling, operations on data types.

Introductory idea of threads and their applications.

Basic I0 packages and standard utilities. Application of Java for system programming.

Introduction to LINUX shell, variables, condition and control structures.

Introduction to TCL/TK programming language.

CSE 325A – ARTIFICIAL INTELLIGENCE (CSE/IT)

3L, IT 3 Hours, 100 Marks

Defining artificial intelligence (AI), historical foundations, development of logic, turing test, AI application areas.

Prepositional calculus, syntax and semantics, Predicate calculus syntax and semantics. Inferencing and unification.

Searching structures and strategies for state space search, using the state space to represent reasoning with the predicate calculus. Heuristic searches and algorithms and use of heuristics in games. Control and implementations of state space search, recursion-based search, pattern directed search and Production systems.

Languages for AI, problem solving, introduction to Prolog, its syntax, abstract data types, production system and designing of alternative search strategies.

Overview of expert system, knowledge engineering process, conceptual models. Framework of organization and applying human knowledge. Managing uncertainty in expert system—concepts of Bayesion probability theory, non-monotonic logic and reasoning with belief, fuzzy logic and Dempster/Shafer approaches to uncertainty. Case studies of typical expert system.

Knowledge representation and its issues, network representation, conceptual graphs and structured representation.

Automated reasoning, resolution theorem proving issues and design of automated reasoning programs.

CSE 328A- ROBOTICS (CSE/IT)

3L, 1T 3 Hours, 100 Marks

Introduction: Automation and Robotics, CAD/CAM for Robotics – An overview of Robotics and applications – classification by coordinate system and control system.

Components of the Industrial Robotics: Functional diagram, representation of robot arms, common types of arms. Components, Architecture, degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

Motion Analysis: Homogeneous transformations as applicable to rotation and translation, numerical problems. Manipulator Kinematics: Specifications of matrices, D-H notation, joint coordinates and world coordinates. Forward and inverse kinematics numerical problems.

Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages.

Robot actuators and Feed back components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

Introduction to Microcontroller Families, Introduction to AVR microcontrollers, Basic Idea of Interfacing of: LEDs, Switches, Relays, LCD, 7 Segment Display, ADC, Stepper Motors, DC Motors, IR Sensors, Serial Communication, GSM module, GPS module, I2C devices, PWM Techniques

Software tools for robot programming, Cross Compilers. Machine vision and image processing
Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

Mini software simulation project

SEVENTH SEMESTER
CSE 411A - DESIGN AND ANALYSIS OF ALGORITHMS (CSE/IT)

3L, 1T 3 Hours, 60 Marks

Review of Algorithm and its specification, performance analysis and Randomized Algorithms. Random access machines (RAM), computational complexity of RAM program. Time and Space complexity, Asymptotic notations (Big-O,θ,Ω, and small-o).

Design of Efficient Algorithms: Designing Methods. Divide and conquer: Binary Search, finding maximum and minimum, Merge Sort, Quick Sort. Greedy methods: Knapsack problem, tree vertex splitting, minimum cost spanning tree. Dynamic programming: Matrix Chain Multiplication, Longest Common Subsequence, Multi Stage Graph and 0/1 Knapsack Problem. Branch and Bound: Traveling Salesman Problem and Lower Bound Theory.

Sorting and Comparative study: Algorithms and comparisons of Radix sort, Heap sort, Merge sort and Quick sort. Order statistics and expected time for order statistics.

Matrix multiplication and related operations: Strassen's Matrix Multiplication Algorithm, inversion of matrices, LUP decomposition of matrices and its applications.

Advanced Trees: Definitions Operations on Weight Balanced Trees (Huffman Trees), 2-3 Trees and Red- Black Trees. Augmenting Red-Black Trees to Dynamic Order Statistics and Interval Tree Applications.

Graph Theory Algorithms: Algorithms for Connectedness, Finding all Spanning Trees in a Weighted Graph and Planarity Testing, Breadth First and Depth First Search, Vertex cover problem.

CSE 412 A – BIG DATA ANALYTICS (CSE)

3L, 1T 3 Hours, 60 Marks

Data warehousing Definition, usage and trends. DBMS vs. data warehouse, Data marts, Metadata, Multidimensional data mode, Data cubes, Schemas for Multidimensional Database: stars, snowflakes and fact constellations.

Data mining definition & task, KDD versus data mining, data mining techniques, tools and applications. Data mining query languages, data specification, specifying knowledge, hierarchy specification, pattern presentation & visualization specification, data mining languages and standardization of data mining.

Introduction to Big Data Platform – Traits of Big data -Challenges of Conventional Systems -Web Data – Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions – Re-Sampling- Statistical Inference - Prediction Error.

Regression Modeling - Multivariate Analysis - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics - Rule Induction - Neural Networks: Learning And Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees - Stochastic Search Methods.

Mining Frequent Item sets - Market Based Model – Apriori Algorithm – Handling Large Data Sets in Main Memory – Limited Pass Algorithm – Counting Frequent Item sets in a Stream – Clustering Techniques – Hierarchical – K-Means – Clustering.

CSE 413A- SOFTWARE ENGINEERING (CSE/IT)

3L, 1T 3 Hours, 60 Marks

Introduction, software characteristics and software crisis. The software engineering approach; software process & process maturity. Various software development models. Software life cycle concept.

The software project management concepts and team organization. Software process and project metrics. Software measurement. Metrics for software quality and its integration with the software process.

Software scope/project estimation – the COCOMO model and the Function Point approach.

Software quality assurance. Software reviews, cost impact and software defects. Formal Technical Reviews, software reliability.

Conventional methods for software engineering. Analysis concepts and principles. The software requirements specifications. Software prototyping.

Software design and software engineering, software architecture. Effective modular design – functional independence, cohesion and coupling concepts. Component level/procedural design.

Software testing techniques and strategies.

CSE 414 A - PRINCIPLES OF COMPILER DESIGN (CSE/IT)

3L, 1T 3 Hours, 60 Marks

Introduction to translators , compilers, interpreters, compilation process.

Lexical analyzer, input buffering, specification and recognition of tokens, regular expressions to NFA, minimization of DFA, keywords and reserve word policies, LEX - the lexical analyzer generator.

