GAUHATI UNIVERSITY

SYLLABUS FOR B.Sc(I.T)

(Bachelor of Science in Information Technology)

Rules and Regulations

1. The course will be of 3years (6 Semester) course.
2. Eligibility : Higher Secondary in Science with Physics and Mathematics.
3. Semester wise Papers

   Each theory paper will consist of 75 marks with 20% (i.e. 15 marks) as internal assessment and 80% (i.e. 60 marks) is for written examination to be held at the end of the semester by the University. Internal marks will be based on continuous evaluation with the break up as follows :

i)	Attendance	:	5 marks
ii)	Unit test (minimum 2 nos.)	:	5 marks
iii)	Assignments (minimum 2 nos.)	:	5 marks

4. There will be a practical paper in each semester from 1st to 5th semester which will be of 100 marks. Marks break up for practical examination as follows :

   A) 20% as internal marks i.e.

i)	Attendance	: 5 marks
ii)	Internal Laboratory Examination(minimum 2 nos.)	: 10 marks
iii)	Practical Assignments	: 5 marks

   B) The rest 80 marks will be assigned in a practical Examination to be held at the end of the semester by the University.

5. There will be a project in 6th semester with total marks of 250, out of which 50 marks will be internal and 200 marks will be based on project viva- voce to be held at the end of the final semester by the University. The internal marks for project will be based on three project progress report and corresponding presentation with a equal duration between the presentations.

   A project can be done individually or may be shared between two students.

6. A student completing the first two semester is eligible to get a certificate "Certificate in Information Technology". A student completing first four(4) semester is eligible to get a "Diploma in Information Technology". The one completing all the six semester will get "B.Sc. in Information Technology" certificate.
7. The pass mark is 45% for each paper and as such the pass mark for each theory paper is 33 (out of 75) ,pass mark for practical is 45(out of 100) and the pass mark of project is

113(out of 250)

8. Qualification of teachers:
   i)3 numbers of teachers having qualification either of M.Sc. IT, M.Sc. Computer Science, or M.C.A from a recognized University with UGC norms.
   ii)Laboratory cum office Assistant: Any Science Graduate with post graduate diploma in IT, Computer Science ,B.SC(comp sc major) BCA , DOEACC A'level or diploma in computer engineering from Govt./AICTE/UGC recognized Institute.
   iii) One Office bearer : 10+2 pass

9. Resources required for opening the course in the college with an intake of 30 students :

   i) A laboratory with 30 computers
   ii) Server
   iii) Printer, Scanner, UPS, Networking equipments and room preparation(AC, vacuum cleaner) with internet connection.
   iv) Furnitures as required.
   v) Library books, journals etc.

10. Subject wise syllabus for six semester:

Semester – I

1. Communicative English
2. Mathematics –I
3. Physics – I
4. Computer fundamental and Programming
5. Practical I

Semester – II

1. Mathematics – II
2. Physics – II
3. Data structure and algorithm
4. Digital logic
5. Practical II

Semester – III

1. Operating Systems
2. Computer Organization
3. Object Oriented Programming(C++)
4. Database Management System
5. Practical III

Semester – IV

1. Microprocessor
2. Software Engineering
3. Data Communication and Computer Networks
4. Theoretical Foundation of Computing
5. Practical IV

Semester – V

1. Compiler Design
2. Web Technology
3. Computer Graphics
4. Environmental Studies
5. Practical V

Semester – VI

1. System Administration
2. Electives
   a) Data Mining
   b) Artificial Intelligent
   c) Computer Oriented Optimization Techniques
   d) Object Oriented Analysis and Design
   e) System Analysis and Design
3. Project

11. Project Rules :
    ---- based on IT related topics
    ---- there will be a project report
    ---- the project should an work equivalent of 200 hours of effort.
    ---- project is appropriate for B.Sc. (I.T.) level course.

12. Laboratory reqirement with aproximate cost as in 2007: **All Cost are in Rupees**
    A) Non _recurring cost

1)	30 computers @ 25,000/-	: 7,50,000/-
2)	10 microprocessor kits @11000/-	: 1,10,000/-
3)	10 work bench @ 12,000	: 1,20,000/-
4)	UPS 15 KVA	:2,00,000/-
5)	Furniture (40 table,40 chair) @ 3000/-	:1,20,000/-
6)	Server	:1,50,000/-
7)	Printer	
	i) DMP X 1	: 12,000/-
	ii) Laser X 1	: 20,000/-
8)	Scanner	: 3,000/-

9) Networking(Switch, wiring) : 60,000/-
10) Electric wiring : 50,000/-
11) Room preparation and AC :1,50,000/-
12) Books :1,00,000/-

TOTAL(Non Recurring)---------- :18,45,000/-

SUB TOTAL of 1,2,3,4,6,7,8 For calculating maintenance cost as below = 13,65000/-

B)Recurring estimate(per annum)
1)maintenance cost (except for first year) for serial no 1,2,3,4,6,7,8 @ 10%per annum : 1,36,500/-
2) Stationary including computer consumables : 25,000/-
3) Internet charges : 25,000/-
4) Contingencies : 12000/-
TOTAL ---------- : 1,98,500/-

1) Teacher with UGC norms approximately @14,000 X 12 = 1,68,000
2) Laboratory assistant @ 8,000 X 12 = 96,000
3) Office bearer @ 4000 X 12 = 48,000

1.1 Communicative English

[Full marks: 75]

This course is designed to introduce students to aspects of effective communication, both oral and written. While the five units of the course are expected to acquaint I.T. students with various levels of communication necessary in everyday life, the emphasis throughout is on helping them acquire the basic skills – particularly the ability to write and speak plain and correct English.

Fundamentals **Marks-15[6 Hours]**

It deal with the fundamentals of effective communication: i) the key stages in the communication cycle, ii) the importance of cross-cultural communications, iii) the barriers to communication and iv) steps to effective communication. Students will be required to answer questions on these issues.

Written Communications **Marks-30[10 Hours]**

Fundamentals of effective writing. Students will here be required to learn some of the basic patterns of English speech. Use of tenses: present, past and future. Modals (can, must, should).Articles and nouns. Pronouns and determiners. Relative clauses. Adjectives and adverbs. Conjunctions and prepositions. Phrasal verbs.

Avoidance of clichés and common errors. Subject and verb agreement. Punctuation. Paragraphing

Oral Communications **Marks-15[12 Hours]**

Oral communication in the workplace. The two-way nature of communication. Speaking skills / Listening skills. Group discussion and interviews. Effective speech (pronunciation / delivery)

Business Communication **Marks-15[12 Hours]**

Different categories of business letters (confirmation, acknowledgement, enquiry, reply, circulars etc.). E-mail. Intercultural sensitivities.

Suggested Reading:

1. Raymond Murphy, ***Murphy's English Grammar*** (Cambridge University Press, 2004)
2. Michael Swan***, Practical English Usage*** (Oxford University Press,2001)
3. Shirley Taylor,: ***A Communication for Business Practical Approach*** (Pearson Education,2006)
4. Bovee, Thill and Schatzman, ***Business Communication Today*** (Pearson Education,2007)
5. ***Cambridge International Dictionary of English*** (Cambridge University Press,2007)

1.2 MATHEMATICS - I

Full Marks: 75

Unit-1 : Sequence and Series **20 Marks (12 Hours)**

Sequence of real numbers, bounded, convergent and non-convergent sequences. Uniquences of the limit and bounds of a convergent sequence. Cauchy sequence, Cauchy's general principle of convergence (proof of the necessary part only). Subsequences, convergence and divergence of monotonic sequences. Algebraic operations on limit (statements of the theorems without proof). Infinite series, statements of basic properties of infinite series (without proof). Absolute and conditional convergence. Tests for convergence : Comparison test, Ratio test.

Unit-2 : Trigonometry **10 Marks (8 Hours)**

Geometrical representation of complex numbers the Argand plane. Polar form of a complex number. Modulus, amplitude and their various properties. De Moiver's theorem. Expansion of cos(x) and sin(x) in positive integral powers of x. Gregory's series, Hyperbolic functions.

Unit-3 : Abstract Algebra **20+5=25 Marks (20 Hours)**

Group Theory : Definition and examples of groups. Permutation group and Cyclic group. Subgroups and Cosets. Lagrange's theorem on the order of a subgroup of a finite group. Normal subgroups. Quotient groups. Homorphism of Group; properties of Homomorphism; isomorphism of group.

