

**SCHEME AND SYLLABUS FOR THE POST OF ASSISTANT EXECUTIVE ENGINEERS IN
ROADS & BUILDINGS SERVICE**

SCHEME

<u>PART-A WRITTEN (OBJECTIVE TYPE) EXAMINATION</u>				
PAPER-1	General Studies & Mental Ability	150 Marks	150 Qns	150 Minutes
PAPER-2	Concerned Subject: Civil OR Electrical Engineering	300 Marks	150 Qns	150 Minutes
<u>PART-B: INTERVIEW</u>		50 Marks		

SYLLABUS

GENERAL STUDIES & MENTAL ABILITY

1. SCIENCE AND TECHNOLOGY:
 - a) General Science and Technology
 - b) Role and impact of science and Technology on India's development.
(Questions will cover general appreciation and understanding of matters of everyday observation and experience as may be expected of a well-educated person who has not made a special study of science and technology disciplines).
2. INDIAN HISTORY AND CULTURE:
 - a) Modern Indian History from 19th century to the present
 - b) Nationalist Movement and Constitutional development
 - c) Indian culture and Heritage including architecture, Fine Arts, dance forms, music, paintings, Folk arts and performing arts.
 - d) History of Andhradesa Society, Culture, Geography and Economic development.
3. INDIAN POLITY:

General and broad understanding of the structural (institutions) and functional (processes) aspects of Indian Political system.
4. INDIAN ECONOMY AND GEOGRAPHY OF INDIA:
 - (a) Structure of National economy
 - (b) Economic development (including planning) since independence
 - (c) Economic Reforms
 - (d) Physical, economic and social Geography of India.
5. CURRENT EVENTS:

Current Events of Regional, National and International importance.
6. GENERAL MENTAL ABILITY: (Reasoning and analytical abilities)

CONCERNED SUBJECT (CIVIL ENGINEERING)

STRENGTH OF MATERIALS:-

Simple stresses and Strains: Types of stresses and strains - Hook's Law, Stress-strain curve for mild steel working stress and factor of safety Poisson ratio - State of simple shear, complementary - Shear Elastic constants and their relations - Compound bars - Thermal stress.

Compound stresses Mohr's circle of stress - Principal stresses and planes.

Shear force and bending moment diagrams: S.F.D. and B.M.D. for cantilevers, simply supported beams and over hanging beams subjected to point loads and uniformly distributed loads. Relations among load, shear force and bending moment.

Bending and shear stress: Basic equation; $M/I = F/Y = E/R$ - Distribution of bending and shear stresses across various cross sections such as rectangular, circular, I and T sections, Torsion of Circular shafts - power transmission.

Columns and struts: Euler's theory and Rankine's Theory - Secant and Perry formulae for eccentrically loaded columns.

Deflections and slopes: Slopes and deflections in cantilevers simply supported beams; propped beams and fixed beams subjected to point loads and uniformly distributed loads.

FLUID MECHANICS AND HYDRAULIC MACHINERY:

Fluid statics: Hydrostatic force on a plane and curved area Centre of pressure and its applications to lockgates and dams Metacentric height.

Fluid Dynamics: Convective and local acceleration, Euler's equation of motion and its integration, Bernoulli's equation motion and its application, flow in curved path. Free and forced vortex.

Flow measurements: Notches and weirs, venturimeters, pitot tube, nozzle meter, current meter.

Compressible Flow: Velocity of pressure wave, wave velocity for adiabatic and isothermal compression, Basic equations of one-dimensional flow continuity, energy and momentum equations.

Laminar and turbulent flow through pipes: Reynolds experiment significance of Reynold's number, formulae for laminar flow through circular pipes, Turbulent flow-Darcy Weisbach equation, friction factor and Moody's diagram.

Turbines: Classification, specific speed velocity triangles Principles of design of reaction and impulse Turbines, characteristic curves.

Pumps: Centrifugal pumps, velocity triangles, Work done and efficiency minimum starting speed, loss of head; specific speed and characteristic curves for centrifugal pumps.

BUILDING MATERIALS:

Timber: Different types and species of structural timber, density – moisture relationship, strength in different directions, defects, preservations, plywood.

Bricks: Types, Indian standard classification, absorption, saturation factor, strength in masonry, influence of mortar strength on masonry strength.

Cement: Compounds of different types, setting times, strength.

Cement mortar: Ingredients, proportions, water demand, mortars for plastering and masonry.

