COURSE TITLE : DC MACHINES
COURSE CODE : 4031
COURSE CATEGORY : B
PERIODS/WEEK : 4
PERIODS/SEMESTER : 56
CREDITS : 4

TIME SCHEDULE

MODULE	TOPICS	PERIODS
1	Principle and Construction of DC Generators	14
2	Characteristics of DC Generators	14
3	Principle and Construction Of DC Motor	14
4	Characteristics and Testing of DC Motors	14
Total		**56**

Course Outcome:

Sl.	Sub	**On completion of this course the student will be able:**
1	1	To know the working principle and construction of DC machines.
	2	To comprehend the conversion of DC.
2	1	To analyze the characteristics of different types of DC generators.
3	1	To know the construction and working of DC Motor.
	2	To know the different types of starters.
	3	To comprehend speed control of DC motor.
4	1	To comprehend the characteristics of DC motor.
	2	To know the methods of testing of DC motors.
	3	To know the construction and working of permanent magnet DC Motors.

Specific Outcome:

MODULE I Principle and Construction of DC Generators

1.1.1 To illustrate the constructional details of DC generator.
1.1.2 To list the Classification of DC generators cording to excitation.
1.1.3 To derive the EMF equations of a DC generator.
1.1.4 To solve problems using EMF equation.
1.1.5 To distinguish between terminal voltage and induced EMF.
1.1.6 To design and draw Lap and Wave windings for DC machines.
1.1.7 To describe the working principle of DC Generator.
1.1.8 To describe the working of single loop DC generator with relevant wave forms.
1.1.9 To compare slip ring and split ring.

MODULE II Characteristics of DC Generators

2.1.1 To state and explain armature reaction.
2.1.2 To illustrate the commutation process in DC generators.
2.1.3 To state methods of improving commutation.
2.1.4 To explain why compensating winding is needed.
2.1.5 To state the necessity of equalizer connections.
2.1.6 To explain why shunt generator failing to build up of voltage.
2.1.7 To illustrate open circuit characteristics of shunt generator.
2.1.8 To illustrate open circuit characteristics of separately excited generator.
2.1.9 To define critical field resistance.
2.1.10 To define critical speed.
2.1.11 To illustrate the internal and external characteristics of:
    i. Shunt generator.
    ii. Series generators.
    iii. Compound generators.
2.1.12 To explain the Parallel operation and load sharing of generators.
2.1.13 To list the applications of DC generators.

MODULE III Principle and Construction Of DC Motor

3.1.1 To explain the working principle of DC motor.
3.1.2 To illustrate Constructional details of DC motor.
3.1.3 To list out the Classification of DC motor based on field connection.
3.1.4 To derive the voltage equation of DC motor.
3.1.5 To derive speed and torque equation.
3.1.6 To compute problems using torque and speed equation.

3.1.7 To illustrate the necessity of starters.
3.1.8 To describe different types of starters.
3.1.9 To describe two point starter.
3.1.10 To describe three point starter.
3.1.11 To describe four point starter.
3.1.12 To explain the factors effecting the speed of control of DC motor.
3.1.13 To illustrate the methods of speed control of DC shunt motors.
3.1.14 To illustrate the methods of speed control of DC series motors.

MODULE 4 Characteristics and Testing of DC Motors

4.1.1 To illustrate the mechanical characteristics of series motor.
4.1.2 To illustrate the electrical characteristics of series motor.
4.1.3 To illustrate the performance characteristics of series motor.
4.1.4 To illustrate the mechanical characteristics of shunt motor.
4.1.5 To illustrate the electrical characteristics of shunt motor.
4.1.6 To illustrate the performance characteristics of shunt motor.
4.1.7 To illustrate the mechanical characteristics for compound motor.
4.1.8 To illustrate the electrical characteristics of compound motor.
4.1.9 To illustrate the performance characteristics of compound motor.
4.1.10 To state the losses in DC machines.
4.1.11 To describe the direct loading method to determine the efficiency of DC shunt motor.
4.1.12 To illustrate Swinburne's test of DC machine.
4.1.13 To State the advantages and disadvantages of Swinburne's test.
4.1.14 To compute the condition for maximum efficiency.
4.1.15 To List the application of following DC motors.
   i. Series.
   ii. Shunt.
   iii. Compound.
4.1.16 To describe the construction and working of permanent magnet D.C motor.
4.1.17 To State the applications of permanent magnet D.C motor.

CONTENTS

MODULE - I

D C generator - Working principle of d c generator - single loop D C generator - DC generator - constructional details – Classification - EMF equation – problems - Voltage equation - current relation in various types of DC generator – problems - Armature winding - design of lap and wave winding -

MODULE- II

Armature reaction – commutation - compensating winding - equalizer connections. Characteristics of DC generator – Open circuit characteristics of self and separately excited generator - critical resistance - critical speed -simple problems - internal and external characteristics of self excited generators - Parallel operation of DC generators – problems - application of DC generators.

MODULE -III

DC motor – working principle-constructional details-classifications-voltage equation-problems - Toque equation - speed equation – problems - Factors affecting speed - speed control – Problems - Starting of DC motors - different types of starters.

MODULE - IV

Characteristics of DC motors – electrical characteristics- mechanical characteristics – performance characteristics. Losses and efficiency- condition for maximum efficiency- problems - Testing of DC motor - load test on DC motors – Swinburn's test- problems - Application of DC motors - Permanent magnet d c motor-construction – working – characteristics - Applications.

REFERENCES:

1. BL Theraja. Electrical technology. Vol- II: S Chand & co.
2. JB Gupta. Theory and performance of electrical Machines: S. K. Kataria & Sons