Ring Theory : Definition and examples. Simple properties of Rings. Integral domain, Fields and their elementary properties.

Unit-4 : **8 Marks (10 Hours)**

Relation between the roots and Coefficients of a general Polynomial equation in one variable. Transformation of equations Descarte’s rule of signs, Symenetric functions of roots; Solution of Cubic equation by Cardon’s Methods.

Unit-5 : Calculus **12 Marks (10 Hours)**

Roll's theorem, Lagrange’s Mean Value theorem and Taylor’s theorem. Meaning of the sign of derivative. Indeterminate forms, maxima and minima (single variable).

Suggested Readings :

1. Higher Algebra (Classical); S. K. Mapa; Ashok Prakashan, Kolkata.
2. Higher Trigonometry, Das and Mukherjee, U. N. Dhur and Sons.

3. A course in Abstract Algebra; V. K. Khanna & KS. K. Bhambri, Vikas Pub. House, Pvt. Ltd., New Delhi.
4. Modern Algebra; S. Singh and Q. Zameerruddin; Vikas Pub. House, Pvt. Ltd., New Delhi.

1.3 PHYSICS- I (Theory) : Marks - 75

Mechanics and Properties of matter : 15 Marks (12 Hrs)

Conservative and non-conservative forces, forces as gradient of potential.

Rotational motion, torque, angular momentum, conservation of angular momentum, work and power in rotational motion, K.E. of rotation, moment of inertia, theorem of parallel and perpendicular axes, moment of inertia of rectangular plate, circular disc, cylinder, sphere (solid and hollow).

Linear harmonic oscillator, oscillation of a loaded spring, compound pendulum.

Hooke's law of elasticity, different kinds of elastic constants, work done in deforming a body. Relations among the elastic constants. Bending of beam fixed at one end and loaded at the other end, torsion of a rod.

Waves and Sound : 5-Marks (5 Hrs)

Equation of wave motion, principle of superposition of waves, interference of waves, beats, stationary waves. Doppler's effect. Intensity level of sound and its unit.

Ultrasonic waves, production and application of ultrasonic waves.

Optics : 10-Marks (8 Hrs)

Fermat's principle - application to reflection and refraction at plane and curved boundaries.

Huygen's wave theory - application to interference of light.

Diffraction of light. Fresnel's and Fraunhofer classes of diffraction, diffraction at a straight single edge, single slit, gratings.

Polarisation of light, polarisation on reflection, Brewster's law. Double refraction.

Heat and Thermodynamics : 10-Marks(10 Hrs)

Thermal conductivity. Rectilinear flow of heat: temperature distribution in a rod heated at one end and in a cylinder heated along the axis.

First law of thermodynamics, work done in isothermal, adiabatic, isobaric and isochoric thermodynamic process. Second law of thermodynamics. Carnot cycle, entropy, change of entropy in reversible and irreversible processes. Maxwell's thermodynamic relations and their applications.

Basic electronics: 15 Marks (12 Hrs)

Basic equation of resistor (Ohm's law), temperature coefficient, specific resistance of materials. Basic equation of capacitor. Relationship between current, charge, voltage permittivity, parallel plate capacitor, its equation and effect of dielectrics. Basic equation of inductor. Relationship among voltage, current and field, number of turns and permeability. Self and mutual inductance, back e.m.f. Basic principle of transformer. Voltage, current and turns ratio.

Semiconductor: 20 Marks (13Hrs)

Semiconductor material, doping, PN-junction, and its properties, diode, diode characteristics, Zener diode, Transistor- its characteristic, transistor configuration: common emitter, common base and common collector. Transistor parameters, common emitter amplifier. Transistor in saturation and cut-off. Transistor as a switch.

Suggested books:

1.Conceptual Physics by Paul G. Hewiit - Pearson Education
2.Engineering Physics by P.V. Naik - Pearson Education
3.Elements of properties of matter by D.S. Mathur - S. Chand
4.A treatise of heat by M.N. Saha and Srivastava- The Indian Press
5.Electricity and Magnetism by Brijlal and N. Subramanyam - Ratan Prakashan Mandir
6.Electricity and Magnetism by Laud
7.Optics by Hecht - Pearson Education
8.A text book of optics by K. G. Mazumdar
9. Semiconductor devices by Kano - Pearson Education

1.4 Computer Fundamentals and Programming

Full marks : 75

Fundamentals: **Marks :20 [Hours 15]**

Introduction to Computers – its type, major components of Digital Computers, Primary and Secondary storage devices, I/O devices. Bootstrapping method of Computer.

Number System- Brief description of Binary, Octal and Hexadecimal Numbers and their simple representations. ASCII, EBCDIC and Gray Codes. Definition of Compiler, Interpreter, Assembler, Linker and Loader.

Programming Practice and Techniques - Definition and concepts of algorithm, flowchart and pseudo code. Programming language - Concept of High level and Low Level language.

Programming in C: **Marks : 55**

Introduction : **Marks : 15 [Hours: 20]**

Elementary data types , Concept of variables, constants and identifiers. Syntax and semantics. Reserved word. Expression in C, precedence and associativity of C operators, unary, binary and ternary operators. C operators - Arithmetic Assignment, relational, logical and bit–wise operators, Cast and sizeof operator. Type conversion, L-value and R-value. Statements in C – Simple I/O Statement, Conditional Statement-(if, nested if, switch), Iterative Statement (while, do-while, for),Other Statement(break , continue, goto, return),

Function: function declaration. Difference between User Defined and Built-in Function, Some commonly used built-in functions. Calling a function. Parameters –Call by value, Call by reference and its absence in C. Recursive Function. Scope and lifetime of variable. Storage classes - Automatic, External, Static, Register.

Arrays and pointers: **Marks : 20 [Hours 15]**

Array D and Initialization, Single and Multi Dimensional Array, Array manipulation-add and delete elements of an array, Merge two sorted array, Sum of rows, columns, and diagonal elements of a matrix, Transpose of a matrix. Pointer declaration, pointer arithmetic. Programs using arrays and pointers like sum, average, minimum, maximum of an array of numbers. String manipulation programs like addition, subtraction, multiplication and their combinations.

Search : Linear and Binary search.
Sort : Selection, Bubble and Insertion sort

Structures and Files: **Marks: 20 [Hours 10]**

Structure and Union– declaration and use. Structure member resolution and structure pointer member resolution operators. Programs to show the use of structure. Standard C library.

Files in C—opening, closing, reading and writing of files. Seeking forward and backward. Examples of file handling programs.

Suggested Reading:

1. Programming with C, B.S. Gottfried, Tata Mc-Graw Hill.
2. The C Programming Language, B.W. Kernighan and D.M.Ritchie, PHI
3. Programming in ANSI C, E. Balagurusamy, Tata McGraw – Hill
4. Programming in C, D. Ravichandran, New Age International (p) Ltd.
5. Let us C, Yashavant Kanetkar, BPB Publication.

1.5 PRACTICAL – I

FULL MARKS:100

Laboratory-I (Computer Programming) **[50 marks]**

At least 8 practical assignments covering paper 1.4 practical assignments should be prepared by the UG Committee of Courses and Studies in Computer Science.

Laboratory-II(Physics) **[50 marks]**

List of Experiments:

1. To study elongation of a wire by different pulling forces using Searle's apparatus and find the value of Young's modulus of the material of the wire.
2. To determine the value of 'g' by a bar pendulum.
3. To determine the moment of inertia of a symmetrical body about an axis by torsional oscillation method.
4. To determine the modulus of rigidity of the material of a rod by static method.
5. To determine the frequency of a tuning fork by Melde's experiment.
6. To determine the width of a given single slit by observing diffraction pattern of monochromatic light.
7. To determine the co-efficient of linear expansion of a rod by optical lever method.
8. To determine the specific resistance of the material of a given wire with the help of a meter bridge and calculate the length required to construct a one ohm resistor.
9. To determine the temperature of a torch-bulb filament by studying the voltage variation using potential divider method and known value of temperature co-efficient of resistance of the material of the filament.
10. To draw characteristic curve of a semiconductor diode and hence determine the dc and ac resistances for a given current under forward biased condition.
11. To draw characteristic curve of a Zener diode and determine the dc and ac resistances for a given current. Also determine the breakdown voltage of the Zener diode.
12. To draw the output characteristic curves of a given transistor in CB and CE mode and hence find its short circuit current gain.