Concrete: Importance of w/c ratio, strength, ingredients including admixtures, workability, testing for strength, mix design methods, non-destructive testing.

STRUCTURAL ANALYSIS:

Analysis of determinate structures – different methods. Analysis of indeterminate skeletal frames – Moment distribution, Slope deflection, Kani's, Stiffness and force methods, Energy methods, Muller Breslan principle and application. Plastic analysis of indeterminate beams and simple portal frames – Shape factors.

DESIGN OF STEEL STRUCTURES:

Principles of working stress method. Design of connections, Simple members, Built-up sections and Frames, Design of industrial roofs. Principles of ultimate load design. Design of simple members.

DESIGN OF CONCRETE AND MASONRY STRUCTURES:

Limit state design for bending, Shear, Axial compression and combined forces. Codal provision for slabs, Beams, Columns and footings. Working stress method of design of R.C. members. Principles of pre-stressed concrete design, Materials, Methods of pre-stressing, losses. Design of simple members and determinate structures. Design of brick masonry as per IS codes.

CONSTRUCTION PLANNING AND MANAGEMENT:

Bar chart, Linked bar chart, Work break down structures, Activity – on – arrow diagrams. Critical path, Probabilistic activity durations, Event based networks. PERT network: Time-cost study, Crashing, Resource allocation.

HYDROLOGY AND WATER RESOURCE ENGINEERING:

Hydrological cycle, Precipitation and related data analysis, Unit hydrographs, Evaporation and transpiration. Floods and their management, Stream gauging, Routing of floods, Capacity of reservoirs. Multi purpose uses of water: Soil-plant – Water relationships, Irrigation systems. Water demand assessment: Storages and their yields. Ground water yield and well Hydraulics. Water logging and drainage design. Design of rigid boundary canals, Lacey's and tractive force concepts in canal design, Lining of Canals, Sediment transport in canals, Non-overflow and overflow dams and their design, Energy dissipators, Design of head works, Distribution works, Falls, Cross-drainage works, Outlets, River training.

ENVIRONMENTAL ENGINEERING:

- a. Water Supplying Engineering: Sources of supply, Yields, Design of intakes and conductors, Estimation of demand. Water quality standards, Control of water borne diseases. Primary and secondary treatment. Conveyance and distribution systems of treated water, Leakages and control. Rural water supply. Institutional and industrial water supply.
- b. Waste Water engineering: Urban rain water disposal, Systems of sewage collection and disposal. Design of sewers and sewerage systems, Pumping. Characteristics of sewage and its treatment. Disposal of products of sewage treatment. Plumbing systems. Rural and semi-urban sanitation.
- c. Solid Waste Management: Sources and effects of air pollution, Monitoring of air pollution, Noise pollution, Standards, Ecological chain and balance. Environmental assessment.

SOIL MECHANICS AND FOUNDATION ENGINEERING:

Properties and classification of soil, Compaction, Permeability and Seepage, Flow nets, Inverted filters, Compressibility and consolidation. Shearing resistance, Stresses and failure. Soil testing in laboratories and in-situ, Earth pressure theories, Stress distribution in soils, Soil exploration, Samplers, Load tests, Penetration tests. Types of foundations, Selection criteria, Bearing capacity, Settlement, Laboratory and field tests, Types of piles and their design and layout. Foundations on expansive soils, Swelling and its prevention, Foundation on swelling soils.

SURVEYING AND TRANSPORT ENGINEERING:

Classification of surveys, Scales, Accuracy, Measurement of distances, Direct and indirect methods, Optical and electronic devices, Measurement of directions, Prismatic compass, Local attraction, Theodolites, Types, Measurement of elevations, Spirit and trigonometric leveling, Contours, Digital elevation modeling concept, Establishment of control by triangulations and traversing, Measurement and adjustment of observations, Computation of coordinates, Field astronomy, Concept of global positioning system, Map preparation by plane tabling and by photogrammetry, Remote sensing concepts, Map substitutes. Planning of Highway systems, Alignment and geometric design, Horizontal and vertical curves, Grade separation, Materials and construction methods for different surfaces and maintenance. Principles of pavement design, Drainage. Traffic surveys, Intersections, Signaling, Mass transit systems, Accessibility, Networking.

