SYLLABUS FOR CHARTERED ELECTRICAL SAFETY ENGINEER EXAMINATION-2021

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/AC networks; Energy meter & its Reading; 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); active power, reactive power, energy, frequency, power factor in single and three phase AC networks, power factor correction, Reactive power compensation.
2. **Transformer:** BIS of transformer, Basic Principle, types & its use, construction, equivalent circuit, Voltage regulation, Parallel operation, Transformer tapping, Temperature rise in transformer and its cooling system, 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. Type test and routine test of transformer.
3. **Electrical machines:** BIS of rotating machine, Basic principle of DC motors, AC motors, Motor -pump set, submerged pump, Electrical Lift, method of start, starters and speed control of AC motors, Load-Torque characteristic, Variable frequency Drives(VFDs) and its application, testing, protection and preventive maintenance of various motors. Fault diagnosis.
4. **Cable and Wiring–** domestic, industrial; Types of house wiring, series –parallel circuit in building wiring, type ,size and material of conductors, Cables - type of cables, current and voltage ratings, cable termination, selection, application, laying methods, cable protection and testing, cable fault identification, causes of breakdown, preventive maintenance, methods and use of equipment for preventive measures like Partial discharge, thermo-vision etc. **Underground Cables** - simple calculations and general principles of laying cables direct in ground, in troughs 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.

5. **Power System :**

a). Generation – Basic knowledge of different type 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 the conductor of transmission line as per CEA Safety Regulation, transmission line protections and relays used, transmission line tests and routine maintenance. **Overhead Lines-** Simple calculation and general principles of construction of low, medium and high voltage lines. Size of conductors, length of spans, sag, strength of poles, spacing of conductors, cross arms, effect of temperature, wind pressure, ice and snow, tension on wire. Insulators, brackets, stays, struts, guard wires and other protective devices. Earthing, lighting arrestors, lighting conductors and their testing and fault location.

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 arrestor, 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.

6. **Distribution and switchgears** - Type and selection of electrical elements used in distribution i.e. fuses, Lightning arrestor, Vaccum Circuit Breaker (VCB), SF_6 CB, Isolators, earth switches, ACBs, MCBs, MCCBs, ELCB/RCCB, switchboards, bus duct, synchronizing panels, linked switch with fuse, Load change over switch, RMU, Panels, APFC Panels, PLC logic panels, testing method of these switchgears and test equipments. Protection of structure and building against lightning, service connection.
7. **Illumination-** Metal filament lamps, florescent lamp circuits, high voltage luminous tube sign installations. Photometric units and simple measurements. Illumination scheme in building and calculation, general requirements of efficient lighting and elementary calculation. Street lighting. Time switches.

8. **Electrical Drawings**- Preparation, representation, interpretation of electrical drawings and execution of electrical works.
9. **Earthing:** IS code of practice for wiring and earthing, Types of system earthing, fault level calculations, type of earthing-rod/ plate/coil, earth conductor sizes, earth resistance measurement and test equipment, different earthing system IT,TT,TNC,TN etc. earthing of substation apparatus, transmission and distribution lines/towers, earthing at consumer premises, earthing of industrial and domestic premises equipment
10. **Safety:** Safety from fire caused due to electricity; 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.
11. **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 Standards 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 and National Building Code.
12. **Testing**:-Insulation resistance test, testing of polarity, continuity test, earth resistance, leakage current testing, other basic routine test for all apparatus and installations.

Approved by

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