2.1 MATHEMATICS II

[Full Marks:75]

Sets, Relations and Functions **10 Marks (12 Hours)**

Sets, relations, properties of binary relations, closures of relation, equivalence relations, equivalence classes and partitions. Partial ordering relations and lattices. Functions, one-to-one and onto, principles of mathematical induction.

Graph Theory **15 Marks (10 Hours)**

Basic Definition of graph. Connectivity of graph, cut points cycles, Hamiltonian graphs, trees, different characterization of trees, bipartite graph, Algorithms on graph, Breadth first search, Depth first search.

Combinatorics **10 Marks (8 Hours)**

Basic of counting principles, principle of inclusion-exclusion, application of inclusion and exclusion. Pigeonhole principle, generalized Pigeonhole principle and its application, permutations and combinations, permutations with repetitions, combinations with repetitions, permutations of sets with indistinguishable objects.

Matrices **15 Marks (15 Hours)**

Row and column operations, vectors and matrices, partitioning of matrices, representing relations using matrices, Determinant of a square matrix, minor, cafactor, the Cayley-Hamilton theorem, inverse of a matrix, product form of inverse. Rank of a matrix. Solutions of simultaneous linear equations, existence of solutions, solution by Gaussian elimination, Eigen values and Eigen vectors.

Logic **15 Marks (15 Hours)**

Connectives, truth tables, normal forms CNF, DNF, Converting expressions to CNF and DNF, Theory of inference, Prepositional calculus. Boolean Algebra. Predicate calculus (only introduction), predicates and quantifiers.

Vector Space **10 Marks (10 Hours)**

Definition and examples of vector spaces. Elementary properties of R^n as a vector space. Subspaces of a vector space. Union, intersection and sum of two subspaces. Subspaces generated by a subset of a vector space. Definition, example and properties of linearly independent and dependent set of vectors. Basis and dimension of a vector space. Examples of finite dimensional vector spaces.

Suggested Readings :

1. Discrete Mathematical Structure, Kolman /Rahman Peason Education.
2. Discrete Mathematics and its Applications, K. H. Rosen, Mc-Graw Hill International Ed.
3. Discrete Mathematics structures with applications to Computer Science, J. P. Tremblay and R. Manohar, Mc-Graw Hill.
4. Discrete Mathematics, N. Ch. S.N. Iyengar, K. A. Venkatesh, V. M. Chandrasekaran, P. S. Arunachalam, Vikash Publishing House Pvt. Ltd.

2.2 Physics - II (Theory) [Full Marks – 75]

Electrostatics **10 Marks (7 Hours)**

Gauss's theorem and its application to determine field due to linear, plane and spherical charge distribution. Field and potential due to a dipole.

Mechanical force on charged conductor, energy in a medium.

Electric polarisation, polarizibility, polarisation vector, Gauss's law in dielectrics.

Magneto statics : **15 Marks (12 Hours)**

Lorentz force, cyclotron motion and frequency, magnetic flux, Biot - Savart's law, magnetic force between current elements, application of Biot - Savart's law to steady current carrying straight conductor, circular coil and solenoid. Forces and couples on dipole in a uniform magnetic field, magnetic shell, potential due to magnetic shell, magnetic induction, intensity of magnetisation, magnetic susceptibility, permeability, hysteresis B-H curve and energy loss in hysteresis.

Current electricity: **15 Marks (12 Hours)**

Thermo electricity: Co-efficient of thermo-emf, thermoelectric power.

Growth and decay of transient current in CR, LR and LCR circuits, oscillatory discharge.

Alternating current: Generation of alternating current, Phasor method of analyzing ac circuits, current and potential across resistive, inductive and capacitive elements and their phase relationships, ac power and power factor, LR, CR and LCR (series and parallel) circuits, quality factor, resonance. Maxwell's LC bridge and Anderson's bridge.

Rotating magnetic field and ac motor.

Electronic Devices: **10 Marks (8 Hours)**

SCR, diac and triac, LED, LDR, photo diode, photo transistor. Relay: Working principle of relay, Relay driver circuit using transistor. Power rectifier and filter: Rectifier, filter. Working of a simple power supply using transformer, rectifier and filter.

Introduction to Digital Logic: 2**5 Marks (20 Hours)**

Boolean algebra and logic gates:

Boolean operators, Rules (postulates and basic theorems) of Boolean algebra, dual and complement of Boolean expression, Sum of product and product of sum form.

Conversion between Boolean expression and truth table. Boolean expression and their simplification by algebraic method and Karnaugh map. Don't care condition. Different types of gates, Logic families: TTL, DTL, RTL, IIL, ECL, MOS, CMOS. Implementation of gates in different families (circuits), comparison of the families. Integrated circuits: SSI, MSI, LSI and VLSI.

Suggested books:

1. Conceptual Physics by Paul G. Hewiit - Pearson Education
2. Electricity and Magnetism by Brijlal and N. Subramanyam - Ratan Prakashan Mandir
3. Digital fundamentals by Floyd & Jain - Pearson Education
4. Electronic devices by Floyd - Pearson Education
5. Electricity and Magnetism by Laud

Electronics fundamentals & applications by D Chattopadhyay and P.C. Rakshit.

2.3 Data Structure and Algorithm

Full Marks: 75

UNIT I **Marks 5 Hours 4**

Concept of Data Types, concept of data structure , Abstract data structure

Arrays : Types, memory representation, address translation functions for one & Two dimensional arrays, different example

Unit II : Linked Structure: **Marks 15 Hours 12**

Singly and doubly linked list, circular and non circular, list manipulation with pointers , example involving insertion and deletion of elements and their comparative studies with implementations using array structure

Unit III : Stacks and Queues **Maks 10 Hours 8**

Definitions, representation using array and linked list structure, application of stack and queues in simulation ,postfix conversion and evolution of arithmetic expressions

Unit IV : ***Trees*** ***Marks 15 Hours 12***

Definition, quantitative properties, memory representation, Trees traversal algorithms (recursive and non-recursive), threaded trees, B-tree & Height balanced tree, Representation of B+ and B* trees

Unit V : Searching & Sorting **Marks 20 Hours 16**

Linear and binary search algorithms, performance and complexity, binary search trees (construction ,insertion , deletion and search) Concept of optimal binary search trees , Sorting Terminology, performance evaluation, sorting algorithms (non recursive, recursive description, Complexity, advantages and disadvantage, implementation) Bubble sort, insertion sort, selection sort, Tree sort, heap sort, quick sort, merge sort & radix sort. External Sorting.

Unit VI : Hashing **Marks 10 Hours 8**

Concept, advantage & disadvantages, different types of functions, collision resolution techniques (open addressing with probing, linear chaining) , Graph Traversal - , BFS, DFS, Spanning Trees, Minimum spanning tree, Algorithm of Kruskal and Primes

Suggested reading:

6. Data Structure , Horowitz and Sahani, Narosa
7. Data Structure and Program Design , Robert L Kruse
8. Data Structure using C and C++, Langsam**,** Augentein & Tanenbaum

2.4 Digital Logic

[Full Marks:75]

Introduction to Digital Logic **Marks: 15[12 Hours]**

Boolean algebra and Logic gates:

Boolean operators, axiomatic definition of Boolean algebra, Rules (postulates and basic theorems) of Boolean algebra, dual and complement of Boolean expression, Canonical form and Standard form, Sum of product and product of sum form. Conversion between Boolean expression and truth table. Boolean expression and their simplification by algebraic method, Karnaugh map method (till four variable k-map) and Quine Mc Cluskey method, Don't care condition.

Logic gates:

Different types of gates, Implementation of logic expression with logic gates.

Combinational circuit: **Marks 15 [12 Hours]**

Adder: half adder, full adder, parallel binary adder, Subtracters: half subtracter and full subtracter, Magnitude comparator, Decoder, Encoder, Application examples of decoder and encoder, Multiplexer, Demultiplexer, Application examples of multiplexer and demultiplexer, programmable logic Array (PLA)

Sequential Circuit: **Marks 15 [10 Hours]**

Simple R-S flip-flop or latch, Clocked R-S flip-flop, D flip-flop, J-K flip-flop, T flip-flop, Edge triggered flip-flop(S-R, D, J-K), Asynchronous preset and clear inputs, master- Slave Flip Flop, J-K Master slave flip flop., edge triggering and level triggering. Analysis of Clocked Sequential circuits, State Reduction and Assignment, Flip –Flop Excitation tables. Design Procedure for sequential circuits.

