Mumbai University

Revised Syllabus for

B.E. Degree Course in

Computer Engineering

(4 Year Syllabus)

(This soft copy has been made from the official hard copy of the syllabus. No responsibility would be taken for any typing mistakes)

SEMESTER VIII

1. COMPUTER NETWORKS & COMMUNICATION

Introduction: Networks, architecture, applications, ISO model.

Physical layer: Review of data communication, transmission and multiplexing, transmission media, error detection, recovery, interfacing, ISDN.

Topology: Introduction to topological problems, graph theory, network flow, traffic analysis, queuing theory and analysis of M/M/I systems.

Local area networks: Bus/ring/tree topology, medium access protocol, and performance.

Data link layer: Line configurations, flow control, error control, bit oriented link control, simplex and sliding window protocols, protocol performance evaluation.

Network layer: Communication networking techniques, circuit switching, message switching, packet switching, broadcast networks. Packet switching: virtual circuits and datagrams, routing, traffic control, congestion control, and error control.

Inter networking: bridge/router/gateway, connection oriented and connection-less inter networking.

Services and protocols for transport layer, session layer and presentation layer. Data encryption and data compression.

Application layer protocols: Architecture and access protocols.

2. SOFTWARE ENGINEERING

Objectives :

- Introductory software engineering course that will present the software development lifecycle and methodology for dealing with each phase.
- Introduce the latest trends in large scale S/W development.
- Apply S/W principles to a large-scale design project.
- Ethics: Whistle blowing, human safety, embedded risk, software reliability, professional code of ethics.
- Fundamental problem solving concepts, top down design, procedural abstraction, control structures, data types.
- Software development process: Software life cycle models, specification design tools, software design objectives, documentation, configuration management, S/W reliability, safety, risk assessment and maintenance.
- Software estimation techniques, loc and FP estimation. Empirical models like COCOMO. Project tracking and scheduling. Reverse engineering.
- Software requirements and specifications: Informal/formal specifications, pre/post conditions, algebraic specifications and requirement analysis models.
- Software design and implementation: Functional/process oriented design, bottom up design, other design techniques (OOD,JSD), implementation strategies (top-down, bottom-up, team) and issues, reuse, performance improvement, debugging and antibugging.
- Verification, validation, testing and maintenance: Verification and validation techniques (pre/post -conditions, invariant, proof of correctness), code and design reading, structured walk through, testing (test plan, white/black box testing, unit and integration testing, regression testing, test case design and acceptance testing) and maintenance activities.
- Code sharing, software components, rapid prototyping, specialization, construction, class extensions, intelligent software agents.
- Introduction to CASE tools.
- Social, legal and ethical implications of computing.

3. . **ELECTIVE I-1 ADVANCED COMPUTER ARCHITECTURE**

Introduction to parallel processing: Trends towards parallel processing, parallelism in uniprocessor systems, parallel computer structure, architectural classification schemes.

Memory and input output systems, memory structure hierarchy, addressing scheme for main memory, virtual memory systems, memory allocation and management strategies, virtual memory of X86 processors, cache memories, management and design criteria. I/O sub systems, interrupt mechanisms, I/O processors and I/O channels.

Pipelined and vector processors: overlapped parallelism, instruction and arithmetic pipelines, vector processing, scientific attached processor.

SIMD computers: SIMD perspectives, array and associative processors, study of an array processor.

Multi processor architecture: loosely and tightly coupled multi processors inter connection networks, parallel memory organization.

Data driven coupling, data flow computer architecture.

Parallel algorithms, detection of parallelism, local balancing, communication and synchronization, features of typical parallel languages, monitors and operating systems.

Introduction to hybrid computers.

ELECTIVE I-2 ARTIFICIAL INTELLIGENCE AND APPLICATIONS

Introduction to artificial intelligence: Introduction to AI languages- LISP and PROLOG.

Basic problem solving techniques: Search and heuristics, search algorithms, space search, AND/OR graph, game tree search.

Logic and theorem solving techniques forward chaining, backward chaining, resolution, and deduction.

Structured knowledge representation: Schemata, context-layered databases, truth maintenance, and procedural attachment.

Inference methods, predicate logic, semantic networks, frame, scripts. Programming in PROLOG.

Machine learning, planning, natural language processing, computer vision, and neural networks.
Introduction to expert systems.

ELECTIVE I—3 IMAGEPROCESSING
Digital image processing systems: Image acquisition, storage, processing, communication, display.

Visual perception: Structure of human eye, image formation in the human eye, brightness, adaptation and discrimination.

Image model: Uniform and non-uniform sampling, quantization.

Image transforms: Introduction to Fourier transform, DFT and two-dimensional DFT, some properties of DFT, separability, translation, periodicity, conjugate symmetry, rotation, scaling, average value, convolution theorem, correlation, FFt algorithms, inverse FFt, filter implementation through FFT.

Other transforms : Other seperable image transforms and their algorithms.

4. ELECTIVE II-1 *ROBOTICS*

Robotic manipulation: Automation and robotics, classification, applications, specifications, notations.

Direct kinematics: Dot and cross products, co-ordinate frames, rotations, homogeneous co-ordinates, link co-ordination, arm equation, (Five-axes robot, four-axes robot, six-axes robot), direct kinematics.

Inverse kinematics: General properties of solutions Tool configuration, five-axes, three-four-axes, six-axes robots (inverse kinematics).

Workspace analysis and trajectory planning work envelopes and examples, workspace fixtures, pick and place operations, continuos path motion, and interpolated motion, straight-line motion.

Robot vision: Image representation, template matching, polyhedral objects, plane analysis, segmentation (thresholding, region labeling, shink operators, euler number, perspective transformations, structured illumination, camera calibration.

Task planning: Task level programming, uncertainty, and configuration space, gross motion, source and goal scenes, task planner simulation.

Moments of inertia.

Principles of NC and CNC machines.

ELECTIVE II-2 COMPILER CONSTRUCTION

Lexical analysis: Some sophisticated pattern matching algorithms and their optimization, use of LEX.

Error recovery: Detection, reporting, recovery and repair of errors in the compilation process.

Syntax analysis: Canonical LR prasers, handling of ambiguous grammars, error reporting in LL (1), operator precedence and LR parsing, efficient generation of LALR (1) sets, optimization of LR parsers, optimization of transformations.

Run time storage: Activation records, handling recursive calls, management of variable length blocks, garbage collection and compaction, allocation strategies for arrays, structures, class.

Type checking: Overloading of functions and operators, polymorphic functions, unification algorithm.

Code generation and semantic analysis: Semantic stacks, attributed translation, analysis of syntax, directed translation, evaluation of expressions, control structures, procedure calls.

Code optimization: Basic blocks and folding, optimization within iterative loops, global optimization through flow graph analysis, code-improving transformations, machine dependent optimization.

Compiler-Compilers: Parser generators, YACC attributed LL (1) parser generator, machine independent code generation.

Other topics: Compilers for parallel machines, compilers for functional languages.

5. PROJECT II

Further to Semester VII work, the students shall collect all necessary information and analyze it. The students shall prepare and submit a report on their project. Broadly the report shall have 4 parts: Introduction, Literature Review, Data collection, Experiments conducted, Software Implementation etc. Acquaintance with survey and research methods and their use in conducting a systematic investigation and style of report preparation and presentation shall form the basis of evaluation.

SEMESTER VII

1. STRUCTURED SYSTEMS ANALYSIS AND DESIGN

THE SYSTEMS APPROACH : Background , reasons for adopting systems approach .Using systems approach for problem solving, And information systems design, Determining the scope and structure of a system.

INFORMATION SYSTEM : Classification , transaction Processing systems , OLTP , Decision support systems , Management information systems.

SSAD : Structured systems development life cycle - Preliminary investigation - information gathering - Structured System Analysis - Structured system design - Implementation - Testing a nd Maintenance.

