

## **CS2K 301 : ENGINEERING MATHEMATICS III**

### **Module I: Linear algebra I(13 HOURS)**

Vector spaces-subspaces-linear dependence and independence-Bases and dimension-Linear transformation-Sums, products and inverse of linear transformations-Linear operator equations.

### **Module II: Linear algebra II(13 hours)**

Rank and equivalence of matrices-quadratic forms-characteristic values and characteristic vectors of a matrix-Transformation of matrices-Functions of a square matrix.

### **Module III: Functions of a complex variable & applications I(13 hours)**

Functions of a complex variable-analysis functions-Cauchy-Riemann equations-Elementary functions of  $z$ -conformal mapping-Bilinear transformation-Schwarz-Christoffel transformation-Transformation by other functions.

### **Module IV: Functions of a complex variable & applications II(13hours)**

Integration in the complex plane-Cauchy's integral theorem- Cauchy's integral formula-Series of complex terms-Taylor's series-Laurent's series-Residue theorem-Evaluation of real definite integrals-The Laplace inversion integral.

## **CS2K 302:DATA STRUCTURES & ALGORITHMS**

### **Module I(12 hours)**

Review of data types-Scalar types-Primitive types-Enumerated types-Subranges Structures types-Character strings-arrays-records-sets-tiles-Data abstraction-Complexity of algorithms-Time and space complexity of algorithms using "big oh" notation-Recursion: Recursive algorithms-Analysis of recursive algorithms.

### **Module II(12 hours)**

Linear data structures-Stacks-Queues-Stack and queue implementation using array-Linked list-Linked list implementation using pointers.

### **Module III(12 hours)**

Non linear structure : Graphs-Trees-Sets-Graph and tree implementation using array linked list-Set implementation using bit string , linked list.

### **Module IV(16 hours)**

Searching-Sequential search-Searching array and linked lists-Binary search-Searching arrays and binary search trees-Hashing-Introduction to simple hash functions-resolution of collisions-Sorting ;  $n^2$  sorts-Bubble sorts-Insertion sort-Selection sort- $N \log N$  sorts-Quick sorts-Heap sorts-Merge sorts-External sort-Merge files.

## **CS2K 303: DISCRETE COMPUTATIONAL STRUCTURES**

### **Module I :Logic (13 hours)**

Propositional Logic-Logical arguments-Consistency completeness and independence-Formal proofs-Natural deduction-Soundness ,completeness and compactness theorems-predicacae logic-Completeness-Resolution-Unification algorithm.

### **Module II :Relational structures(13 hours)**

Sets relations and functions-Pigeonhole principle-Cardinals-Countable and uncountable sets-Digonalization- Equivalence and partitions-Partial order-Lattices and Boolean algebra.

### **Module III: Group theory (13 hours)**

Groups and subgroups – Products and quotients-Homomorphism theorems-Cosets and normal subgroups-Lagrange's theorem-Permutation groups-Cayley's theorem-Hamming codes and Syndrome decoding.

#### **Module IV: Rings and Fields (13 hours)**

Rings, integral domains and fields – Ideals and quotient rings – Euclidean domains – Polynomial rings and division algorithm – Factorization and unique factorization – Irreducibility – Field properties and extensions – Ruler and compass constructions – Introduction to cyclic codes.

### **CS2K 304: BASIC ELECTRONICS ENGINEERING**

#### **Module I :( 15 hours)**

Electronic components – concepts of voltage and current sources – Energy Bands in solid metals insulators and semiconductors-intrinsic and extrinsic semiconductors-PN junction theory –V characteristics-Diode resistance-Rectifiers-Performance analysis of rectifiers-Filters ,zener, varactors and power diodes-LEDs, Transistor-Working and amplifying action-Characteristics-Comparison between CE,CB and CC configurations-CE Amplifier, construction of transistors – Use of data sheet Thermal runaway-UJT, introduction to FETs.

#### **Module II :( 12 hours)**

Transistor biasing - Selection of operating point - Bias stabilization - Different biasing circuits - PNI biasing –Small signal amplifiers-Single stage amplifier –Graphical method –Equivalent circuit method –Amplifier analysis –FET amplifier –Multistage amplifier –Gain analysis –RC coupled amplifier Frequency response-Two stage RC coupled amplifier –Distortion in amplifiers- Classification of amplifiers.

#### **Module III :( 13 hours)**

Power amplifiers-Single-ended power amplifier – Harmonic distortion – Push –pull amplifier – Tuned voltage amplifier – Resonance-Single-tuned voltage amplifier-feedback in amplifiers – Types of feedback-Voltage gain with feedback-Negative feedback-Oscillators-Classification-LC oscillators-RC oscillators-Crystal oscillators-Astable multivibrator.

#### **Module IV :( 12 hours)**

Operational amplifiers-Inverting and noninverting amplifiers-Adder-Voltage follower-Differential amplifier-Integrator and differentiator-Zero-crossing detector-Precision diode-Peak detector-Logarithmic amplifier-Square and triangular wave generator-Analog computation-Active filters.

### **CS2K 305: SWITCHING THEORY & LOGIC DESIGN**

#### **Module I :( 14 hours)**

Number Systems and codes-Boolean algebra-Postulates and theorems-Constants , Variables and functions – Switching algebra – Electronic gates and mechanical contacts Boolean Functions and logical operations-Normal and canonical forms – Self-dual functions – Logical operations – Karnaugh map – prime cubes –Minimum sum of products and product of sums-Quine-McClusky algorithm.

#### **Module II :( 13 hours)**

Combinational Logic-Analysis and design of combinational Logic circuits-Universal Property of the NAND and OR gates-Adders-Parallel Adders and Look-ahead address-Comparators-Decoders and encoders-Code conversions-Multiplexers and demultiplexers-Parity generators and checkers-ROMs, PLAs.

#### **Module III :( 10 hours)**

Fault diagnosis and tolerance-Fault classes and models-Fault diagnosis and testing-Test generators-Fault table method-Path sensitization method-Boolean difference method-Fault-

tolerance techniques. Programmable logic arrays-PLA minimization-Essential prime cube theorem-PLA folding –Design for testability.

**Module IV :( 15 hours)**

Counters and shift registers-SR,JK,D and T flip-flops-Excitation tables-Trigging of flip-flops-Flip-flop applications-Latches-Ripple counters-Synchronous counters-Up-down counters-Design of sequential circuits-Counter decoding-Counter applications-Shift registers and their applications-Clock mode sequential machine-State tables and diagrams.

**CS2K 306: ELECTRIC CIRCUITS AND SYSTEMS**

**Module I :( 12 HOURS)**

Review of basic circuit's concepts- node and mesh analysis, coupled circuits-Definition of graph, cut sets and loops-trees incidence matrix-applications of graph theoretic methods for the formation of networks-equations-Applications of Laplace transform for the solution of differential equations.

**Module II :( 12 hours)**

Review of network theorems-Transient Analysis of RL, RC and RLC circuits-Concepts of time constants-Polyphase circuits-3 phase circuits with balanced and unbalanced loads-Star-delta transformation.

**Module III :( 12 hours)**

Bridge circuits-Principles of Maxwell's bridge –Wiens Bridge Adersons Bridge and Scherring Bridge –Transport networks-Concept of impedance-Admittance and hybrid parameters-Interconnection of two networks-Driving point and transfer functions-Poles and zeros.

**Module IV :( 16 hours)**

Introduction to systems-System engineering-Block diagram-Transfer function-Control system characteristics-Dynamic responses-Feed back control-System response-First and second order system-System time constants-Frequency response-Stability analysis using frequency response (Bode Plot) using root locus.

**CS2K 307(P): PROGRAMMING LAB**

**Set I:( 3 lab sessions)**

HCF(Euclid's algorithm)and LCM of given numbers-Find mean-Median and mode of a given set of numbers-Conversion of numbers from binary to decimal, hexadecimal, octal and back-Evaluation of functions like e, sin x, cos x.etc. For a given numerical precision using Taylor's series-Testing whether a given number is prime.

**Set 2 :( 2 lab sessions)**

String manipulation programs; sub-string search, deletion-Lexicographic sorting of a given set of strings-Generation of all permutations of the letters of a given string using recursion.