Counters: **Marks 15 [13 Hours]**

Ripple counters: Binary Ripple Counter, BCD Ripple Counter. Synchronous Counters: Binary Counter, Binary Up and down Counter, BCD Counter, Timing Sequences. Ring counter and Johnson counter. Counter design using state diagram, state table and state equation.

Resisters and the Memory Unit **Marks 15 [13 Hours]**

Resisters: Shift registers (serial in serial out, serial in parallel out, parallel in serial out, parallel in parallel out), Resisters with parallel Load, Bidirectional shift resister with parallel load.

Memory Unit: Semiconductor memory: RAM, RAM Family, Examples of RAM: Integrated circuit Memory, Magnetic core Memory, Cache memory. Flash memory, Basic flash memory, Comparison of flash memory with other memories, SIMM and DIMM.

Suggested Reading

1. Digital Logic and Computer Design, Morris M. Mano
2. Digital Fundamentals, Floyd and Jain

2.5 PRACTICAL II

[Full Marks:100]

Laboratory-I (Data Structure) [50 marks]

At least 8 practical assignments covering paper 2.3 practical assignments should be prepared by the UG Committee of Courses and Studies in Computer Science.

Laboratory-II(Physics - II) [50 marks]

1. To determine the horizontal component of earth's magnetic field with the help of a tangent galvanometer and a copper voltameter.
2. To construct and calibrate a thermocouple and hence determine the melting point of a given specimen (e.g., petroleum wax).
3. To study the growth and decay of current in an RC circuit for three different values of R. Compare the experimental values of time constant with theoretical values.
4. To determine the quality factor of a series resonant circuit containing L, C and R for three different values of R.
5. To study the variation of potential drop with frequency across the inductor, capacitor and non-inductive resistor of a series LCR circuit for an ac signal and hence find the response frequency. Compare it with the theoretical value.
6. To determine the value of co-efficient of self-inductance of a coil with the help of Anderson's bridge.
7. To study the ripple factor of a half-wave and full-wave rectifier using semiconductor diode and L and π section filter.
8. To assemble (a) OR (b) AND and (c) NOT gates with resistance, diode and transistors and verify their truth table.
9. Use 7400 series components to verify truth tables of AND, OR and NAND gates.
10. Implement logic circuit for sum of product logic expression.

3.1 OPERATING SYSTEMS

UNIT – I **Marks: 5[4 Hours]**

Introduction: What is an operating system, evolution of operating systems. simple batch systems, time-sharing systems, personal-computer systems, parallel systems, distributed systems, real-time systems. functions of an operating systems.

UNIT – II **Marks 15 [12 Hours]**

Memory Management: logical versus physical address space, swapping. contiguous allocation, paging, segmentation, fragmentation, segmentation with paging. protection.

Virtual Memory: paging, demand paging, page-replacement algorithms, , page tables, TLBs-translation lookaside buffers, inverted page tables, thrashing.

UNIT – III **Marks: 20[16 Hours]**

Processes and Threads

Processes: Process model, process creation, process termination, Process hierarchies, process states ,implementation of processes.

Threads: The thread model, thread usage, threads in user space and kernel, threads in linux

Interprocess Communication: race conditions, critical regions, mutual exclusion with busy waiting,sleep and wakeup, semaphores, message passing, mail box, interprocess communication in linux.

Classical IPC problems: the dining philosophers problem, the readers and writers problem, the sleeping barber problem.

Scheduling: introduction to scheduling, scheduling in batch system and interactive systems, scheduling in real time systems, policy versus mechanism, thread scheduling.

UNIT – IV **Marks: 20[16 Hours]**

Deadlocks: System model, conditions for deadlock , conditions for deadlock modeling, deadlock detection with one and multiple resource of each type ,recovery from deadlock , deadlock avoidance, deadlock prevention .

Secondary-Storage Structure: Disk structure, disk scheduling, disk management, disk reliability .

Device Management: Techniques for device management, dedicated devices, shared devices, storage devices, buffering,

Input/Output:

Principles of I/O hardware: I/O devices, device controller, memory mapped I/O, direct memory access

Principle of I/O software: programmed I/O, interrupt driven I/O, I/O using DMA.

I/O software layers: Interrupt handlers, device drivers, device independent I/O software, User-space I/O software.

Disks: Disk formatting, disk arm scheduling algorithm.

UNIT – V **Marks: 15[12Hours]**

File System :File Concept, file structure, file types, file access, file attributes, file operation, directory structure, directory operations, linux file system ,file system structure, implementing files, implementing directories, shared files ,file system reliability, file system performance, allocation methods, free-space management. file system calls in linux. Structure of ext2 file system. ext3 file system and journalling.

Suggested reading:

1. Tanenbaum " Modern Operating Systems"

2. Silberschatz , Galvin, Gang , 'Operating system concepts'

3.2 Computer Organization

[Full Marks:75]

Introduction: **Marks:15[12 Hours]**

Functional units of a computer, basic instructions, interconnection of functional units, bus structure, memory locations, memory addresses, memory operations, instruction and instruction sequencing (straight line sequencing and branching), addressing modes, introduction to assembly language, stack, subroutine, I/O instructions.

Register Transfer Logic: **Marks: 10[8 Hours]**

Introduction, inter register transfer, arithmetic micro-operation, logic micro-operation, shift micro-operation, Conditional control statements, fixed point binary data, instruction code, design of a simple computer.

Processor logic design: **Marks: 10[8 Hours]**

Processor organization, design of arithmetic and logic unitt, status register, design of accumulator.

Control logic design: **Marks 10[8 Hours]**

Hardware control, microprogrammed control block diagram, symbolic microprogram, microprogrammed CPU organization.

I/O Subsystem: **Marks: 15[12 Hours]**

Program controlled I/O, Interrupts: enabling and disabling interrupts, handling interrupts from multiple sources (priority control), DMA, structure and working of hard disk, CDROM, printer.

Memory subsystem: **Marks: 15[12Hours]**

Semiconductor memory, SRAM, DRAM, ROM, speed size and cost, Cache memory, mapping functions, replacement algorithms.

Advanced topics: **Marks: 10[8 Hours]**

Introduction to pipelining, Characteristics of RISC and CICS.

Suggested Reading:

1. Computer System Architecture, M.Morris Mano, PHI publication
2. Computer Architecture, Hamachar, Vranesic and Zaky.

3.3 Object Oriented Programming (C++)

[Full Marks:75]

Principles of Object Oriented Programming **Marks: 10[8 Hours]**

Basic concept of OOP, Procedural programming vs OOP. Introducing Object-Oriented Approach relating to other paradigms. Benefits of OOP and methods. Applications of OOP. Abstraction, Encapsulation, Inheritance, Polymorphism, Review of C, Difference between C and C++

Basic Elements and Ideas: **Marks: 10[8 Hours]**

Keywords and Identifiers in C++, Variables and Constants, Declaration and Initialization of Variables, Concept of Dynamic Initialization of variables, Enumerated variables, Basic Data Types, Arrays and Strings, User Defined Data types, Arithmetic, Relational, Logical Operators and Operator Precedence, Manipulators, Type Conversions and type cast operators, Console I/O: cin, cout functions. Control Statements.-if; if-else; else….if; switch statements. Loops: for, while, do-while, Break, continue, go to. Pointer-new, delete operators. Functions in C++: main function, function prototyping, call by reference, return by reference, functions- inline, friend, virtual, library.

Classes and Objects: **Marks: 10[8 Hours]**

Encapsulation, information hiding, abstract data types, Object & classes, attributes, functions, C++ class declaration, member functions, State identity and behavior of an object, static data members and member functions, friend functions, constant member functions. Constructors and destructors, instantiation of objects, Default parameter value, object types.

Overloading: **Marks: 10[8 Hours]**

Function overloading: Function overloading with various data types, scooping rules for function overloading, Special features of function overloading.

Operator overloading: Concept of Operator Overloading , Overloading of Unary and Binary Operators., overloading binary operators using friends, manipulation of strings using operators.

Inheritance: **Marks: 10[8 Hours]**

Concept of inheritance, Types of Inheritance-Single, multilevel, multiple, hierarchical, hybrid, virtual base class, abstract class. Type of Derivations – public, private & protected, Constructors in Derived Classes.