STRUCTURED SYSTEM ANALYSIS : Data flow analysis ,DFD ,Data Dictionaries , Decision trees , Structured English.

STRUCTURED DESIGN : Analysis of input ,output and control . Data modelling - Files and database design**.**

DESIGN TOOLS : Logical design ,physical design , study of design tools ,CASE methodology.
Verification and validation ,software reliability.

IMPLEMENTATION : Selection of Hardware and Software.Implications to multi -user ,networked ,client server ,enterprise - wide environments.

MAINTENANCE : need for maintenance ,corrective , adaptive and enhansive maintenance. Preventive maintenance . Recovery procedures. Reverse engineering. Fine tuning.

PERFORMANCE EVALUATION : figure of merits ,performance monitors ,bench marking

2. Microprocessors III

The 80386 Microprocessor : Software Model, memory address space, data organisation, data types, registers and memory segmentation in the real address mode, real mode instructions. Real
interrupts.

The 80386 Protected Virtual Address Mode: Register model, memory management, address translation, segmentation and segment descriptor table, segment selectors and descriptors, protection model, data access and control transfer, Multi tasking, task state segment and task switches. I / O level protection , paging, protected mode interrupts and exceptions. their priorities, and interrupt / exception transfer methods. Virtual 86 mode of operation. Protected mode specific instructions.

The 80386 signal interface: Bus states, pipelined and non pipelined bus cycles, memory and I / O interfaces, cache memory concepts, cache architectures, Direct mapped, two way set associative cache, cache coherency, Typical cache controller and its operating system concepts. Virtual memory concepts, single tasking and multi tasking concepts, requirements of protection in multitasking applications. Usage in a cache memory subsystem.

The Industry Standard bus Architecture: Introduction to 8 and 16 bit transfers. ISA interrupt subsystem, 82C59A usage and cascading of two 82C59A devices, The IRQ-2 redirect, shareable interrupts, NMI, DMA review, DMA transfer modes of the 8237A controller, ISA DMA subsystem, DMA bus cycle, DMAC addressing capability, addressing local bus memory, ISA bus master capability, bus masters and DRAM refresh. The ISA real time clock and configuration RAM, ISA timer.

3. DATA COMMUNICATION

Elements Of Communication Systems: Communication channel and their characteristics.

Elements of Signals: Classification of systems, LTI systems and reconstruction method, Review of probability and random variables, probability density function, description of random processes in the frequency domain, Gaussian and White processes.

Modeling of Information sources: Measure of information, source coding techniques like Huffman code, Lempel – Ziv Code, Block Code & Cyclic codes, Quantisation, Pulse Code, DPCM, Multiplexers and multiplexing PCM signals, Delta Modulation and adaptive delta modulation, Frequency division multiplexing, synchronous TDM and statistical TDM.

Modulation: its need, basic PAM techniques, Binary PSK, DPSK, QPSK< frequency shift keying, M-ary FSK.

Broadband Signal Receiver: Probability of error, filtering, correlation type demodulator, matched filter demodulator, coherent detector, correlation, errors in binary & M-ary modulation, PAM with ISI.
Noise calculations in digital communication systems.

Introduction to equalizations,

Introduction to data compression techniques.

Introduction to computer communications: Architecture – OSI layer model, circuit and packet switching, protocols, ISDN, Frame Relay and Cell relay techniques.

4. DIGITAL SIGNAL PROCESSING

Discrete Time Signals and Systems: Discrete time signal sequences, Linear Shift Invariant system, Stability, Linear Constant Coefficient difference equations, Frequency domain representation of discrete time systems and signals, symmetry properties of Fourier Transform, Sampling of continuous time signal, Two dimensional sequences and system.

Z Transform: Z-transform, Inverse z transform theorem and properties, System functions, Two-dimensional transforms.

The Discrete Fourier Transform: Representation of periodic sequences, The Discrete Fourier Series, Properties of the discrete Fourier series, Sampling the z-transform, Fourier representation of finite deviation sequences, the discrete fourier transform, properties of the DFT, Linear convolution using the DFT, two dimensional DFT.

Flow Graph and Matrix Representation of Digital Filters: Signal flow graph representation of digital networks, Matrix representation of digital networks, Basic network structures for IIR, Transposed forms, Basic network structures for FIR systems, Parameter Quantization effects, Tellegen's theorem for digital filters and its applications.

Digital Filter Design Techniques: Design of IIR digital filters from analog filters, Properties of FIR digital filters, Design of FIR filters using windows, Comparison of IIR and FIR filters.

Computation of The Discrete Fourier Transform: Goertzel's Algorithm, Decimation in time algorithms, Decimation in frequency algorithms, FFT algorithms for a N composite number, General computational considerations in FFT algorithms, Chirps Z transform algorithm.

Discrete Hilbert Transform: Real and Imaginary part sufficiency for causal sequences, Minimum phase condition, Hilbert Transform relation for the DFT and the complex sequences.

5. THEORITICAL COMPUTER SCIENCE

BASIC LANGUAGE & AUTOMATA THEORY : Review of finite automata, regular sets, Context-free grammars & languages, Moore & Mealy state machines, thier capabilities & limitations. Deterministic & Non-Deterministic FSM's, Push-down stack & memory machine. (PDM)

TUNING MACHINES : Recursive languages, Turing acceptors, techniques for Turing machine construction, Church's hypothesis, Turing machines as generators, variations & equivalence of Turing machines.

UNDECIDABILITY : Universal Turing machines, undecidability of the halting problem, and undecidable problems about context-free languages.

THE CHOMSKY HIERARCHY : Grammars and their rel ations to automata, relations between classes of languages, LR(0) and LR(1) grammars , parser construction.

CLOSURE PROPERTIES OF FAMILIES OF LANGUAGES : Abstract families of languages, language operations, closure and decidability properties.

PROJECT - I

The students are expected to take up a project under the guidance of a teacher from the institute, to be completed in Semester VII and VIII.
This may include:

- Experimental Analysis / Verification.
- Development of Design methods and Verifications.
- Design and Fabrication of a model or a circuit.
- Development of Software for analysis and / or design or decision-making during engineering and management practice.

The student may be asked to work individually or in a group having not more than five in a group.
Basic study through review of literature on the topic selected shall be completed in semester VII. The scope of the project, identification of necessary data, sources of such data etc. shall be identified. The student / group has to prepare a brief hand written report on the work done . The report should include the objective of the project, scope of the project, methodology and review of the literature.

SEMESTER VI

1. OPERATING SYSTEMS

Introduction to history of operating systems : Early batch systems, multiprogramming, timesharing, distributed O.S and multiprocessor O.S. Basic concepts: Processes, files, system calls, shell, layered structure v/s monolithic structure of O.S.

Processes : Process model, process states, process hierarchies, implementation of processes, data structures used such as process table, PCB, creation of processes, context switching, exit of processes.
Interprocess communication: Race conditions, critical sections, problems of mutual exclusion, Peterson's solutions, producer-consumer problem, semaphores, every counters, monitors, message passing.
Process scheduling: Objectives, preemptives v/s non-preemptives scheduling, comparative assessment of different algorithms such as round robin, priority based scheduling, FCFS, SJF, multiple queues with feedback.

Memory management : Multiprogramming with fixed partition, variable partitions, virtual memory, paging, demand paging, design and implementation issues in paging such as page tables, inverted page tables, page replacement algorithms, page fault handling, working set model, local v/s global allocation, page size, segmentation, segmentation with paging.

File systems : File types, attributes, access and security, file operations, directory structures, path names, directory operations, implementation of file systems, implementation of file and file operation calls, implementation of directories, sharing of files, disk space management, block allocation, free space management.

Deadlocks : Conditions, modeling, detection and recovery, deadlock avoidance, deadlock presentation.

