

No	Course Information	
1	Unit name:	Electrical Machine and Control I
2	Code:	EP 51014
3	Classification:	Engineering subject
4	Credit value:	2.5
5	Semester/ Year Offered:	1/5
6	Pre-requisite:	EP21014, Basic Electronics EP31014, Power Electronics
7	Mode of delivery:	Lecture, Practical
8	Assessment system and breakdown of marks:	Tutorial, Practical, Exam
	Test	20%
	Mid-term/ final Examination	30%
9	Academic staff teaching unit:	
10	Course outcome of unit: In this course students will be able	<ul style="list-style-type: none"> ➤ To describe the modern variable speed system ➤ To determine the speed, current, torque response and efficiency of various dc motors by using their modeling and transfer functions. ➤ To represent the performance and design of speed control dc motor drives ➤ To determine the performance of the chopper power circuit ➤ To measure the speed, torque, current and voltage of DC motors
11	Synopsis of unit:	The course covers the electrical machine and control system. The course introduces students to control system, description of the motor-drive applications, the status of power devices, classes of electrical machines, power converters, controllers and mechanical systems. This is followed by a discussion of the theory of operation of separately-excited and permanent-magnet dc brush motors and their modeling and transfer functions. Then, the various dc motor drives and designing the chopper power circuit are discussed.

Topic:

Chapter

Title

1.

Introduction

- 1.1 Introduction
- 1.2 Power Devices and Switching
- 1.3 Motor Drives
- 1.4 Scope of the Book
- 1.5 References

2

Modeling of DC Machinees

- 2.1 Theory of Operation
- 2.2 Induced EMF
- 2.3 Equivalent Circuit and Electromagnetic Torque
- 2.4 Electromechanical Modeling
- 2.5 State-Space Modeling
- 2.6 Block Diagram and Transfer Function
- 2.7 Field Excitation
- 2.8 Measurement of Motor Constants
- 2.9 Flow Chart for Computation
- 2.10 Suggested Readings
- 2.11 Discussion Questions
- 2.12 Exercise Problems

3

Phase-Controlled DC Motor Drives

- 3.1 Introduction
- 3.2 Principal of DC Motor Speed Control
- 3.3 Phase-Controlled Converter
- 3.4 Steady-State Analysis of the Three-Phase Converter-
Controlled DC Motor Drive
- 3.5 Two-Quadrant, Three-Phase Converter- Controlled DC
Motor Drive
- 3.6 Transfer Functions of the Subsystems
- 3.7 Design of Controllers

- 3.8 Two-Quadrant DC Motor Drive with Field Weakening
- 3.9 Four-Quadrant DC Motor Drive
- 3.10 Converter Selection and Characteristics
- 3.11 Simulation of the One-Quadrant DC Motor Drive
- 3.12 Harmonics and Associated Problems
- 3.13 Sixth-Harmonic Torque
- 3.14 Application Considerations
- 3.15 Applications
- 3.16 Parameter Sensitivity
- 3.17 Research Status
- 3.18 Suggested Reading
- 3.19 Discussion Questions
- 3.20 Exercise Problems

4

Chopper-Controlled DC Motor Drive

- 4.1. Introduction
- 4.2 Principal of Operation of the Chopper
- 4.3 Four-Quadrant Chopper Circuit
- 4.4 Chopper for Inversion
- 4.5 Chopper with Other Power Devices
- 4.6 Model of the Chopper
- 4.7 Input to the Chopper
- 4.8 Other Chopper Circuit
- 4.9 Steady-State Analysis of Chopper-Controlled DC Motor Drives
- 4.10 Rating of the Devices
- 4.11 Pulsating Torques
- 4.12 Closed-Loop Operation
- 4.13 Dynamic Simulation of the Speed-Controlled DC Motor Drive
- 4.14 Application
- 4.15 Suggested Readings
- 4.16 Discussion Questions
- 4.17 Exercise Problem

14	<p>Main references:</p> <p>R.Krishnan: Electric Motor Drive: Modeling, Analysis, and Control,</p>
15	<p>Additional references:</p> <p>P.W.Franklin, Theory of DC Motor Controlled by Power Pulses.</p>

Information on Lab Practical

Job No (1) Study on the Characteristics of Separately Excited DC Motor

Objective: To understand the characteristics of separately excited DC motor.

Required Equipments:

EMT DC machine assembly, EMT tabletop structure, EMT 6, EMT 8, EMT 9

Job No (2) Simulation of Single Phase Half Wave Controlled Rectifier

Objective: (1) To measure the dc output voltage of single phase half wave controlled rectifier

(2) To construct the model of single phase half wave controlled rectifier

Required Equipments:

(1) PC 1 set

(2) MATLAB software

Job No (3) Simulation of Single Phase Full-wave Controlled Rectifier

Objective : (1) To measure the dc output voltage of single phase full wave controlled rectifier

(2) To control the dc output voltage by varying the triggering angle

Required Equipments:

(3) PC 1 set

(4) MATLAB software

Job No (4) Simulation of Single Phase Full-wave Controlled Rectifier With Source Impedance

Objective : (1) To measure the dc output voltage of the single phase full wave controlled rectifier with impedance

(2) To control the dc output voltage by varying the triggering angle

Required Equipments:

(1) PC 1 set

(2) MATLAB software

Job No (5) First-Quadrant Chopper DC Drive

Objective : (1) To demonstrate the first-quadrant chopper DC drive during speed

regulation

Required Equipments:

- (1) PC 1 set
- (2) MATLAB software