Syntax analyzer, context free grammars, top down parsing, Brute force parser, recursive descent parser, LL (1) parser. Bottom up parsing, operator precedence parsing, LR parser, LALR parser, YACC - the parser generator.

Syntax directed translation schemes, implementation of syntax directed translators, synthesized attributes, inherited attributes, construction of syntax trees, bottom up evaluation of S- attributed definitions, L- attributed definitions, top down translation of L - attributed definitions.

Errors, lexical phase errors, syntactic phase errors.

Intermediate languages, postfix notation, syntax trees, parse trees, three address code- quadruples, triples and indirect triples.
Translation of assignment statements, boolean expressions, statements that alter flow of control, array references, procedure calls, declarations, case statement, record structures.

Symbol tables, operation on symbol tables, symbol table organization for non-block structured languages, symbol table organization for block-structured languages.
Run time storage management, storage allocation and referencing data in block structured languages, storage allocation in FORTRAN.

Code optimization, sources of optimization, loop optimization, DAG and optimization of basic blocks.

Code generation, a machine model, next use information, register allocation and assignment, a simple code generator, code generation from DAG's, peephole optimization.

ELECTIVE-I

CSE 453A – CLIENT-SERVER TECHNOLOGY (CSE/IT)

3L, 1T 3 Hours, 60 Marks

Introduction: Client/Server architecture, Benefits, application, centralize multiuser, Distributed single user architecture, distributed computing environment.

Approach to Distribution: Distributed models, multi tiered environment, cooperative processing, application components, and distribution points. Presentation distribution, distributed processing, distributed function and transaction processing, data distribution.

Client technologies: Function, Application and tools, operating system, hardware plate forms, database access, interprocess communication tools.

Server technologies: Function, server operating system, hardware plate forms, data access, distributed data access, database engines.

System networks Architectures: Components, layers, pear-to-pear communication between SNA layers.

Data Management: Distributed data management, method of the distribution, distributed data access. Database transaction management.

Distributed DBMS: Architecture, storing data in a distributed DBMS, Distributed catalog, management, Distributed query processing, Update distributed data. Introduction to distributed transactions, distributed concurrency control, and distributed recovery.

CSE 454 A – MULTIMEDIA TECHNOLOGY (CSE/IT)

3L, 1T 3 Hours, 60 Marks

Introduction to multimedia and its applications, Basic requirements for multimedia, Multimedia building blocks - Text, Sound, Images, Animation, Video and related tools.

Multimedia Hardware: SCSI, MCI, Memory and storage devices, Output Hardware, Communication devices.

Multimedia Software: Basic tools - Painting and drawing tools, 3-D modelling and animation tools, Images and editing tools, OCR software, Sound Editing programs, Animation, Video and Digital Movies, Video Formats, Compressing movie files.

Multimedia Authoring tools: Selecting a right tool based on various features, card and page based authoring tools, Icon based authoring tools, Time based authoring tools, Object - Oriented Tools.

Assembling and delivering a project: The multimedia team, Planning and costing, designing and producing.

Multimedia and the internet: working of internet, Tools for www - web page makers and editors, HTML and Multimedia, Video on demand, Images, sound and animation for the web.

EIGHTH SEMESTER

CSE 421 A - ADVANCED COMPUTER ARCHITECTURE (CSE)

3L, 1T 3 Hours, 50 Marks

Introduction to parallel processing and trends: parallelism in uni-processor system, parallel computer structure, architectural classification schemes for parallel computers, multiplicity of instruction – data streams, serial versus parallel computers, parallelism versus pipelining.

Memory hierarchy: hierarchical memory structures, virtual memory system, memory allocation and management.

Principles of pipelining: pipelining principles and classifications, general pipelines and reservation tables, interleaved memory organization, instruction pre-fetch and branch handling, data buffering and busing structures, internal forwarding and register tagging, hazard detection and resolution, job sequencing and collision prevention, dynamic pipelines and reconfigurability.

Structure for array processors: SIMD computer organization, masking and data routing mechanism Inter PE communication, introduction to associative array processing.

Multiprocessor architecture: loosely coupled and tightly coupled multiprocessors, processor characteristics for multiprocessing, interconnection networks, cache coherence protocols.

Introduction to advance processors: Data flow computers, the VLIW architecture, fault tolerant architecture and study of TANDEM HIMALAYAN K2 system architecture.

CSE 422 A - EMBEDDED SYSTEMS (CSE)

3L, 1T 3 Hours, 50 Marks

Introduction to Embedded Systems and their basics, Real time systems, Multitasking. Use of programming languages, Real time kernel, size of embedded programs.

Data Representation – Fixed Precision Binary numbers, binary representation of Integers and Real numbers, ASCII and BCD.
Hardware requirements and time constraints, reliability and cost, design decisions.

Selection of microprocessor/microcontroller for embedded systems, computing the size of memory required RAM and ROM.

S/W tools for embedded system development- High level languages support, Use of cross compilers, Use of tools sets in Embedded Linux , GNU Tool chain for cross compiling.

Concurrent Software, Scheduling, Memory Management, Shared Memory, System Initialization.

Mixing C and assembly, C-Run time environment, Costing of an Object, Using Unions.

Case Study: Use of tool-sets in Embedded Linux, GNU Tool Chain for cross compiling.

ELECTIVE-II

CSE 462A–OBJECT ORIENTED SOFTWARE ENGINEERING (CSE/IT)

3L, 1T 3 Hours, 50 Marks

Object-oriented concepts and principles. Identifying the elements of an object model. Object oriented projects metrics and estimation.

Object-oriented analysis: Domain analysis, the OOA process, the object-relationship model.

Design for object- oriented systems. The system design process.

Object-oriented testing - testing OOA and OOD models. The object-oriented testing strategies. Inter class testing.

Technical metrics for O-O systems. Class-oriented metrics & metrics for O-O projects.

Advanced topics in software engineering. Component-based software engineering and development. Classifying and retrieving components.

Review of CASE tools.

CSE 464A – REAL-TIME SYSTEMS (CSE)

3L, 1T 3 Hours, 50 Marks

Introduction to real-time computing: Characteristics of real-time system & tasks, performance measurement of real-time systems, estimation of program runtime.

Real-time system design: hardware requirements, systems development cycle, data-transfer techniques, synchronous and asynchronous data-transfer techniques, standard interfaces.

