Program: **Diploma in Electrical & Electronics Engineering**	
Course Code: **3032**	Course Title: **DC Machines & Traction Motors**
Semester : **3**	Credits: **3**
Course Category: **Program Core**	
Periods per week: **3 (L:2 T:1 P:0)**	Periods per semester: **45**

Course Objectives:

- To familiarize with the construction and operation of DC machines.
- To recognize the classification and applications of DC machines.
- To analyze the performance of DC generators and DC motors.
- To provide a basic knowledge of electric traction systems.

Course Prerequisites:

Topic	Course Code	Course Name	Semester
Magnetism and Electromagnetism		Elementary Concepts of Electrical Systems	2

Course Outcomes:

On completion of the course, the students will be able to:-

COn	Description	Duration (Hours)	Cognitive Level
CO1	Identify the construction and operation of dc generator	10	Applying
CO2	Identify the electrical characteristics and uses of dc generators	10	Applying
CO3	Select dc motor for specific applications based on performance characteristics	12	Applying
CO4	Choose various methods of speed control of dc motors and traction motors.	11	Applying
	Series Test	2	

CO - PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3						
CO2	3						
CO3	3						
CO4	3						

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline

Module Outcome	Description	Duration (Hours)	Cognitive Level
CO1	**Identify the construction and operation of dc generator.**		
M1.01	Illustrate the constructional details of DC Machines.	3	Understanding
M1.02	Explain the principle of operation of a DC generator.	2	Understanding
M1.03	Derive EMF equation of DC generator and solve problems	3	Applying
M1.04	Compare the armature windings of a DC machine.	2	Understanding
Contents: Dc machines-constructional details -Dc generator - working principle - simple loop generator - dc generator classification -- voltage equation - emf equation – problems – losses -power stages- efficiency-condition for maximum efficiency(derivation needed)- problems - armature winding - lap and wave windings(basic concepts, comparison and uses -only)			
CO2	**Identify the electrical characteristics and uses of dc generators**.		
M2.01	Illustrate armature reaction and its effects in DC generators	2	Understanding
M2.02	Explain commutation process in DC generator and methods for improving commutation	2	Understanding
M2.03	Illustrate the characteristics of various types of DC generators and solve problems	3	Applying

M2.04	Outline parallel operation and uses of various DC generators.	3	Understanding
	Series Test - 1	1	

Contents:

Armature reaction –effects - compensating winding- commutation - interpoles- equalizer connections. characteristics of dc generators – separately excited(characteristics curves only) - self excited generators-open circuit characteristics - critical resistance - critical speed - problems -internal characteristics-voltage build up of a shunt generator - conditions- external characteristics – concept of parallel operation of dc generators –uses of dc generators.

CO3	**Select dc motor for specific applications based on performance characteristics**		
M3.01	Explain the working principle of DC motor and solve various motor parameters	4	Applying
M3.02	Illustrate the performance characteristics of dc motors and select motors for specific applications.	4	Applying
M3.03	Illustrate the working of various types of starters.	2	Understanding
M3.04	Outline the procedures for testing of DC motors	2	Understanding

Contents:

DC motor – working principle - significance of back emf-dc motor classifications - voltage equation -condition for maximum power (derivation required)- problems –torque in dc motor-general torque equation (derivation needed)-armature torque and shaft torque (definitions and equations only) – problems.

Characteristics of dc motors – electrical characteristics- mechanical characteristics – performance characteristics-losses- power stages- efficiency- condition for maximum efficiency- problems.– applications of dc motors.

Starting of dc motors - necessity of starter- types of starters -schematic diagram and working -three point starter-four point starter.

Testing of dc motor - load test on dc motors – Swinburne's test

CO4	**Choose various methods for speed control of dc motors and traction motors.**		
M4.01	Identify different types of speed control of dc motors.	3	Applying
M4.02	Summarize the use of DC series motors in electric traction	2	Understanding

M4.03	Illustrate Speed control of traction motors	3	Understanding
M 4.04	Explain braking of traction motors	3	Understanding
	Series Test – II	1	

Contents:

Speed control of dc motor -factors affecting speed – speed control methods - list various methods- flux control and armature control (shunt and series motors only)- voltage control method - basic concept and diagram only - problems

DC electric traction motor - general features -speed control method - series-parallel control - shunt transition -bridge transition - electrical braking in traction - diagram with basic concept- rheostatic braking - regenerative braking

Text /Reference:

T/R	Book Title/Author
T1	Electrical Technology-BL Theraja, A K Theraja. Vol- II: S Chand & co.
T2	Electrical Technology-BL Theraja, A K Theraja. Vol- III: S Chand & co.
R1	Bimbra P. S., Electrical Machinery, Khanna Publishers.
R2	Utilization of Electric Power: Including electric drives and electric traction - N V Suryanarayana: New age international publishers
R3	Dc Machines and Transformers -K Murugesh Kumar: S Chand & company
R4	Theory and performance of Electrical Machines- JB Gupta.: S. K. Kataria & Sons
R5	Deshpande M. V., Electrical Machines, Prentice Hall India, New Delhi, 2011
R6	Electrical Machines, Nagrath I. J. & Kothari D. P, Tata McGraw-Hill Education
R7	B.R. Gupta,' Fundamental of Electric Machines' New age International Publishers,3rd Edition

Online Resources

Sl.No	Website Link
1	NPTEL courses: https://nptel.ac.in/courses/108/102/108102146
2	https://nptel.ac.in/courses/108/105/108105155
3	https://nptel.ac.in/courses/108/106/108106071
4	https://nptel.ac.in/courses/108/105/108105053

5	www.swayam.gov.in
6	Virtual labs : http://vlabs.iitb.ac.in/vlab/labsee.html
7	http://em-coep.vlabs.ac.in
8	http://vem-iitg.vlabs.ac.in
9	NPTEL channel:www.youtube.com/channel/UC640y4UvDAlya_WOj5U4pfA
10	www.javatpoint.com/electrical-machines-tutorial