Electrical Engineering Syllabus

SECTION-A

GENERAL HINDI:- In General Hindi Section, Questions will designed to check the Understanding & Perfect use of Hindi Words under Hindi Language. Paper will be of High School Level. Questions will be asked from:-

1: Unseen Passage, 2: Use of Symbols, 3: Antonyms, 4: Phrases and Idioms, 5: Synonyms, 6: Sentence Correction.

GENERAL ENGLISH): Verbal Ability: English grammar, sentence completion, verbal analogies, word groups, instructions.

GENERAL AWARENESS, APTITUDE AND REASONING:

Question will be asked from Indian History, Geography, Indian Economy, Sports,etc.; critical logical reasoning and verbal and non-verbal deduction.

SECTION-B

1. EM Theory Electric and magnetic fields:Gauss's Law and Amperes Law. Fields in dielectrics, conductors and magnetic materials. Maxwell's equations. Time varying fields. Plane-Wave propagating in dielectric and conducting media. Transmission lines.

2. Electrical Materials:Band Theory, Conductors, Semi-conductors and Insulators. Super-conductivity. Insulators for electrical and electronic applications. Magnetic materials. Ferro and ferri magnetism. Ceramics, Properties and applications. Hall effect and its applications. Special semi conductors.

3.Electrical Circuits:Circuits elements. Kirchoff's Laws. Mesh and nodal analysis. Network Theorems and applications. Natural response and forced response. Transient response and steady state response for arbitrary inputs. Properties of networks in terms of poles and zeros. Transfer function. Resonant circuits. Three phase circuits .Two -port networks. Elements of two-element network synthesis.

4. Measurements and Instrumentation:Units and Standards. Error analysis, measurement of current, Voltage, power, Power-factor and energy. Indicating instruments. Measurement of resistance, inductance, Capacitance and frequency. Bridge measurements . Electronic measuring instruments. Instrument transformers, Digital voltmeters and multimeters, phase, time and frequency measurement, Q-meters, Transducers and their applications to the measurement of nonelectrical quantities like temperature, pressure, flow-rate displacement, acceleration, noise level etc., Data acquisition systems. A/D and D/A converters.

5. Electrical Machines and Power Transformers:Magnetic Circuits - Analysis and Design of Power transformers. Construction and testing. Equivalent circuits. Losses and efficiency. Regulation. Auto-transformer, 3-phase transformer. Parallel operation. Basic concepts in rotating machines. EMF, torque, basic machine types. Construction and operation, leakage losses and efficiency. D.C. Machines. Construction, Excitation methods. Circuit models. Armature reaction and commutation. Characteristics and performance analysis. Generators and motors. Starting and speed control. Testing, Losses and efficiency. Synchronous Machines. Construction. Circuit model. Operating characteristics and performance analysis. Synchronous reactance. Efficiency. Voltage regulation. Salient-pole machine, Parallel operation. Hunting. Short circuit transients. Induction Machines. Construction. Principle of operation. Rotating fields. Characteristics and performance analysis. Determination of circuit model. Circle diagram. Starting and speed control. Fractional KW motors. Single-phase synchronous and induction motors.

6. Power systems:Types of Power Stations, Hydro, Thermal and Nuclear Stations. Pumped storage plants. Economics and operating factors. Power transmission lines-Modeling and performance characteristics. Voltage control. cable performance, Insulation; corona and radio interference; distribution systems; bus impedance and admittance matrices; power factor correction; ; principles of over-current, differential and distance protection; solid state relays and digital protection; circuit breakers; Load flow studies. Optimal power system operation. Load frequency control. Symmetrical short circuit analysis. Z-Bus formulation. Symmetrical Components. Per Unit representation. Fault analysis. Transient and steady-state stability of power systems. swing curves and equal area criterion. Power system Transients. Power system Protection Circuit breakers. Relays. HVDC transmission and FACTS concepts.