Case studies : Unix : Implementation of processes, memory model, file systems, deadlock handling, Strategies, scheduling, IPC, system calls.
WINDOWS NT: Layered structure, interopretability.

Distributed Systems : Introduction to H/W and S/W concepts in distributed systems, network operating systems and NFS, NFS architecture and protocol, client-server model, distributed file systems, RPC- Basic operations, parameter passing, RPC schematics in presence of failures, threads and thread packages.

2. SYSTEMS PROGRAMMING

Introduction to system programs and system programming, review of different

System programs such as assemblers, loaders, linkers, compilers, interpreters, operating systems, device drivers etc.

Elements of assembly language programming, overview of assembly process, design of one-pass and two pass assemblers, macros and macro processors, design of a macro pre-processor, implementation of macro assembler.

Loader schemes, linking schemes, an absolute loader and direct link loader.

COMPILERS

- Introduction to compilers, structure of a compiler, phases of compilation, such as Lexical analysis, code generation, code optimization, table management.
- Implementation aspects of programming language constructs such as data elements, Declarations, binding attributes to names, in built data structures such as arrays, records, sets, strings, expression evaluation, statements of different types, parameter passing (call by reference, value, name), storage management, recursion.
- Design of lexical analyzer.
- Basic parsing techniques such as shift reduce parsing, operator-precedence parsing,
- Top-down parsing, bottom-up parsing.
- Symbol tables: Contents, data structures, representation of scope.
- Syntax directed translation.

3. ANALOG AND DIGITAL INTEGRATED CIRCUITS

Linear Application of OP-AMP: Inverting and Non-inverting, Summing amplifier, Differentiator, Integrator. Adder, Subtractor, Instrumentation amplifier, Voltage follower, V-I, I-V Converter, Precision Rectifiers, Peak Detectors, Clipper, Clamper, Sample/Hold, Log, Antilog, Multiplier, Gyrator.

Voltage Regulators: Specification, Functional Block diagram and applications of 723, 3T regulator ICs like 78xx series and LM317. Principles and working of switching mode regulator.

Timer IC 555: 555 Timer Functional Diagram and Specifications, Application as Monostable, Astable, Bistable, Pulse width modulator.

7107 block diagram, operational details. **7217** a 4-digit Counter, block diagram and operational details.

Power Control ICs: Temperature control and small d.c. motor speed regulation by ICs like SL440, PA436, CA3059 - their block diagram and operational details.

Basic Digital Circuits: Basic operation of gates, Noise margin, Transfer characteristics, Propagation delay and Fan out, Propagation delay of the following - CMOS inverter, TTL gates, ECL circuits. Comparison and interfacing of above logic families.

Combinational Digital Circuits: Functional logic diagram of following ICs their working and applications. Standard gate ICs, Digital Comparator, Decoder - Demultiplexer, Multiplexer, Encoder and their applications.

Sequential Circuits & Systems: Latch, Clocked SR flip-flop, JK, T, D type flip-flop, Asynchronous counters including design, Synchronous counters including design.

4. MICROPROCESSORS II

Overview of microcomputer system, Hardware and Software principles.

Introduction to single chip microprocessor Intel MCS51 family: Architectural and operational features, instruction set , timings , machine cycles, interrupt structures and priorities, internal timer / counter, serial interface. connection of external memory, power saving modes, EPROM programming for EPROM versions

Architecture and organization of 8086/8088 microprocessor: Study of instruction set, assembly language programming, introduction to mixed language programming using C and assembly languages.8086 minimum and maximum mode operation, timing diagrams, 8288 bus controller.8086 interrupt structure.

Memory system design for 8086 Interface of dynamic read/write memory, timing for memory interfacing, connection of I/O controllers,chips:8255,8259,UART 8250 programmable DMA 8237, data communications, EIA RS-232C & IEEE 488, error detection & correction--parity &cyclic redundancy check

The 8087 Co- Processor: Study of architecture of 8087 co-processor, host & 8087 interface, assembly language programming for 8086-8087 interface

Introduction to multi processors systems: Multiprocessor configurations, Study of 8289 bus arbiter, deign of 8086 based multi processors systems(without timing considerations)

5. DATA BASE MANAGEMENT SYSTEMS

Basic Concepts: Purpose of DBS, data obstruction, data models, instances and schemes, data independence, DDL, DML, DB manager, DB administrator, DB users, database system architecture.

Entity Relationship Model: Entity & entity sets, relationships & relationship sets, attributes, mapping constants, keys, ER diagram, generalization, aggregation.

Relational Model: Relational data structure, architecture, data structure, data manipulation, embedded SQL, external level, internal level, relational algebra, relational calculus, SQL, QBE, integrity constants, normalization, indexing & hashing.

Crash Recovery: Failure verification, storage hierarchy, transaction model, log-based recovery, buffer management, and checkpoints.

Concurrency Control: Schedules, serializability, log based protocols.

Transaction Recovery: Storage model, recovery from transaction failure, deadlock handling.

Security & Integrity: Security & integrity violation, authorization & views, security systems in SQL, encryption.

Heiracheal Model: Architecture, data structure, external level, data manipulation, internal level, and logical databases.

Network Model: Architecture, data structure, external level, and data manipulation.
Selection of DBMS.

Introduction to OODB, distributed DB, temporal DB, and active DB.

6. PRINCIPLES OF ECONOMICS AND MANAGEMENT

- Nature and significance of economics, science, engineering, technology and their relationship with economic development, appropriate technology for developing countries.
- Demand, supply, elasticity of demand and supply, Competition: monopoly, oligopoly, monopolistic competition, creating categories of monopoly organisation, price determination under perfect competition and monopoly, price discrimination, equilibrium of firm under competition and monopoly.
- Functions of money, supply & demand for money, money price level & inflation, black money, meaning, magnitude & consequences.
- Functions of Commercial banks, multiple credit creation, banking system in India, shortcomings & improvements.
- Central banking: function of central banking illustrated with reference to RBI, monetary policy making, objectives and features.
- Sources of public revenue, principles of taxation, direct and indirect taxes, distribution of incidence, tax structures, reform of tax system
- Theory of international trade, balance of trade and payment, theory of protection, tariffs and subsidies. foreign exchange control, devaluation
- New economic policy: Liberalization, extending privatization, globalization, and market friendly state, export -led growth.
- Causes of underdevelopment, determinants of economic development, economic and non-economic factors, stages of growth, strategy of development, big push , balanced & unbalanced, critical minimum effort strategy, necessity & type of economic planning.
- Nature of planning, decision making process, management by objectives.
- Communication process, media channels and barriers to effective communication.
- Maslow, Herzberg and Macgregor's theory of motivation. McClelland's achievement motivation, Blanchard's situational leadership theory.
- Production Management.
- Production planning and control, work study, materials management.
- Preventive maintenance, Quality control, Total quality management, Quality Circles.
- Need for good cost accounting system, cost control techniques of financial control, financial statements, financial ratios, break-even analysis, budgeting and budgetary control.
- Marketing functions. Management of sales and advertising marketing research.
- Human Resource management - selection, training and appraisal and compensation administration.

SEMESTER V

1. APPLIED MATHEMATICS V

Probability and topics in Statistics: Statistical experiments with random outcomes, Sample space, probability defined on the basis of sample space and on the basis of events and their combinations. Theorem on probabilities, conditional probability. Bayes theorem. Random variable, probability distribution for discrete and continuous random variables. Density function and distribution functions. Expected values, variance , moments, moment generating functions, Bernoulli's trials, Binomial , Poisson, normal distributions for detailed study with proof, Other common distributions, T , F, Beta, Gamma, X with indication of the applications(without proof) Central limit theorem, Bivariate probability and frequency distributions, Correlations, regression, lines of regression. Introduction to random samples, use of random numbers, stochastic processes, Time series , queuing theory.