Virtual Functions and Polymorphism: **Marks: 10[8 Hours]**

Polymorphism, Categorization of polymorphism techniques: compile time polymorphism, Polymorphism by parameter, run time polymorphism- pointers to derived class, Early binding vs. Late binding, virtual function, pure virtual function.

Files and Exception Handling: **Marks: 10[8 Hours]**

Need For a Data File, Opening and Closing a File, Detecting End-of File, Classes for File Stream Operations, Sequential Input and Output Operations, Random Access File Processing.

Concept and Use of Exception Handling. Throwing Mechanism, Catching Mechanism, Specifying Exception.

Templates:

Function Template and Class Template. **Marks: 5[4 Hours]**

Suggested readings:

vi) Herbert Schild, " The complete reference to C++", Osborn McGraw Hill

vii) R. Lafore, "Object Oriented Programming using C++", Galgotia Publications

viii) Ian Graham, "Object Oriented Methods", Addison Wesley.

ix) E. Balaguruswamy, "Object Oriented Programming with C++", Tata McGraw Hill 1997.

x) D. ravichandran, "Programming With C++", Tata McGraw Hill Publishing Company Ltd.

3.4 Database Management Systems

[Full Marks:75]

File structure: **Marks: 10[6 Hours]**

Record storage and primary file organization: memory hierarchies and storage devices, Storage of DataBases, Placing file records on disks: Records and its Types, Files, Fixed length records and variable length records, Record Blocking, allocating file blocks on disks, operation on files.

Issues in Physical Design : Concept of indexes

Overview of Database Management System: **Marks : 15[10 Hours]**

Definition of DataBase, Traditional File Approach vs. DBMS approach, Characteristics of the Data Base Approach, DBMS user, Role of a DBA, Advantage of using DBMS, DBMS architecture, Data independence

ANSI/SPARC 3 level architecture.

Relational Models: **Marks: 20[17Hours]**

Fundamental integrity rules: entity integrity, referential integrity, Relational algebra(Select , Project, Cross ,Product , theta join, equi join, natural join, outer join),Set Operation

ANSI SQL –92 Standard : DDL, DML, SQL constructs(Select .. From… Where… Group by ….. Having… Order by….), Insert, Delete, Update, View, Definition and use, nested quires, Constraints considers(NOT NULL , UNIQUE, Check Primary key. Foreign key)

Database Design: **Marks : 20[17Hours]**

Conceptual model, logical model, physical model.

ER model as a tool for conceptual design-entities, attributes and relationships, weak and strong entities, conversion of ER model into relational schema.

Normalization: informal design guidelines for relational schemas(overview level), functional dependencies, different types of keys. Normal forms(first, second, third, BCNF), multivalued and join dependencies. Fourth, fifth normal forms, Domain key normal form.

Overview of advanced DBMS: **Marks : 10[10Hours]**

(only a general idea at surface level)

Types of file organizations in contemporary dbms software: heap files, sorted file, hashing techniques, ISAM and B-tree.

Query processing: Query processing stages and what is done in each stages, use of query

execution plans in improving application performance.

Concept of transaction and transaction processing: ACID properties of database concurrency and database recovery.

Introduction to distributed database, client/server database, object oriented database. Database security.

Suggested reading:

1. Introduction to database management system, C.J. Date
2. Fundamentals of data base management system, Elmasri & Navathe

3.5 PRACTICAL III

FULL MARKS:100

At least 5 practicals each covering paper 3.1, 3.3 and 3.4 with equal weitage. Practical assignments should be prepared by the UG Committee of Courses and Studies in Computer Science.

4.1 Microprocessor

[Full Marks:75]

Internal Organization of 8085A microprocessor: Marks: 10[10 Hours]

User Programmable registers, PC, SP, accumulator, flags, data bus, address bus, control bus, instruction word size, opcode format, data format, memory addressing, I/O addressing, address decoding for memory and I/O.

8085A microprocessor architecture: Marks: 15[10 Hours]

Pinout of 8085A microprocessor, multiplexed address/data bus, control and status signal, demultiplexing of control signals, other signals, bus timings, fetch decode and execute cycle, timing diagram for opcode fetch memory read and memory write, interfacing memory and I/O.

Assembly language programming in 8085A microprocessor:

Marks:20[17 Hours]

Complete instruction set in detail, programming examples, logic operation, counters and time delays, stack and subroutine, processing arrays, bit manipulation.

Interfacing: Marks: 20[14 Hours]

In and OUT instruction, decoding addresses, Interfacing LED, relay, seven segment display, switch, keyboard,.

Interrupts: Marks: 10[11 Hours]

Vectored interrupts, interrupt priorities, general purpose programmable peripheral devices, 8255A control and status registers, programming 8255A, introduction to 8279, 8254 and 8237 (block diagrams and basic functions).

Suggested Reading :

Microprocessor Architecture, Programming and Application with the 8085 by Ramesh S.Gaonkar

4.2 Software Engineering
[Total Marks 75]

Unit I : Introduction **Marks 15 Hours 12**

Software Processes & Characteristics, Software life cycle Models ---- Waterfall, Prototype, Evolutionary and Spiral Models Software Requirements analysis & specifications: Requirement engineering, requirement, elicitation techniques like FAST, QFD, requirements analysis using DFD, Data dictionaries, ER Diagrams, Requirements documentation, Nature of SRS, Characteristics & organization of SRS.

Unit II : Software Project Planning **Marks 20 Hours 16**

Size Estimation like lines of Code & Function Count, Cost Estimation Models, COCOMO, Risk Management.

Unit III : Software Design **Marks 20 Hours 16**

Data design**,** Architectural design**,** Interface design, Function Oriented Design, Object Oriented Design, Cohesion & Coupling, Classification of Cohesiveness & Coupling, Software Metrics: different types of project matrics.

Unit IV : Software Testing and Maintenance **Marks 20 Hours 16**

Testing Process, Design of Test Cases, Types of Testing, Functional Testing, Structural Testing, Test Activities, Unit Testing, Integration Testing and System Testing. Debugging Activities Software Maintenance: Management of Maintenance, Maintenance Process, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation. Software quality Assurance.
CASE tools--- Analysis tools, design tools, SQA tools, software testing tools.

Suggested readings:

1. Rajeev Mall “Software Engineering” PHI
2. Pressman Roger “ Software Engineering A Practitioners Approach” Tata McGraw Hill
3. James F. Peters, Witold Pedrycz “Software Engineering An Engineering Approach

4.3 Data Communication and Computer Networks

[Full Marks:75]

Introduction to Computer Networking: Marks:15[12 Hours]

Overview of Computer Network, The uses of computer network, Network Topologies, Layered Architecture, Relationship of Service to Protocol, Interface between layers, Connection oriented vs. Connectionless service The OSI reference model, TCP reference model, General Comparison between OSI and TCP/IP

The maximum data rate of a channel, Guided and wireless transmission media, satellite communication and their relative merits and demerits,Nyquist law, Shenno's Law, Fourier series.

Interconnecting Devices:

Repeaters, hubs, bridges, switch, routers and gateways, their functions and difference

Medium Access sub layer: Marks:10[8 Hours]

Channel allocation Static and Dynamic, Pure and slotted ALOHA, Persistent and non Persistent CSMA ,CSMA/CD, Ethernet 10,100 & 1000 MBPS data rate, cable type and length and other characteristics, IEEE 802.3 Ethernet frame format

Data Link layer : Marks:13 [10 Hours]

Data Link layer design issues: services provided to the network layer, framing, error control, flow control, link management

Error detection and correction: Error correction codes, error detecting codes, Hamming code and CRC

Elementary Data link protocols, ARQ and sliding window protocols

Network Layer: Marks:12[13 Hours]

Virtual circuit vs. datagram subnet. Establishment of connection in connection oriented services, Routing Algorithms: distance vector routing, link state routing,

Flow control, Definition of congestion and quality of service.

Internet protocols (IP) address structure and frame format , Checksum calculation, Fragmentation

Address Resolution Protocol (ARP), ARP Packet format. RARP(only overview),Concept of ICMP

Transport Layer: Marks: 10[7 Hours]

Works of the transport layer , Basic functionality of transport layer, connection establishment ,connection release, end to end flow control, leaky bucket and Token bucket algorithm, Port Numbers, Socket Addresses , The TCP protocol - TCP Segment, Connection in TCP, Flow Control & Error Control mechanism in TCP, TCP operation, The UDP protocol.

