

Course Title: Advanced Electrical Machinery

Course Code: EPEG 302

Credit Hours: 3

Course Description:

This course provides a thorough understanding of the design, performance and applications of important ac electrical machines.

Course Contents:

Unit 1: Power Transformers

Types, Construction and applications, Transformers tapping, Per unit systems, Three phase connections and harmonic suppression, Vector groups, Three-phase transformation using two transformers, Parallel operation and load division, Cooling systems of transformers, Specific loading and output equations of power transformers

Unit 2: Three-Phase Induction Motors

Principle of operation, Rotating magnetic field, Production of torque, Reversal of rotation, Squirrel cage and wound rotor construction, Equivalent circuit, Synchronous speed, Slip and its effect on rotor frequency and voltage, Equivalent circuit, Losses and efficiency, No load and blocked rotor tests, Transformation ratio, Power and torque, Power factor, Torque-speed characteristics, Starting and speed control, Induction generator

Unit 3: Synchronous Generators

Introduction, Construction, Power and torque, Speed and frequency, EMF equation, Alternators on load, vector diagram, Voltage regulation, Equivalent circuit, Measurement of parameters, Generator operating alone, Capability chart, Synchronization, Parallel operation with infinite bus and power sharing, Parallel operation of same size generators, Loss of field excitation, Cooling systems, Shut down procedures

Unit 4: Synchronous Motors

Principle of operation, Torque, Torque-angle characteristics, Method of starting, Counter voltage (CEMF) and armature reaction voltage, Excitation method, V curves, Losses and efficiency, Power factor improvement, Speed control, Ratings, Hunting and damping

Unit 5: Single-Phase Induction Motors

Cross field and revolving field theory, Working, Torque-speed characteristics and applications of split-phase induction motor

Unit 6: Computers Applications in Modern Machines

Computer aided design (CAD) and computer aided manufacturing (CAM).

References:

1. S. J. Chapman, *Electric machinery fundamentals*, McGraw- Hill
2. C I. Hubert, *Electric Machines*, Prentice Hall Inc
3. A.E. Fitzgerald, C. Kingsley, S. D. Umans, *Electrical Machinery*, McGraw Hill

4. D. P. Kothari, I. J. Nagrath, *Electrical Machines*, McGraw- Hill
5. I. L. Kosow, *Electrical Machinery & Transformer*, PHI
6. A. K. Sawhney, *Electrical Machine Design*, Dhanpat Rai & Co.
7. M. N. Bandyopadhyay, *Electrical Machines*, PHI
8. P.C. Sen, *Principles of Electrical Machines and Power Electronics*, John Wiley & Sons