Task assignment and scheduling: priority scheduling, dynamic scheduling, buses in dynamic scheduling, dynamic priority assignment. Real-time programming languages and tools. Desired language characteristics, data typing. Control structure, run-time error handling, over-loading and generics, run-time support, real-time databases.

Real-time communication, fault-tolerance techniques, cause of failure, fault types, fault detection, redundancy, integrated failure handling.

Reliability evaluation techniques; parameter values, reliability model for hardware redundancy, software error model, clock synchronization.

CSE 466 A - GRAPH THEORY (CSE/IT)

3L, 1T 3 Hours, 50 Marks

Introduction to graphs, applications, representation of graphs. Walk, Paths and circuits. Isomorphism, connectedness, Euler graph, subgraph, operations on graph, Hamiltonian Paths and Circuits, Traveling Salesman problem, algorithm of graph traversals, connectedness.

Tree, Spanning tree, Fundamental Circuits, Cut-sets, Connectivity and Separability, 1-isomorphism, 2-Isomorphism, Network flow, Algorithm for spanning tree, cut vertex.

Planar and Dual graphs, Kuratowski's two graph, representations of planar graph, algorithm for detection of planarity, geometric and combinatorial dual graph, thickness and crossings.

Matrix representation of graphs, incident matrix circuit matrix, cutset matrix, path matrix, adjacency matrix. Coloring, covering and partitioning, chromatic number, chromatic polynomial, matching, bipartite graph, four color problem.

Directed graphs, types, binary relations, connectedness, Euler digraph, tree, fundamental circuits, adjacency matrix, tournaments, acyclic digraph, decyclization, algorithm for finding directed circuits.

CSE 470A – COMPUTATIONAL SCIENCE (CSE/IT)

3L, 1T 3 Hours, 50 Marks

Modeling and Simulation: Definition of simulation and modeling; relationship between simulation and modeling, Purpose including benefits and limitations: role – addressing performance, optimization; supporting decision, making, forecasting, safety considerations.

Application areas: healthcare (including assisting with diagnostics); economics and finance; city and urban simulations; simulation in science and in engineering.

Types of simulations – physical, human in the loop, interaction, computer, virtual reality. The simulation process. simplifying, assumptions; validation of outcomes.

Model building: use of mathematical formula or equation, graphs, constraints. Methodologies and techniques. Use of time stepping for dynamic systems.

Theoretical considerations; Monte Carlo methods, stochastic processes, queuing theory. Software in support of simulation and modeling; packages, languages.

Operations Research: Linear programming: Integer programming, The Simplex method, Probabilistic modeling, Queuing theory, Markov models and chains, Prediction and estimation, Decision analysis, Forecasting, Risk management.

Software tools for Simulations and Modeling.

ELECTIVE-III

CSE 465 A - INFORMATION THEORY AND CODING (CSE/IT)

3L, 1T 3 Hours, 50 Marks

Uncertainty, information, measure of information, average information, entropy, property of entropy, information rate. Discrete memoryless source, Source coding theorem,

Discrete memoryless channel, self and Mutual information, properties, channel capacity, channel coding theorem, Shannon – Hartley theorem, Information capacity theorem.

Data compaction, prefix coding, Huffman coding, Lempal-Ziv coding. Compression of information.

Type of errors, codes, error control coding, linear block code, error detection and correction codes, syndrome decoding, cyclic codes, hamming code, BCH, convolution codes, encoders and decoders, performance of codes.

CSE 469A-BIOINFORMATICS (CSE/IT)

3L, 1T 3 Hours, 50 Marks

Introduction to Molecular Biology and Biological chemistry: Genetic material, Gene structure and information content, protein structure and functions, nature of chemical bonds, molecular biology tools, genomic information content.

Data Searches and pair-wise alignments: Dot plots, Gaps, Dynamic Programming, database searches and family of algorithms –BLAST and FASTA.

Substitution patterns: Pattern substitution with in genes, estimating substitution numbers, variation of evolutionary rates between genes, molecular clocks.

Phylogenetics: Its history, phylogentic trees, distance matrix methods. Character-based methods – parsimony, ancestral sequences. Strategies for faster searches – branch and bound, heuristic. Consensus trees, parametric tests. The tree of life.

Genomics and gene Recognition: prokaryotic and eukaryotic genomes and their structures, open reading frames, gene expression.

Protein and RNA structure prediction: Amino-acids, polypeptide composition, structure. Algorithms for modeling protein folding, and reverse protein folding.

Information integration for life science discovery: Nature of biological data, data sources, challenges in information integration.

SYLLABUS OF OPEN ELECTIVES-I

BCT 291 A Open Elective-I: Sustainable Architecture

3L **3 Hrs, MM 100**

Concepts of sustainability : Energy and Global environment, Energy use and Climate change – Its impact, Types of Energy systems, Concept of Sustainability - Principles of conservation -synergy with nature, Bioregionalism - community basis shelter technology within bioregional patterns and scales, Ethical- environmental degradation.

Sustainable planning & Design: Sustainable Development -Sustainable approach to site planning and design - site inventories- relationships between site factors - development impacts from one area of the site on the other areas - phasing of development - limits of change - Design facility within social and environmental thresholds

Sustainable Building Materials and Construction : Properties, Uses and Examples of -Primary, secondary and Tertiary Sustainable Materials, Principles to improve the energy efficiency - siting and vernacular design, shade, ventilation, earth shelter, thermal inertia and air lock entrances. Techniques of sustainable construction - technologies, methods of effectiveness, and design synthesis – alternative materials and construction methods: solar water heating panels; photovoltaic electricity generation; use of local materials and on site growth of food, fuel and building materials.

Recycling and Reuse : Pre building, Building, Post building stages - Architectural Reuse, Waste prevention, Construction and Demolition recycling- Conservation of natural and building resources- Energy and material savings – types of wastes - Elimination of waste and minimize pollution- various Decomposing methods – Innovative reuse of various wastes Case Studies and Rating systems : Sustainable Development Case Studies: illustrated examples of the planning, development, and construction. Green architecture and various international rating systems for sustainability- EAM (UK), CASBEE (Japan), LEED (US), Green Star (Australia), etc. – Indian systems – TERI GRIHA rating, LEED India rating, IGBC

CE 291A Open Elective-I :Energy Efficient Building Design

3L **3 Hrs, MM:100**

Environment and man, external environment and built environment, Built-environment – integrated approach.