Optimisation Techniques

- Problem formulation
- Simplex Method
- Revised Simplex Method
- Duality & Sensivity
- Unconstrained optimisation of several variables
- Numerical methods for unconstrained optimisation : Random search & Univariate method, Fletcher Reverse method, Newtons method

2. COMPUTER ORGANIZATION

- General organization of a digital computer, functional blocks, data representation, fixed and floating point decimal arithmetic, bit slice microprocessor (introduction), full adders, ripple carry adders, look ahead carry generators, multiplicationand division circuits, an arithmetic unit.
- Instruction cycle, instruction sequencing, formats and its interpretation, microprogram concepts and control unit design.
- Semiconductor memory and memory organization, virtual memory, segments, pages, paged segments, cache memory and interleaved memory.
- Concepts of I/O organization, data transfer methods, programmed I/O, DMA, interrupt-based transfer, I/O channels, I/O processors, serial transmission and synchronization.
- Introduction to assembly level programming - concepts of assemblers, macros, linkers, and loaders, linking loaders.
- Multiprogramming and time-sharing, introduction to advanced computer architecture (pipelining, array processors & multiprocessors).
- Introduction to operating systems. Case study (comparative) of DOS & UNIX.

3. OBJECT ORIENTED PROGRAMMING METHODOLOGY

- Introduction to object oriented programming, it's need and requirements, general object oriented philosophy, software usability, code sharing, rapid prototyping, information hiding.
- Classes, attributes and methods, encapsulation, constructor, destuctors, iterator classes, class interface.
- Function overloading, inline, functions, operators & operator overloading, iterators.
- Inheritance base class, derived classes, friend class, static class, type checking, class scopes.
- Multiple inheritance & polymorphism, abstract classes, virtual function, virtual base class, static & dynamic binding, overloading, overriding type conversions.
- Object oriented design, class identification, defining inheritance, visibility & dependency coupling & cohesion.
- Case study of classes like ADT class, I/O class, string class, editor class.
- Language study: C++, object Pascal.

4. DISCRETE STRUCTURES

Introduction to sets: Review only.

Logic : Propositions and logical operations, Truth tables, Equivalence and implication, Laws of logic, Mathematical induction and quantifiers.

Set theory : Method of proof for set, Venn diagram, set membership tables, definitions, Laws of set theory, Partition of sets.

Permutations, combinations and discrete probability :
Introduction to permutations and combinations, Generation of permutation and combination, Discrete probability, Conditional probability.

Relations and Diagraphs :
Relations and diagraphs. , Paths and the relations and diagraphs, Properties of relations, Equivalence relations, Computer representation of relations and diagraphs, Manipulation of relations, Transitive closure, Warshall's algorithm.

Function and pigeon hole principle :
Definition, Types of functions: injective, surjective, bijective, Composition, identity and inverse, Pigeon hole principle.

Graphs , Posets, Hasse Diagram, Lattices

Finite Boolean Algebra, Groups & their Applications

Introduction to Rings & Fields.

5. MICROPROCESSORS - I

Introduction to microprocessors: Features , Programmers model, external & internal organisation.

8085 Architecture: 8085 Architecture & organisation, Instruction cycles, machine cycles and T-states, address decoding techniques, minimum system design, Memory interfacing with timing considerations, clock, reset & buffering circuits

8085 Instruction set: Instruction format, addressing modes, classification of instruction set.

8085 Programming: Assembly language programming:- basic structure, data transfer, arithmetical, logical, transfer of control & miscellaneous instruction types.

Stack & subroutines: Stack operations, limitations, subroutine concepts, parameter passing techniques, subroutine design, delay subroutine design & applications, Re-entrant & recursive subroutines, concept of counters and timers.

I/O data transfer techniques: I/O interface concepts, speed considerations, program controlled I/O, asynchronous & synchronous I/O techniques interrupt driven program controlled I/O, direct memory access data control techniques, handshake signals, concepts of serial communication, matrix keyboard & multiplexed display interface.

Interrupts: Requirements, single level interrupt, multilevel interrupt & vector interrupt system, 8085 interrupt structure and its operation,8259A interrupt controller.

I/O controllers: Features, organisation & operating modes of 8155 multifunction device,8255 programmable peripheral interface, 8254 programmable timer,8237 programmable DMA controller.

6. COMPUTER GRAPHICS

Introduction: Application areas, display devices and hard copy devices, interactive input devices, display processors, co-ordinate systems, vector generation.

Raster Algorithms: Line drawing algorithms -- DDA and Bresenham's algorithm, and aliasing techniques, circle generation algorithm, ellipses and other curves generation, style primitives and display processor interface, area filling-scan line algo, boundary fill and flood fill techniques, text generation and display processor interface.

Geometric transformations in 2D : basic transformations, world, NDC, device and homogeneous co-ordinate systems, composite transformations.

Windowing and clipping: Windowing concepts, window view part transformation algorithms, line clipping algorithms like Cohen-Sutherland and Liang and Barsky, area chipping methods like Sutherland and Holgman.

Segmentation: Segments, segment files, segmented display processor, segment attributes.

Graphics hardware: Display controller, use of DAC and buffer organization.

Introduction to 3-D: 3D co-ordinate system, 3D display techniques, and 3D transformations.

Three-dimensional representations: Modeling polygon and curved surfaces, sweep representations, CSG and B-rep techniques.

3D viewing: Projection methods, viewing transformations, chipping in 3D.

Image synthesis: Hidden line and hidden surface removed techniques like back-face depth buffer method, scan line method, arc subdivision method, ochre methods.

Light and shading: Illumination theory, reflections, textures and surface patterns, shadows, half toning surface shading methods, Gounand shading, Phang shading, Ray tracing.

User interfaces: Interactive input techniques, physical device classification, interactive picture contraction techniques, positioning methods, constraints, grids and field input functions, event handle, design of user interface command language, mean design, output formats.

SEMESTER IV

1. APPLIED MATHEMATICS IV

Complex Variables: Regions and paths in the Z plane. Path/Line integral of a function. Inequality conditions for a path integral to be independent of the path joining two points. Contour Integral, Cauchy's theorem for analytical functions with continuous derivatives. Cauchy Goursat theorem(statement only) and its use for multiply connected regions. Cauchy's integral formula and deductions. Morera's theorem and maximum modulus theorem. Taylor's and Laurent's developments, Singularities, poles, residue at isolated singularity and its evaluation. Residue theorem - Application to evaluate real integrals.

Matrices: Brief revision of vectors over real field, inner product, normal, linear independence, orthogonality. Characteristic values and vectors, and their properties for Hermitian and real Symmetric matrices. Characteristic polynomial. Cayley Hamilton theorem, functions of a square matrix, minimal polynomial, diagonable matrix. Quadratic forms, orthogonal, congruent and Lagrange's reduction of quadratic forms, rank, index, signature of a quadratic form, value class of a quadratic form. Statement of bilinear form.

Vector Calculus: Scalar and Vector point functions, directional derivative, level surfaces, gradient, surface and volume integrals, definition of curl, divergence. Use of operator. Conservative, irrotational, solenoidal fields. Green's theorem for plane regions and properties of line integral in a plane, Statements of Stoke's theorem, Gauss Divergence theorem, related identities, deductions, statement of Laplace's differential equation in cartesian, spherical, polar and cylindrical co-ordinates.

2. ELECTRONICS II

Low and High frequency analysis of BJT and FET amplifier circuits.

Analysis of: RC coupled amplifiers Cascode Amplifiers, Darlington pair and DC amplifiers. Design of two stage RC coupled amplifier.

Feedback Amplifiers: Introduction to negative and positive feedback, current, voltage, series and shunt feedback. Its effect on input impedance, output impedance, voltage gain, current gain and bandwidth.