**Set 3 :( 2 lab sessions)**

Matrix operations: programs to find the product of two matrices-Inverse and determinant (using recursion) of a given matrix-Solution to simultaneous linear equations using Jordan eliminations.

**Set 4 :( 3 lab sessions)**

Files: Use of files for storing records with provision for insertion, deletion, search, sort and update of a record.

**CS2K 308(P): ELECTRONICS LAB**

Silicon, germanium and zener diode characteristics  
Characteristics of UJT and UJT relaxation oscillator

Static transistor characteristics in CE and CB configurations  
Clipping, clamping, differentiating and integrating circuits  
Series voltage regulator  
Frequency response of CE amplifier with and without feedback  
Emitter follower: measurement of input and output impedance  
RC phaseshift oscillator  
Op amp: inverting and noninverting amplifier, voltage follower  
Op amp: differential amplifier

## **CS2K 401: ENGINEERING MATHEMATICS IV**

### **Module I: Fourier transforms (13 hours)**

Fourier integrals and Fourier transforms-Fourier integral as the limit of a Fourier series- Fourier integral approximations and Gibbs phenomenon-properties of Fourier transforms-Applications of Fourier integrals and transforms-singularity functions and their Fourier transforms-Fourier integral to the Laplace transformation

### **Module II: Probability distributions (13 hours)**

Random variables-Introduction-Discrete random variables-Probability distributions-continuous random variables-probability density functions –mathematical expectation-the expected value of a random variable-moments-moment generating function-special probability distributions-binomial distribution-geometric distribution-hypergeometric distribution-Poisson distribution-special probability densities –uniform density-gamma, exponential and chi-square distributions-normal distribution-normal approximation to binomial distribution.

### **Module III: Jointly distributed random variables (13 hours)**

Joint distribution functions-Independent random variables-covariance and variance of sums of random variables-joint probability distribution of functions of random variables-limits theorem-stochastic processes-conditional probability and conditional expectation

### **Module IV: Markov chains and Poisson processes (13 hours)**

Markov chains-Introduction-Chapman-Kolmogorov Equations-Classification of states-Limiting probabilities-Exponential distribution and Poisson processes-introduction-Exponential distribution-properties of exponential distribution-Poisson process-Counting process-Definition of Poisson process-Interarrival and waiting time distributions –Further properties of Poisson processes.

## **CS2K 402: SYSTEM PROGRAMMING**

### **Module I (15 hours)**

Background –System software machine architecture- the simplified instructional computer-traditional machines-RISC machines-Assemblers-Basic assembler functions-Machine dependent and machine independent –Assembler features-Assembler design-Assembler design options-Implementation examples-AIX Assembler

### **Module II :( 15 hours)**

Loaders and linkers –Basic loader functions-machine dependent and machine independent loader features-loader design options and implementation examples- Macro processor functions-Machine independent macro processor features-Macro processor design options and implementation examples.

### **Module III :( 15 hours)**

Introductions to operating systems-Basic principles-Batch processing-Multiprogramming-Timesharing systems and real-time systems-parallel and distributed systems-computer system structure-computer system operation-I/O structure-structure-storage Hierarchy-Hardware

protection-General system architecture-Operating system structure-system components-OS services-System calls-system structure-Virtual machines

**Module IV :( 9 hours)**

General overview of the UNIX operating system-History of UNIX-System structure-User perspective Services-Hardware assumptions-Unix Architecture-System concepts-Kernel data structures-System administration process (concepts only)

**CS2K 403: THEORY OF COMPUTATION**

**Module I :( 12 hours)**

Preliminaries-Review of proof techniques-Mathematical induction-Countable and uncountable sets-Basic concepts of languages-Automata and grammar-regular languages: regular expressions-finite deterministic and non deterministic automata-regular grammar-Equivalence between various models(Kleene's theorem)-Boolean Closure properties-Homomorphism, substitution-Decision Algorithms-Myhill Nerode theorem and DFA state minimization-Pumping lemma and proof of existence of non regular languages

**Module II :( 16 hours)**

Context Free Languages-Equivalence of CFG and PDA-Normal forms(CNF and GNF)-Closure properties of CFL's -DCFL's and their properties-Ambiguous CFL's-Decision procedures - CYK algorithm-Pumping Lemma and proof for existence on non context-Free languages-Context sensitive Languages-Equivalence of LBA and CSG-Turing machines: TM computations-Equivalence of standard TM with multitape-Two way finite tape and non deterministic TMs-Turing acceptable(Turing decidable and Turing enumerable language classes-Equivalence of type)grammars with TM's -Church thesis Chomsky Hierarchy.

**Module III :( 12 hours)**

Computability-Closure properties of recursive and recursively enumerable languages-Undesirability-Halting Problem-Reductions-Post Correspondence problem-Unsolvable problems about CFLs-Computational Complexity-Time and space bounded simulations-Classes P and NP-NP-completeness-Cook's theorem-Bounded Tiling Problem-Integer programming-Travelling salesman problem.

**Module IV :( 12 hours)**

Propositional Calculus -Validity and satisfiability-Normal forms-compactness theorem-Resolution-NP completeness of satisfiability-Predicate Calculus: Normal forms and Herbrand's expansion theorem-Skolem Lowenheim Theorem-Unsolvability of satisfiability-Resolution.

**CS2K 404:ELECTRIC CIRCUITS &SYSTEMS**

**Module I :( 13 hours)**

Diode switch, clipping And clamping circuits-Transistor switch-Bistable multivibrator-Schmitt trigger -Monostable and astable multivibrator-Miller and bootstrap sweep generators

**Module II :( 13 hours)**

Logic levels-Concepts of SSI, MSI, LSI and VLSI-Logic families: NOT gate, TTL, ECL, CMOS logic interfacing-Comparison of logic families-TTL and MOS flip flops

**Module III :( 13 hours)**

Memories: Basic concepts-Read only Memories-Programmable ROMs-Static and dynamic random access memories-Memory expansion-Magnetic surface storage devices-cd roms -special memories-sample and hold circuit-D/A converter-A/D converter-Timing circuits

**Module IV :( 13 hours)**

Communication systems-Need for modulation-external and internal noise-noise figure definition-Amplitude modulation and demodulation-frequency and phase modulation-noise and FM modulation-demodulation-TRF and superheterodyne receiver-radiation and propagation of electromagnetic waves

## **CS2K 405: COMPUTER ORGANISATION & DESIGN**

### **Module I :( 14 hours)**

Computer abstraction and technology-below your computer-under the covers-historical perspective-Measuring performance-relating the metrics-evaluating, comparing and summarizing performance-case study:SPEC95 benchmark-instructions-operations and operands of the computer hardware-representing instructions –making decision-supporting procedures-beyond numbers-other styles of addressing-starting a program-case study:80X86

### **Module II :( 12 hours)**

Computer arithmetic –signed and unsigned numbers-addition and subtraction-logical operations-constructing an ALU-multiplication and division-floating point –case study: floating point in 80X86

### **Module III :( 11 hours)**

The processor: building a data path-simple and multicycle implementations-microprogramming-exceptions-case study: pentium pro implementation

### **Module IV :( 15 hours)**

Memory hierarchy-caches-cache performance-virtual memory-common framework for memory hierarchies-case study-Pentium pro memory hierarchy-I/O-I/O performance measures-types and characteristics of I/O devices-buses-interfaces in I/O devices-design of I/O system

## **CS2K 406: HARDWARE SYSTEM DESIGN**

### **Module I :( 13 hours)**

Historical background of microprocessors-inside the pc :motherboard-graphic adapter s and monitors-drive controllers-floppy and hard disk drivers-streamers and other drives-parallel interfaces and printers –Serial interfaces and modems-Network adapters and LANs-CMOSRAM and real clock-keyboard ,mouse and other rodents-The power supply-Operating system-BIOS and memory organization/8086/8088Hardware specification :Clock generator-Bus buffering and latching-bus timing-Ready and Wait states –Minimum and maximum modes-advanced processors-Features of 8036,80486 and Pentium processors

### **Module II (13 HOURS)**

Microprocessor architecture Real model and protect mode memory addressing-Memory paging-addressing modes-Data addressing-Program memory addressing-Stack memory addressing-Data movement instructions-Arithmetic and logic instructions-Program control instructions-Programming the microprocessor: modular programming-Using keyboard and display –Data conventions-disk files-interrupt books