The Application Layer: **Marks:15[10 Hours]**

Client Server Model - concept of Concurrency and Iterative Server, Connectionless Iterative Server, Connection-Oriented Concurrent Server:

FTP- Control Connection, Data Connection, Communication, Command Processing, File Transfer

Concept of DNS, Telnet, WWW , HTTP. Architecture of WWW.

Electronic mail ,mail transfer Agent & Mail user agent ,URL

Suggested Reading:

1. Computer Networks, Andrew S. Tanenbum

4.4 Theoritical Fundation of Computing
Full Marks 75

Theory of Computation

Finite Automata **Marks: 12[10 Hours]**

DFA, NFA, NFA with ε-moves. Equivalence of DFA and NFA. Reduction of the number of states in a finite automata.

Regular Languages and Regular Grammar **Marks: 8[6 Hours]**

Concept of languages and grammar. Regular expressions. Connection between regular expressions and regular languages. Regular grammars, Right and Left-Linear Grammars. Equivalence between Regular languages and Regular grammars.

Properties of Regular Languages **Marks: 12[9 Hours]**

Closure under simple set operations- union, intersection, concatenation, complementation and star-closure. Decision algorithms for emptiness, finiteness and infiniteness, equality. Proof of non-regularity using Pigeonhole principle and using pumping lemma for regular languages.

Context free languages **Marks: 12[10 Hours]**

Context-free grammars, leftmost and rightmost derivations, derivation trees. Parsing and Ambiguity in grammars and languages. Simplification of Context free Grammars- removing useless productions, empty-productions and unit-productions. Normal forms- Chomsky and Greibach normal forms.

Pushdown Automata **Marks: 12[10 Hours]**

Definition and language accepted (acceptance by empty stack and final state and their equivalence). Pushdown Automata and Context free languages. Deterministic PDA and Deterministic Context free Languages.

Properties of Context free Languages **Marks: 7[5 Hours]**

Pumping Lemma for CFL. Using Pumping Lemma to show certain languages not to be Context free. Closure properties of CFL – closure under union, concatenation and star-closure. and showing that CFLs are not closed under intersection and complementation. Decision algorithms for emptiness, finiteness and infiniteness.

Analysis of Algorithm

Complexity Classes **Marks: 12[10 Hours]**

Time and Space complexity of algorithms, average case and worst case analysis, asymptotic notation as a measure of algorithm complexity, O, , o, , and notations. Analysis of sorting algorithms- Selection sort, Bubble sort, Insertion sort, Heap sort, Quick sort and analysis of searching algorithms – linear search and binary search.

Suggested Reading

1. An introduction to Formal Languages and Automata, Peter Linz, Narosa.
2. Introduction to Automata Theory, Languages and Computation, Hopcroft and Ullman, Addison Wesley.
3. K. L. P. Mishra, N. Chandrasekaran; Theory of Computer Science (Automata, Languages and Computation), P. H. I.
4. T. H. Cormen, C. E. Leiserson and R. L. Rivest, Introduction to Algorithms, Tata-Mcgraw Hill Publishers.

4.5 Practical IV

[Full Marks:100]

At least 5 practical assignments each covering paper 4.1, 4.2 and 4.3. Practical assignments should be prepared by the UG Committee of Courses and Studies in Computer Science.

5.1 Compiler Design

Full Marks 75

Unit I : Introduction **Marks 10 Hours 8**

What is a compiler? Phases of compiler. Overview of working of a compiler, linker, loader.

Unit II : Lexical Analysis **Marks 15 Hours 12**

NFA, DFA, conversion from NFA to DFA. Regular expression. Regular expression to NFA conversion. Minimisation of DFA. ,Structuer of Lexical analyser ,use of finite autometa to wr**ite lexical analyser .**

Unit III : Syntax analysis **Marks 15 Hours 12**

Grammar representation. Derivation and parse tree. Ambiguity and possible elimination. Top down parsing. Recursive descent and predictive top down parsing. Elimination of Left recursion. Bottom up parsing. Operator precedence parsing, LR parsing (including SLR and LALR). Error detection and recovery. Parser table construction. Writting a parser for a subset of C using yacc.

Unit IV : Code generation **Marks 20 Hours 16**

Symbol table contents, implementation. Type checking. Syntax directed translation. Forms of intermediate codes. Abstract Syntax Trees, Directed Acyclic Graph, Three address code. Intermediate code generation for different language constructs , boolean expressions, if, if-else, while, case or switch, function calls. Target code generation issues, registerallocation, Runtime storage management

Unit V : Code Optimisation Marks 15 Hours 12

DAG, basic blocks, Common sub-expression elimination, variable propogation, code motion, strength reduction, elimination of dead code, loop optimisation. Data flow analysis.

Suggested Reading:

1) Aho, Sethi, Ullman; Compilers, Principles, Techniques, Tools, Pearson Education

2) Compiler Design, Santanu Chattopadhyay, P.H.I.

Web Technology

Total Marks 75

Internet Basics: Marks 3 [4 hours]

History of the internet , the world wide web, getting connected ,web page, home page, web site, Internet services: - email.

Client Server Model: - Marks 15 [12 hours]

Structure of an HTML document. HTML tags. The HTTP protocol details. Client side software. Web browsers (Netscape/Mozilla as example). DHTML

Web server architecture and functions of an web server. JDBC and ODBC. Server side vs client side scripts, advantages and disadvantages of each. Client side and server side scripting languages and their uses. Dynamic web page. CGI scripts, Java Scripts and JSP as examples. PHP and Perl as scripting language. Browser plugins.

Web Object Model: CORBA Marks 5[4 hours]

XML: - Marks 12[10 hours]

Well formed XML syntax. references, well formed documents ML semantics. DTD, XML Schema, RELAX-NG. Displaying XML on web. XML extensions. Processing XML files, Using a programming language and the SAX API,Using a programming language and the DOM API,Using a transformation engine and a filter ,Push Parsing ,Data binding ,Non-extractive XML

Distributed Multitiered Application: Marks 20[12 hours]

J2EE Components ,J2EE Clients, Web Components, Business Components.
J2EE Containers, Container Services , Container Types, Enterprise JavaBeans Technology, Java Servlet Technology, JavaServer Pages Technology.
Application server: -Persistence, Transaction processing, Concurrency control, Events using, Java Message Service, naming and directory services (JNDI),Security (Java Cryptography Extension (JCE) and JAAS)
Deployment of software components in an application server

Remote procedure calls using RMI-IIOP. Exposing business methods as Web Services.

J2EE 1.4 API Marks 15 [12 hours]

Java Message Service API, Java Transaction API, JavaMail API, JavaBeans Activation Framework, Java API for XML Processing, Java API for XML-Based RPC, SOAP with

Attachments API for Java, Java API for XML, Registries, J2EE Connector Architecture, JDBC API

Web Security: **Marks 5[3 hours]**

Firewall, wrapper and Proxy.

Suggested reading:

1. The Internet Complete, M.L. Young
2. Using CGI by J. Dwight, M. Erwin, R. Niles.
3. Mastering JavaScript and Jscript by J. Jaworski
4. Dynamic HTML by D. Godmann.
5. Understanding HTML by D.P. Nagpal
6. http://java.sun.com/j2ee

5.3 Computer Graphics

[Full Marks:70]

UNIT 1: **Marks:15 [15 hours]**

Introduction: computer graphics and its applications.

Graphics Devices:

Input Devices : Keyboard, Mouse, Trackball & Space ball, Joystick, Data Glove, Digitizers, Image Scanners, Touch panels, Light Pens systems.

Output display devices : Refresh CRT, Raster-scan display and Random-scan display technique, color display techniques-Beam penetration method and Shadow-mask method, Direct view storage tubes, emissive & non-emissive flat-panel displays-Plasma panels, Thin-film electrostatic displays, LED and LCD monitor, Three-dimensional viewing devices and Virtual-Reality systems;

Display processor : Raster-scan systems, Random-scan systems,

UNIT 2: **Marks:20 [15 hours]**

Output primitives: line-drawing algorithms-DDA algorithm and Bresenham's Line Algorithm, Mid point Algorithm for Circle and Ellipse Generation, Curve generation.

Attributes for output primitives : Area-filling Algorithms - scan-line polygon-fill, Nonzero-winding number rule; Scan-line curve filling, Boundary-fill algorithm, Flood-fill algorithm; Character generation techniques-generation of bitmap and outlined font.