Climate: elements of climate, classification of climate, Micro-climate, site climate.

Comfort: desirable conditions, thermal comfort factors, comfort indices, effective and corrected effective temp. Tropical summer index.

Thermal Design: heat loss from a building under steady state condition, heat gains due to solar radiation, steady state and cyclic conditions, Means of thermal control – mechanical, structural control, air infiltration into buildings by natural means, shape of buildings,-thermal cube, fabric heat loss, ventilation loss and volume.

Light & Lighting: illumination requirement, day-lighting, artificial lighting, energy conservation.

Noise Control: Sources of noise, means of control, control requirements, behaviour of sound in rooms, vibration & vibration control.

Building Services: Mechanical & electrical services in building, lifts, escalators.

ChE 291 A Open Elective-I : Renewable Energy Sources

3L **3 Hrs, MM:100**

Sources of energy: Energy sources and their availability, renewable energy sources.

Energy from Biomass: Introduction, Biomass as a source of energy, Biomass conversion technologies, Biogas generation, classification of biogas plants, Biomass gasification.

Solar Energy: Sun and solar energy, solar radiation and its measurement, solar energy collectors, solar energy storage, Photovoltaic systems, Application of solar energy.

Wind Energy: Wind as an Energy source, Basic principles of wind energy conversion, Types of Wind machines, Components of wind energy conversion system, Performance of wind machines, application of wind energy.

Geothermal Energy: Introduction, Origin and distribution of geothermal energy, types of geothermal resources, Hybrid geothermal power plant, Application of geothermal energy.

Hydrogen energy: Introduction, Hydrogen production, Hydrogen storage, Hydrogen transportation.

Energy from the Oceans: Introduction, Ocean Thermal Electric Conversion (OTEC), Energy from Tides, Ocean Waves.

EE 291 A Open Elective I: Industrial Application Of Electrical Drives

3L **3 Hours, 100 Marks**

Operating-Characteristics : Individual, group and collective drives, steady state individual and joint characteristics of electric motors and driven industrial units under different conditions of operation.

Transient Characteristics : Causes of transient conditions starting, braking, reversing, speed transition and sudden system changes. Forces and torques on the drives referred to a common reference shaft. General equation of motion, Accelerating and deaccelerating times. Starting and braking time and means of reducing.

Drives Control : Parameters characterizing speed control methods of electric drives, speed control of Industrial d.c. and a.c. motors under constant and varying torque and h.p. conditions.

Families of speed torque characteristics : Idea of manual and automatic control gears, Master-controller.

Motor Ratings : Continuous-short time and intermittent ratings, overload capacity. Effect of altitude, Motor heating and cooling curves. Equivalent current, power and torque. Selection motor for various duty cycles. Permissible frequency of starting, features of load diagram construction. Load equalisation and use of fly wheels. Types of motor enclosures.

Illumination : Units of light, Point , linear and surfact sources. Laws of illumination. Candle power distribution, MSCP and reduction factor, Indoor lighting system and their classification. Contrast, glare, shadow and colour. Mounting height and spacing. General and local lighting Total lumen and point by point methods of calculations. Outdoor lighting distributor and protector fittings. Isolux diagram. Flood, gas, discharge and arc-lamp-working, characteristics and applications.

Electric Heating and Welding : Principles of electric heating. Direct and indirect resistance heating, lead baths and salf baths. Resistance oven convection and rediation ovens. Arc resistance and induction furnance, elements of operation, performance and power supply arrangements. temperature regulation of ovens and furnances. Induction, high frequency and dielectric heating and their uses. Elementary study of different kinds of electric welding operation, Power supply for welding. Elements of Electrics Traction : Electric traction versus others System of electric traction for tramways, trolley buses, motor coach trains and locomotive hauled trains. Idea about suitability of electric motor for traction. Conductor rail and pantograph. meaning for multiple-unit operation.

Economics : Methods for economic selection of Industrial drives, loss factor and cost of losses, Effect of load factor. Power factor and factory diversity factor. Methods of power factor improvement and its economic limit. Economic calculations for illumination schemes Echnomic value of good lighting.

EE 292 A Open Elective I: Engineering Economics

3L **3 Hours, 100 Marks**

Introduction: Economics for Electrical Engineering, concept of physical efficiency and financial efficiency of electrical goods and services supply and demand, Elasticity. Necessities and luxuries, free competition, monopoly, law of diminishing returns.

Interest and Depreciation: Interest rates and equivalence, annuities and various factors, concept of depreciation in utilizing electrical energy, economic life of electrical machines, salvage value, various methods of depreciation calculations, equivalent capital recovery depreciation.

Economical choice of Electrical Apparatus: Motors, transformers, Economical choice between synchronous motors and Induction motor running them simultaneously.

Comparison of Alternatives: Basic economic study patterns, annual cost, capitalized cost, present worth, rate of return, Increment investment, pay back and benefit to cost ratio methods and their respective fields of applications.

Ma-291 A Open Elective-I :Mathematical Statistics for Engineers

3L **3 Hrs., M M :100**

Theory of probability : Theoretical probability distribution (Binomial, Poisson and Normal).
Correlation and Regression Analysis : Karl-Pearson's coefficient , Spearman's coefficient, Regression analysis of two variables system.
Sampling Theory : Test of significance, Large sample tests for mean and proportions. χ^2 (chi-square) , t and F Test of significance for Small sample.
Theory of attributes: association and independence of attributes, coefficient of association.
Index Number: Various types of index numbers, construction of index number of prices, fixed base and chain base methods

ME- 291A Open Elective-I: Renewable Energy Sources

3L **3 Hrs, MM:100**

Principal types of fossil fuel fired power plants and their effects on livestock and environment; Concepts of NCES, Criteria for assessing the potential of NCES, Limitations of RES.

Solar Energy - Solar radiation data, solar energy conversion into heat, Analysis of Flat plate and Concentrating collectors, Testing procedures, Paraboloid Dish, Central Receiver; concept of collector tracking, energy storage systems; Solar thermal systems for residential water heating, Solar Pond, industrial process heating and power generation. Photo voltaic: p-n junctions, I-V characteristics of solar cells, Calculation of energy for photovoltaic power generation; Battery Characteristics, DC Power Conditioning Converters, AC Power Conditioning -Inverters.

