

# PCEE4203 **Electrical Machines- I**

## **MODULE- I**

**(12 Hrs)**

1. GENERAL PRINCIPLES OF DC MACHINES: Armature Windings (Simplex Lap and Simplex Wave), Methods of Excitation, Expression for EMF Induced and Torque Developed in the Armature, Counter Torque and Counter or Back EMF, Armature Reaction, Commutation, Brush Shift and its Effects, Interpoles, Compensating Windings.
2. DC GENERATOR CHARACTERISTICS: Characteristics for Separately Excited DC Generator (No-Load and Load), Conditions for Self Excitation, Critical Resistance and Critical Speed, Characteristics for Self Excited DC Shunt Generator (No-Load and Load), Voltage Regulation, Parallel Operation of DC Shunt Generators and DC Series Generators.

## **MODULE- II**

**(13 Hrs)**

3. DC MOTOR CHARACTERISTICS: Characteristic for Speed~Armature Current, Torque~Armature Current and Speed~Torque of (i) Separately Excited DC Motor, (ii) DC Shunt Motor, (iii) DC Series Motor, and (iv) DC Compound Motor, Comparison Between Different types of DC Motors and their Application.
4. DC MOTOR STARTING and PERFORMANCE: Necessity of a Starter, Starting of DC Shunt, Series and Compound Motors, Precautions During Starting of DC Series Motor, Speed Control of DC Shunt and Series Motors, Classification of Losses, Efficiency Evaluation from Direct and Indirect Methods (i) Brake Test (Direct method), (ii) Swinburne's Test (Indirect method), (iii) Regenerative/Hopkinson's Test (Indirect method).

## **MODULE- III**

**(15 Hrs)**

5. SINGLE PHASE TRANSFORMERS: Constructional Features, EMF Equation, Turns Ratio, Phasor Diagrams at No-Load and Load Conditions, Equivalent Circuit, Determination of Parameters From Tests (Polarity Test, Open Circuit Test and Short Circuit Test, Back to Back test), Voltage Regulation, Per Unit Calculation, Losses and Efficiency, Auto Transformers and their application.
6. THREE PHASE INDUCTION MACHINES: Constructional Features of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Principle of Operation, Concept of Slip, Slip Speed, Equivalent Circuit and Phasor Diagram, No-Load and Blocked Rotor tests, Determination of Parameters, Slip~Torque Characteristics and Effect of Rotor resistance on it, Losses and Efficiency. Starting of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Speed Control of Induction Motors, Cogging, Crawling and Electrical Braking of Induction Motors, Brief Idea on Induction Generators.

### **Text Book :**

1. Electric Machines – D P Kothari and I J Nagrath – Tata McGraw Hill.

### **Reference Book(s):**

1. The Performance and Design of DC Machines – A E Clayton.
2. Theory and Performance of AC Machines – M G Say
3. Electrical Machinery – P S Bimbhra – Khanna Publishers.
4. Electrical Machines –P.K.Mukherjee & S.Chakravorti–Dhanpat Rai Publications.
5. Electric Machinery – Fitzgerald, Charles Kingsley Jr., S. D. Umans – Tata Mc Graw Hill.
6. Electric Machinery And Transformers – Guru & Hiziroglu – Oxford University Press.
7. Electric Machines – Charles Hubert – Pearson Education.