UNIT 3 : **Marks:20 [15 hours]**

2-D Geometric Transformations: Basic transformations-translation, rotation and Scaling, matrix representations and Homogeneous co-ordinate representations, Composite transformations among translation, rotation and scaling, General Pivot-point rotation, General fixed-point scaling, General scaling directions, Other transformations-reflection and shear, Transformation between co-ordinate Systems, Definition of Affine transformations.

2-D viewing: definition, viewing transformation pipeline, window-to-viewport co-ordinate transformation.

2-D Clipping : Concept and Algorithm: point clipping, line clipping - Cohen-Sutherland algorithm, Area clipping, text clipping, polygon clipping.

Interactive picture construction techniques: Basic positioning methods, constraints, grids, gravity fields, rubber-band methods, dragging, painting & rawing.

UNIT 4: **Marks:10 [10 hours]**

3-D concepts: Display methods-Parallel projection, perspective projection,3-D geometric transformations: Transformation, Translation, Rotation and Scaling around axes, 3-D Viewing Projections – Parallel and Perspective.

UNIT 5: **Marks:10 [5 hours]**

Visible surface detection: Definition, Algorithms for visible surface detection – Depth buffer method, A-buffer method, Ray-casting method, Curved surfaces, Wireframe Methods

Illumination and Surface rendering: definition and importance, light sources,
Basic illumination models-Ambient light, Diffuse reflection, Specula reflector and Phong model, combined diffuse and secular reflections for
multiple light sources, Warn model, Intensity attenuation, Color considerations, Transparency, Shadows.

Suggested Readings:

1. Computer Graphics, D. Hearn and M.P.Baker, PHI Ltd.

5.4 Environmental Studies

Total Marks 75

Unit I: The Multidisciplinary nature of environmental studies 4 lectures Marks 5

Definition**,** scope and importance

Need for public awareness

Unit 2: Natural Resources 8 lectures Marks 10

- Renewable and non-renewable resources
- Natural resources and associated problems
  a) *Forest resources:* Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
  b) *Water resources:* Use and over utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
  c) *Mineral resources:* Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
  d) *Food resources:* World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problem, water logging, salinity, case studies.
  e) *Energy resources:* Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources, case studies.
  f) *Land resources:* Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable lifestyles.

Unit 3: Ecosystems 8 lectures Marks 10

- Concept of an ecosystem
- Structure and function of and ecosystem.
- Producers, consumers and decomposers
- Energy flow in the system
- Ecological succession
- Food chains, food webs and ecological pyramids
- Introduction, types, characteristic features, structure and function of the following ecosystem:-
  a) forest ecosystem

b) grassland ecosystem
c) desert ecosystem
d) aquatic ecosystem(ponds, streams, lakes, rivers, oceans, estuaries)

Unit 4: Biodiversity and its conservation 8 lectures Marks 10

Introduction- definition, genetics, species and ecosystem diversities

Biogeographical classification of India

Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.

Biodiversity at global, national and local level.

India as a mega-diversity nation.

Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wild life, man-wild-life conflicts.

Endangered and endemic species of India.

Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity

Unit 5: Environmental pollution 8 lectures Marks 10

- Definition
- Causes, effects and control measure of
    a. air pollution
    b. water pollution
    c. soil pollution
    d. marine pollution
    e. noise pollution
    f. thermal pollution
    g. nuclear pollution
- Solid waste management: Causes, effects and control measures of urban and industrial waste.
- Role of individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides.

Unit 6: Social issues and the Environment: 8 lectures Marks 10

- From unsustainable to sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people, its problem and concern, case studies.
- Environmental ethics: issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion, nuclear

accidents and holocaust, case studies.

- Waste land reclamation
- Consumerism and waste product
- Environment protection acts
- Air(prevention and control of pollution) acts
- Wild life protection act
- Forest conservation act
- Issues involved in enforcement of environmental legislation, public awareness.

Unit 7: Human population and the environment 8 lectures Marks 10

- Population growth, variation among nations
- Population explosion- family welfare programme
- Environment and human health
- Human rights
- Value education
- HIV/ AIDS
- Women and child welfare
- Role of information technology in environment and human health
- Case studies

Unit 8: Field work **8 lectures Marks 10**

- Visit to a local area to document environmental assets- river/forest/grassland/hill/mountain
- Visit to a local polluted site- urban/rural/ industrial/ agricultural
- Study of common plants, insects, birds
- Study of simple ecosystem, ponds, river, hill slopes etc.

5.5 Practical: V

FULL MARKS:100

At least 15 practical assignments covering paper 5.1, 5.2 and 5.3. Practical assignments should be prepared by the UG Committee of Courses and Studies in Computer Science. Weitage of the papers will be equal.

6.1 System Administration

Full marks 75

Unit I : Marks 5 [Hours 4]

Introduction to Linux Basic features of Linux operating system, Advantages of Linux, Installation requirements, Partitioning the Hard drive for Linux, Installing the Linux system, System startup and shut down.

Unit II : Marks 15 [Hours 12]

File System Understanding file and directory, Linux standard directories, commands for files and directories – ls, cp, md, rm, mkdir, rmdir, more, creating and viewing files etc, setting user and group ownership of files and directories and access permissions, basic commands for starting and stopping processes. Running processes on the system, Mounting and unmounting file system.

Unit III : Marks 20 [Hours 16]

Linux commands Shell and shell programming, standard input, standard output and standard error, redirection and piping, understanding processes, kernel, compiling linux module, back ground processes, manages multiple processes, kill, ps, who, sleep, printing command, grep, fgrep, find, vi editor, Linux system monitoring and logging. Backup and restore procedure, Linux kernel program,

Unit IV : Marks 15[Hours 12]

System administration Managing user accounts – Adding a user, password, creating groups, adding and deleting a group, modifying group attributes, managing user accounts, Monitoring memory usage and disk space usage on the system, customizing system log configuration, Setting up Postgresql and Mysql Database server.

Unit V : Marks 20 [Hours 16]

Networking IP address. Classful and classless domain. Network address, netmask, gateway address. Interface configuration using ifconfig. ping and netstat. Configuration using DHCP, manual configuration. Web server, DNS server proxy server, mail server, NIS serve and, NFS server. Apache web server setup. Squid proxy setup. Basic Sendmail setup, the Network Information System setup, Network File System setup, Domain Name Service(DNS) setup, NFS client and server setup. iptables and firewall setup. Multiple interfaces, adding routes.

Books

xi) Red Hat Linux: Proffitt

xii) Introduction to system Administration: IBM series

xiii) Using Linux – By Jack Tacket, David Gunter
xiv) Linux System Administration Handbook: Mark F Komarinski, Cary collect
xv) Unix Network Programming – Vol – I and Vol – II : Stevens

6.2(A) DATA MINING

[Full Marks:75]

Data Warehousing **Marks: 15[12 Hours]**

Overview and concepts: Need for Data Warehousing, Basic elements of Data Warehousing, differences between Database Systems and Data Warehouse.
Planning and Requirements: Project planning and management, collecting the requirements.
Architecture and Infrastructure: Data Warehouse Architecture and its components, Infrastructure and metadata.
Data Design and Data Representation: Principles of dimensional modeling, advanced topics- data extraction, transformation and loading, data quality.
Information Access and Delivery: Matching information to classes of users, OLAP in Data Warehouse, Data warehousing and the web.
Implementation and Maintenance: Physical design process, Data Warehouse deployment, growth and maintenance.

Data Mining

Introduction : **Marks: 10[5 Hours]**

Basics of data mining, Different definitions of Data Mining and related concepts, Data mining process- Data preparation, data cleaning and data visualization. KDD process. Data miming techniques: Clustering, Association rules and Decision trees.

Clustering: **Marks: 15[12 Hours]**

Partitional versus Hierarchical Clustering, types of data in clustering. Partitional clustering methods – k-means, k-medoids, PAM, CLARA, CLARANS. Hierarchical clustering methods – BIRCH, CURE. Density based clustering methods- DBSCAN. Categorical clustering – DBSCAN.

Rule Mining: **Marks: 15[13 Hours]**

What is an association rule? Mining association rules, frequent sets and border sets, algorithms for mining association rules – Apriori algorithm, Pincer-Search algorithm, Border algorithm. Generalized association rule, quantitative association rule, association rule with item constraint.

Decision Trees: **Marks: 10[8 Hours]**

Introduction, tree construction principle, decision tree generation algorithms – CART, ID3.