Wind Energy**:** Energy available from wind, General formula, Lift and drag. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Determination of torque coefficient, Principle of Operation of wind turbines, types of wind turbines and characteristics, Generators for Wind Turbines, Control strategies.

Biomass and Biofuels: Conversion routes- combustion, pyrolysis of biomass to produce solid, liquid and gaseous fuels; Constructional details of gasifier; Aerobic and anaerobic digestion, Biofuels and their production; biofuels, Biomass systems for thermal applications and power generation.

Geothermal Energy: Definition and classification of resources, typical geothermal gradient; Dry, flash and binary steam systems; Utilization for electricity generation and direct heating, Wellhead power generating units. Basic features: Atmospheric exhaust and condensing, Exhaust types of conventional steam turbines.

An overview of other renewable devices- Fuel cells: principle, types, applications; Ocean thermal energy conversion (OTEC), Thermoelectric, MHD, Wave energy, Tidal energy, etc.

Economic Viability: Calculation of the cost of energy supply from renewables, Payback period, Carbon footprints; Comparison with conventional fossil fuel driven systems in terms of costs and emissions; Calculation of carbon dioxide reduction and incremental costs for renewable options.

ME 292 A Open Elective-I: Automobile Engineering

3L **3Hrs, MM:100**

Power Unit: Automobile engine types, classification; Engine parts: cylinder head, block and crank case, piston and rings; Carburation, fuel injection, valve operation; Fuel combustion, mechanical power and engine performance characteristics; Engine cooling and thermal stresses in parts,.

Chassis and Suspension: Load on frame, general considerations for strength and stiffness, engine mounting; Dampers, leaf and coil springs, various arrangements of suspension systems.

Transmission System: Clutches, flywheels, torque convertors; Gear-box: simple, synchromesh and overdrive; Type of universal joints, propeller shaft, differential; Rolling, air, gradient resistances and propulsive power calculation.

Steering: Steering geometry, Ackermann and Davis steering mechanisms; Telescopic steering; Steering shaft, gear-box, linkages, steering angles, front and rear axles; Vehicle longitudinal, static and dynamic balancing and electronic stability; Power steering: types and mechanism; Effect of caster, camber, toe-in and toe-out on tyre wear.

Brakes and Tyres: Servo-action, brake components; Bendix and Gerling system lock-head, hydraulic, vacuum, air and power brakes, and retarders; Pneumatic and tubeless tyres;

Features of a Modern passanger Car: Introduction to ABS, Front and side air bags, EBD, Climatizer, ESP, night-vision dashboard system; sun-roofing, collision warning system, Hybrid cars.

MI 291A Open Elective-I: Tunneling for Engineering Projects (MI)

3L **3 Hrs, MM:100**

Tunneling: Introduction about tunnels, functions, advantages and disadvantages of tunnels compared to open cuts, Criteria for selection of size and shape of tunnels, consideration in tunneling, geological investigation, tunnel alignment, tunnel shafts, pilot tunnels. Advantages of twin tunnels and pilot tunnels, portals and adits.

Conventional Method of Tunneling: Drilling, Blasting, Loading and Transport of Muck, Supports, Ventilation, Drainage, and Equipments. Drivage work in varying ground conditions using conventional methods

Fast Tunneling: Dill jumbos, trackless mucking and transportation units. Tunnel boring machine

Tunneling in Soft Ground: General characteristics of soft ground, shield methods, needle beam method and NATM method of tunneling in practice.

Tunneling (rock bolting and guniting), Safety measures, Ventilation in tunneling, Lighting, Drainage.

PI 291A Open Elective-I: Manufacturing Science

3L **3 Hrs, MM:100**

History and introduction to science of basic manufacturing processes and its classification.

Primary manufacturing processes: Introduction to liquid state forming process (casting), solid state forming process (drawing, extrusion, rolling, forging and other sheet metal working) and power state forming process (powder metallurgy).

Secondary manufacturing processes: Introduction to material removal processes

Conventional Machining processes (basic machining operations performed of lathe, shaper, milling, drilling and grinding machine).

Introduction to basic metal joining processes (welding, brazing, soldering and mechanical fastening).

Non conventional machining processes (Basic introduction, classification, need for their development, characteristics and their industrial applications).

SYLLABUS OF OPEN ELECTIVES-II

BCT 341 A Open Elective-II: Traditional Indian Architecture

3L, **3 Hrs, MM 100**

To provide theoretical knowledge base on the uniqueness of Indian traditional Architecture principles, the meaning of space, the manifestation of energy, the selection of site and how 62 integration of built form with site happens at metaphysical level based on articulation of celestial grid.

To introduce the principles of Vastu and relationship between building and site. To familiarize the students with the units of measurement in traditional architecture. To introduce concepts of orientation and cosmogram according to the Vasthu Purusha Mandala. To study the detailing and design of various building components and their material and method of construction.

Vastu - its definition and classification - Relationship to earth.. Features of good building site - good building shapes - macro, micro, enclosed and material spaces - relationship between built space, living organism and universe - impact of built space on human psyche.

Orientation of building, site, layout and settlement - positive and negative energies - importance of cardinal and ordinal directions - The celestial grid or mandala and its types. The Vaastu Pursha Mandala and its significance in creation of patterns, and lay-outs, Types of lay-outs. Simple design of residential buildings.

Building heights -Base and basement - wall and roof specifications - column and beam designs - Pitched roof and domical roofs - significance of pyramid.

Use of wood, stone, metal, brick and time - marking technology, corbelling technology, jointing technology - foundations for heavy and light structures - Landscaping in and around buildings - Aesthetics in Indian Architecture.

CE 341A Open Elective-II: Non Urban Public Hygiene & Drinking Water

3L, **3 Hrs, MM 100**

Communicable disease: Disease and immunity, communicable disease sources, mode of transfer. Control of communicable disease.

Fly and mosquito control: Life cycle of flies and mosquitoes. Various methods of fly and mosquitoes control.

Milk and food sanitation: Essential of dairy farm and cattle shed sanitation. Tests for milk and dairy products. Food epidemic, food poisoning. Botulism. Rural sanitation, village latrines, aqua privies, storm water and sullage problems, animal waste, methods of composting. Biogas collection and disposal of refuse, solid waste management through vermicomposting.