### **Module III (13 HOURS)**

Memory interface :Memory devices-Address decoding, 8 bit(8088),16 bits(8086),32 bit(80486)and 64 bit(Pentium)memory interface-Dynamic RAM.I/O interface –Port decoding-PPI,8279 interface –Dynamic RAM.I/O interface –Port address decoding –PPI ,8279 interface - 8254 timer interface\_16550 interfaces –ADC/DAC interfaces

### **Module IV (13 HOURS)**

Interrupts: Interrupt processing –Hardware interrupts-Expanding the interrupts-8259A programmable interrupt controller-DMA: DMAoperation-8237 DMA controller-Shared bus

operation-Disk memory systems-Video displays-Bus interface: ISA bus –EISA and VESA buses  
-PCI BUS

### **CS2K407 (P): DATA STRUCTURES LAB**

1. Stack and Quene: Implementation using arrays and linked lists
2. Searching Methods: Binary search and Hashing
3. Sorting: Recursive Implementation of Quick sort and merge Sort
4. Binary Search Tree: Implementation with insertion, deletion and traversal
5. Infix Expression Evaluation: Using expression tree
6. Graph Search Algorithms: DFS and BFS on a connected directed graph
7. Minimal Spanning Tree: Implementation of Kruskal's and Prim's Algorithms
8. Shortest Path Algorithms: Dijkstra and Floyd warshall Algorithms
9. Disjoint Set operations: Union and Fluid using rank and path Compression
10. Applications of Heap: priority Quene and Heap Sort.

### **CS2 408(P): DIGITAL ELECTRONICS LAB**

1. Verification of truth tables of AND, OR, NOT, NAND, NOR and XOR gates, use for gating digital signals
2. TTL characteristics
3. Verification of the postulates of Boolean algebra and DeMorgan's theorem using logic gates
4. Half and full adders, half and full subtractors
5. Digital comparator, parity generator and checker, and code convertor.
6. Characteristics and operations of RS gated RS, D, T and JK master slave flip-flops.
7. Multiplexer and demultiplexer using gates.
8. Shift register, ring counter and twisted ring counter.
9. Decade counter and variable modulo asynchronous counter.
10. Astable multivibrator and Schmitt trigger using gates, monostable multivibrator and frequency divider using 555.

### **CS2K 501: SOFTWARE ENGINEERING**

#### **Module I :( 13 hours)**

Introduction-FAQs about software engineering – professional and ethical responsibility – system modeling – system engineering process – the software process – life cycle models – iteration – specification – design and implementation – validation – evolution – automated process support – software requirements – functional and non-functional requirements – user requirements – system requirements – SRS – requirements engineering processes – feasibility studies – elicitation and analysis – validation – management – system models – context models – behavior models – data models – object models – CASE work benches.

#### **Module II: (13 hours)**

Software prototyping – prototyping in the software process – rapid prototyping techniques – formal specification – formal specification in the software process – interface specification – behavior specification – architectural design – system structuring – control models – modular decomposition – domain-specific architectures – distributed systems architecture – object-oriented design – object and classes – an object-oriented design process case study - design evolution - real-time software design - system design - real time executives - design with reuse - component based development - application families - design patterns - user interface design - design principles - user interaction - information presentation - user support - information evaluation.

#### **Module III: (13 hours)**

Dependability - critical systems - availability and reliability - safety - security - critical systems specifications - critical system development - verification and validation - planning - software inspection - automated static analysis - clean room software development - software testing - defect testing - integration testing - object-oriented testing - testing workbenches - critical system validation - software evolution - legacy systems - software change - software maintenance - architectural evolution - software-engineering - data-engineering.

#### **Module IV: (13 hours)**

Software project management - project planning - scheduling - risk management - managing people - group working - choosing and keeping people - the people capability maturity model - software cost estimation - productivity estimation techniques - algorithmic cost modeling - project duration and staffing quality management - quality assurance and standards - quality planning - quality control - software measurements and metrics - process improvement - process and product quality - process analysis and modeling - process measurements - process CMM - configuration management - planning - change managements - version and release management - system building - CAES tools for configuration management.

### **CS2K 502 : NUMERICAL ANALYSIS & OPTIMISATION TECHNIQUES**

#### **Module I: Numerical Analysis (10 hours)**

Errors in numerical calculations - sources of errors - significant digits - numerical solution of polynomial and transcendental equations - bisection method - regula-falsi method - Newton-Raphson method - fixed point method of iteration - rates of convergence of these methods - solution of system of algebraic equations - exact methods - Crout's triangularisation method - iterative methods - Gauss-Seidel and relaxation method - polynomial interpolation - Lagrange interpolation polynomial - divided differences - Newton's divide difference interpolation polynomial - finite differences - operators  $\nabla$ ,  $\Delta$ ,  $e$ ,  $\delta$  -Gregory-Newton forward and backward difference interpolation polynomials - central differences - stirlings interpolation formulae.

#### **Module II: Numeric Analysis II (16 hours)**

Numerical differentiation - differentiation formulae in the case of equally spaced points - numerical integration - trapezoidal and Simpon's rules - compounded rules - errors of interpolation and integration formulae numerical solution of ordinary differential equations - single step methods - Taylor series method - Euler's method - modified Euler's method - Picards' iteration method - kutta methods(2<sup>nd</sup>,3<sup>rd</sup> and 4<sup>th</sup> order formulae - derivation not required ) - multistep methods - Milnes' predictor and corrector formulae

#### **Module III: Optimization techniques (16 hours)**

Optimization methods - mathematical formulation of linear programming problem - simplex method - artificial variables - Chames M methods - two phase technique - duality in linear programming - dual simplex method.

#### **Module IV: Optimization techniques II (10 hours)**

Transportation assignment and routing problems.

### **CS2K 503: PROGRAMMING LANGUAGE CONCEPTS**

#### **Module I: (12 hours)**

Introduction - role of programming languages - towards higher-level languages - programming paradigms - language description - expression notation - abstract syntax trees - lexical syntax - context-free grammars - introduction to semantics - imperative programming - statements - syntax - directed control flow - syntactic concerns - handling - special cases in loops - types - the role of types - basic types - structured types - procedure activations - introductions to procedures - parameter passing methods - scope rules.

#### **Module II: (13 hours)**

Object oriented programming - grouping of data and operations - constructs for program structuring - information hiding - program design with modules - modules and defined types of class declarations - dynamic allocation - templates - object oriented programming - object oriented thinking - inheritance - derived class and information hiding.

**Module III: (13 hours)**

Functional programming - elements of functional programming - a little languages of expressions - types - functions declarations - approaches to expression evaluation - lexical scope - type checking - functional programming in a typed language - functional programming with lists - structure of lists - list manipulation - storage allocation for lists.

**Module IV: (14 hours)**

Logic programming - computing with relations - introduction to a logic programming language - data structures and control in the language - concurrent programming - parallelism in hardware - implicit synchronization - concurrency as interleaving - liveness properties - safe access to save data - synchronized access to shared variables.

**CS2K 504: DIGITAL DATA COMMUNICATION**

**Module I: (13 hours)**

Data communication networks - standards - ISO reference model - internal architecture - protocol implementation issues - transmission media - attenuation and distortion - limited bandwidth - signal types - propagation delay - public carrier circuits - modulation - multiplexing - physical layer interfacing standards.

**Module II: (14 hours)**

Data transmission basics - transmission modes - asynchronous and synchronous transmission - bit-character and frame synchronization - coding - error detection methods - parity - block sum check - cyclic redundancy check - data compression - Huffman coding - dynamic Huffman coding - facsimile compression - transmission control circuits - communication control devices.

**Module III: (12 hours)**

Protocol basics - error control - stop-and-wait & sliding window protocol - link utilization - selective repeat and go-back-N-link management.

**Module IV: (13 hours)**

Data link control protocols - character-oriented protocols - half-duplex protocols - bit-oriented protocols - high level data link control (HDLC) - LAPB - LAPD - logical link control - protocol - operation.

**CS2K 505: OPERATING SYSTEM**

**Module I: (12 hours)**

Review of operating system strategies resources processes - threads - objects - operating system organization - design factors - functions and implementation considerations - devices - characteristics - controllers - drivers - device management - approaches - device drives - typical scenarios such as serial communication - storage devices etc.

