ASSISTANT ENGINEER

SYLLABUS: (AE) CIVIL ENGINEERING

PART-I

1. **Surveying**

   Geomatics Engineering: Principles of surveying; Errors and their adjustment; Maps – scale, coordinate system; Distance and angle measurement; Traversing and triangulation survey; Total station; Horizontal and vertical curves; Basics of photogrammetry and remote sensing; Uses of drones.

2. **Structural Engineering**

   Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and its applications; Centre of mass.

   Solid Mechanics: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion; Buckling of column; Combined and direct bending stresses.

   Structural Analysis: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams and cables; Displacement methods: Slope deflection and moment distribution methods; Influence lines.

   Concrete Structures: Limit state design concepts; Design of beams, slabs, columns; Bond and development length; Water tanks; Prestressed concrete beams.

   Steel Structures: Limit state design concepts; Design of tension and compression members, beams and beam-columns, column bases; Connections – simple and eccentric, beam-column connections, plate girders and trusses; Concept of plastic analysis - beams and frames; Steel tanks.

3. **Geotechnical Engineering**

   Soil Mechanics: Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability – one dimensional flow, Seepage through soils, flow nets, uplift pressure, piping, capillarity, seepage force; Principle of effective stress and quicksand condition; Compaction of soils; One-dimensional consolidation, time rate of consolidation; Shear Strength, Mohr's circle, effective and total shear strength parameters.

Foundation Engineering: Sub-surface investigations; Earth pressure theories; Stability of slopes; Stress distribution in soils; Shallow and deep foundations.

4. Water Resources Engineering

Fluid Mechanics: Basic properties of fluids, fluid statics; Continuity, momentum and energy equations and their applications; Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth; Concept of lift and drag.

Hydraulics: Flow measurement in channels and pipes; Dimensional analysis; Open channel hydraulics – Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, gradually varied flow and water surface profiles.

Hydrology: Hydrologic cycle; evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, ground water hydrology – steady state well hydraulics and aquifers.

Irrigation: Types of irrigation systems and methods; Crop water requirements – Duty, delta, evapo-transpiration; Gravity dams and Spillways; Lined and unlined canals, Design of weirs on permeable foundation; Cross drainage structures.

PART-II

1. Transportation Engineering

Highways: Geometric design of highways – alignments, cross-sectional elements; Specifications of hilly roads; Materials – desirable properties as per IRC and tests; Desirable properties of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible and rigid pavement (PQC) using IRC codes; Durability aspects of pavements; New machinery and technology adopted in highway construction and maintenance; Basics for preparation of DPRs.

Traffic Engineering: Traffic studies on flow and speed, peak hour factor, accident study, statistical analysis of traffic data; Traffic signs; Signal design; Types of intersections; Highway capacity.

Bridges: Site selection; Economic spans, bridge components; Types of bridges and selection of suitable type, IRC specifications and standard loading; Types of bridge foundations; Pier, pier caps, abutments; Approaches and bearing; Basics of T-beams

with diaphragm, culverts, box girder bridges, cable-stayed and suspension bridges; Construction procedures of foundation and super structures.

2. Environmental Engineering

Water and Wastewater Quality and Treatment: Sources of water; Basics of water quality standards – Physical, chemical and biological parameters; Water requirement; Water quality index; Drinking water standards, Unit processes and operations of water treatment; Water distribution system; Sewerage system design, quantity of domestic wastewater, Primary and secondary treatment; Effluent discharge standards; Sludge disposal; Reuse of treated sewage for different applications.

Air Pollution: Types of pollutants, their sources and impacts, air pollution control, air quality standards, Air Quality Index and limits, Effects of air pollution on human health.

Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

3. Construction Materials and Management

Construction Materials: Structural Steel – Composition, material properties and behaviors; Concrete – Constituents, mix design, quality control, short-term and long-term properties.

Construction Management: Types of construction projects; Project planning and network analysis – PERT and CPM; Cost estimation.

ASSISTANT ENGINEER

SYLLABUS: AGRICULTURAL ENGINEERING

Paper-I

1. Thermodynamics and Heat Engines:

Concepts of energy, temperature, and heat equations; laws of thermodynamics; pure substances and their properties; entropy; air-standard, Otto and Diesel cycles; indicator diagrams.

