

Electrical Machines – II

- 1.1 Course Number: EEV311
- 1.2 Contact Hours: 3-1-0 Credits: 11
- 1.3 Semester-offered: 3rd Year-Odd
- 1.4 Prerequisite: Knowledge of Basic Electrical Engineering and Electrical Machine - I
- 1.5 Syllabus Committee Member: Dr. Umakant Dhar Dwivedi, Dr. Vijay Kumar Singh, Dr. Saptarshi Ghosh, and Dr. Saurabh Pandey.

2. Objective: The objectives of this course are to have the basic knowledge of construction, operating principle, characteristics and application of Synchronous Generator, Synchronous Motor, Single Phase Induction Motors, AC series motor, hysteresis motor, reluctance motor, Single Phase Synchronous Motors, Two Phase AC Servo Motor, Permanent Magnet DC Motor.

3. Course Content:

Brief review of transformer. Rotating machine: general constructional features. Conditions for steady production of electromagnetic torque; MMF and flux density distribution along the air-gap of a rotating machine by a single coil and by multiple coils; Production of rotating field by a 3-phase winding; The expression of induced voltage in a coil when it moves relative to a field distribution; Types and constructional features of 3-phase induction motor. Slip and its importance, Typical torque slip characteristic. Fixing operating point when load torque is present; Estimation of equivalent circuit parameters from no load and locked(blocked) rotor tests; Single phase induction motor: double revolving field theory and development of equivalent circuit and expression for torque; Synchronous machine: Types and constructional features. EMF equation and concept of synchronous reactance; Synchronous machine connected to bus and operating as motor, Phasor diagram under various operating conditions; Salient pole synchronous machine: concept of direct axis and quadrature axis reactances; Swing equation under dynamic condition. Equal area criteria. Steady state and transient stability limits.

4. Readings

4.1 Textbook:

- i. *P.K.Mukherjee & S. Chakravorti: Electrical Machines, Dhanpat Rai Publications(P) Ltd., New Delhi*
- ii. *I.J. Nagrath, D.P. Kothari: Electrical Machines, Tata McGraw Hill*
- iii. *R.K. Srivastava: Electrical Machines, Cengage Learning, India*

4.2 Reference books:

- i. *Irving L. Kosow: Electric Machinery and Transformers, Prentice Hall India Publication*
- ii. *A.E. Fitzgerald, Charles Kingsley: Electrical Machines, IV Edition, McGraw Hill*
- iii. *A.S. Langsdorf: Theory of Alternating Current Machinery, Tata McGraw Hill*

- iv. *M. G. Say: The Performance and Design of Alternating Current Machines, III Ed., CBS Publ. & Dis.*
- v. *M. G. Say: Alternating Current Machines, III Edition, ELBS*
- vi. *Clayton & Hancock: The Performance and Design of Direct Current Machines, ELBS*
- vii. *M.G.Say & O.S Taylor: Direct Current Machines, ELBS*

5. Outcome of the Course:

To make students different aspects of Industrial Electrical Machines used in Power generation and Drive application, their constructional details, operations, control and applications.