**Module II: (12 hours)**

Process management - system view - process address space r - process and resource abstraction - process hierarchy - scheduling mechanisms - various strategies - synchronization - interacting and co coordinating processes - semaphores - deadlock - prevention - avoidance - detection and recovery.

**Module III: (12 hours)**

Memory management - issues - memory allocation - dynamic relocation - various management strategies - virtual memory - paging - issues and algorithms - segmentation - typical implementation of paging & segmentation systems.

#### **Module IV: (16 hours)**

File management - files - implementation - storage abstractions - memory mapped files - directories and their implementation - protection and security - policy and mechanism - authentication - authorization - case study of UNIX kernel and Microsoft Windows NT (concepts only).

### **CS2K 506A: COMPUTATIONAL COMPLEXITY**

#### **Module I (13 hours)**

Problems and algorithms - classification of problems - decision - search - optimization and enumeration problems - review of unsolvability - rice theorem - fixed point theorem - degrees of unsolvability - complexity classes - P, NP, co NP, PSPACE-NP hardness -NP completeness - cook's theorem reductions NP O co-NP - primality-pratt's theorem - approximability - weak verifiers and non approximability.

#### **Module II (13 hours)**

Parallel modes and complexity - class NC - P-completeness - logarithmic space - Land and NL- NL completeness - randomized complexity classes RP, BPP, PP etcrelation between classes.

#### **Module III (13 hours)**

Function search problems - classes FP and FNP - FNP - completeness - optimization problems - DP completeness - relation with P=NP problem polynomial hierarchy - counting problems - #P completeness - class +P relation between + and NP

#### **Module IV (13 hours)**

One way function - public key cryptography class UP randomized cryptography - alternation and games AP - completeness - equivalence of AP and PSPACE - PSPACE completeness - games against nature - interactive protocols - classes APP, ABPP and IP Shamir's theorem (IP=PSPACE) - zero knowledge proofs.

### **CS2K506B: COMMUNICATION SYSTEMS**

#### **Module I (14 hours)**

Noise in communication systems - classifications - SNR - CNR - noise-figure relationships between noise figures - voce signal digitization - PAM - PPM - PWW - PCM -delta modulation - PCM- - and DM voce signal comparison TDM of PCM signals - CCITT - digital radio block diagram - ASK - FSK - PSK - QAM - digital demodulation - QAM demodulation.

#### **Module II (12 hours)**

Line - of sight micro wave links - analog line of sight microwave links - digital line of sight microwave links - communication satellites - classification communication satellite systems- orbits - planetary - mechanics - launching - stabilization - subsystems and repeaters - satellite earth stations - antenna sub system - transmitter - receiver.

#### **Module III (13 hours)**

Fiber optic communications nature of light - optical laws - optical fibers - optical sources - photo detection - optical communications systems - system parameters - analog optical fiber links - digital optical fiber systems.

#### **Module IV (13 hours)**

Satellite access - FDM access - TDM access - satellite links - satellite link analysis and design - system measurements - Fourier series - the Z-transform - modulator /demodulator sensitivity measurements - digital microwave link measurements and performance evaluation - high definition TV - system specification.

### **CS2K 506C: DATA MODELLING AND DESIGN**

#### **Module I (10 hours)**

Overview of object oriented systems - objects - attributes - encapsulation - class hierarchy - polymorphism - inheritance - messages - history of object orientation.

#### **Module II (14 hours)**

UML - classes - attributes - and operations - class diagrams - generalizations and association constructs - composition and aggregation - collaboration diagrams - sequence diagrams - asynchronous messages and concurrent execution - state diagrams - nested states - concurrent states and synchronization - transient states - architecture and interface diagrams packages - deployment diagrams for hardware artifacts and software constructs - window-layout and window-navigation diagrams.

#### **Module III (14 hours)**

Encapsulation structure - connascence - domains of object classes - encumbrance - class cohesion - state spaces and behavior of classes and subclasses class invariants - pre conditions and post conditions - class versus type principle of type conformance - principle of closed behavior cases studies.

#### **Module IV (14 hours)**

Abuses of inheritance - danger of polymorphism- mix-in classes - rings of operations - class cohesion and support of states and behavior - components and objects - design of a component - light weight and heavy weight components - advantages and disadvantages of using components - case studies.

### **CS2K 506D: DIGITAL SIGNAL PROCESSING**

#### **Module I (12 hours)**

Discrete time signals and systems - discrete signal sequences - linear shift invariant systems - discrete signals - stability and casualty - difference equations - frequency domain representations - Fourier transforms and its properties - relationship between system representations, review of Z-transforms.

#### **Module II (15 hours)**

Discrete Fourier transforms - representation of discrete Fourier series - properties of discrete Fourier series - periodic convolution using DFT- FFTs -DIT-FFT and DIF - FFT - FFT algorithm for composite N.

#### **Module III (13 hours)**

Design of digital filters - IIR and FIR filters - low pass analog filter design - Butterworth and Chebyshev filter - design examples - bilinear transformation and impulse invariant techniques FIR filter design - linear phase characteristic - window method.

#### **Module IV (12 hours)**

Realization of digital filters - Discrete from I and II cascade and parallel form - finite word length effects in digital filters - quantizer characteristics - saturation overflow - quantization in implementing systems - zero input limit cycles - introduction to DSP processors.

## **CS2K 506E: OBJECT ORIENTED PROGRAMMING**

### **Module I (12 hours)**

OOPS and Java basics - java virtual machine - java platform API - extended security model - applet classes - exceptions and abstract classes - java applet writing basics - GUI building with canvas - applet security - creation window applications - writing console applications - utility and math packages.

### **Module II (10 hours)**

Switch programming - working with switch components - using the clipboard input / output streams - printing working with 2D an3D graphics using audio and video - creating animations.

### **Module III (10 hours)**

Java beans development kit - developing beans - notable beans - network programming client and server programs - naming and directory services - working with java management APIS

### **Module IV (20 hours)**

Distributed application architecture - CORBA - RMI and distributed applications working with remote objects - object sterilization and Java spaces - Java IDL and ORBs connecting to database - using JDBC integrated database support into web applications java servelets - JSDK - JAR files - java native interface.

## **CS2K 507 (P): PROGRAMMING PARADIGMS LAB**

Lab 1: (object oriented programming in java/C++) - implementation of abstract data type-binary tree

Lab 2 : (object oriented programming) - define a base class “shape” and derived classes for rectangle, square, eclipse, circle with proper class hierarchy.

Lab 3: (object oriented programming) - define base class for vectors and use inheritance to define complex and real vectors with standard operations.

Lab 4: (functional programming in Lisp/scheme/Haskell) implementation of quick sort

Lab 5: (functional programming) implementation of binary search tree with insertion, deletion and search operations

Lab 6: (functional programming) implementation of set with membership, union, and intersection operations

Lab 7: (logic programming in prolog/Visicalc) - program to find the gcd of two given integers.

Lab 8: (logic programming) program to check whether a given NFA accepts the given string

Lab 9: (concurrent programming Java / Ada) program to find the least common ancestor of two given nodes in a binary tree.

Lab 10: (concurrent programming) program for the readers and writers problem.

## **CS2K 508(P): HARDWARE LAB**

Lab 1: Identification of components / cards and PC assembling from components

Lab 2: Assembly language program for implementing arithmetic operations

Lab 3, 4: Implementation of a file manager using DOS /BIOS interrupts

Lab 5: TSR (terminate and Stay Resident) programming

Lab 6: ADC interface.

Lab 7: Stepper Motor interface using DAC.

Lab 8, 9: Parallel interface: Printer and HEX keyboard.