2. Farm Power:

Sources and status of power in India; farm power and agricultural productivity relationship; construction and operational features of IC engines, various systems of IC engines, namely carburetion, ignition, cooling, and lubrication; valves and valve timing; special features of diesel engines; tractors and their classification; power transmission, repair, and maintenance; tractor testing and tractor economics; power tillers - their economics and suitability; energy in agriculture.

3. Farm Machinery:

Design, construction, operation, repair, and maintenance of tillage tools, implements, and equipment such as mouldboard and disc ploughs; harrows; cultivators; rotary tillers; seeding and planting machines; hoes; weeders; sprayers and dusters; harvesters, threshers, and combines; soil and crop factors influencing machine performance and energy requirements; selection of farm machines; economics of agricultural mechanization; earth-moving machinery.

4. Heat and Mass Transfer:

Heat transfer process; Steady state conduction, Fourier law, Convection and radiation heat transfers, equations for radiative, convective and overall heat transfers for various geometries; Heat flow through slab, sphere and cylinder; Heat Exchangers; Mass transfer process and their application in food engineering; Fick's law of diffusion and convective mass transfer; Psychrometrics; Thermal properties of materials and fluids.

5. Renewable and Bioenergy:

Solar energy, solar collectors, air heaters, solar dryers, water heaters, solar cold storage, photovoltaic systems, PV pumps, fencing; wind energy, suitable sites, types of windmills,

components, applications, performance; biomass resources, agro residues, biochemical and thermochemical conversion, biogas plant, pyrolysis, gasification, briquetting; alternate energy systems, hydropower; energy storage systems; energy conservation, energy plantation, environmental impact, global warming; biofuels, feedstock, production, emission standards and control.

6. Post Harvest Process and Food Engineering:

Unit operations in post-harvest processing (Cleaning, grading, separating, drying, milling, storage, evaporation etc.); Importance of engineering properties of agricultural produces and machinery for the processing of grains; Processing of cereals, pulses oilseeds and vegetables, animal feed, spices, dairy products, meat and fish; Dairy operations; Homogenization, pasteurization, sterilization and products; Refrigeration and freezing of food products.

7. Storage and Handling:

Changes in stored grains and products during storage; Design features of various storage structure; Aeration, Fumigation, controlled atmospheric storage, modified atmosphere storage, cold storage and frozen storage; Management of cold storage; Storage of food products, fruits and vegetables, dairy products, meat and fish; Packaging; concept, methods; Food Laws and Regulations in India; Material handling; Application, conveyer, elevator, design concept.

Paper-II

1. Hydraulics and Fluid Mechanics:

Fluid properties, units, and dimensions: surface tension and capillarity, equation of continuity, Bernoulli equation, laminar and turbulent flow, steady and unsteady flow, flow of fluids in pipes and open channels, design of open channels for non-erosive and non-silting velocities, most economical cross-section, measurement of irrigation water, and other water measuring devices such as weirs, notches, orifices, and flumes.

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(AGRICULTURAL ENGINEERING)

2. Surveying and Levelling:

Linear measurements, chain surveying, cross staff survey; Errors in measurements, their elimination and correction; Compass survey, planimeter; Plane table surveying, methods, advantages and disadvantages; Levelling, levelling difficulties and error in levelling, contouring; Computation of area and volume, estimation of earthwork.

3. Soil Mechanics:

Three phase system of soil, determination of index properties, classification of soils; Soil water: analysis of effective and neutral pressures under different hydraulic pressures at different points below the soil. Darcy's law, determination of permeability by laboratory and field methods, horizontal and vertical hydraulic conductivity and seepage analysis using flownet. Compaction, consolidation and shear strength analysis using Mohr circle. Analysis of active and passive earth pressures on retaining wall, Rankine's theorem of earth pressure.

