

## **Syllabus for Written Exam for the post of MSA-Gr.I (Electrical)**

**Basic mathematics:** Precedence rule of arithmetic operations, factorization of numbers, linear equations, quadratic equations, inequalities, ratio and proportion, properties of simple 2-D geometrical shapes, perimeter calculation, area calculation, volume calculation, basic trigonometry.

**General reasoning:** Coding and decoding, number series, letter and symbol series, blood relations, cause and effect, analogies, seating arrangement, comparative analysis, verbal classification, number grouping.

**Electrical circuits:** Characteristics of basic circuit elements such as resistors, capacitors and inductors, Ohm's law, Kirchhoff's current law, Kirchhoff's voltage law, equivalent resistance, instantaneous power, the phasor concept for an AC circuit, RMS value, impedance, reactance, active power, reactive power, apparent power, power factor, form factor, peak factor, series resonance, parallel resonance, three-phase circuit, balanced circuit, unbalanced circuit, star connection, delta connection, star-delta conversion.

**Magnetic circuits:** Different magnetic materials, B-H curve, saturation, hysteresis, mean-flux path technique for magnetic circuit analysis, magneto-motive force, reluctance, inductance calculation.

**Electrical machines:** Construction and working principle of transformers, autotransformer, tap-changing transformer, single-phase and three-phase transformers, transformer winding, transformer protection, cooling of transformers, transformer oil testing, construction and working principle of DC machines, winding arrangements of DC machines, torque-speed characteristics of different types of DC motors, starters in DC motors, DC motor speed control, DC motor applications, stator winding arrangement AC machines, concepts of electrical speed and mechanical speed, construction and working principle of three-phase synchronous machines, synchronous condenser, construction and working principle of three-phase induction machines, induction motor torque-slip characteristics, starting and speed control of three-phase induction motors, working principle of single-phase induction motors, single-phase induction motor starting, different applications of induction motors, working principle and application of universal motors.

**Analog and power electronics:** Semiconductor material, P-N junction, characteristics and working principle of semiconductor devices (diode, thyristor, GTO, IGBT, MOSFET, JET, FET, BJT, UJT, diac, triac), Class A, B & C power amplifiers, oscillators, multivibrators, single-phase half-wave and full-wave diode rectifier circuits, filters, heat sink, snubber circuit.

**Measurement and instrumentation:** Principles of ammeter, voltmeter, multimeter, wattmeter and energy meter, measurement range extension, current transformer and potential transformer, familiarity with the features of an oscilloscope.

**Wiring and earthing:** IE rules for electric wiring, types of domestic and industrial wirings, specifications for wiring, grading of cables and current ratings, principle of laying out in domestic wiring, different methods of earthing, earth leakage relay, lightning arrestor.

**Electric appliances and batteries:** Different types of illumination and lamps, lighting efficiency, illumination limits, electric fans, electric pumps, washing machine, induction heater, voltage stabilizer, UPS, different types of battery cells, rechargeable batteries, general defects of batteries and their remedies, battery maintenance, battery efficiencies.