# EEPC2003 ELECTRICAL MACHINES-II (3-0-0)

**Module I (08 Hours)**
Three-phase synchronous generators:
Construction, Salient pole type and Cylindrical rotor structure, Armature windings, Winding factor, EMF equation, Armature reaction, Synchronous impedance, Alternator on load, Phasor diagrams, Open Circuit and Short Circuit tests, Short Circuit Ratio, Voltage regulation by EMF, MMF and ZPF methods, Two reactance concept of Salient pole Synchronous machines, Slip test, Power equations, Power angle characteristics.

**Module II (06 Hours)**
Parallel operation of alternators:
Requirements for parallel operation, synchronizing of alternators, three dark lamp method, synchroscope, synchronizing current, synchronizing power, synchronizing torque, effect of increasing the excitation, effect of increasing the driving torque and effect of change in speed of one of the alternators, load sharing between two alternators.

**Module III (04 Hours)**
Synchronous motors: Rotating magnetic field, operating principle of a synchronous motor, phasor diagrams, power equations, load angle, 'V' and inverted 'V' curves, synchronous condenser, starting methods, hunting.

**Module IV (06 Hours)**
Three-phase induction motors: Construction, principle of operation, types, squirrel cage rotor, slip ring induction motor, slip, torque equations, starting torque, full load torque, maximum torque, torque-slip and torque-speed characteristics, effect of rotor resistance, effect of change in supply voltage, effect of change in frequency, power losses and efficiency, synchronous watt, equivalent circuit of induction motor, phasor diagrams, power output, testing of induction motors, No-load test, Blocked rotor test, load test, measurement of slip, circle diagram.

**Module V (06 Hours)**
Starting and speed control of three-phase induction motors: DOL starting, stator resistance starting, auto transformer starting, star-delta starting, starting of sip ring induction motors, speed control by variation of supply voltage-supply frequency, rotor resistance control, crawling and cogging effects.
Single-phase induction motors: Construction, principle of operation, double field revolving theory, equivalent circuit, performance characteristics, starting methods, capacitor start-capacitor run single phase induction motors.

**Course Outcomes (COs)**

CO1: Explain the construction and working principles of synchronous generators, derive EMF equations, and analyze armature reaction and voltage regulation. (Knowledge, Understanding)

CO2: Demonstrate the requirements and procedures for the parallel operation of alternators and analyze the impact of synchronizing current, power, and torque on system stability and load sharing. (Application, Analysis)

CO3: Describe the construction, operating principles, and characteristics of synchronous motors, and analyze V and inverted V curves for performance assessment. (Knowledge, Understanding, Analysis)

CO4: Explain the structure, operation, and torque characteristics of three-phase induction motors, evaluate effects of rotor resistance and supply variations, and analyze equivalent circuits. (Understanding, Application, Analysis)

CO5: Analyze different starting and speed control methods for induction motors, assess performance of single-phase induction motors, and apply theories like double field revolving theory for performance analysis. (Analysis, Evaluation)

**Textbooks:**

1. "Theory & Performance of Electrical Machines" by J.B. Gupta, 15th edition, S. K. Kataria & Sons, reprint 2015.
2. Fitzgerald& Kingsley's "Electric Machinery", Stephen D. Umans, 7th edition, McGrawHill publishers, 2014.

**Reference books:**

1. "Electric Machinery" by P.S. Bimbhra, 2nd edition, Khanna Publishing House, 2022.
2. "Electric Machines" by D.P. Kothari and I.J. Nagrath, 5th edition, McGrawHill publishers, 2017.
3. "The Performance and Design of Alternating Current Machines", by M. G. Say, CBS Publishers & Distributors, 2005.