4. Soil and Water Conservation Engineering:

Water erosion: Mechanics and forms- splash, sheet, rill, gully, ravine and stream bank erosion; Soil loss estimation; Wind erosion: Factors affecting, mechanics, soil loss estimation and control measures - vegetative, mechanical measures, wind breaks and shelter belts and stabilization of sand dunes. Water erosion control measures: Agronomical measures, contour farming, strip cropping, conservation tillage and mulching; Engineering measures- bunds and terraces, bunds: contour and graded bunds- design; terraces: level and graded broad base terraces, bench terraces - planning, design and layout procedure; Gullies: classification, stages of development; Gully and ravine reclamation- principles of gully control, vegetative measures, temporary structures and diversion drains. Grassed waterways and design. Permanent structures for soil conservation and gully control- check dams, drop, chute and drop inlet spillways- design requirements, planning for design, design procedures. Water harvesting techniques: Classification based on source, storage and use; Farm pond-components, site selection, design criteria, capacity, embankment.

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(AGRICULTURAL ENGINEERING)

5. Hydrology and watershed management:

Hydrologic cycle, components; Precipitation and its forms, rainfall measurement and estimation of mean rainfall, estimation of missing rainfall, optimum number of rain gauges. Frequency analysis of point rainfall; Mass curve, hyetograph; Infiltration - factors influencing, measurement and indices; Evaporation - estimation and measurement; Runoff - factors affecting, measurement, stage-discharge rating curve, estimation of peak runoff rate and volume, rational method and SCS curve number method; Hydrograph, synthesis and analysis, base flow separation, unit hydrograph theory and its applications, S-curve. Flood peak, design flood and computation of probable flood; principles of flood routing, channel and reservoir routing. Definition of watershed, geomorphological analysis of watershed, watershed prioritization, principles and practices of sustainable and integrated watershed management; watershed workplan.

6. Irrigation and Drainage Engineering:

Water wealth and irrigation in India; soil-water-plant relationship; forms and occurrence of soil water; methods and devices for soil moisture measurement; water requirement of crops; irrigation scheduling; irrigation methods, their hydraulics and design—flood, border, furrow, sprinkler, and drip irrigation; concept of irrigation efficiencies; water conveyance and control; design of canals, Lacey and Kennedy's theories. Drainage needs and its benefits; Darcy's Law, hydraulic conductivity; drainage coefficient; drainage methods, surface drainage; design of open ditches, their alignment and construction; designs and layout of subsurface drains; depth and spacing of drains and drainage outlets; installation of drains and drainage wells; drainage of salt-affected areas.

7. Ground Water, Wells and Pumps:

Occurrence and movement of groundwater, groundwater resources development and utilization, artificial recharge techniques. Well hydraulics; steady and unsteady flow towards a well in confined, unconfined; pumping tests Design, construction and development of tube wells; Water lifting devices, Classification of pumps, components of centrifugal pumps, pump selection, performance curves, effect of speed on capacity, head and power, effect of change of impeller dimensions on performance characteristics, Hydraulic ram, deep well turbine pump, and submersible pump.
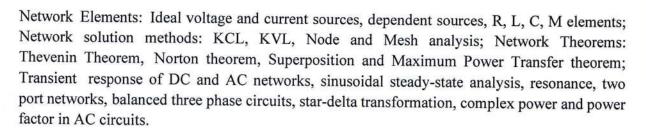
ASSISTANT ENGINEER

SYLLABUS: ELECTRICAL ENGINEERING

Paper-I

1. Electric Circuits

Network Elements: Ideal voltage and current sources, dependent sources, R, L, C, M elements; Network solution methods: KCL, KVL, Node and Mesh analysis; Network Theorems: Thevenin Theorem, Norton theorem, Superposition and Maximum Power Transfer theorem; Transient response of DC and AC networks, sinusoidal steady-state analysis, resonance, two port networks, balanced three phase circuits, star-delta transformation, complex power and power factor in AC circuits.

2. Electromagnetic Fields

Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss's Law, Divergence, Electric field and potential due to point, line, plane and spherical charge distributions, Effect of dielectric medium, Capacitance of simple configurations, Biot-Savart's law, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Magneto motive force, Reluctance, Magnetic circuits, Self and Mutual inductance of simple configurations.

3. Electrical Machine-I

Magnetic circuits, Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three-phase transformers: connections, vector groups, parallel operation; Auto-transformer, Electromechanical energy conversion principles; DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, speed control of dc motors.