Power system protection: Switch gear methods of Arc Extinction, Restrilling and recovery voltage, testing of circuit breakers, Protective relays, protective schemes for power system equipment C.T. and P.T. surges in transmission lines and protection. Analog and Digital Computation.

7.Communication Systems: Types of modulation; AM, FM and PM. Demodulators. Noise and bandwidth considerations. Digital communication systems. Pulse code modulation and demodulation. Elements of sound and vision broadcasting. Carrier communication. Frequency division and time division multiplexing, Telemetry system in power engineering.

8.Power Electronics: Power Semiconductor devices. Thyristor, Power transistor, GTOs and MOSFETs, Characteristics and operation. AC to DC Converters, 1-phase and 3-phase DC to DC Converters, AC regulators, Thyristor controlled reactors; switched capacitor networks. Inverters; single-phase and 3-phase. Pulse width modulation. Sinusoidal modulation with uniform sampling. Switched mode power supplies.

Electronics & Telecommunication Engineering Syllabus

SECTION-A

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GENERAL AWARENESS, APTITUDE AND REASONING: Question will be asked from Indian History, Geography, Indian Economy, Sports,etc.; critical logical reasoning and verbal and non-verbal deduction.

SECTION-B

1.Materials and Components:Structure and properties of Electrical Engineering materials; Conductors, Semiconductors and Insulators, magnetic, Ferroelectric, Piezoelectric, Ceramic, Optical and Super-conducting materials. Passive components and characteristics Resistors, Capacitors and Inductors; Ferrities, Quartz crystal Ceramic resonators, Electromagnetic an Electromechanical components.

2.Physical Electronics:Electron Devices and ICs:Electrons and holes in semiconductors, Carrier Statistics, Mechanism of current flow in a semiconductor, Hall effect; Junction theory; Different types of diodes and their characteristics; Bipolar Junction transistor; Field effect transistors; Power switching devices like SCRs, CTOs, power MOSFETs; Basics of ICs - bipolar, MOS and CMOS types; basic of Opto Electronics.

3.Signals and Systems:Classification of signals and systems: System modelling in terms of differential and difference equations; State variable representation; Fourier series; Fourier representation; Fourier series; Fourier transforms and their application to system analysis; Laplace transforms and their application to system analysis; Convolution and superposition integrals and their applications; Z-transforms and their applications to the analysis and characterisation of discrete time systems; Random signals and probability, Correlation functions; Spectral density; Response of linear system to random inputs.

4.Network theory:Network analysis techniques; Network theorems, transient response, steady state sinusoidal response; Network graphs and their applications in network analysis; Tellegen's theorem. Two port networks; Z, Y, h and transmission parameters. Combination of two ports, analysis of common two ports. Network functions : parts of network functions, obtaining a network function from a given part. Transmission criteria : delay and rise time, Elmore's and other definitions effect of cascading. Elements of network synthesis.

5.Electromagnetic Theory:Analysis of electrostatic and magnetostatic fields; Laplace's and Piossons's equations; Boundary value problems and their solutions; Maxwell's equations; application to wave propagation in bounded and unbounded media; Transmission lines : basic theory, standing waves, matching applications, misconstrue lines; Basics of wave guides and resonators; Elements of antenna theory.

6.Electronic Measurements and instrumentation: Basic concepts, standards and error analysis; Measurements of basic electrical quantities and parameters; Electronic measuring instruments and their principles of working : analog and digital, comparison, characteristics, application. Transducers; Electronic measurements of non electrical quantities like temperature, pressure, humidity etc; basics of telemetry for industrial use.

7.Analog Electronic Circuits:Transistor biasing and stabilization. Small signal analysis. Power amplifiers. Frequency response. Wide banding techniques. Feedback amplifiers. Tuned amplifiers. Oscillators. Rectifiers and power supplies. Op Amp PLL, other linear integrated circuits and applications. Pulse shaping circuits and waveform generators.