Advanced Topics **Marks: 10[8 Hours]**

(only basics of the following topics):

Web mining : Web Content Mining, Web Structure , Mining, Web Usage mining.

Spatial mining, Temporal mining – Temporal association rules, sequence mining and GSP algorithm, discovery of frequent episodes.

Suggested Reading:

1. A.K. Puzari, Data Mining Techniques, University Press.

2.J. Han and M. Kamber. Data Mining: Concepts and Techniques. Morgan Kaufman. 2001.

6.2.(B) Artificial Intelligence

Total Marks 75

UNIT: I **Mark:15[12 Hours]**

Definition of artificial intelligence, Numerical computation, information storage, repetitive operations, other definitions of artificial intelligence, numeric versus symbolic, algorithm versus non algorithms, area if artificial intelligence, expert system, natural language processing, speech recognition, automatic programming, organization of artificial intelligence system, the underlying assumptions, artificial intelligence techniques.

UNIT : II **Marks: 15[13 Hours]**

Is the good solution absolute or relative, production systems, production system characteristics, problem solving: defining the problem as a state space search, Water Jug Problem , Basic problem solving methods : Reason forward from the initial states , Reason backward from the goal states, Problem trees versus Problem Graphs, Knowledge representation: Matching and Indexing.

UNIT: III **Marks: 15[12 Hours]**

Heuristic search, Heuristic functions, OR-graph, AND-OR graph, Weak methods: Generate and Test, Hill Climbing, Breadth first search, Best first search- OR graph, Problem reduction, Constraints satisfaction, Means-End Analysis.

UNIT: IV **Marks: 15[13 Hours]**

Game playing: The Minimax Procedure , Adding Alpha Beta Cutoffs, Knowledge Representation using predicate logic, Representing simple facts in logic, Augmenting the representation with computable functions and predicates, Resolution, Conversion to clause form, The basis of resolution, Resolution in prepositional logic , The Unification algorithm, Resolution in predicate logic , Resolution algorithm for predicate logic, Introduction to Nonmonotonic Reasoning, Statistical and probabilistic reasoning.

UNIT: V **Marks: 15[10 Hours]**

Natural language Understanding, Introduction to Understanding, What makes understanding hard, Understanding single sentences , Keyword matching , Syntactic analysis , semantic analysis , semantic grammars ,Case grammars Learning: Introduction to learning, Random learning and Neural nets, Learning by parameter adjustment, Learning in General Problem Solver (GPS), Concept Learning.

Suggested Readings:

1.Artificial Intelligence Elaine Rich McGraw Hill book Co. 1982.

2.Artificial Intelligence PH Winston, Addison Wesley,1983.

3.Artificial Intelligence Concepts, Techniques and Applications- Yoshikai Shirai & Junichi Tsujii, John Willeysons.

4.Artificial Intelligence A knowledge based application- MW Richaugh ,PWS Rent Publishing, Boston.

6.2.(C) Computer Oriented Optimization Techniques
Full Marks 75

Unit I : Linear Programming Techniques Marks 15[Hours 12]

The simplex algorithm, Charma's method of penalties, the two phase algorithm, problem of degeneracy and cycling, Duality theorem, revised simplex algorithm, revised simplex method versus simplex method. Sensitivity analysis, changes in the requirement vector, the cost vector and the coefficient matrix.

Unit II :Transportation and Assignment problem Marks 20 [Hours 16]

Various algorithms such as the algorithm of stepping stones, Hungerian etc.

Unit III : Non-linear programming Marks 15 [Hours 12]

Constraint minima and maxima, necessary and sufficient condition for maxima and minima: Kuhn-Tucker principle, quadratic programming

Unit IV : Queuing theory Marks 15 [Hours 12]

The exponential distribution, queue disciplines such as M/M/1, M/M/C.

Unit V : Simulation Marks 10 [Hours 8]

Even type of simulation, Monte Carlo techniques, simulation techniques applied to queues.

Suggested Readings:

1. S.L Gass, "Linear Programming"
2. K.V.Mittal & G Mohan, " Optimization Methods"
3. K.Swarap, P.K.Gupta, M.Mohan, " Operation Research"

6.2.(D) Object Oriented Analysis and Design

[Full Marks:75]

Introduction **Marks 5[2 Hours]**

What is object oriented programming?Usefulness of object oriented development.

Object Modeling **Marks 10[8 Hours]**

Objects and classes,Links and Association,advanced links and association concepts,Generalization and Inheritance,grouping constructs,Aggregations,Abstract Classes,Generalization as Extension and Restriction.

Dynamic Modeling **Marks 10[7 Hours]**

Events and States,Operations,Nested State Diagram,Concurrency,Synchronization of concurrent activities,relation of objects and dynamic models.

Function Modeling **Marks 10[8 Hours]**

Data Flow Diagram,Process,Data Flow,Actor,Data Store,Control Flow,Operations and Constraints,Relation of functional to object and dynamic model.

Design Methodology **Marks 20[15 Hours]**

Analysis,Problem statement,Design:-Breaking a system into a sub systems,Identifying Concurrency,allocating subsystems to processors and tasks,Management of data Stores,Handling Global Resources,Handling Boundary Conditions,Choosing Software Control Implementation,setting trade off priorities.

Object Design **Marks-20[20 Hours]**

Overview of object design,Combining the Three Models,Design Optimization,Implementation of Control,Adjustment of Inheritance,design of association,Object Representation,Physical Packaging and Documentation.

Recommended Books:

Object Oriented Modeling and Design, James Rumbaugh, Blaha, Premelani. Eddy, Lorensen

6.2.(E) System Analysis and Design
[Full Marks:75]

Introduction **Marks : 5[6 Hours]**

System Definition and Concepts: General Theory systems, Manual and automated Systems, Real-life Business Sub –Systems. System .Environments and Boundaries .Real-Time and distributed systems. Basic principles of successful systems. Approach to system Development: Structured system Analysis and Design, Prototype, joint Application Development.

Systems Analyst. **Marks : 5[2 Hours]**

Role and Need of Systems Analyst. Qualification and responsibilities .System Analysis as a profession

System Development Cycle **Marks : 10[6 Hours]**

Introduction to Systems Development Life Cycle(SDLC) Various phases of SDLC: Study, Analysis, Design, Development, Implementation, Maintenance
Systems documentation consideration: principles of systems Documentation, Types of documentation and their importance, Enforcing documentation discipline in an organization.

System Planning **Marks : 10[10 Hours]**

Data and fact gathering techniques: interviews, Group Communication-Questionnaires, presentations &Site visits. Assessing project Feasibility: Technical, Operational, Economic, Cost
Benefits Analysis, Schedule Legal and contractual, political. Modem methods for determining system requirements: joint Application, Development program, prototyping, Business process Re-engineering. System Selection plan and proposal.

Modular and Structured Design **Marks : 5[3 Hours]**

Module Specifications. Top –Down and bottom-up design. Module coupling and Cohesion. Structure charts.

System design and Modeling **Marks : 15[15 Hours]**

Process Modeling, logical and physical design, Conceptual Data Modeling : entity-Relationship Analysis, Entity –relationship Modeling, ERDs and DFDS Concepts of Normalization. Process Description: Structured English, Decision Thee, Decision Tables Documentation: Data Dictionary Recording Data Description

Input and output **Marks : 10[9 Hours]**

Classification of forms, input/ output forms design. User- interface design, Graphical interfaces. Standards and guidelines for GUI Design. Designing physical Files and databases: Designing Fields, Designing Physical Records , Designing Physical Files, Designing Databases. Introduction to CASE Tools, Features Advantages and Limitations of CASE Tools, Awareness about some commercial CASE Tools.

System Implementation and Maintenance **Marks : 10[5 Hours]**

Planning Consideration. Conversion methods, procedures and controls. System acceptance criteria. System Evaluation and performance. Testing and Validation. Preparing User Manual. Maintenance Activities and Issues.

Computer System Audit and Security **Marks : 5[3 Hours]**

Audit of Computer System Usage. Types of Threats to Computer System and Control Measures: Threat and Risk Analysis, Disaster Recovery and Contingency planning, viruses.

Recommended Books:

1. J Hoffer,"Modern Systems Analysis and Design", Joey George and Joseph Valacich, Pearson Education

2 A Dennis and BH Wixom,"System Analysis and Design" John Wiley and Sons, Inc.