4. Power Systems-I

Overview of different conventional generation systems. Renewable power generation systems, Hybrid power generation systems. Economic analysis of renewable and hybrid generation systems; Cogeneration systems. AC and DC transmission and distribution systems. Different types of conductors, Mechanical designs of overhead lines including sag. Line insulators. Underground cables. Complex power, PU systems. Line parameter: resistance, capacitance and inductance of shot medium and long, lines, Skin effect, corona effects, performance of short, medium and long transmission lines. Efficiency and Voltage regulation of shot, medium and long transmission line. Introduction to Load flow analysis, Generation and absorption of reactive power in the transmission systems. Line compensation, Economic operation of power systems. Unit power commitment.

ASSISTANT ENGINEER

(ELECTRICAL ENGINEERING)

5. Electrical and Electronic Measurements.

Indicating instrument, deflecting torque, controlling, torque, damping torque, PMMC instruments, dynamometer type instruments, Moving Iron instrument, wattmeter, energy meter, Megger, measurement of power and energy, Bridges and Potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, Digital voltmeters and multi-meters, Phase, Time and Frequency measurement; Oscilloscopes, Error analysis

Paper-II

1. Signals and Systems.

Representation of continuous and discrete time signals, shifting and scaling properties, linear time invariant and causal systems, Fourier series representation of continuous and discrete time periodic signals, sampling theorem, Applications of Fourier Transform for continuous and discrete time signals, Laplace Transform and Z transform. R.M.S. value, average value calculation for any general periodic waveform.

2. Electrical Machine-II

Three-phase induction machines: principle of operation, types, performance, torque-speed characteristics, no-load and blocked-rotor tests, equivalent circuit, starting and speed control; Operating principle of single-phase induction motors; Synchronous machines: cylindrical and salient pole machines, performance and characteristics, regulation and parallel operation of generators, starting of synchronous motors; Types of losses and efficiency calculations of electric machines.

3. Power Systems-II

Models and Economic Load Dispatch (with and without considering transmission losses), Series and shunt compensation, Electric field distribution and insulators, Distribution systems, Per-unit quantities, Bus admittance matrix, Gauss- Seidel and Newton-Raphson load flow methods, Voltage and Frequency control, Power factor correction, Symmetrical components, Symmetrical and unsymmetrical fault analysis, Principles of over- current, differential, directional and distance protection; Circuit breakers, System stability concepts, Equal area criterion.

4. Control Systems Engineering

Mathematical modelling and representation of systems, Feedback principle, transfer function, Block diagrams and Signal flow graphs, Transient and Steady-state analysis of linear time invariant systems, Stability analysis using Routh-Hurwitz and Nyquist criteria, Bode plots, Root

loci, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model, Solution of state equations of LTI systems.

5. Analog and Digital Electronics

Simple diode circuits: clipping, clamping, rectifiers; Amplifiers: biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers: characteristics and applications; single stage active filters, Active Filters: Sallen Key, Butterwoth, VCOs and timers, combinatorial and sequential logic circuits, multiplexers, demultiplexers, Schmitt triggers, sample and hold circuits, A/D and D/A converters.

6. Power Electronics

Diodes, Zener diode, Diac, traic, BJT, Static V-I characteristics and firing/gating circuits for Thyristor, MOSFET, IGBT; DC to DC conversion: Buck, Boost and Buck-Boost Converters; Single and three-phase configuration of uncontrolled rectifiers; Voltage and Current commutated Thyristor based converters; Bidirectional ac to dc voltage source converters; Magnitude and Phase of line current harmonics for uncontrolled and thyristor based converters; Power factor and Distortion Factor of AC to DC converters; Single phase and three-phase voltage and current source inverters, sinusoidal pulse width modulation, AC voltage controller.

ASSISTANT ENGINEER

SYLLABUS: MECHANICAL ENGINEERING

Paper I

Applied Mechanics and Design: -

1. **Engineering Mechanics:**

   Free body diagrams and equilibrium; centroid of a length and area, moment of inertia, parallel axis theorem, perpendicular axis theorem, projectile motion; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular).

2. **Strength of Materials:**

   Stress and strain, stress-strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; strain energy methods; thermal stresses.

3. **Theory of Machines:**

   Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of four bar, inverted and non-inverted slider-crank mechanism; gear trains; flywheels, balancing of reciprocating and rotating masses and governors.

4. **Vibrations:**

   Free and forced vibration of single degree of freedom systems; effect of damping; vibration isolation; resonance, critical speeds of shafts.