8. Digital Electronic Circuits:Transistor as a switching element; Boolean algebra, simplification of Boolean functions, Karnaguh map and applications; IC Logic gates and their characteristics; IC logic families : DTL, TTL, ECL, NMOS, PMOS and CMOS gates and their comparison; Combinational logic Circuits; Half adder, Full adder; Digital comparator; Multiplexer Demultiplexer; ROM and their applications. Flip flops. R-S, J.K, D and T flip-flops; Different types of counters and registers Waveform generators. A/D and D/A converters. Semiconductor memories.

9. Communication Systems:Basic information theory; Modulation and detection in analogue and digital systems; Sampling and data reconstructions; Quantization & coding; Time division and frequency division multiplexing; Equalization; Optical Communication : in free space & fiber optic; Propagation of signals oat HF, VHF, UHF and microwave frequency; Satellite Communication.

10. Microwave Engineering:Microwave Tubes and solid state devices, Microwave generation and amplifiers, Waveguides and other Microwave Components and Circuits, Misconstrue circuits, Microwave Antennas, Microwave Measurements, Masers, lasers; Microwave propagation. Microwave Communication Systems terrestrial and Satellite base

Civil Engineering Syllabus

SECTION-A

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GENERAL ENGLISH): Verbal Ability: English grammar, sentence completion, verbal analogies, word groups, instructions.

GENERAL AWARENESS, APTITUDE AND REASONING:

Question will be asked from Indian History, Geography, Indian Economy, Sports,etc.; critical logical reasoning and verbal and non-verbal deduction.

SECTION-B

1. Engineering Mechanics, Strength of Materials and Structural Analysis:

1.1 Engineering Mechanics:

Units and Dimensions, SI Units, Vectors, Concept of Force, Concept of particle and rigid body. Concurrent, Non Concurrent and parallel forces in a plane, moment of force, free body diagram, conditions of equilibrium, Principle of virtual work, equivalent force system.First and Second Moment of area, Mass moment of Inertia. Static Friction.

Kinematics and Kinetics: Kinematics in Cartesian Co-ordinates, motion under uniform and nonuniform acceleration, motion under gravity. Kinetics of particle: Momentum and Energy principles, collision of elastic bodies, rotation of rigid bodies.

1.2 Strength of Materials:

Simple Stress and Strain, Elastic constants, axially loaded compression members, Shear force and bending moment, theory of simple bending, and Shear Stress distribution across cross sections, Beams of uniform strength.

Deflection of beams: Macaulay's method, Mohr's Moment area method, Conjugate beam method, unit load method. Torsion of Shafts, Elastic stability of columns, Euler's Rankine's and Secant formulae.

1.3 Structural Analysis:Castiglianio's theorems I and II, unit load method of consistent deformation applied to beams and pin jointed trusses. Slope-deflection, moment distribution.

Rolling loads and Influences lines: Influences lines for Shear Force and Bending moment at a section of beam. Criteria for maximum shear force and bending Moment in beams traversed by a system of moving loads. Influences lines for simply supported plane pin jointed trusses.

Arches: Three hinged, two hinged and fixed arches, rib shortening and temperature effects.

Matrix methods of analysis: Force method and displacement method of analysis of indeterminate beams and rigid frames.

Plastic Analysis of beams and frames: Theory of plastic bending, plastic analysis, statical method, Mechanism method.

Unsymmetrical bending: Moment of inertia, product of inertia, position of Neutral Axis and Principle axes, calculation of bending stresses.

2. Design of Structures: Steel, Concrete and Masonry Structures:

2.1 Structural Steel Design:Structural Steel: Factors of safety and load factors. Riveted, bolted and welded joints and connections. Design of tension and compression member, beams of built up section, riveted and welded plate girders, gantry girders, stancheons with battens and lacings.

2.2 Design of Concrete and Masonry Structures: Concept of mix design.

Reinforced Concrete: Working Stress and Limit State method of design–Recommendations of I.S. codes Design of one way and two way slabs, stair-case slabs, simple and continuous beams of rectangular, T and L sections. Compression members under direct load with or without eccentricity.Cantilever and Counter fort type retaining walls.