Lab 10: Serial Interface: PC to PC serial interfacing using MODEM

## **CS2K 601: DESIGN & ANALYSIS OF ALGORITHMS**

### **Module I :( 13 hours)**

Analysis: RAM model-cost estimation based on key operations-big Oh-big omega little Oh-little omega and theta notations-recurrence analysis masters theorem-solution to recurrence relations with full history probabilistic analysis linearity of expectations-worst and average case analysis of quick sort-merge sort ,heap sort, binary search-hashing algorithms-lower bound proofs for the above problems-amortized analysis aggregate-accounting and potential methods analysis of Knuth-Morris Pratt Algorithm-amortized weight balanced trees

### **Module II :( 13 hours)**

Design: divide and conquer-starons algorithm, on median finding algorithm-dynamic programming-matrix chain multiplication optimal polygon triangulation optimal-binary search trees-Floyd Warshall algorithm-CYM algorithm greedy Huffman coding –Knapsack ,Kruskels and Prims algorithms for mst-back tracking-branch and bound traveling salesman problem matroids and theoretical foundations of greedy algorithms

### **Module III :( 13 hours)**

Complexity :complexity classes-P, NP, Co NP, NP-Hard and NP complete problems-cooks theorem(proof not expected) NP completeness reduction for clique vertex cover subset sum-Hamiltonian cycle-TSP-Integer programming approximation algorithms vertex cover –TSP –set covering and subset sum

### **Module IV :( 13 hours)**

Probabilistic algorithms : Pseudo random number generation methods-Monty Carlo algorithms-Probabilistic counting-verifying matrix multiplication-primality testing-Miller Rabin test-Integer factorization-pollards rho heuristic amplification of stochastic advantage applications to cryptography interactive proof system –less vages algorithms randomized selection and sorting-randomised solutions for eight queen problem-universal hashing-Dixon’s integer factorization algorithm

## **CS2K 602: DATA BASE MANAGEMENT SYSTEM**

### **Module I:(12hours)**

Introduction: characteristics of data base approach-advantages of using DBMS data base concept and architecture-data models-schemes-instances-data independence-data base languages and interface-data base modeling using entity relationships(ER) entity set attributes and keys relationship-type role and structural constriats – week entity types enhanced entity relationships(EER) and object modeling-subclasses-super classes and inheritance specialization and generalization –modeling of union types

### **Module II :( 12 hours)**

File organization and storage: secondary storage devices –RAID technology operations in files-heap files and sorted files-hashing techniques-types of single level ordered index multi – level indexes B-trees and B+ trees-indexes on multiple keys-other types of indexes

### **Module III :( 14 hours)**

Data base design: functional dependencies normal forms – general definition of second and third normal forms-Boyce cod normal form-multi valued dependency and fourth normal form join dependency and fifth normal form inclusion dependencies-practical database design turning database design process relational model concepts relational algebra operations-queries in SQL-insert delete and update statements in SQL views in SQL.

### **Module IV (16 hours)**

Transaction processing: desirable properties of transactions schedules and recoverability-serializability of schedules concurrency control- locking techniques-time stamp ordering multi version concurrency control-granularity of data items-database recovery techniques based on deferred up data and immediate updating-shadow pages-ARIES recovery algorithm database security and authorization security issue access control based on granting / revoking of privileges introduction to statistical database security.

### **CS2K 603: GRAPH THEORY AND COMBINATORICS**

#### **Module I (13 hours)**

Introduction to graphs-definitions-sub graphs-paths and cycles-matrix representation of graphs-Euler tours-Chinese postman problem planar graphs Euler's formula-platonic bodies-applications of Kuratowski theorem Hamiltonian graphs-graph colouring and chromatic polynomials-map colouring.

#### **Module II (14 hours)**

Trees – definitions and properties – rooted trees – trees and sorting weighted trees and prefix codes biconnected components and articulation points – kruskals and prim algorithms for minimal spanning trees Dijkstra's shortest path algorithm bellman ford algorithm – all pairs shortest path – Floyd warshal algorithm the max flow min cut theorem maximum bipartite matching

#### **Module III (11 hours)**

Fundamental principles' of counting- permutation and combinations binomial theorem combinations with repetition – combinational number principle of inclusion and exclusion derangements with forbidden positions

#### **Module IV (14 hours)**

Generating functions – partitions of integers the exponential generating function – the summation operator – recurrence first order and second order-no homogeneous recurrence relations - method of generating functions

### **CS2K 604: COMPUTER NETWORKS**

#### **Module I (13 hours)**

Computer networks – local area networks – wired LANs – Ethernet – token ring – token bus wireless LAN protocols – high speed and bridged LANs fast Ethernet-IEEE 802.12-FDDI bridges

#### **Module II (13 hours)**

Wide area networks – characteristics – packet switched networks circuit switched networks – ISDN – private networks – internetworking – architecture – internetworking issues – internet protocol standards – IP and Ipv6

#### **Module III (13 hours)**

Transport protocols – user datagram protocol – transmission control protocol – specification – transport layer service definition

#### **Module IV (13 hours)**

Session layer – presentation layer date encryption – presentation protocol - remote operations service element – commitment – concurrency and recovery – TCP/IP application protocol – directory service

### **CS2K 605: COMPILER DESIGN**

#### **Module I (10 hours)**

Introduction – analysis of the source program phases of a compiler – compiler construction tools  
lexical analysis role of the lexical analyzer specification of tokens – recognition of tokens –  
lexical analyzer generators

### **Module II (15 hours)**

Syntax analysis role of the parse – context free grammars, top down parsing – bottom-up parsing  
operator precedence parsing – LR parser (SLR, canonical LR, LALR) parser generator

### **Module III (13 hours)**

Syntax directed translation syntax directed definitions – S-attributed definitions – L – attributed  
definitions – bottom up and top down translation – type checking – type systems – specification  
of a type – checker – run time environments – source language issues – storage organization  
storage allocation strategies – access to non local names parameter passing symbol tables

### **Module IV (14 hours)**

Intermediate code generation – intermediate languages – declarations – assignment statement –  
Boolean expression procedure calls – introduction to code optimization – sources of optimization  
– introduction to data – flow analysis – introduction to code generation – issues in the design  
introduction of a code generator – target machine a simple code generator

## **CS2K 606A: STOCHASTIC PROCESSES**

### **Module I (13 hours)**

Markov chains and poisson processes (a brief revision) continuous time markov chains –  
definition – transition probability function – chapman-Kolomogorov equations – rate matrix -  
Kolomogorov forward and backward equations – computing the transition probabilities limiting  
probabilities pure birth process – birth and death process M/M/I queue

### **Module II (13 hours)**

Renewal theory and its applications – the renewal process  $N(t)$  – distribution of  $N(t)$  – renewal  
function – renewal equation – limit theorems and their applications – elementary renewal theorem  
(without proof) applications of renewal theorem – central limit theorem of renewal processes  
(without proof) – renewal reward processes – regenerative processes – delayed renewal process –  
alternating renewal processes

### **Module III (13 hours)**

Queuing theory I : introduction – preliminaries – cost equations – Little's formula – steady state  
probability – exponential models – single server exponential queuing system – single server  
exponential – system having finite capacity – a queuing system with bulk service – network of  
queues – open systems – closed systems – the system M/G/I – preliminaries – work and cost  
identity – applications of work to M/G/I – busy periods – discussion of M/D/I model and M/E<sub>k</sub>/I  
model

### **Module IV (13 hours)**

Queuing theory II : variations on the M/G/I – the M/G/I with random sized batch arrivals –  
priority queues – the model G/M/I – the G/M/I busy and idle periods – multi server queues –  
Erlang loss system – the M/M/k queue – the G/M/K queue – the M/G/K queue – M/G/O queue

## **CS2K 606B: DISTRIBUTED SYSTEMS**

### **Module I (10 hours)**

Operating system fundamentals-distributed system concepts and architectures-major design  
issues-distributed computing environments (DCE)

### **Module II (13 hours)**

Concurrent process and programming-threads and processes-client server model-time services language mechanisms for synchronization-concurrent programming languages

### **Module III (13 hours)**

Interprocess communication and communication and coordination-message passing  
Communication-name and directory services –distributed mutual exclusion-leader election

### **Module IV (16 hours)**

Distributed process scheduling –static process scheduling, dynamic load sharing and balancing-distributed process implementation-real –time scheduling-concepts of distributed file systems-distributed shared memory-distributed computer security.

## **CS2K 606C: UNIFIED SOFTWARE DEVELOPMENT**

### **Module I (13hours)**

The unified process-use –case driven –architecture-centric –iterative and incremental-life of the unified process –the four P<sub>s</sub> – people – project – product – and process in software development – process tools use cases – capturing – analysis – design and implementation – architectures – use cases – steps – description – iterative and incremental development – risks

### **Module II (12 hours)**

Requirements – purpose and role – domain and business models – capturing the requirements as use cases – artifacts – workers – workflow – analysis – role of analysis – artifacts – Workers – workflow

### **Module III (12 hours)**

Design role of design – artifacts – workers – workflow – implementation – role of implementation – artifacts – workers – workflow – implementation – role of implementation – artifacts – workers – workflow test role of testing artifacts – workers – workflow.

