

SYLLABUS FOR THE RECRUITMENT TEST TO THE POST OF FIELD SUPERVISOR (ELECTRICAL/MECHANICAL)

Technical Paper - 100 Marks

Duration - 3 Hours

Personal Interview - 50 Marks (for short listed candidates only).

The questions will be of multiple choice.

Part - A Common for Electrical and Mechanical Engineers – 20 Marks

1. Basic Electricity
2. D.C. Circuits
3. Batteries
4. Capacitors
5. A.C. Fundamentals
6. Electrical Engineering Materials
7. Elements of Mechanical Engineering

PART - B Electrical - 40 Marks

1. ELECTRICAL ENGINEERING

Basic concepts: Concepts of resistance, inductance, capacitance, and various factors affecting them. Concepts of current, voltage, power, energy and their units.

Circuit law: Kirchhoff's law, Simple Circuit solution using network theorems.

Magnetic Circuit: Concepts of flux, mmf, reluctance, Different kinds of magnetic materials, Magnetic calculations for conductors of different configuration e.g. straight, circular, solenoidal, etc., electromagnetic induction, self and mutual induction.

AC Circuits: Instantaneous peak, R.M.S. and average values of alternating waves, Representation of sinusoidal wave form, simple series and parallel AC Circuits consisting of R.L. and C, Resonance, Tank Circuit. Polyphase system - star and delta connection, 3 phase power, DC and sinusoidal response of R-Land R-C circuit.

Measurement and measuring instruments: Measurement of power (1 phase and 3 phase, both active and re-active) and energy; 2 wattmeter method of 3 phase power measurement; Measurement of frequency and phase angle; Ammeter and voltmeter (both moving oil and moving iron type), extension of range wattmeter; Multimeters; Megger; Energy meter AC Bridges; Use of CRO, Signal Generator; CT; PT and their uses; Earth Fault detection.

2. ELECTRICAL MACHINES

DC Machines - Construction, Basic Principles of DC motors and generators, their characteristics, speed control and starting of DC Motors, Method of braking motor, Losses and efficiency of D.C. Machines.

1 phase and 3 phase transformers - Construction, Principles of operation, equivalent circuit, voltage regulation, O.C. and S.C. Tests, Losses and efficiency, Effect of voltage, frequency and wave form on losses, Parallel operation of 1 phase & 3 phase transformers, Auto-transformers.

3 phase induction motors - rotating magnetic field, principle of operation, equivalent circuit, torque-speed characteristics, starting and speed control of 3 phase induction motors, Methods of braking, effect of voltage and frequency variation on torque speed characteristics.

Fractional Kilowatt Motors and Single-Phase Induction Motors - Characteristics and applications.

Synchronous Machines - Generation of 3-phase e.m.f. armature reaction, voltage regulation, parallel operation of two alternators, synchronizing, control of active and reactive power, Starting and applications of synchronous motors.

3. GENERATION, TRANSMISSION AND DISTRIBUTION

Power Stations - Different types of power stations, load factor, diversity factor, demand factor, cost of generation, inter-connection of power stations, power factor improvement, various types of tariffs, types of faults, short circuit current for symmetrical faults.

Switchgears - rating of circuit breakers, Principles of arc extinction by oil and air, H.R.C. Fuses, Protection against earth leakage / over current, etc. Buchholtz relay, Merz-Price system of protection of generators & transformers, protection of feeders and busbars, Lightning arresters, various transmission and distribution system, comparison of conductor materials, efficiency of different system.

Cable - Different type of cables, cable rating and de-rating factor.

4. UTILIZATION OF ELECTRICAL ENERGY

Illumination, Electric heating, Electric welding, Electroplating, Electric drives and motors.

5. FUNDAMENTAL OF COMPUTER AND APPLICATION

Basic concept, bus architecture, operating system, Basic computer system, memory organization, input/output device, storage device. MS application.

PART C Mechanical - 40 Marks.

1. THEORY OF MACHINES

Momentum, Energy and Impulse: Simple Mechanism; Friction; Belt, Rope and Chain Drive; Gears; Governors; Cams.

2. FLUID MECHANICS

Units and Dimensions; Fluid Properties; Buoyancy; Types of Flow; Bernoulli's Theorem; Orifices; Flow in Pipes; Streamlines; Viscous Flow; Flow around Immersed Bodies.

3. TURBOMACHINERY

Gas turbines, Compressors, Hydraulic turbines and Pumps

4. THERMODYNAMICS

Properties of Gases; Properties of Steam; Power Cycles; Steam Boilers; Steam Engines; Condenser; Fuels; Combustion of Fuels.

5. HEAT TRANSFER

Modes of Heat Transfer; Fourier's Law and Heat Exchangers.

6. MECHANICAL MEASUREMENTS

Measurement of Displacement; Velocity; Acceleration; Force; Torque; Strain; Speed; Temperature; Pressure Flow; Shock; Vibration and Sound.