Water tanks: Design requirements for Rectangular and circular tanks resting on ground.

Prestressed concrete: Methods and systems of prestressing, anchorages, Analysis and design of sections for flexure based on working stress, loss of prestress.

Design of brick masonry as per I.S. Codes.

3. Fluid Mechanics, Open Channel Flow and Hydraulic Machines:

3.1 Fluid Mechanics: Fluid properties and their role in fluid motion, fluid statics including forces acting on plane and curved surfaces.

Kinematics and Dynamics of Fluid flow: Velocity and accelerations, stream lines, equation of continuity, irrotational and rotational flow, velocity potential and stream functions. Continuity, momentum and energy equation, Navier-Stokes equation, Euler's equation of motion, application to fluid flow problems, pipe flow, sluice gates, weirs.

3.2 Dimensional Analysis and Similitude: Buckingham's Pi-theorem, dimensionless parameters.

3.3 Laminar Flow:Laminar flow between parallel, stationary and moving plates, flow through tube.

3.4 Boundary layer: Laminar and turbulent boundary layer on a flat plate, laminar sub layer, smooth and rough boundaries, drag and lift. Turbulent flow through pipes: Characteristics of turbulent flow, velocity distribution and variation of pipe friction factor, hydraulic grade line and total energy line.

3.5 Open channel flow:Uniform and non-uniform flows, momentum and energy correction factors, specific energy and specific force, critical depth, rapidly varied flow, hydraulic jump, gradually varied flow, classification of surface profiles, control section, step method of integration of varied flow equation.

3.6 Hydraulic Machines and Hydropower:Hydraulic turbines, types classification, Choice of turbines, performance parameters, controls, characteristics, specific speed. Principles of hydropower development.

4. Geotechnical Engineering:

Soil Type and structure – gradation and particle size distribution – consistency limits.
Water in soil – capillary and structural – effective stress and pore water pressure – permeability concept – field and laboratory determination of permeability – Seepage pressure – quick sand conditions – Shear strength determination – Mohr Coulomb concept.Compaction of soil – Laboratory and field tests.Compressibility and consolidation concept – consolidation theory – consolidation settlement analysis.Earth pressure theory and analysis for retaining walls, Application for sheet piles and Braced excavation.Bearing capacity of soil – approaches for analysis – Field tests – settlement analysis – stability of slope of earth walk.Subsurface exploration of soils – methods.Foundation – Type and selection criteria for foundation of structures – Design criteria for foundation – Analysis of distribution of stress for footings and pile – pile group action-pile load test. Ground improvement techniques.

5. Construction Technology, Equipment, Planning and Management:

5.1 Construction Technology:
Engineering Materials:Physical properties of construction materials with respect to their use in construction - Stones, Bricks and Tiles; Lime, Cement, different types of Mortars and Concrete.Specific use of ferro cement, fibre reinforced C.C, High strength concrete.Timber, properties and defects - common preservation treatments.Use and selection of materials for specific use like Low Cost Housing, Mass Housing, High Rise Buildings.
5.2 Construction:
Masonry principles using Brick, stone, Blocks – construction detailing and strength characteristics.Types of plastering, pointing, flooring, roofing and construction features.Common repairs in buildings.Principles of functional planning of building for residents and specific use - Building code provisions.Basic principles of detailed and approximate estimating - specification writing and rate analysis – principles of valuation of real property.Machinery for earthwork, concreting and their specific uses – Factors affecting selection of equipments – operating cost of Equipments.
5.3 Construction Planning and Management:Construction activity – schedules- organization for construction industry – Quality assurance principles.Use of Basic principles of network – analysis in form of CPM and PERT – their use in construction monitoring, Cost optimization and resource allocation.Basic principles of Economic analysis and methods.Project profitability – Basic principles of Boot approach to financial planning – simple toll fixation criterions.