Oscillators: Positive feedback, oscillators using feedback principle. Derivation for frequency of oscillation and conditions for maintenance of oscillations of (i) RC phase shift (ii) Wien Bridge (iii) Tuned collector / drain (iv) Tuned gate (v) Hartley / Colpitts (vi) Crystal Oscillators.

Analysis of Differential Amplifier: Discrete components, operational amplifiers (ideal), Basic Op-Amp circuits.

Relaxation Oscillator and Linear Sweep Circuits.

Analysis of large signal amplifiers: Class A, B, AB and C. Design of audio frequency power amplifiers of class A and class B type.

Special Devices: Photo sensitive devices, display devices and Schottky diode.

3. PRINCIPLES OF COMMUNICATION ENGINEERING

Signals and their representations:
Fourier series, Fourier transform, continuous spectra, frequency selective networks and transformers.

Basic Information Theory:
Information , entropy of discrete systems, rate of transmission, redundancy, efficiency and channel capacity.

Amplitude Modulation:
Frequency spectrum, power relations, basic requirements and description of various modulators, comparison. DSB, DSBSC, SSB, VSB, spectrum modulators and detectors.

Frequency Modulation: Frequency spectrum of FM, phase modulation, effect of noise, generation of FM and demodulators.

Pulse Modulation: Sampling theorem, low pass and band pass signals, elements of PAM, PWM, PPM, PCM and Delta Modulation. FDM,TDM.A.M. and FM radio transmitters and receivers. Characteristics, block diagrams.

4. LOGIC CIRCUITS

Number systems and codes: Binary, Octal and Hexadecimal number systems. Conversion from any base to another base number system. Binary, BCD, Excess-3, Alphanumeric, EBCDIC, Hollerith, ASCII codes, code conversion, error detecting and correcting codes, parity and Hamming codes.

Binary Arithmetic: Basic rules for addition and multiplication. Sign magnitude notation, One's complement notation. Two's complement notation. Addition and multiplication using binary, octal and hexadecimal number systems.

Boolean Algebra and Logic Gates: Boolean algebra theorems, reduction of logic expressions using boolean algebra, truth tables, minterms, maxterms, SOP and POS forms. Standard SOP and POS forms. Basic and universal logic gates, control aspect of gates, enabling and disabling of gates. K map representation of logical functions, simplification of logic functions using K-maps upto 6 variables. Quine McCluskey method and Veitch diagrams used for logic function reduction.

Combinational Logic Circuits: Concepts of combinational and sequential logic circuits. Realisation of following circuits using gates.:

(a) Systems implementing combinational logic.
(b) Arithmetic circuits, half and full adders, subtractors, multipliers, code converters, parity generators, parity checkers, comparators.
(c) Multiplexers, demultiplexers, encoder, decoder.
(d) Concept of mode control
(e) Application of MSI devices for multiplexer, demultiplexer/decoder, parity generator/checker, concept of capacity expansion using gates. Use of MSI devices for adders, Sequential adder, BCD adder / subtractor, carry look ahead adder, multiplier, fast multipliers, Arithmetic Logic Unit

Sequential Circuits: Concept of Synchronous and Asynchronous operation.

(a) Flip Flops : Basic cell, SR , clocked SR, D, T , J-K, J-K with preset and clear, Master Slave J-K flip flops. Concept of level triggering and edge triggering , flip flop excitation tables, triggering and timing of flip flops.
(b) Registers: Shift registers, bi-directional, serial to parallel, parallel to serial conversion.
(c) Analysis of clocked sequential circuits.
(d) Asynchronous counters: up-down counters, modulo N counter, glitch problem.
(e) Synchronous counters: Use of K- maps for synchronous counters, ring counters, twisted ring counters, counters using shift registers, sequence generators using flip flops.

5. **C PROGRAMMING**

- Features of C, ANSI C, structure of a C program.
- Character set, variable names, data types, constants and declarations, scope and lifetime of variables.
- Arithmetic, logical, relational, increment, bitwise, assignment operators and expressions, conditional expressions, precedence of order of evaluation and type conversion.
- Basic input and output, formatted input and output.

Control structures : Concept of a block statement. IF, IF-Else, Switch, Looping structures - FOR, DO, WHILE, Break and Continue statements, GOTO statement.

Functions : external variables, scope rules, nesting of functions, function of arrays.

Arrays : One dimensional, two dimensional and multi dimensional arrays, their initialisation and manipulation, String handling features.

Pointers : addresses, their initialisation, pointer arithmetic, pointers and functions, pointers and arrays, pointers to pointers, pointers to functions.

Structures and Unions. : Basics of structures, initialisation, structures and functions, structures and arrays, pointers to structures, structures within structures, unions and bit fields.

Dynamic Memory Management : malloc ( ) , calloc ( ) , free ( ), sizeof( ) functions.

File Management : Low level and high level file access. Sequential and random access files, error handling.

Pre processor : macro substitution, header file inclusion, study of standard libraries like stdio.h, ctype.h, string.h, math.h, stdlib.h, stdarg.h, dos.h

6. BUSINESS DATA PROCESSING

Introduction to Business Organization : Need , Structure and nature of Information Systems – data processing activities- Management Information Systems .Introduction to structured programming . Typical analysis of systems like –Inventory, Accounting, Payroll, Production, etc.

Introduction to Input / Output and Data Storage devices : their organisation and access methods .File concept,record layout. Organisation and access strategies of files.

Cobol programming : character set, words,data names, verbs, structure of a cobol program. Elementary and group data items ,structuring of data ,picture clauses.

Arithmetic operations : Add, Subtract, Multiply, Divide and Compute statements, arithmetic expressions and operator precedence.

Data transfer statements: Move; editing and edit pictures .

Condition statements : relational and logical operators,simple and compound conditions .Control structure- IF,nested IF,GOTO,GOTO depending on, PERFORM statements.

Array processing and table handling: OCCURS clause , single and multi-dimensional tables-their definition and usage . PERFORM verb and tables- PERFORM . .TIMES, PERFORM . . UNTIL, PERFORM. . VARYING options.Index tables and index names , SET verb. Searching of tables –SEARCH verb.

Sequential file processing: fixed and variable record file, sorting and merging ,sequential file update operations , magnetic tape files.

Direct access files : index sequential while handling , update of indexed files ,relative files, relative file handling, key address transformations.

Introduction to report writer : report section , report group , description and procedure division statements.

Introduction to sub-routines , sub-programs, segmentation and overlay management.

Introduction to system analysis and database management systems.

SEMESTER III

1. APPLIED MATHEMATICS III

Complex Variables: Functions of complex variables, continuity(only statement), derivability of a function, analytical regular function, necessary condition for a function to be analytic, statement of sufficient conditions, Cauchy Riemann equations in polar co-ordinates. Harmonic functions, orthogonal trajectories, Analytical and Milne Thomson method to find f(z) from its real or imaginary part. Mapping - conformal mapping, linear and bilinear mapping with geometrical interpretations.

Fourier Series and Integrals: Orthogonal and orthonormal functions, expression of a function in a series of orthogonal functions, sine and cosine functions and their orthogonality properties. Fourier series, Drichlet conditions, periodic functions, even and odd functions, half range sine and cosine series, Parseval's relation. Complex form of Fourier series, introduction to Fourier integral, relation with Laplace transform.

Laplace Transforms: Function of bounded variable (statement only), Laplace transforms of 1, at, exp(at), sin(at), cos(at), sinh(at), cosh(at), erf(t), shifting properties, expressions with proofs for L { t f(t) }, L { f(t)/t }, Laplace of an integral and derivative. Unit step functions, Heavyside, Dirac Delta functions and their Laplace transform, Laplace transform of periodic functions. Evaluation of inverse Laplace transforms, partial fraction method, Heavyside development, Convolution theorem. Application to solve initial and boundary value problems involving ordinary differential equations with one variable.