Septic tank (only salient features), percolation pits, sub surface disposal.

Rural water supply: Importance of village community in India, conditions of Indian villages with special regards to economic, social and health aspects. Quality of water needed for village community, sources of water for village water supplied, domestic roof water harvesting. Types of wells of sanitary aspects in well construction. Disinfections of wells. Different types of pumps used for village wells. Operation and maintenance of pumps, water borne diseases. Quality of water, human and cattle population and their water requirement. Rate of water supply. Standards of potable water. Rain water storage.

Treatment of water: Disinfection, desalination, Defluoridation, distribution of water.

ChE 341 A Open Elective-II: Petroleum Refining Technology

3L, **3 Hrs, MM 100**

Origin occurrence of petroleum, Formation and Evaluation of Crude Oil. Testing of Petroleum Products. Petroleum refining processes, general processing, topping and vacuum distillations. Thermal cracking in vapor, liquid and mixed phase. Overview of Refinery Products

Catalytic cracking - Houdry fixed bed, fluidized bed, T.C.C. Houder flow etc. Catalytic reforming - conversion of petroleum gases into motor fuel with special reference to alkylation, polymerization, hydrogenation and dehydrogenation.

Treatment Techniques: Removal of Sulphur Compounds in all Petroleum Fractions to improve performance, Destruction of Sulphur Compounds and Catalytic Desulphurization, Solvent Treatment Processes, Dewaxing, Clay Treatment and Hydrofining.

Production of aviation gasoline, motor fuel, kerosene, diesel oil, tractor fuel and jet fuel, hydrodesulfurisation, Lubricating oil manufacture, Petroleum waxes and asphalts.

Octane number, Cetane number, Diesel index, their determination and importance Storage of petroleum products: tanks, bullets, special types of spheres etc. Transportation of petroleum products: road, rail, sea and pipeline; Importance of pipeline transportation.

EE 341 A Open Elective II: Optimization Techniques

3L **3 Hrs, 100 Marks**

Introduction to Optimization : Historical Development, Engineering application of optimization, Statement & Classification of optimization problems, Classical optimization techniques for single & multiple variable functions.

Linear Programming : Introduction, application, standard form, Basic Solutions, Simplex method, Revised Simplex method, Duality, Transportation problem, Carmarkar's method.
Nonlinear programming : Unconstrained Optimization, Introduction, Fibonacci method, Golden section search, Gradient method, Newton's method, Quasi Newton method.
Dynamic Programming : Introduction, Multistage decision process, Concept of optimization & principle of optimality, Computational procedure in dynamic programming.
Advanced topics in optimization : Introduction, Separable programming, Multi objective optimization, Calculus of variation.
Books :
Engineering Optimization – S. S. Rao, New Age International Publishers.
An introduction to optimization – Er. K. P. Chong, S. H. Zak (Wiley Slident Edition)
Operations Research : An international – H. A. Taha (PHI)
Introduction to operation research – Hiller F.K. & Lieberman (TMH)

Ma 341 A Open Elective-II :Mathematical Theory of Operations Research

3L **3 Hrs., MM : 100**

Linear programming problems-Simplex Method, two phase method, Duality of LPP.
Theory of games: Competitive strategies, minimax and maximin criteria, two person zero-sum games with and without saddle point, dominance .
Inventories: Single item deterministic inventory models with finite and infinite rates of replenishment, economic lot-size model with known demand
Replacement problems: Replacement of item that deteriorate, replacement of items that fail completely, group replacement policty, individual replacement policy
Queing theory-Ques with Poisson input and exponential service time, the queue length, waiting time and busy period in steady state case, model with service in phase, multiserver queueing models.

ME 341A Open Elective-II : Economics Analysis and Management of Operations

3L **3 Hrs., MM: 100**

Business Goals & Form of Business Organization, Introduction to Management- Elements of Management, Principle of Management.
Concept of Costing- Breakeven Analysis, Deprecation & Estimate.
Marketing- 5Ps of Marketing- Product, Price, Demand Forecasting, Promotion, Person and Place. Concept of Advertising and It's Objective.
Financial Analysis-Statement and Financial Ratio.
Introduction to Privatization Liberalization, Globalization Ratio & Their Impact on Economy.

ME 342A Open Elective-II: Systems Design and Analysis

3L **3 Hrs., MM: 100**

Introduction: Basic concept of Finite element method; Rayleigh-Ritz and weighted residual method of variational approximation, Numerical Solution of equilibrium problem by Gaussian elimination.
Finite Element Analysis of One-dimensional Problem; Basic Concepts, derivation of elements equations, connectivity of elements, imposition of boundary conditions, Solution of equations, Application in One dimensional problem of Solid mechanics and heat transfer.
Finite Element Analysis of Two Dimensional Problem: Single variable problems: finite element discertization, interpolation, function, numerical integration and modeling considerations for triangular, rectangular, Quadrilateral, Isoparametric and Plane frame elements, Evaluation of equation and their solutions, Application in Two Dimensional Problem of Solid mechanics, Heat Transfer and Eigen value problems.

MI 341A Open Elective-II: Application of GIS & Remote Sensing in Engineering

3L **3 Hrs, MM:100**

Remote Sensing: Introduction to Remote Sensing, Terminology in Remote Sensing, Types of Remote sensing, advantage and disadvantage of remote sensing data, Electromagnetic radiation atmospheric. Windows remote sensing platforms and sensors systems, path-row referencing system, remote sensing data product, procedure for obtaining satellite data. Hardware and software related to remote sensing.
Different types of platforms, sensors and their characteristics, Orbital parameters of a satellite, Multi concept in remote sensing.
Image Interpretation and analysis: Elements of visual image interpretation, Digital image pre-processing, radiometric correction, geometric correction, resolution of remote sensing data, image enhancement, contract enhancement, spatial filtering band rationing

image classification supervised and unsupervised classification, remote sensing applications in forestry, geology, hydrogeology, Land use and land cover mapping.
Principles of interpretation of aerial and satellite images, equipments and aids required for interpretation, ground truth – collection and verification, advantage of multidate and multiband images. Digital image Processing concept.
Geographic Information System (GIS): Fundamental of GIS: Basis concept including definition and history of GIS, Essential Elements of GIS, Uses and users of GIS, General GIS Applications, Geodesy, Grids, Datum's and projection systems, GIS Data structure, Data Formats, GIS layers and Digitization overview of GPS and its application, Hardware and software related to GIS.
Raster and vector Based GIS: Raster based GIS, Definition of Raster Based GIS, Spatial Referencing Definition and Representation of Raster Data. Vector based GIS, Definition and concept of vector based GIS, Data structure, Data Capture and Basic operations of spatial analysis, advantages and disadvantage in raster and vector based GIS, Introduction to network in GIS, GIS Project Planning Management and Implementation.
Application of GIS :in Map revision, Land use, Agriculture, Forestry, Archaeology, Municipal, Geology, water resources, soil Erosion, Land suitability analysis, change detection, Use of GIS in Mining.