CONCERNED SUBJECT (ELECTRICAL ENGINEERING)

ELECTRICAL CIRCUITS:

Basic electrical laws, Analysis of DC networks, transient response of RLC networks excited by impulse, step, ramp and sinusoidal excitations. Transform methods, transfer functions, poles and zeros steady state AC networks, frequency domain analysis, resonance, coupled circuits, two port networks, three phase networks, power in a.c. networks, power measurement in 3-phase networks.

E.M. THEORY:

Electro static and electro magnetic fields, vector methods, Fields in dielectric, conducting and magnetic materials, Laplace and Poisson's equation. Time varying fields, Maxwell's equation, Poynting Theory, properties of transmission lines.

ELECTRICAL MEASUREMENT AND INSTRUMENTS:

Electrical standards, Error analysis, Measurement of current, voltage, power, energy, power factor, resistance, inductance capacitance frequency and loss angle. Indicating instruments, extension of range of instruments, DC and AC bridges. Electronic measuring instruments. Electronic multimeter, CRO, frequency counter, digital voltmeter, transducers, Thermocouples, Thermistor, LVDT, strain gauges, Piezo electric crystal, Measurement of non-electrical quantities like, pressure, velocity, temperature, flow rate, displacement acceleration and strain.

CONTROL SYSTEMS

Open and closed loop control systems, Mathematical modeling, block diagram, signal flow graphs, time response and frequency response of linear systems, error constants and series Rootlocus technique, Bodeplot, polar plot, M-circles, N-circles, Nichol's charts, stability, Routh Hurwitz criteria. Nyquist stability criteria, compensators, design in frequency domain. Control system components. Servo motors, synchros, tacho generator, error detector. State variable approach, modeling, state transition matrix, transfer function, response.

ELECTRONICS:

Solid state devices and circuits. Small and large signal-amplifiers with and without feedback at audio and radio frequency, multistage amplifiers. Operational amplifiers and applications. Integrated circuits oscillators, RC, LC and crystal oscillators wave form generators, multi-vibrators – Digital circuits, Logic gates, Boolean algebra combinational and sequential circuits. A to D and D to A converters Micro processors (8085) instruction set, memories, interfacing programmable peripheral devices – Number system flow charts – expressions and statements in C – language – simple programs for engineering application.

D.C. ELECTRICAL MACHINES:

Fundamentals of electro mechanical energy conversion, constructional features of D.C. Machines, emf equation types and characteristics of generators application, Torque in DC motor, types of DC motors, applications. Testing of D.C. motors, efficiency, and starting and speed control.

TRANSFORMERS:

Construction – Principle of operation of 1-phase transformers – Vector diagram on No Load and – Load – Parallel operation – Regulation – efficiency – Equivalent circuit 3 phase transformer connections – Scott connection.

INDUCTION MOTORS:

Production of rotating magnetic field, production of torque types of motors equivalent circuits, Circle diagram, torque slip characteristics, starting and maximum torque, speed control, principle of single phase induction motors, Applications.

SYNCHRONOUS MACHINES:

Generation of emf in 3 phase AC Generator, Armature reaction, regulation by Synchronous impedance and Ampere turn methods, parallel operation, transient and sub-transient reactances, theory of salient pole machines.

Synchronous Motor: Torque production, performance characteristics, methods of starting, V-Curves, synchronous condenser.

Special Machines: Stepper motor, Methods of operation, Amplidyne and metadyne-applications.

ELECTRICAL POWER GENERATION:

General layout – Types of power stations, economics of different types, base load and peak load stations, load factor and its effects, pumped storage schemes.

POWER TRANSMISSION:

Calculation of line parameters, concepts of short, medium and long transmission lines, ABCD parameters, insulators, Corona, P.U. quantities, fault calculations, symmetrical components load flow analysis using Gauss Seidal, New-ton Raphson, methods, economic operation, stability, steady state and transient stability, equal area criterion, ALFC and AVR control for real time operation of interconnected systems.

POWER SYSTEM PROTECTION:

Principles of arc quenching, circuit breaker classification, Recovery and restriking voltages, relaying principles over current, directional over current relays-generator and transformer protection using differential relays-line protection using distance relays Surgeo phenomena in transmission lines – Travelling wave theory, protection against surges.

UTILISATION :

Industrial Drives – Motors for various drives – Braking methods – Speed control of motors – Economics of rail traction – Mechanics of train movement – Estimation of power and energy requirements – Illumination – Lams Factory lighting – Street lighting – Induction and dielectric heating.

Sd/- Secretary