Matrices: Types of matrices, adjoint of a matrix, inverse of a matrix, elementary transformations, rank of a matrix, linear dependent and independent rows and columns of a matrix over a real field, reduction to a normal form, partitioning of matrices System of homogenous and non homogenous equations, their consistency and their solutions.

2. ELECTRONICS I

Application of diodes as rectifiers: Filter analysis and specifications of the devices and components required for C, L, LC, CLC & RC filters. Single and double ended clipping circuits, clamping circuits.

Bipolar Junction Transistors: Introduction to biasing, modelling, Derivation and analysis of different types of transistor models, viz. hparameter model, rparameter model, hybrid pi model, high frequency model. Analysis of biasing circuits, fixed bias, collector

to base bias and voltage divider bias. Calculation of stability factors. Thermal stabilisation and compensation, thermal runaway. Amplification, derivation of expressions for voltage gain, current gain, input impedance and output impedance of CC, CB & CE amplifiers.

Field Effect Transistors: Characteristics and coefficients, biasing circuits for FET amplifiers, AC equivalent circuit of FET. Derivation of expressions for voltage gain and output impedance of CS, CD & CG amplifiers.
BJT as a switch Analysis in transient and steady state.

Design of CE and CS single stage amplifiers. Designing using data sheets of appropriate components.

Voltage Regulators: Analysis of Zener, Series and shunt type of regulators.

3. ELECTRICAL NETWORKS

Linear graphs: Introductory definitions, The incidence matrix A, the loop matrix B, relationship between sub matrix of A and B. Cutsets and cutset matrix, Fundamental cutsets and fundamental tiesets, Planar graphs, A and B matrices, Loop, node, node pair equations, duality.

Network Equations: Time domain analysis, first and second order differential equations, initial conditions, evaluation and analysis of transient and steady state responses to step, ramp, impulse and sinusoidal input functions.

Laplace Transform: It's applications to analysis of network for different input functions described above.

Network Functions: Driving point and Transfer functions. Two port networks, open circuit and short circuit parameters, transmission parameters, hybrid parameters, chain parameters, interconnection of two port networks, cascade connection, series and parallel, permissibility of connection.

Representation of Network Functions: Pole, Zeros and natural frequencies, location of poles, even and odd parts of a function, magnitude and angle of a function, the delay function, all pass and minimum phase functions. Net change in angle, Azimuth polynomials, ladder networks, constant resistance network, maximally flat response, Chebyshev response, calculation of a network function from a given angle and a real part, Bode method.

Fundamentals of Network synthesis: Energy functions, passive reciprocal networks, the impedance function, condition on angle, positive real functions, necessary and sufficient conditions , the angle property of a positive real function, Bounded real function. Reactance functions, Realisation of reactance functions, ladder form of a network, Azimuth polynomials and reactance functions. Impedance and admittance of RC networks. Ladder network realisation, resistance inductance network.

4. ENGINEERING MATERIALS AND COMPONENTS.

Materials for resistors: Carbon, wire wound, film etc., conductors and switches, electrical conductivity of alloys, colour code for resistors, elastic and plastic deformation of solids, strain hardening, brittleness, fibre structure and directional properties, annealing, hot and cold working, soldering, brazing and welding process and materials, fluxes.

Semiconductors: Conduction process in semiconductor, electrical conductivity of p and n type semiconductors, diffusion process, pn junction and current flow in pn junction., breakdown in pn junction, hall effect and its measurements. Crystal growth (especially epitaxial growth) and I.C. fabrication. Materials for photoconductive, photoemissive and solar cell.

Dielectric properties of insulators: In static fields, polarization and dielectric constant. Dielectric constant of gases. The internal field in solids and liquids. Spontaneous polarization, ferroelectric materials. Types and values of condensers, temperature compensation, electrolytic capacitors. Insulators - dielectric properties, permitting polarization, dielectric loss, non linear dielectric material, piezo electricity, ferro electricity, breakdown of solid insulators.

Magnetic properties of materials: The magnetic dipole moment of current loop, diamagnetism, origin of permanent dipole moment in matter. Paramagnetism, ferromagnetism, hysteresis, spontaneous magnetisation and Curie- Weiss law. Ferromagnetic, ferrimagnetic and anti-ferromagnetic materials and the effect of hardening.

Components: Resistors, thermistors, varistors, selenium surge suppresors, variable resistors, potentiometers, variable capacitors, characteristics of capacitors, inductors, transformers for If and Hf applications, relays, fuses, characteristics, heat sink materials, switches, connectors.

5. NUMERICAL METHODS

Errors in Numerical Computation.: Their types, analysis and estimation, numerical instabilities in computation.

Solutions to Transcendental and Polynomial equations: Bisection method, secant method, Regula Falsi method, Newton Raphson method for polynomial equations.

Solutions to System of Linear Algebraic Equations.: Cramers rule, Gauss elimination method, Gauss Jordan method, Triangularization methods- Gauss Siedel method of iteration.

Interpolation and Approximation.: Linear interpolation and high order interpolation using Lagrange and Newton Interpolation methods, finite difference operators and interpolation polynomials using finite differences. Approximations- least square approximation technique, linear regression.

Numerical Differentiation.: Methods based on interpolation and finite differences.

Numerical Integration.: Trapezoidal rule, mid-point method, Simpsons 1/3rd and 3/8th rule.

Solutions to ordinary differential equations .: Taylor series method, Picards method of successive approximation. Eulers method, Eulers predictor and corrector method. Runge Kutta method for 2nd and 4th order. Initial and boundary value problems.

Numerical Optimisation.: Golden section search, Brents method, minimisation using derivatives, introduction to linear programming

6. COMPUTER METHODOLOGY AND ALGORITHMS.

SORTING : Bubble Sort, Selection Sort, Saker Sort, Insertion Sort, Shell Sort, Quick Sort, Heap Sort, Merge Sort, Radix Sort.

Searching: Sequential Searching, Hashing

Stacks and Queues

Linked Lists

Binary Tree : Insertion, Deletion, Traversal

Graph : Representation, Transitive Closure or path matrix, Graph Traversal, Shortest path problem, minimal cost spanning tree, Backtracking and greedy algorithms.

Matrix Operations: Strassen's Matrix Multiplication, LU decomposition matrix, Sparse matrices.

Algorithms and its Efficiency

Hash functions, collision handling techniques, array representation, evaluation of expression in Postfix form, Infix to Postfix conversion.

SEMESTER II

1. APPLIED MATHEMATICS - II

Differential Equations:

1. Exact differential Equations and those which can be made exact by use of integrating factor. Integrating factor by inspection, Linear equations & reducible to linear (Bernoulli equations), method of substitution to reduce the eqn. to one of the above forms.
2. Linear Diff. Eqn. of nth order with constant coefficients, complimentary function & particular integral when the function of the integral on the R.H.S. are exponential, Sin(ax + b), Cos(ax + b).Cauchys Linear equation(Homogenous eqn.). The Legendre Linear equation, Variation of parameters & method of undetermined coefficients.
3. Elementary application of above diff. Eqn. in solving engineering problems from Electrical Engg., Chemical Engg., Mechanical Engg., and Civil Engg.

Integral Calculus: Rectification of plane curves, Double and Triple integrals, Their geometrical interpretation & evaluation. Evaluation of double integrals by change of order and change to polar. Application of double and triple integrals to areas, volumes & mass.

Beta & Gamma Functions:
1. Beta & Gamma function & their properties, relation between Beta & Gamma functions.
2. Error Functions.
3. Differentiation under the integral sign.

2. APPLIED PHYSICS II

Theory of production of X-rays: Continuous and Characteristic X-rays spectra, X-ray diffraction, Laue spots, Braggs law and Moseleys law. Determination of crystal structure. Braggs spectrometer method and power method.