### **Module IV (15 hours)**

Iteration workflow – phases – planning risks – use – case prioritization – resources needed – assessment – inception – phases inception iteration – execution of the workflows – business case – assessment – elaboration – phases – elaboration iteration – execution of the workflows – business case – assessment – construction – phases – construction iteration – execution of the workflows – business case – assessment – transition – phases – activities – business case – assessment – making the unified process work

## **CS2K 606D: IMAGE PROCESSING**

### **Module I (20 hours)**

Introduction – digital image representation - fundamental steps in image processing – elements of digital image processing systems – digital image fundamentals – elements of visual perception – a simple image model – sampling and quantization – basic relationship between pixels – image geometry – image transforms - introduction to Fourier transform – discrete Fourier transform - some properties of 2-fourier transform (DFT) – the FFT – other separable image transforms – hostelling transform

### **Module II (12 hours)**

Image enhancement – point processing – special filtering frequency domain colour image processing – image restoration – degradation model – diagonalization of circulant and block circulant matrices – inverse filtering – least mean square filter

### **Module III (10 hours)**

Image compression – image compression models – elements of information theory – error-free compression – lossy compression – image compression standards

### **Module IV (10 hours)**

Image reconstruction from projections – basics of projection – parallel beam and fan beam projection – method of generating projections – Fourier slice theorem – filtered back projection algorithms – testing back projection algorithms

## **CS2K 606E: LINEAR SYSTEMS ANALYSIS**

### **Module I: System concepts and modeling of systems (11 hours)**

Systems – Subsystems – elements – systems approach – classification – of systems – static and dynamic systems - linear and non linear systems – distributed and lumped systems – time invariant and time varying systems – stochastic and deterministic systems – system modeling and approximations – superposition principle – homogeneity and additivity – modeling of electrical systems – active and passive elements – resistance inductance and capacitance – dynamic equations using Kirchoff's current and voltage laws – RL,RC and RLC circuits and their dynamic equations – block diagrams and signal flow graphs – Mason's gain formula

### **Module II: Modeling of non-electrical systems (11 hours)**

Modeling of translational and rotational mechanical systems – differential equations for mass spring dashpot elements, D'Alembert's principle – rotational inertial stiffness and bearing friction – gear trains-equivalent inertia and friction referred to primary and secondary shafts – dynamic equations for typical mechanical systems – electro mechanical analogues-force current and force-voltage analogue-capacitance and resistance of thermal ,hydraulic pneumatic systems dynamic equations for simple systems comparison of electrical ,electromechanical hydraulic and pneumatic systems

### **Module III: Transfer function and time domain analysis (15 hours)**

Use of Laplace transforms – concept of transfer function impulse response – convolution integral response to arbitrary inputs – transfer function of typical systems discussed in module I time domain analysis – test inputs step – velocity and ramp inputs – transient and steady state response first and second order under damped and over damped responses – maximum overshoot – settling time –rise time and time constant – higher order systems steady state error-error constants and error different types of inputs Fourier series expansion of periodic functions -symmetry conditions exponential form of Fourier series – Fourier integrals and Fourier transform spectral properties of signals – analysis by Fourier methods

### **Module IV: State space analysis and stability of systems (15 hours)**

Concept of state – state space and state variables – advantage over transfer function approach – state equations for typical electrical and mechanical and electromechanical systems – representation for linear time varying and time invariant systems – solution of state equation for typical test inputs zero state and zero input response - concept of stability bounded input bounded output stability – Lyapunov's definition of stability – asymptotic stability in the sense of Lyapunov –Routh-Hurwitz criterion of stability for single input single output linear systems described by transfer function model

## **CS2K 606F: INFORMATION THEORY & CODING**

### **Module I (14hours)**

Information theory –information and entropy –properties of entropy of a binary memory less source –extension of a discrete memory less source –source coding theorem –Shannon-fano coding-Huffman coding-Lempel-Ziv coding –discrete Memory less source –binary symmetric

channel-mutual information-properties channel capacity channel coding theorem information capacity theorem

### **Module II (14 hours)**

Coding –linear block code –generator matrices-parity check matrices-encoder-syndrome and error detection minimum distance-error correction and error detection capabilities –cyclic codes-coding and decoding

### **Module III (14 hours)**

Introduction to algebra –group-fields-binary field arithmetic-construction of galois field –basic properties-computation-vector-spaces-matrices-BCH codes-description-decoding-reed soloman codes

### **Module IV (14 hours)**

Coding –convolution codes-encoder generator matrix transform domain representation state diagram –distance properties maximum likelihood decoding viterbi decoding sequential decoding-interleaved convolution codes

## **CS2K 607(P): SYSTEM LAB**

### **Operating systems**

1. Implementation of dining philisosopher problem by multiprogramming using threads, semaphores and shared memory
2. Implementation of Is/dir command of Unix/dos to display contents of a given floppy disk
3. program to generate disk usage staus report for a given Unix/dos formatted floppy disk giving details like free space availability etc
4. Implementation of banker’s algorithm
5. Inter-process communication using mailbox and pipes

### **Database management systems**

1. Conversion of a given relational scheme to 3Nfand BCNF
2. Implementation of B tree and B+ tree
3. Implementation of a database stored in an RDBMS accessible Through a web browser
4. Program to convert SQL subset into relational algebra (tool like YACC msy be used)
5. Implementation of optimistic concurrency control algorithm

## **CS2K 608(P): MINI PROJECT**

Each student group (not more than five members in a group)is expected to de4velop a complete software product is to be deployed and should have user manuals-detailed report is also to be submitted-the students may be assessed individually and in groups

## **CS2K 701:INDUSTRIAL MANAGEMENT**

### **Module I (13 hours)**

Principles of management-Management functions –planning –organizing- organization structures-span of control-delegation-directing-leadership and motivation-controlling-decision making-decision tree-decision making under uncertainty-equally likely, minimax and maximum criteria

### **Module II (14 hours)**

Operation management-production systems and functions-product design and selection –concept of total quality management and ISO 9000 system of standards-concept of supply chain management-project management-projects and management-network analysis-critical path method (CPM) network-finding critical path-slacks-crashing (time –cost trade of) PERT network.

### **Module III (12 hours)**

Marketing management –concept of market and marketing-marketing function-marketing mix-market research advertising and sales promotion-human resources management-man power requirement analysis recruitment and training-job analysis-job evaluation-wages and incentives.

### **Module IV :( 13 hours)**

Financial management-objectives/functions-concept of time value of money-basics of financial accounting-profit and loss account-balance sheet costing –elements of costs-cost sheet-allocation of overheads-break-even analysis depreciation-significance and methods of depreciation

## **CS2K 702: COMPUTER ARCHITECTURE**

### **Module I (15 hours)**

Fundamentals-task of computer designer-trends in technology usage and cost-performance measurement-quantitative principles of computer design-instruction set architecture-classification-addressing and operations-encoding and instruction set-role of compilers-case study the DLX architecture pipelining-pipeline for DLX pipeline hazards-data and control hazards – implementation difficulties-pipelining with multicycle operations.

### **Module II (12 hours)**

Instruction level parallelism –concepts and challenges-dynamic scheduling-dynamic hardware prediction –multiple issues of instructions-compiler and hardware support for JLP-vector processing-vector architecture vector lines and stride-compiler vectorization enhancing vector performance.

### **Module III (13 hours)**

Memory hierarchy design-reducing cash misses and miss penalty reducing with time-main memory virtual memory and its protection-case study protection in the Intel Pentium-cross cutting issues –I/O systems-performance measures-reliability and availability –design and I/O system-case study-Unix file system performance.

### **Module IV (12 hours)**

Interconnection networks –simple networks –connecting more than 2 computers-practical issues – multiprocessor-introduction application domains-centralized-shared memory and distributed-shared memory architecture –synchronization-models of memory consistency.

## **CS2K 703: NUMBER THEORY & CRYPTOGRAPHY**

### **Module I (12 hours)**

Divisibility –gcd and LCM –prime numbers –fundamental theorem of arithmetic – perfect numbers –floor and ceiling functions-congruence: properties-complete and reduced residue systems –Fermat’s theorem-Euler function.

