

Karnataka

**ELECTRICAL SCIENCES**

## **ELECTRICAL AND ELECTRONICS**

### **Syllabus**

**1. DC & AC Machines:** Principle of operation, emf equation of DC Machine, constructional features, classification, generator action, voltage regulation, motor action, characteristics, applications, efficiency, testing of DC machines, starting of DC motors. Principle of operation and constructional features of Induction motor, equivalent circuit, circle diagram of IM, torque equation, starting of IM, speed control, application of single phase IM.

Transformers : single phase & 3 phase transformer, principle of operation, equivalent circuit, vector diagram, efficiency & regulation. Polarity test, OC & SC tests. Predetermination of efficiency & regulation. Power & distribution transformers. All day efficiency, Sumpner's Test.; 3 Phase transformer connections: 3 phase to 6 Phase, Scott connection & open delta, Harmonics.

Auto transformers: construction, application, 3ph autotransformer; Construction & operation of cylindrical rotor & salient pole synchronous generators, Emf Equation harmonics & their minimization; Armature reaction, regulation by emf method, mmf method & ZPF Methods. two reaction theory for salient pole machine. Determination of  $X_d$  &  $X_q$  from slip Test, synchronization, synchronizing with Infinite bus, parallel operation of two alternators, operation on infinite bus, load sharing, effect of change in excitation. Power angle, equation of power in terms of power angle.

Synchronous Motor : Principle of operation, V & Inverted V curves, Synchronous Motor as Synchronous Condenser for pf Improvement, Method of starting, Torque & Torque Angle.

**2. Power Generation, Transmission & Distribution:** Hydal, Thermal & Nuclear power plants, plant factors, terminologies connected with the above plants, Power plant Economics, major equipment in power station, power factor improvement, Substations. MVA calculation, current limiting reactors, Typical transmission & distribution schemes, over head transmission lines. Line parameters: calculation of resistance, inductance & capacitance. Short medium & Long transmission Lines. HVDC Transmission concepts; Insulators: Types, potential distribution in suspension insulators, string efficiency, testing of insulators; Underground cables - types, material used, grading of cables, charging current, testing of cables; AC Distribution system: radial & ring main systems. Switch gear and Protection: Fuses, Circuit breakers, switches, relays, protection schemes.

**3. Power Electronics:** Power semiconductor devices - power diodes, power transistors, power MOSFET, IGBT, their switching characteristics, merits & demerits, their typical applications; Thyristor - Two - transistor analogy, static & dynamic characteristics- turn on & turn off characteristics, gate characteristics. Triggering schemes, snubber circuits, Over current & Over voltage protection; Commutation: Line & forced commutation.

**4. Power System Analysis & Computer Methods In Power Systems:** Representation of power system components: Single line diagrams, per unit concept. Symmetrical 3 phase faults: short circuit currents and selection of circuit breaker; Symmetrical components: Resolution of unbalanced voltages & currents into their symmetrical components. Power in terms of symmetrical components, Positive, negative & Zero sequence networks of power systems; Power systems Stability: Steady state and transient stability. Swing equation, equal-area criteria & its application; Load flow studies, Solution of load flow studies by Gauss Sidal, N.R. method & fast decoupled method, economic operation of power system.

5. Classification of Electric drives heating & power rating of motors, Industrial drives, and electric traction.