Optics: Interference in thin film, Newtons rings and fringes in wedge shaped films. Fraunhoffer diffraction grating (with derivation of formula).

Principles of Laser: Spontaneous and Stimulated radiation, Population inversion, Pumping methods. Ruby and He-Ne laser, Carbon dioxide laser, Semiconductor lasers (Dye lasers and holography).

Fiber Optics: Types of optical fibres, step index and graded index, numerical aperture. Communication through optical fibers.

Dual nature of matter: DeBroglie waves, Verification of matter waves, uncertainty principle, electron microscope- Introduction and application. Detection and measurement of radiation. Structure of nuclear binding energy, Nuclear fission. Nuclear reactors, Nuclear fusion. Detection and measurement of nuclear radiation by emulsion plates, cloud chamber & Bubble chamber.

Super Conductivity: Basic theory, Meissner effects, London equation, properties of super conductors.

3. APPLIED CHEMISTRY II

Phase rule: Basic principles of phase rule, application of phase rule to water system. Condensed phase rule, allotropes of iron, study of iron-carbon equilibrium diagram.

Corrosion: Definition, electrochemical theory of corrosion, factors affecting the rate of corrosion, different types of corrosion, protection against corrosion, factors affecting the rate of corrosion - design and selection. Cathodic and anodic protection, protective coatings- metallic, inorganic, organic coatings, corrosion inhibitors.

Fuels: Classification, calorific value, determination by bomb calorimeter and Dulongs formulae, problems based on calorific value, characteristics of fuel, types of coal and its analysis. Preparation and properties of metallurgical coke. Liquid fuels, classification, refining of petroleum, thermal and catalytic cracking, synthetic gasoline, purification of gasoline, knocking, octane and cetane number, anti knock agents. Gaseous fuels - natural gas, coal gas, producer gas, water gas. Problems based on combustion of fuels.

Cement: Raw materials, composition, method of manufacture : wet and dry process. Properties of cement, setting and hardening of cement, testing of cement.

Alloys: Introduction, purpose of making alloys, composition. Properties and uses of plain carbon steels and alloy steels - heat resistant steel, shock resistant steels, magnetic steels, corrosion resistant steels, tool steels. Non Ferrous alloys - Copper(Brass, Bronze, German Silver), Nickel(Nichrome, Monel), Aluminium (Duralumin, Y-alloy, Magnalium), Lead and Tin (Solders, Brazing alloys, type metal, wood metal).

Biotechnology: Introduction, application to waste treatment, energy development, industrial product development, basic ideas of industrial fermentation.

4 ENGINEERING DRAWING II

- Development of lateral surfaces of solids when cutting plane is perpendicular to H.P. or V.P. including curved cuts.
- Intersection of surfaces of solids- prism, pyramid, cone or cylinder penetrated by any prism or cylinder.
- Isometric & Oblique parallel projections, simple block and cylindrical type objects & spheres.
- Primary auxiliary views of machine parts involving inclined surfaces.
- Reading of orthographic projections, drawing of missing views & converting into sectional views.
- Free hand sketches of the following machine elements
  1. Rivet heads and riveted joints.
  2. Thread profiles of IS V & square threads, metric, buttress, acme, knuckle, I.S. convention of representing external and internal V and square threads.
  3. Bolts- hexagonal, square-prevention of rotation of bolts.
  4. Nuts-hexagonal, square, wingnut locking by lock nuts, castle nut, split pin lock plate.
  5. Studs- plain- collar.
  6. Washer-plain, chamfered & spring washer.
  7. Set screws.
  8. Foundation bolts-rag, eye.

5. ENGINEERING MECHANICS II

Kinematics of a particle: Velocity and acceleration in terms of rectangular co-ordinate system. Rectilinear motion, motion along plane curved path., tangential & normal components of acceleration, acceleration-time, velocity-time graphs and their uses, projectile motion, simple harmonic motion.

Kinematics of rigid bodies: Translation, pure rotation & plane motion of rigid bodies, link mechanism, instantaneous centre of rotation for the velocity & velocity diagrams for bodies in plane motion, acceleration in plane motion, relative velocities.

Kinetics of particles and kinetics of rigid bodies: D'Alemberts principle, equation of dynamic equilibrium, linear motion, curvilinear motion, mass moment of inertia about centroidal axis & about any other axis. D'Alemberts principle for bodies under the motion of rotation about a fixed axis and plane motion. Application to motion of bars, cylinders, spheres.

Momentum and Energy principles: Linear momentum, principle of conservation of momentum, work done by a force. Work-energy equation, principle of conservation of energy, potential and kinetic energy & power, impact of solid bodies, elastic impact, semi elastic and plastic impact.

Simple Lifting Machines: Mechanical Advantage, Velocity Ratio & efficiency of the machine, law of machine, condition of maximum efficiency, self locking of the machine. Following machines will be studied- a) Single purchase crab, b) Double purchase crab, c) Differential wheel and axle, d) Differential pulley block, e) worm and worm wheel, f) Simple screw jack.

Stress & Strain: Stress, Strain, modulus of elasticity, Bulk modulus, yield stress, ultimate stress, factor of safety, shear stress, Poissons ratio, Bars of varying section, composite sections, temperature stresses.

Belt Friction: Transmission of power by belts and ropes, centrifugal and initial tension in the belts or ropes. Condition for maximum power transmission. Flat belts on flat pulleys & ropes on grooved pulleys.

6. COMMUNICATION SKILLS II

Report Writing: . What is a report, qualities of a report, formats (letter report, memorandum, book report)

Reports. Informative report, analytical report, feasibility report, survey report, current event report.

Project. Practical session, topics to be assigned to group of students for report writing and presentation in class.

Meeting Documentation. Writing of a notice, agenda and minutes of a meeting.

Special types of exposition:

a) Description of objects.
b) Explanation of a process.
c) Giving instructions- oral instructions, written instructions.

7. COMPUTER PROGRAMMING II

- Flow of control in Pascal, the compound statement, the iterative statement, conditional statements, unconditional branching, avoidance of unconditional branching.
- Structured Data types, Arrays and multidimensional arrays, Packed arrays, records and sets.
- Functions and Subprograms, parameter passing.
- Debugging and testing, documentation and maintenance.
- Problem design methods, Top-down modular programming.
- Additional Data structures, pointers, linked lists, list representations, node, operations on a linked list, binary search trees, searching the tree, operations on a tree.

8. BASIC ELECTRICITY AND ELECTRONICS II

AC Circuits: Sinusoidal voltage and current, waveforms, RMS and average value, form factor, crest factor, frequency, periodic time, behavior of resistance, inductance and capacitance in AC circuit, RLC series and parallel circuit, phasor diagram, resonance, bandwidth and quality factor.

Polyphase Circuits: Three phase system of voltages and currents, star and delta connection, balanced three phase circuit, relationship between line and phase currents and voltages, phasor diagram, power in three phase circuits, measurement of power by one wattmeter, two wattmeter and three wattmeter methods.

Transformers: Construction of single phase transformers, function and working principle, development of equivalent circuit, phasor diagram, O.C. and S.C. tests, efficiency and regulation, all day efficiency, condition for maximum efficiency.

Semiconductor Electronics: PN diode construction, characteristics, effect of temperature on diode, rectification using diodes, C, L, LC and PI filters. BJT construction, characteristics, CE, CB and CC configuration.

9. BASIC WORKSHOP PRACTICE – (For semester I and semester II)

Fitting: Use of setting and fitting tools for chipping, cutting, filling, marking, Center punching, drilling , tapping, die threading.
Carpentry: Use and setting of hand tools like hacksaws, jack planes, chisels and gauges for construction of various joints, wood turning, modern wood working methods, joining methods.
Welding: Use of welding machine. electric arc welding, edge preparation for welding, types of joints, Sheet metal working and brazing: use of sheet metal working hand tools, cutting, bending, spot welding and brazing.
Forging and Smithy: Use and setting of hand tools such as hammers, chisels, flat and swages, use of hearth, anvil etc.
Machine tools and machining processes: Lathes, milling machines, drilling machines, grinding machines, operations such as turning, milling, grinding and drilling.

