

SYLLABUS FOR ELECTRICAL SUPERVISOR CERTIFICATE OF
COMPETENCY (SCC – MV (MINING))

Electricity Theory (Elementary Knowledge)

Principles of Electricity – Electric voltage, Current and resistance, Ohm's law – specific resistance, Laws of resistance and their application for calculating voltage drop, series and parallel circuits, Practical units of voltage, current, resistance, power and energy. Relation between electrical power unit (KW) and Mechanical Power Units (HP).

Electro Magnetism – Concept of Electro Magnetic Force (EMF), production of E.M.F., Flemings Right and Left Hand Rules, Magnetic, Chemical and heating effects of electric current. Magnetic properties of material, Electromagnets and their various applications.

Materials – Conductors, Semiconductors and insulator materials and their relative merits. Transformer oil, Effect of heat and moisture on insulation. Lubricants and their uses.

Different types of wires, cables, switches, circuit breakers, cutouts, etc,

Generation of Electricity – Sources of natural energy. Renewable and Non-Renewable source methods of production of electricity both Alternating Current and Direct Current.

A.C. Generators (Alternators) – Essential components and constructional feature, Methods of voltage and frequency control conditions and methods for synchronizing, simple associated switch board and its accessories.

D.C. Generators – Essential components and constructional features, Shunt, series and compound dynamos and their characteristics, causes for sparking. Interpoles, Commutators and their maintenance. Carbon brushes, their adjustment and care. Methods of voltage regulation. Conditions for parallel operation, simple associated switch board and its accessories.

Batteries – Primary cells, Dry cells, storage or secondary batteries or

accumulators and their installations. Lead acid cells, Nickel, Iron or Alkaline cells. Initial and subsequent charging of batteries. Charging circuits and their calculations. Series and parallel circuits. Maintenance of batteries. Use of Hydrometers.

A.C. Motors – Theory of induction (squirrel cage and slip-ring type) synchronous and commutator motors, their uses, installation, method of starting, speed control and reversal of direction.

D.C. Motors – Theory of series, shunt and compound wound type motors, their uses, installation, method of starting, speed control and reversal of direction.

A.C. Circuits – Knowledge of vectors. Phase and phase difference. Resistance, inductance and capacitance in an A.C. Circuit. Periodicity or frequency. Power and power factor. Single phase and three phase systems. Star and delta connections. Phase sequence.

Controlling and Regulating Gear – Knowledge of various types of switches, circuit breakers, cutouts, starters, regulators and protective devices for both A.C. and D.C. motors and their wiring with the motors.

Transformation – Knowledge of single phase and three phase transformers, their construction, use and maintenance. Phasing out, parallel working, auto transformer, transformer tapplings, temperature rise, instrument transformer.

Conversions – Principle of operation of motor generator sets, rotary convertors and mercury arc rectifiers.

Transmission and Distribution –

Overhead Lines – Simple calculations and general principles of construction of low, medium and high voltage lines. Size of conductors, length of spans, sag, strength of poles, spacing of conductor, cross arms, effect of temperature, wind pressure, ice and snow, tension on wire. Insulators, brackets, stays, struts, guard wires and other protective devices. Earthing, lightning arrestors, lightning conductors and their testing and fault location.

Underground Cables – underground cables, simple calculations and general principles of laying cables direct in ground, intrenchments and pipes. Handling, bending, jointing, plumbing. Underground and above ground junction boxes. Distribution board and pillars. Joint box compound, melting of compound and filling boxes with compound. Testing and fault location.

Illumination – Metal filament lamps, fluorescent lamp circuits, high voltage luminous tube sign installations. Photometric units and simple measurements. General requirements of efficient lighting and elementary calculations. Street lighting. Time switches.

Generation: –

(a) DC and AC power supply for auxiliaries, arrangement of unit auxiliary and station service boards, station lighting and automatic changeover. Station batteries and charging methods. Standby and emergency power and lighting systems.

(b) Testing & Measurement – Working principle and basis of instrument and measurements. Details of measuring instruments for pressure, flow, temperature, level, vibration, alignment and current, voltage, power, reactive power, frequency, energy, winding temperature, auto controllers, recorder, insulation, tester, its use for primary detection of faults, data acquisition system, digital distributed control, UPS etc. Testing of electrical & mechanical testing equipments.

(c) Control & Protection – Sequential operation & interlocks, general machine start/stop, sequence of operation.

SAFETY RULES – Working Knowledge of –

(a) Safety regulation -2010 of CEA (Measures relating to safety and electric supply)

(b) Fire safety procedures, fire protection of generators, transformer and fire fighting and emulsifier type protection, regarding Factory Act, Electricity Act-2003.

Protection and restoration of persons suffering from electric shock

MINES INSTALLATIONS –

- ❖ **WIRINGS** – Wiring layouts of different types such as cleats, lead covered, cab type sheathed for lighting purposes and armoured cables for power installations, different types of trailing cables and their use.
- ❖ **CIRCUIT DIAGRAMS** – Electrical connections for –: • D.C. & A.C. generators, switch boards, transformers etc. • Distribution boards with circuit breakers switches, fuse units and gate-end switches. • D.C. & A.C. motors, their starters and regulators.
- ❖ **APPARATUS** – Installation and maintenance of –: • Electrical Winders, haulages and pump units, their control gears and starters. • Rectifiers rotary convertors and electric locomotives. • Portable and transportable machineries, coal cutting machines, loaders, conveyors, gate-end switches. Drill panels with drill units and their control systems. • General principles and elementary calculations of load, power and energy consumption in pumping, hauling and winding installations and other working face machineries.
- ❖ **POWER AND ENERGY MEASUREMENT AND CHARGES** – Measurement of power, Wattmeters, energy meters both D.C. & A.C. power factor correction by capacitors. Simple calculations relating to cost of power and energy. Elementary knowledge of methods of charging for demand and energy.
- ❖ **TESTING AND FAULT ATTENDANCE** – Detection and location of earth or other faults in electrical apparatus and cables. Insulation and continuity test. Rectification of faults. Test for insulation resistance to earth. Testing of leakage, protective devices. Earth testing.
- ❖ **PROTECTIVE DEVICES** – Elementary knowledge of earthing of metal frames of machineries. Use of fuses. Over-load, no-volt and earth leakage protection of circuit breakers.

SAFETY RULES – Working knowledge of –: The CEA Safety Regulation - 2010 i.e. (Measures relating safety and Electric supply) for mining installation.

