

(Annexures appended to the Government Resolution  
No. Misc 2019/ C.R. 96/ Energy 5 dated 20<sup>th</sup> September 2019)

**ANNEXURE - I**

**INDICATIVE SYLLABUS FOR CHARTERED ELECTRICAL SAFETY ENGINEER**

- 1. Electrical elements and measurement :** Basic knowledge of electrical circuit elements and parameters, measurement methods and measuring instruments used for electrical parameters i.e. current, voltage, power in DC networks; active power, reactive power, energy, frequency, power factor in single and three phase AC networks; power factor correction, Reactive power compensation.
- 2. Transformer :** Basic Principle, types, construction, equivalent circuit, Voltage Regulation, Parallel operation, knowledge of erection and commissioning, pre-commissioning tests and test equipments used, transformer oil test and analysis, various transformer protections and relays used, knowledge of fire safety of transformer, preventive maintenance of transformer.
- 3. Electrical machines, cables and wiring :** Basic principle of DC motors, AC motors, starters and speed control of AC motors, Variable Frequency Drivers (VFDs) and its application, testing, protection and preventive maintenance of various motors.  
Internal wiring – Domestic, industrial; Cables – types of cables, current and voltage ratings, selection, application, laying methods, cable protection and testing, causes of breakdown, preventive maintenance, methods and use of equipment for preventive measures like Partial discharge, thermo-vision etc.
- 4. Power System :**
  - a) Generation –** Basic knowledge of different types of power plants – Thermal, Hydro, Nuclear, Renewable energy sources, Non-conventional energy sources, DG sets, various generator tests, protections and relays used.
  - b) Transmission system –** Basic knowledge of transmission line electrical parameters, type of conductors, types of towers, type of insulators, Reactive power compensation, various clearances from conductor of transmission line as per CEA Safety Regulation, transmission line protections and relays used, transmission line tests and routine maintenance.
  - c) Electrical Substation –** Type of substation – AIS and GIS, layout and Bus bar scheme, earthing layout, type and basic principle of substation apparatus including circuit breaker, CT, CVT/PT, isolator, earth switch, wave trap, surge arrester, LT switchgears, DC Batteries, Chargers, UPS, SCADA System, protection schemes and relays used for protection of various substation equipments, various operational interlocks, pre-commissioning tests of substation apparatus, procedure and test equipments used.

5. **Distribution and LT Switchgears** – Type and selection of electrical elements used in distribution i.e. fuses, ACBs, MCBs, MCCBs, ELCB/RCCB, switchboards, bus duct, synchronizing panels, linked switch with fuse, RMU, HT and LT Panels, APFC Panels, PLC logic panels, testing method of these switchgears and test equipments.
  
6. **Earthing** – Types of system earthing, fault level calculations, type of earthing - rod/plate, earth conductor sizes, earth resistance measurement and test equipment used, earthing of substation apparatus, transmission and distribution lines/towers, earthing at consumer premises, earthing of industrial and domestic equipment.
  
7. **Safety from electricity and fire** – Personal protective equipments (PPE's) used in connection with safe use of electricity like Hand Gloves, Rubber Shoes, Waist belt, earthing rod, Goggles etc., Safe working clearances for different voltage levels, fire extinguishers used for different applications, knowledge of Static electricity, Lightning protection, Electrical Safety Audit, Elementary knowledge of first aid.
  
8. **Act, Safety Regulations and relevant Code and Standards** – Electricity Act, 2003, Factories Act, 1948, CEA(Measures relating to Safety and Electric Supply) Regulations 2010, CEA(Technical Standards for Construction of Electrical Plants and Lines) Regulations, 2010, CEA(Technical Standard for Connectivity to the Grid) Regulations, 2007, Relevant IS/NEC/IEC Standards mentioned in CEA Regulations or used in connection with generation, transmission, distribution of electricity, testing procedure, earthing of electrical apparatus and switchgears, fire safety, National Electrical Code, National Building Code, all amendments in the Acts, Regulations, Code and Standards as mentioned above.

\* \* \* \* \*