SEMESTER I

1. APPLIED CHEMISTRY I

Water: Impurities in water and their effects on quality, hardness and estimation of hardness by soap and EDTA methods, problems based on determination of hardness, softening of water, methods of softening: lime soda, permutit and ion exchange methods, calculation of requirement of softening reagents, boiler feed water, boiler problems and methods of rectification, industrial uses of water.

Refractories: Definition, criteria of good refractories, classification of refractories ,properties, testing and failure of refractories, glass, manufacture and properties, types of glass.

Polymers: Classification of polymers, types of polymerization, methods of polymerization, classification of plastics, compounding of plastics, fabrication of plastics, industrial uses of plastics, manufacture, properties and uses of polyethylene, polyvinyl chloride, phenol formaldehyde and urea fomaldehyde.

Lubricants: Definition and function ,classification: solid, semisolid, blended and synthetic lubricants. purification and refining of lubricants from mineral oils, mechanism of lubrication, physical and chemical testing of lubricants, testing of lubricants.

Elastomers: Natural rubber, its drawbacks, vulcanisation and its effects upon properties, compounding of rubber, synthetic rubber: nitrile, neopropene, polyurethane, silicon and styrene rubber. Industrial uses of rubber and recovery of rubber from waste.

Pollution and Pollution Control: Atmospheric pollution, nature of pollutants, their effects and methods to reduce atmospheric pollution. water pollution, nature of pollutants, their effects and methods to reduce water pollution.

2. APPLIED MATHEMATICS - I

Complex Variables: Definition, Cartesian, polar & amplitude ; exponential form. de moivres theorem. power & amp; roots of exponential and trigonometric forms. hyperbolic and logarithmic functions. inverse hyperbolic and inverse trigonometric of all types of functions.

Vector Algebra: Triple Product, Vector Differentiation, Curvature and Torsion, Equation of planes.

Calculus: Successive differentiation, std form to find the nth derivative, Leibnitz theorem, Rolles theorem ,Lagranges and Cauchys mean value theorem, Taylors theorem, Taylor and Maclaurins series, indeterminate forms, Lhospitals rule, expansion of functions in power series, partial derivatives of first and higher orders, total differentiation concept of commutative partial derivatives, Eulers theorems of homogeneous functions, deduction from Eulers theorems ,errors, approximations, maxima and minima functions of two variables.

3. APPLIED PHYSICS - I

Elements of Crystal Structure: Packing Factor, Diamond cubic and Barium Titanate structure, Miller indices, indices of crystal directions, ligancy and critical radius ratio of ionic crystals, crystal imperfections, expression of equilibrium, number of point defects.

Formation of energy bands and classification of solids: Conductors, insulators, semi conductors, intrinsic p and n type, semiconductor diode as a rectifier, npn and pnp transistors.

Ultrasonics: Piezoelectric and magnetostriction effect ,piezoelectric crystals, quartz and ceramics, ultrasonic transducers, application: echo sounding, thickness measurement, cavitation and non-destructive testing, flaw detection.

Thermoelectric Effect: Law of intermediate temperatures and metals, neutral temperature and inversion temperature, peltier effect, thermocouple as a temperature measuring device, semiconductor as a device to measure temperature.(thermistors)

Motion of Charged ParticLes in Electric and Magnetic Fields : Magnetic and Electrostatic Focusing, cathode ray tube ,cyclotron, mass spectrograph.(Aston and Bain bridge).

4. BASIC ELECTRICITY AND ELECTRONICS I

Fundamentals of electricity: Units, electric current, Ohms law, Kirchoffs laws, loop and nodal analysis, series and parallel combination of resistances.

Network theorems: Star delta transformation, superposition theorem, Thevenins theorem,Nortons theorem, maximum power transfer theorem.

Electromagnetism: Amperes law, force between magnetic poles, field intensity, flux, flux density, Biot- Savarts law, mmf, reluctance, magnetisation curve, hysteresis loop and losses, series and parallel magnetic circuits, self and mutual inductance, laws of electromagnetic induction, Flemings right and lefthand rule, energy stored in an inductor, rise and decay of current in r-l circuit, time constant.

Electrostatics: Coulombs law, electric field, electric field intensity, electric flux and flux density, absolute electric field potential and potential difference, dielectric and dielectric strength, capacitance, parallel plate capacitor, composite parallel plate capacitor, energy stored, charging and discharging in r-c circuits, capacitances in series and parallel.

5. COMPUTER PROGRAMMING I

Basic Anatomy of Computers: Components of computer systems, IBM compatible PC

Introduction to operating systems: Need for an operating system, internal commands of MS- DOS, external commands. batch files, introduction to system software.

Introduction to Lotus 1-2-3: Worksheet using keyboard with 1-2-3 basic skills, using 1-2-3 menus, commands indicating range of cells moving pointer, constructing blank forms, changing entries in the cell, sorting the worksheet, using formulae, keyboard macros.

Pascal Programming:

- Introduction to computer programming, steps involved in computer programming, the problem definition phase.
- Algorithms ,developing algorithms, efficiency of algorithms
- Simple Pascal-concept of data types, the standard scalar data types, additional scalar data types, names in Pascal, scalar variables.
- Elementary Pascal programming, arithmetic expressions, use of standard functions, boolean expressions, the assignment statement, input and output, structure of a Pascal program.

6. COMMUNICATION SKILLS I

Communication: What is communication? Importance of communication, barriers to communication, verbal and non verbal communication, oral and written communication ,techniques to improve communication, internal and external communication.

Business correspondence: Principles of correspondence, language style, format of the business letter, types of business letters, application letter with bio data. enquiries, reply to enquiry, claims, adjustments, sales letters.

Group Discussion: Importance of group discussion, techniques of group discussion.

Precis Writing: Importance of precis, techniques of precis writing, one word substitution, precis of short units, precis of passages, summaries of letter reports, short messages.

7. ENGINEERING DRAWING I

- Introduction, Lettering
- Engineering Curves
- Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypercycloid, Involutes, Archemedian spirals, tangents and normals to the above curves, simple helical curves on cylinder and cones.
- Projection of Points and Lines
- Projections of planes including planes inclined to both planes.
- Projections of solids prism, pyramids ,cylinder and concluding those axes inclined to both the HP and VP
- Sections of Solids
- Orthographic Projections.

8. ENGINEERING MECHANICS I

System of Coplanar Forces: Resultant of concurrent forces, parallel forces and non parallel non concurrent system of forces, moment of force about any point, couples, Varignons theorem, distributed forces in plane.

Centroids of plane areas: Center of gravity of wires bent into different shapes, moment of inertia of plane areas.
Equilibrium of system of coplanar forces: Conditions of equilibrium for concurrent, parallel and non concurrent, non parallel system of forces and couples. types of supports, determination of reactions at supports for various types of structures.
Analysis of pin jointed plane frames: Perfect frame ,method of joints, method of sections.

Forces in space: Resultant of concurrent, parallel ,general force system. moment of a force about a point, finding scalar and vector components of the force and the moment of the force along the axis.

Equilibrium of forces in space: Condition of equilibrium ,application to simple space pin jointed frames having roller/hinged supports by method of joints.

Friction: Laws of friction, cone of friction ,equilibrium of bodies on an inclined plane, application to problems involving wedges ,ladders, screw jack etc.

Virtual work: Equilibrium for an ideal system, applications to the reactions of beam with internal hinges and link systems.

Graphic statics: Bows notation, force polygon, funicular polygon, Maxwell diagram, problems involving beam reactions, centroid of plane areas or bent bars, determination of forces in trusses.