5. **Design:**

   Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; *principles* of the design of machine elements such as bolted, riveted and welded joints, shafts, spur gears, rolling and sliding contact bearings, brakes and clutches.

Manufacturing and Industrial Engineering: -

1. **Engineering Materials:**

   Structure and properties of engineering materials, heat treatment, stress-strain diagrams for engineering materials.

2. **Metal Casting, Forming and Joining:**

   Design of patterns, moulds and cores; solidification and cooling; riser and gating design, design considerations.

Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy.

Physics of welding, brazing and soldering; adhesive bonding; design considerations in welding.

3. **Machining and Machine Tool Operations:**

Mechanics of machining, single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, principles of design of jigs and fixtures

4. **Metrology and Inspection:**

Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

5. **Computer Integrated Manufacturing:**

Basic concepts of CAD/CAM and their integration tools.

6. **Production Planning and Control and Inventory Control:**

Forecasting models, aggregate production planning, scheduling, materials requirement planning.

Deterministic and probabilistic models; safety stock inventory control systems.

7. **Operations Research:**

Linear programming, simplex and duplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

Paper II
Fluid Mechanics and Thermal Sciences: -

1. **Fluid Mechanics:**

Fluid properties; fluid statics, manometry, buoyancy; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; viscous flow of incompressible fluids; boundary layer; elementary turbulent flow; flow through pipes, head losses in pipes, bends etc.

2. **Heat-Transfer:**

Modes of heat transfer; one dimensional heat conduction, thermal resistance concept and electrical analogy, unsteady heat conduction, fins; dimensionless parameters in free and forced convective heat transfer, various correlations for heat transfer in flow over flat plates and through pipes; thermal boundary layer; effect of turbulence; radiative heat transfer, black and grey surfaces, shape factors, network analysis; heat exchanger performance, LMTD and NTU methods.

3. **Thermodynamics:**

Thermodynamic system and processes; Zeroth, First and Second laws of thermodynamics; Carnot cycle; Irreversibility and availability; behaviour of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes; analysis of thermodynamic cycles related to energy conversion.

4. **Applications:**

i) *Power Engineering*: Rankine cycle and Brayton cycle with regeneration and reheat, intercooling.

ii) *I.C. Engines*: Air-Standard Otto, Diesel and Dual combustion cycles.

iii) *Refrigeration and air-conditioning*: Vapour refrigeration cycle, heat pumps, air cycle refrigeration, Reverse Brayton cycle; moist air: psychrometric chart, basic psychrometric processes.

iv) *Turbomachinery:* Pelton wheel, Francis and Kaplan turbines - impulse and reaction principles, velocity diagrams, centrifugal and reciprocating pumps, specific speed of turbines and pumps.

ASSISTANT ENGINEER

SYLLABUS: ELECTRONICS & COMMUNICATION ENGINEERING

PART-I: Core Electronics Engineering

1. Electronics Materials:

Classification of materials into conductors, semiconductors, and insulators. Semiconductor physics including energy bands, intrinsic and extrinsic semiconductors. Electrical and optical properties of materials. Defects of crystals. Fabrication technology such as growth, chemical vapour deposition, physical vapour deposition, deposition and lithography techniques.

2. Electronics Measurement and Instrumentation Measurement:

concepts including accuracy, precision, and resolution. Electrical instruments like voltmeter, ammeter, and ohmmeter. Digital measurement techniques. Transducers and sensors with their types and applications.

3. Digital Electronics:

Number systems and Boolean algebra. Logic gates and combinational circuits. Sequential circuits including flip-flops, registers, and counters. ADC and DAC converters.

4. Microprocessor and Microcontroller:

Architecture and operation of 8085/8086 microprocessors. Instruction set and programming. Microcontroller basics with 8051 architectures. Peripheral interfacing and applications.

5. Fundamentals of Networks, Filters, and Transmission Lines:

Network theorems and analysis. Passive and active filters. Transmission line equations and parameters. Impedance matching and Smith chart.

6. Signals and Systems:

Classification of signals and systems. Fourier series and transform. Laplace and Z-transform. Sampling theorem and signal reconstruction.

