

## PEL4I101 ELECTRICAL MACHINES-II

### Module-I

#### University Portion (80%):

General principles of DC machines: Armature Windings (Simplex Lap and Simplex Wave), Expression for EMF Induced and Torque developed in the Armature counter Torque and Counter or Back EMF, Methods of Excitation, Armature Reaction, Commutation.

DC Machine Characteristics: Conditions for Self Excitation, Critical Resistance and Critical Speed. Internal and External Characteristics for self and Separately Excited DC Generator. Characteristic for Speed~ Armature Current, Torque~ Armature Current and Speed~ Torque of a DC Shunt, Series and Compound Motor and Comparison.

#### College/Institute Portion (20%):

Constructional features, Brush Shift and its Effects, Interpoles, Compensating Windings or related advanced topics as decided by the concerned faculty teaching the subject.

### Module-II

#### University Portion (80%):

DC Motor Starting and Performance: Necessity of a Starter, Starting of DC Shunt, Series and Compound Motors, Speed Control of DC Shunt and Series motor Losses, efficiency and power flow diagram.

Three Phase Synchronous Generators: Synchronous Generator Construction (both Cylindrical Rotor and Salient Pole type), the Speed of Rotation of a Synchronous Generator, Induced voltage in A.C Machines, The Internal Generated Voltage of a Synchronous Generator, The Equivalent Circuit of a Synchronous Generator (Armature Reaction Reactance, Synchronous Reactance and Impedance).

Cylindrical Rotor type Three Phase Synchronous Generators: The Phasor Diagram of a Synchronous Generator, Power and Torque in Synchronous Generators (Power Angle Equation and Power Angle Characteristic), Measuring Synchronous Generator Model Parameters (Open Circuit and Short Circuit Tests and Determination of Synchronous Impedance and Reactance, The Short Circuit Ratio), Voltage Regulation and Speed Regulation. Voltage Regulation by Synchronous Impedance Method

#### College/Institute Portion (20%):

Braking of Dc motor, Application, Zero Power Factor characteristic, Potier Reactance, Voltage Regulation by Potier Reactance (Zero Power Factor = ZPF) Method or related advanced topics as decided by the concerned faculty member teaching the subject.

### Module-III

#### University Portion (80%):

Salient Pole type Three Phase Synchronous Generators: Two Reaction Concept, Development of the Equivalent Circuit of a Salient Pole type Three Phase Synchronous Generator (Direct axis and Quadrature axis Reactance, Phasor Diagram for various load power factors.), Torque and Power Equations of Salient Pole Synchronous Generator (Power Angle Equation and Power Angle Characteristic with stator resistance neglected). Slip Test for determination of Direct axis and Quadrature axis Reactance.

Parallel operation of Three Phase A.C. Synchronous Generators

The Conditions Required for Paralleling, The General Procedure for Paralleling Generators, Frequency - Real Power and Voltage – Reactive Power Characteristics of a Three Phase Synchronous Generator.

**College/Institute Portion (20%):**

Operation of Generators in Parallel with large Power Systems, Operation of generators in parallel with other Generators of the same size or related advanced topics as decided by the concerned faculty member teaching the subject.

**Module-IV**

**University Portion (80%):**

Three Phase Synchronous Motors: Basic Principles of Motor operation, Steady State Synchronous Motor operation, Starting Synchronous Motors, Synchronous Generators and Synchronous Motors, Operation of synchronous motors connected to bus and phasor diagrams for normal, under and over excited conditions, V and  $\Lambda$  curves, Synchronous Motor Ratings. Application.

Special Purpose Motors:

The Universal series motor: constructional features and performance characteristics

**College/Institute Portion (20%):**

Other types of Motors: Reluctance Motors, Stepper Motors or related advanced topics as decided by the concerned faculty member teaching the subject.

**Text Books:**

1. Stephen J. Chapman-*'Electric Machinery and Fundamentals'*- Mc Graw Hill International Edition, (Fourth Edition), 2015.
2. M.G.Say-*'Alternating Current Machines'*, English Language Book Society (ELBS)/ Longman , 5<sup>th</sup> Edition, Reprinted 1990.

**Reference Books:**

1. B.S.Guru & H.R.Hiziroglu-*'Electric Machinery & Transformers'*-3<sup>rd</sup> Ed-Oxford Press, 2014.
2. P.C.Sen-*'Principles of Electric Machines and Power Electronics'*-2<sup>nd</sup> Edition, John Wiley and Sons, Wiley India Reprint, 2014.
3. A.E.Fitgerland, Charles Kingslay Jr. & Stephen D. Umans -*Electric machinery* – 6<sup>th</sup> Edition Mc Graw Hill – Reprint 2015.
4. D.P. Kothari & I.J. Nagrath - *Electric Machines* – 4<sup>th</sup> Edition Mc Graw Hill – Reprint 2015.
5. P S Bimbhra – *Electrical Machinery* –Khanna Publishers.