### **Module II (12 hours)**

Indeterminate equations –linear and second degree diophantine equations –congruences in one unknown –Chinese remainder theorem –congruence of higher degree with prime and composite modulo-Wilson’s theorem –quadratic residues

### **Module III (14 hours)**

Introduction to cryptography-attacks-services and mechanisms-security attacks-security Services-conventional encryption-classical techniques-model-steganography-classical encryption techniques-modern techniques-DES-cryptanalysis-block cipher principles and design -algorithms –triple DES-IDEA-blowfish-confidentiality –placement of encryption function –traffic confidentiality-key distribution –random number generation

#### **Module IV (14 hours)**

Public key encryption –RSA algorithm –key management and exchange-elliptic curve cryptography-message authentication-requirements-function and codes –hash functions-security of hash functions and MACS-hash algorithms MD5 message digest algorithm –secure hash algorithm -digital signatures –authentication protocols-digital signature standard –authentication application-kerberos.

#### **CS2K 706(P): COMPILER LAB**

- Lab 1, 2 : Generation of lexical analyzer using tools such as LEX
- Lab 3, 4 : Generation of parser using tools such as YACC
- Lab 5, 6 : Creation of symbol tables
- Lab 7, 8 : Creation of type checker
- Lab 9, 10 : Generation of intermediate codes

#### **CS2K 707(P): SEMINAR**

Each student is expected to present a seminar on a topic of current relevance in computer science and engineering –they are expected to refer research and review papers from standard journals like ACM,IEEE,JPBC,IEE etc-at least three cross references must be used-the seminar report must not be the reproduction of the original paper.

#### **CS2K 708(P): PROJECT**

This project is for a duration of two semesters –each student group (not more than five members in a group) is expected to develop a complete product-the design and development may include hardware and /or software-the 7<sup>th</sup> semester is mainly for the design of the product-an interim report is to be submitted at the end of the semester-the assessment may be made individually and in groups.

#### **CS2K 801: ECONOMICS**

##### **Module I (13 hours)**

Definition of economics-nature of economic science-nature an scope of managerial economics-basic terms and concepts-goods-utility-value-wealth-factors of production-land-its peculiarities-labor-its peculiarities and division of labor-capital and capital formation-organization of enterprise-economics of large and small scale-consumptions-wants-its characteristics and classification-law of diminishing marginal utility-relation between economic decision and technical decision-economical efficiency and technical efficiency.

##### **Module II (13 hours)**

Demand-demand schedule-demand curve-law of demand-elasticity of demand-types of elasticity-factors determining elasticity-measurement-its significance-supply-supply schedule-supply curve-law of supply-elasticity of supply-time element in the determination of value-market price and normal price-perfect comparison-monopoly-monopolistic competition.

##### **Module III(13 hours)**

Forms of business-proprietorship-partnership-join stock company-co-operative organization-state enterprise-mixed economy-money and banking-nature and function of money-theory of money-inflation and deflation -banking-kinds-commercial banks-central banking function-control of credits-monetary policy-credit instrument.

##### **Module IV (13 hours)**

International trade-distinction between internal and international trade –theory of international trade-free trade v/s production-balance of trade and balance of payments-exchange controls-trade policy of the govt of India-national income-concepts-measurements-difficulties in the measurement and its significant-features of underdeveloped economy with special reference to India-taxation-cannons of taxation-direct and indirect tax-impact and incidence of the tax-working capital-factors effecting-sources.

## **CS2K 802: COMPUTER GRAPHICS AND MULTIMEDIA**

### **Module I (13 hours)**

Introduction to computer graphics-basic raster graphics algorithms for drawing 2D primitives-scan converting lines-circles-generating characters-geometrical transformations-2D transformations-homogeneous coordinates and matrix representation of transformations-window-to-view port transformation-input devices and interactive techniques-interaction hardware-basic interaction tasks-3D graphics-viewing in 3D-projections-basics of solid modeling- 3D transformations.

### **Module II (10 hours)**

Introduction to multimedia-media and data streams-properties of a multimedia system-data stream characteristics-information units-multimedia hardware-platforms-memory and storage devices-input and output devices-communication devices-multimedia software- multimedia software tools- multimedia authoring tools.

### **Module III (12 hours)**

Multimedia building blocks-audio-basic sound concepts-music-speech-MIDI v/s digital audio-audio file formats-sound for the web-image and graphics-basic concepts-computer image processing-video and animation-basic concepts-animation techniques-animation for the web

### **Module IV(12 hours)**

Data compression-storage space and coding requirements-classification of coding /compression technique –basic compression technique like JPEG, H.261 .MPEG and DVI-multimedia data base system-characteristics of multimedia database management system- data analysis –data structure Operation on data – integration in a data base model

## **CS2K 803: ARTIFICIAL INTELLIGENCE**

### **Module I :( 16 hours)**

Introduction –definition and basic concepts-aims –approaches – problems in AI-AI application – perception and action – representing and implementing action functions-production systems-networks-problem solving methods-forward versus backward reasoning-search in state spaces – state space graphs – uniformed search – breadth first search – depth first search – heuristic search – using evaluation functions – General graph – searching algorithm – Algorithm A\* admissibility of A\* the consistency condition – iterative deepening A\* algorithm AO\* heuristic functions and search efficiency – alternative search formulations and applications assignment problems – constraint satisfactions – heuristic repair – two agent games – the mini-max search – alpha –beta procedure – games of chance .

### **Module II: (14 hours)**

Knowledge representation – the propositional calculus - using constraints on feaute values- the language –rules of interference – definition of proof semantics – soundness and completeness – the PSAT problems – meta theorems – associative and distributive laws – resolution in propositional calculus – soundness of resolution – converting arbitrary WFFS to conjunctions of clauses - resolution refutations – horn clauses – the predicate calculus - motivation – the language and its syntax – semantics – quantification – semantics of quantifiers – resolution in predicate calculus - unification converting – arbitrary wffs to clause form – using resolutions to

prove theorem – answer extraction – knowledge representation by networks texonomic knowledge semantic networks frames scripts.

### **Module III ( 12 hours)**

Neural networks – introduction motivation – notation – the back propagation method – generalization and accuracy – reasoning with uncertain information – review of probability theory – probabilistic inference – bayes networks – genetic programming – program presentation in GP- the GP process – communication and integration – interacting agents – a model logic of knowledge – communication among agents – speech acts – understanding language strings - efficient communication – natural language processing knowledge based system – reasoning with horn clauses – rule based expert systems.

### **Module IV (10 hours )**

Programming in LISP – basic LISP primitive – definitions – predicates – conditional and binding recursion and iteration association lists – properties and data abstraction lambda expressions macros – I/O in LISP examples involving arrays and search

## **CS2K804:ELECTRONIC COMMERCE**

### **Module I: (14 hours)**

Web commerce concepts-electronic commerce environment-electronic market place technologies-web based tools for e-commerce-e-commerce softwares-hosting services and packages mode of e-commerce EDI-commerce with WWW/internet

### **Module II: (12 hours)**

Security issues threats to e commerce –approaches to safe-e-commerce –secure transactions and protocols-intruder approaches security strategies and tools –encryption- security teams-protection e-commerce assets protecting client machines – servers and channels-transaction integrity

### **Module IV: (14 hours)**

Strategies for marketing-creating web presence identifying and reaching customers –web branching sales -on the web strategies for purchasing and support activities -EDI- supply chain management software for purchasing –strategies for web autions virtual communities and web portals inter national legal –ethical and tax issues –planning and managing e –commerce project .

## **CS2K 805 A : CONCRETE MATHEMATICS**

### **Module I : (10 hours )**

Recurrent programs-tower of Hanoi-Lines in the plane- the Josephus problem-sums –notation sum and recurrence –manipulation of sums –multiple sums- general methods-finite and infinite calculus infinite sums

### **Module II: (18 hours)**

Integer functions –floor and ceilings-applications floor /ceiling recurrences-mod the binary operation-floor/ceiling sums-number theory divisibility primes prime-examples-factorial factors-relative primality-mod the congruence relation-independent residues-additional applications-phi and mu.