PART-II: Applied Electronics & Communication Engineering

1. Industrial Electronics:

Power semiconductor devices such as SCR, TRIAC, and DIAC. Industrial applications of power electronics. Inverters, converters, and choppers. Industrial control circuits.

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(ELECTRONICS & COMMUNICATION ENGINEERING)

2. Audio and Video Systems:

Audio systems including microphones, amplifiers, and speakers. Video fundamentals and display technologies. TV transmission and reception. Digital video processing techniques.

3. Analog Electronics:

Semiconductor diodes and their applications. Bipolar junction transistors and biasing techniques. Operational amplifiers and their applications. Feedback and oscillator circuits.

4. Communication Systems:

Modulation techniques including AM, FM, and PM. Digital communication techniques like PCM, ASK, FSK, and PSK. Noise and interference in communication. Basics of wireless and mobile communication, wireless communication technologies (Wi-Fi, Bluetooth, multiple input multiple output, etc.), cellular networks.

ASSISTANT ENGINEER

SYLLABUS: COMPUTER ENGINEERING

Part-I

1. **Digital Logic:**

   Number system, Error detection and Correcting Code, Logical Gates. Boolean algebra and Boolean expression. Methods of minimizing Boolean Function. Combinational circuit design adder, multiplexer, decoder etc. and sequential circuits design, flip flops Number representations and computer arithmetic (fixed and floating point).

2. **Computer Organization and Architecture:**

   Machine instructions and addressing modes. ALU, data and data-path and CPU control design. Execution of a complete Instruction Hardware and Microprogram control. Basic concepts of pipelining. Memory hierarchy: semiconductor RAM and ROM memories, cache memory, secondary storage; I/O interface (interrupt and DMA mode).

3. **Programming**

   Programming in C: Creation of algorithm for solving various problems and the use of C language, features such as expressions, control structure (branching and looping), arrays and structure, function, recursion, pointer, dynamic memory management, processor directives, file handling. Programming in C++: Feature of object-oriented programming language includdeing class and objects, constructors and destructors, inheritance, compile-time and run-time polymorphism, abstract classes, interfaces, exception handling and class templets.

4. **Data Structure and Algorithms:** stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs, searching and sorting techniques, hashing. Asymptotic analysis of algorithms, Recurrence relations, Greedy approach, Dynamic programming, Divide and conquer, Tree and Graph traversals Spanning trees, shortest paths, NP-hard, NP-complete.

5. **Operating System:**

   Processes, Threads, Inter-Process Communication, Concurrency and Synchronization. Deadlock, CPU scheduling. Memory management and virtual memory. File systems, I/O Systems, Protection and security.

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(COMPUTER ENGINEERING)

Part -II

1. Compiler Design:

Lexical analysis, parsing, syntax-directed translation. Runtime environments, intermediate and target code generation. Basics of code optimization.

2. Databases:

ER-model. Relational model (relational algebra, tuple calculus). Database design (Integrity constraints, normal forms). Query Languages (SQL), File structures (sequential files, indexing, B and B+ trees). Transactions and concurrency control.

3. Information System and Software Engineering:

Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project, design, coding, testing, implementation, maintenance.

4. Computer Networks:

Concept of layering. LAN technologies (Ethernet). Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms (distance vector, link state). TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Basics of Wi-Fi. Network security: authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls.

5. Web Technologies:

HTML, XML, basic concepts of client-server computing. Scripting, JDBC, Servlets, JSP.

Assistant Engineer (AE)

Proposed Syllabus: General Paper (Mains)

The proposed syllabus for **General Paper (Mains)** (General English, General Studies and Aptitude) (**150 marks**):

General English: Questions in this section will be designed to test fundamental language skills, Grammar rules, vocabulary skills, reading and comprehension.

General Studies: Questions in this section will aim at testing the candidate's general awareness of the surrounding environment and its implication to the society as expected from an educated person without any specialized study. It will include current affairs, recent developments, day to day pragmatic observations and matters of importance, especially in the field of science and technology. This section will also include questions pertaining to general awareness related to International, National and North-East India.

Aptitude: The questions will cover range of topics that assess technical knowledge and aptitude. The questions will include logical reasoning, quantitative aptitude, analytical ability, engineering mathematics, numerical analysis etc. It will also include questions on ethics and values in the engineering profession.

Note: The questions in General Paper (Mains) will be of objective type.