PI 341A Open Elective-II: Principles of Management & Economics

3L **3 Hrs, MM: 100**

Introduction: Definition of management; Historical developments. Evolution of management; various schools of management theories; management functions; principles of management.
Types of organization: Organization and organization structures; Line, staff, function and committee type structures of organizations; flow of responsibility and authority in organization. Types of business organizations: sole proprietorship, partnership, private and public limited, co-operative societies, public sectors, joint sectors- their formation and dissolution.
Personnel management: Objectives of personnel management; functions of personnel management; nature of personnel management.
Economic analysis: Money time relationship; Law of supply and demand, Demand curves, demand elasticity, equilibrium concept, economies of scale.
Financial management: Assets and liabilities; balance sheet; profit and loss accounts, ratio analysis.
Operations management: Introduction to operations management; history, function and scope of operations management, areas of operations management; general model of managing operations; Introduction to production planning and control.
Introduction to marketing management; Budget and budgetary control; Purchasing process; Motivation; Leadership; Moral, job satisfaction.

SE 341A Open Elective-II :Structural Dynamics

3L **3 Hrs, MM: 100**

Vibrations of single degree of freedom system, sources of vibration, Types of vibration, Degree of freedom, spring action and damping, equation of motion of single degree of freedom system, undamped system of single degree of freedom, combination of stiffnesses, damped system of single degree of freedom, dry friction, damping forced vibration of damped system, introduction to multi degree freedom system.

SYLLABUS OF OPEN ELECTIVES-III

BCT 391 A Open Elective-III: Climate Responsive Architecture

3L, **3 Hrs, MM 100**

Understanding Climate and its impact on architectural design, fundamentals of climatology and environmental studies.
Introduction – Elements of Climate, measurement and representation of climatic data. Classification of climate, major climatic zones of India.
Thermal Comfort: Effect of climatic elements on Thermal comfort; indices for Thermal comfort Thermal performance of building elements: Thermal and physical properties of building materials and their effect on indoor environments.
Natural ventilation: Functions, effects of openings and external features on internal air circulation. Design considerations for achieving natural ventilation.
Sun path diagram, use of solar charts, types of shading devices
Day light factor: components, design considerations for indoor spaces
Micro Climate: factors and effects
Construction techniques for improving thermal performance of walls and roofs. Passive cooling techniques: traditional and contemporary
Design considerations for buildings and settlements in tropical climates with special reference to hot-dry, warm-humid and composite

climates; Mahoney Tables.

Exercises:

Design of shading devices.

Layout of Residence for hot - dry, warm-humid and composite climates.

CE 391A Open Elective-III: Ecosystem & Biodiversity

3L, 3 Hrs, MM 100

Concept of an ecosystem, structure & function of ecosystem, Bio-Geo chemical cycles (Hydrological, carbon, oxygen, nitrogen, phosphorus & sulphur cycle), energy flow in ecosystem, food chain

Major ecosystems (Description only) : Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystem, Riverine and stream ecosystem, Marine ecosystem, Estuarine ecosystem.

Biodiversity : Definition and its importance. Biodiversity at global, national & local level. Hot spots of biodiversity, Threats to biodiversity & causes of biodiversity loss. Conservation of biodiversity.

Value of biodiversity: Consumptive use, productive use, social value, ethical value, aesthetic value& optional value.

Bio-geographical classification of India. India as mega- diversity nation

ChE 391 A Open Elective-III: Nanotechnology

3L, 3 Hrs, MM 100

Introduction to Nanotechnology: Introduction to nanotechnology and materials, Nanomaterials, Introduction to nano sizes and properties comparison with the bulk materials, different shapes and sizes and morphology.

Fabrication of Nanomaterials: Wet Chemical Synthesis Methods, Colloidal Nanoparticles Production, Sol Gel Methods, Microwave and Atomization, Gas phase Production Methods : Chemical Vapour Depositions.

Kinetics at Nanoscale: Nucleation and growth of particles, Issues of Aggregation of Particles, Layers of surface Charges, Zeta Potential and pH.

Carbon Nanomaterials: Synthesis of carbon buckyballs, List of stable carbon allotropes extended fullerenes, metallofullerenes solid C60, bucky onions nanotubes.

Nanomaterials characterization: Instrumentation Fractionation principles of Particle size measurements, Particle size and its distribution, XRD, Zeta potential Microscopies SEM, TEM, Atomic Forced Microscopy, Scanning and Tunneling Microscopy

Applications in Chemical Engineering: Self-assembly and molecular manufacturing : Surfactant based system Colloidal system applications, ZnO,TiO_2, Silver Nanoparticles Functional materials Applications, Production Techniques of Nanotubes, Carbon arc, bulk synthesis, commercial processes of synthesis of nanomaterials, Nanoclay, Commercial case study of nano synthesis - applications in chemical engineering.

EC 391 A Open Elective-III: Electronic Instrumentation

3L 3 Hrs, MM:100

Transducers: Construction, characteristics and circuits for common types of resistive, capacitive, inductive, magneto-structive; piezo-electric. Photo-electric and thermo-electric transducers for measurement of process physical variables. Various sensing elements and transducers for measurement of Force, Pressure, Humidity, Moisture, strain, Velocity, Acceleration and pH. Inductive and Capacitive proximity switches. Physical and electrical loading of and by the transducer Systems.