### **Module III(12 hours)**

Binomial co-efficients basic identities-basic practice tricks of the trade generating functions-hyper geometric functions hyper geometric transformations-partial hyper geometric sums-mechanical summations

### **Module IV(12 hours)**

Special numbers-stirling numbers-eulerian numbers-harmonic numbers-harmonic summation-bernoulli numbers-Fibonacci numbers-continuants

## **CS2K 805B : PARALLEL ARCHITECTURES AND ALGORITHMS**

### **Module I(11 hours)**

Trends in parallel architectures-convergence of parallel architectures-fundamental design issues parallel application case studies-the parallelization process-examples

### **Module II(14 hours)**

Programming for performance-partitioning-data access and communication-orchestration for performance-performance factors-case studies-implications for programming models-work load-driven evaluation-scaling workloads and machines-evaluating a real machine-evaluating an architectural idea-illustrating workload characterization

### **Module III(15 hours)**

Cache coherence-memory consistency design space for snooping protocols-assessing protocol design trade-offs-synchronization-snoop-based multiprocessor design-correctness requirements-single-level caches with an atomic bus-multilevel cache hierarchies-split-transaction bus-case studies-extending cache coherence

### **Module IV(12 hours)**

Scalable multiprocessors-scalability - realizing programming models-physical DMA - user-level access - dedicated message processing - shared physical address space – clusters and networks of workstations – implications of parallel software – synchronization – directory –based cache coherence – scalable cache coherence – directory-based approaches – assessing directory protocols and tradeoffs – design challenges for directory protocols – memory-based directory protocols – cache-based directory protocols – performance parameters – synchronization-hardware or software tradeoffs

## **CS2K 805C: NEURAL NETWORKS AND FUZZY LOGIC**

### **Module I (13 hours)**

Introduction to artificial neural networks-biological neurons-Mc Culloch and Pitts models of neurons-types of activation function-network architectures-knowledge representation-learning process-error-correction learning-supervised learning-unsupervised learning-single unit mappings and the perceptrons- perceptrons convergence theorem (without proof)-method of steepest descent-least mean square algorithms-adaline /Medaline units-multiplayer perceptrons-derivation of the back-propagation algorithm.

### **Module II (13 hours)**

Radial basis and recurrent neural networks-RBF network structure-Covers Theorem and the separability of patterns-RBF learning strategies-K-means and LMS algorithms-comparison of RBF and MLP networks-recurrent networks-Hopfield networks-energy function-spurious states-error performance-stimulated annealing-the Boltzman machine-Boltzman learning rule-the mean field theory machine-MFT learning algorithm-applications of neural network-the XOR problem-traveling salesman problem-image compression using MLPs-character retrieval using Hopfield networks.

### **Module III (13 hours)**

Fuzzy logic-fuzzy sets-properties-operations on fuzzy sets-fuzzy relations-operations of fuzzy relations-the extension principle-fuzzy measures-membership functions-fuzzification and defuzzification methods-fuzzy controllers-Mamdani and Sugeno types-design parameters-choice of membership functions- fuzzification and defuzzification methods-applications.

### **Module IV (13 hours)**

Introduction to genetic algorithm and hybrid systems-genetic algorithms-natural evolution-properties-classification-GA features-coding-selection-reproduction-crossover and mutation operations basic GA and structure. Introduction to hybrid systems-concept of neuro-fuzzy and neuro-genetic systems.

## **CS2K 805D : MANAGEMENT INFORMATION SYSTEMS**

### **Module I(12 hours)**

Information systems – functions of management – levels of management – framework for information systems – systems approach – systems concepts – systems and their environment – effects of system approach in information systems design – using systems approach in problem solving – strategic uses of information technology

### **Module II(10 hours)**

An overview of computer hardware and software components – file and database management systems – introduction to network components – topologies and types – remote access – the reasons for managers to implement networks – distributed systems – the internet and office communications

### **Module III(14 hours)**

Applications of information systems to functional – tactical and strategic areas of management, decision support systems and expert systems

### **Module IV (16 hours)**

Information systems plannings – critical success factor – business system planning – ends /means analysis – organizing the information systems plan – systems analysis and design – alternative applications development approaches – organization of data processing – security and ethical issues of information systems

## **CS2K 805E : ADVANCED TOPICS IN ALGORITHMS**

### **Module I : Advanced data structures(13 hours)**

Balanced binary search trees – AVL trees – red black trees – B/B+ trees – priority queues – binomial heaps – Fibonacci heaps – mergeable heap operation – disjoint set representation – path compression algorithm – hashing – chaining – open addressing – hash functions – probing – double hashing – universal hashing – graph algorithms – review - DFS – BFS – connected Components – topological sorting – strong connectivity - minimal spanning tree – kruskal and prime algorithms – shortest path problem – Dijkstra's and bellman – ford algorithms – johnson's algorithm for sparse graphs – flow networks - ford fukerson algorithm – maximum bipartite matching – preflow push and lift to front algorithms

### **Module II(13 hours)**

Introduction to parallel algorithms – PRAM models – EREW,ERCW,CREW, and CRCW – relation between various models – handling read and write conflicts – work efficiency – Brent's theorem – parallel merging, sorting, and connected components – list rank – Euler tour technique – parallel prefix computation – deterministic symmetry breaking

### **Module III: Distributed algorithms(13 hours)**

Distributed models – synchronous algorithms – leader election – BFS – shortest path – maximal independence set – minimal spanning tree – consensus algorithms with link and process failures – Byzantine agreement problem – asynchronous algorithms – Dijkstra's mutual exclusion algorithm – bakery algorithm – randomized algorithm for during philosophers' problem

#### **Module IV: Selected topics(13 hours)**

Polynomials and FFT – representation of polynomials – DFT and FFT – divide and conquer FFT algorithm – efficient parallel FFT implementations – pattern matching – finite automata based methods – Rabin Karp algorithm – Knuth Morris Pratt algorithm – Boyer Moore heuristic – computational geometry – two dimensional problems – line segment intersection convex hull – Graham’s scan – Jarvis’ march technique – closest pair of points in a set

### **CS2K 805F: PATTERN RECOGNITION**

#### **Module I (12 hours)**

Introduction-introduction to statistical-syntactic and descriptive approaches-features and feature extraction-learning-Bayes Decision Theory-introduction-continuous case-2-category classification-minimum error rate classification-classifiers-discriminant functions-and decision surfaces-error probabilities and integrals-normal density-discriminant functions for normal density.

#### **Module II (12 hours)**

Parameter estimation and supervised learning-maximum likelihood estimation-the Bayes classifier-learning the mean of a normal density-general Bayesian learning-non parametric technique-density estimation-parzen windows-K-nearest neighbour estimation-estimation of posterior probabilities-nearest-neighbour rule.

#### **Module III(12 hours)**

Linear discriminant functions-Linear discriminant function and decision surfaces-generalised linear discriminant functions-2-category linearly separable case-non-separable behavior-linear programming procedures-clustering-data description and clustering-similarity measures-criterion function for clustering.

#### **Module IV(16 hours)**

Syntactic approach to PR-introduction to pattern grammars and languages-higher dimensional grammars-tree,graph,web,plex and share grammars-stochastic grammars-attribute grammars-parsing techniques-grammatical inference.

### **CS2K 806(P): NETWORKS LAB**

Lab 1 : Implementation of PC to PC file transfer using serial port and MODEM

Lab 2,3 : Software Simulation of IEEE 802.3,802.4 and 802.5 protocols.

Lab 4,5 : Software Simulation of Medium Access Control Protocols-1) Go Back N, 2) Selective Repeat and 3) Sliding Window.

Lab 6 : Implementation of a subset of Simple Mail Transfer Protocol using UDP.

Lab 7,8 : Implementation of a subset of File Transfer Protocol using TCP/IP.

Lab 9: Implementation of “Finger “ utility using Remote Procedure Call (RPC).

Lab 10 : Generation and processing of HTML forms using CGI.

### **CS2K 807 (P): PROJECT**

This project is the continuation of the 7<sup>th</sup> semester project-the 8<sup>th</sup> semester is for the development-testing and installation of the product-the product should have user manuals-a detail report is to be submitted at the end of the semester-the assessment may be made individually and in groups.

### **CS2K 808(P): VIVA VOCE**

There is only university examination for this-the university will appoint examiners for conducting the viva voce examination-the examiners will ask questions from the subjects studied for the B. Tech course, Mini project, and Project and Seminar reports of the student.