6. Surveying and Transportation Engineering

6.1 Surveying:Common methods and instruments for distance and angle measurement for CE work – their use in plane table, traverse survey, leveling work, triangulation, contouring and topographical map.Basic principles of photogrammetry and remote sensing.
6.2 Railway Engineering:Permanent way – components, types and their functions – Functions and Design constituents of turn and crossings – Necessity of geometric design of track – Design of station and yards.
6.3 Highway Engineering:Principles of Highway alignments – classification and geometrical design elements and standards for Roads.Pavement structure for flexible and rigid pavements - Design principles and methodology of pavements.Typical construction methods and standards of materials for stabilized soil, WBM, Bituminous works and CC roads.Surface and sub-surface drainage arrangements for roads - culvert structures.Pavement distresses and strengthening by overlays.Traffic surveys and their applications in traffic planning - Typical design features for channelized, intersection, rotary etc – signal designs – standard Traffic signs and markings.

7. Hydrology, Water Resources and Engineering:

7.1 Hydrology:Hydrological cycle, precipitation, evaporation, transpiration, infiltration, overland flow, hydrograph, flood frequency analysis, flood routing through a reservoir, channel flow routing-Muskingam method.
7.2 Ground water flow:Specific yield, storage coefficient, coefficient of permeability, confined and unconfined equifers, aquifers, aquitards, radial flow into a well under confined and unconfined conditions.
7.3 Water Resources Engineering:
Ground and surface water resource, single and multipurpose projects, storage capacity of reservoirs, reservoir losses, reservoir sedimentation.
7.4 Irrigation Engineering:(i) Water requirements of crops: consumptive use, duty and delta, irrigation methods and their efficiencies.(ii) Canals: Distribution systems for canal irrigation, canal capacity, canal losses, alignment of main and distributory canals, most efficient section, lined canals, their design, regime theory, critical shear stress, bed load.(iii) Water logging: causes and control, salinity.(iv) Canal structures: Design of, head regulators, canal falls, aqueducts, metering flumes and canal outlets.(v) Diversion headwork: Principles and design of weirs of permeable and impermeable foundation, Khosla's theory, energy dissipation.(vi) Storage works: Types of dams, design, principles of rigid gravity, stability analysis.(vii) Spillways: Spillway types, energy dissipation.(viii) River training: Objectives of river training, methods of river training.

8. Environmental Engineering:

8.1 Water Supply:Predicting demand for water, impurities, of water and their significance, physical, chemical and bacteriological analysis, waterborne diseases, standards for potable water.
8.2 Intake of water:Water treatment: principles of coagulation, flocculation and sedimentation; slow-; rapid-, pressure-, filters; chlorination, softening, removal of taste, odour and salinity.
8.3 Sewerage systems:Domestic and industrial wastes, storm sewage–separate and combined systems, flow through sewers, design of sewers.
8.4 Sewage characterization:BOD, COD, solids, dissolved oxygen, nitrogen and TOC. Standards of disposal in normal watercourse and on land.
8.5 Sewage treatment:Working principles, units, chambers, sedimentation tanks, trickling filters, oxidation ponds, activated sludge process, septic tank, disposal of sludge, recycling of wastewater.
8.6 Solid waste: Collection and disposal in rural and urban contexts, management of long-term ill effects.

9. Environmental pollution: Sustainable development. Raw wastes and disposal. Environmental impact assessment for thermal power plants, mines, river valley projects. Air pollution. Pollution control acts.

Computer Science - CSE & IT Syllabus

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SECTION-B

Computer Science and Information Technology

Digital Logic: Boolean algebra. Combinational and sequential circuits. Minimization. Number representations and computer arithmetic (fixed and floating point).

Computer Organization and Architecture: Machine instructions and addressing modes. ALU, data - path and control unit. Instruction pipelining. Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).

Programming and Data Structures: Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

Algorithms: Searching, sorting, hashing. Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph search, minimum spanning trees, shortest paths.

Theory of Computation: Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and context-free languages, pumping lemma. Turing machines and undecidability.

Compiler Design: Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation.

Operating System: Processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU scheduling. Memory management and virtual memory. File systems.

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.

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.