Signal Conditioning: Analog and digital signal conditioning for instrumentation. Objectives of DAS, components of analog DAS and digital Data acquisition system, digital data recording system, multi channel DAS, modern digital acquisition system.

Electronic Displays: Principle of LED numeric, matrix and alpha-numeric displays, flat panel CRT, LCD, electro-luminiscent and electrophoretic and touch screen displays.

EE 391 A Open Elective III: Soft Computing Techniques

3L 3 Hours, 100 Marks

Soft Computing : Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.

Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and

various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non monotonic reasoning, forward Reasoning, backward reasoning, Weak & Strong Slot & filler structures, NLP.

Neural Network : Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, characteristics and applications of ANN, single layer network, Perceptron training algorithm.

Fuzzy rule base system : fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.

EE 392 A Open Elective III: Energy Conservation

3L **3 Hours, 100 Marks**

Elements of Energy Conservation and Management : General energy problem, Sector wise Energy consumption, demand supply gap, Scope for energy conservation and its benefits, Energy conservation Principle Maximum energy efficiency, Maximum cost effectiveness. Mandatory provisions of EC act Features of EC act Standards and labeling, designated consumers, Energy Conservation Building Codes (ECBC). Energy management concept and objectives Initializing Planning, Leading, Controlling, Promoting, Monitoring and Reporting, energy management programmes.

Energy Conservation Approaches In Industries : energy saving opportunities in electric motors Benefits of Power factor improvement and its techniques Shunt capacitor, Synchronous Condenser etc., Effects of harmonics on Motors, and remedies leading to energy conservation Energy conservation by VSD Methods and techniques of energy conservation in ventilation and air conditioners compressors pumps, fans and blowers Area Sealing, Insulating the Heating / cooling fluid pipes, automatic door closing Air curtain, Thermostat / Control Energy conservation in electric furnaces, ovens and boilers lighting techniques Natural, CFL, LED lighting sources and fittings

Energy Conservation in Power Generation, Transmission and Distribution : Performance improvement of existing power plant: cogeneration, small hydro, DG Set. Demand side management Load response programmes Types of tariff and restructuring of electric tariff Technical measures to optimize T and D losses.

Ma 391 A Open Elective-III: Advanced Numerical Analysis

3L **3 Hrs., MM : 100**

Solution of Algebraic and Transcendental Equations: Newton-Raphson method for real multiple roots, for complex roots and for system of non-linear equations; Synthetic Division, Birge-Vieta Method.

Solution of simultaneous Linear Equations and Eigen Value Problems: Direct methods: Gauss-elimination, Gauss-Jordan, Iterative Methods: Jacobi iteration, Gauss-seidel iteration and Successive Relaxation method. Eigen value Problems: power method

Curve fitting and Function Approximation: Chebyshev approximations, Chebyshev Expansion, Chebyshev Polynomials. Economization of Power Series.

Numerical Solution of Partial Differential Equations: Finite difference Approximation to partial derivatives. Solution of Laplace and poisson equations, Solution of one and two dimensional heat and wave equation by the method of separation of variables.

ME 391A Open Elective-III: Design Planning and Control of Production System

3L **3 Hrs, MM:100**

Production Planning: Planning horizon, product exploring, Make and buy decisions, operations planning, demand forecasting, conversion of forecast into production goal.

Scheduling: Operation sequencing and balancing, Scheduling for mass production and job order production, MRP, ERP.

Inventory System: Cost factors relevant to operations and inventory control, EOQ with shortages and uniform production, quantity discount.

Project Planning and Control:Network control, control cost consideration and optimization, Resource allocation and levelling, Aggregate production planning, decision rules.

Supply Chain Management:: Strategic framework of Supply chain – meaning, scope and performance of supply chain, supply chain drivers and obstacles. Role of e-business in a supply chain.

ME 392A Open Elective-III: Finite Elements Method

3L **3 Hrs, MM:100**

System Fundamental Concept: System definition, systems approach, Classification- General Systems, Discrete Systems, Controlled systems.

Procedure for Engineering a system: Defining system objective, formulation of objective criteria, Development of system alternatives.

Systems Optimization: Formulation of system, Design problem and application of search methods, Linear programing and dynamic programing for optimum solutions.

System Schedule: Time models, resource allocation, Time cost trade-off, system cost economic flow graph.

MI 391A Open Elective-III: Project Environment Clearance

3L **3 Hrs, MM:100**

Brief introduction of Environment Protection Act 1986 and other relevant legal provisions applicable to get environment clearance in India.

Impact of major engineering projects on various components of the environment: Socio-Economy, Land, Water, Air, Noise and others.

Preparation of Environment management plan: Public hearing, collecting baseline data, Environment impact assessment and predication, Environment management plan, environment monitoring and management.

PI 391A Open Elective-III: Quality Management

3L **3 Hrs,MM: 100**

Introduction: History of Quality, Objectives , importance and need of quality, Contributions of Quality Gurus- Juran, Deming, Crosby, Feigenbaum, Ishikawa, Taguchi etc., Impact of Quality on business performance.

Process and Statistical Quality Control: Quality System; Quality control techniques; Process capability; Control Charts- Theory of control charts, control limits and specification limits, Control charts for variables-X R Charts, Control Charts for attributes p, np, c and u charts.

Acceptance Sampling : Fundamental concepts of acceptance sampling; OC Curves; Single , Double and multiple sampling;

Quality Management: Introduction to Quality management; quality control and quality assurance; Quality control tools; cost of quality and cost of poor quality.

ISO 9000: ISO 9000 series; terminologies; need for ISO 9000 certification; basic procedure and work instructions; steps in ISO 9000 registration; Internal and third party audit for registration; Clauses of ISO 9000-2000 .

SE 391A Open Elective-III :Finite Element Method

3L **3 Hrs,MM: 100**

Introduction to Finite Element Method, Basic Concept of Finite Element Method, Analysis of continuum:- Structural, thermal, Potential etc., Finite Element Analysis of an elastic continuum:- Displacement approach, Direct Formulation, Energy Integral, Co and C1 continuity, Convergence criteria.

Elements:- Types and Properties. Conforming and Non conforming.

Shape Functions:- Langrangian and Serendity family for one and two dimensional cases.

Pascal triangle, Super / Sub and Iso parametric elements.

Steps in Finite Element Analysis of an elastic continuum.