ELECTRICAL MACHINES-I (THEORY) EE-200

Pre-requisite: Circuit Analysis I Credit Hours 03 Contact Hours 48

RECOMMENDED BOOKS

- "Electrical Machines", U A Bakshi, M. V. Bakshi, 2012, 5th revised edition, Technical Publications, India. **ISBN-10:** 9350990628
- "Electric Machinery," E. Fitzgerald, Charles Kingsley, Jr. and Stephen D. Umans, 7th edition 2013, McGraw-Hill, ISBN: 0073380466
- "Electric Machinery Fundamentals," Stephen J. Chapman, 5th Edition, 2011, McGraw-Hill, ISBN: 0073529540.

REFERENCE BOOKS

- "Electrical Machines, Drives and Power Systems," Theodore Wildi, 6th Edition, 2013, Pearson, ISBN: 1292024585.
- "A Text Book of Electrical Technology", B. L. Theraja, A. K. Theraja, 2008, Chand (S.) & Co Ltd., India, ISBN-10: 8121924413

OBJECTIVE OF COURSE

This course examines the basic theory, construction, operation, characteristics and application of rotating electrical machines. It includes the study of direct current motors, direct current generators, and single-phase transformers. The main focus of this course is on the generalized concepts of electromechanical energy conversion, the voltage-current characteristics, voltage regulation of DC generators, torque speed characteristics, speed regulation of DC motors. Working principles, construction and operation of single phase transformers will also be studied.

S.NO	CLO/PLOS MAPPING	DOMAIN	PLO
01	Study the construction, characteristics, operation and application of electric machines viz. transformers, DC motors, DC generators, single-phase AC motors, special purpose motors and autotransformers.	C1	01
02	Describe the importance of electric machines in a power system and their indirect/direct impact on modern	C4	06

society considering the breadth of their applications and the extent of use.

03	Develop an ability to recognize, formulate and solve electromechanical and electromagnetic engineering problems related to DC and single-phase AC machines and transformers.	C2	02,03
04	Use equivalent circuits and phasor diagrams to analyze single-phase induction motors in steady state conditions.	C4	02
05	Examine the voltage-current characteristics of DC generators and the torque speed characteristics, and speed regulation of DC motors.	C4	04

COURSE CONTENTS

Fundamentals of Electromechanical Energy Conversion

- Introduction and Morphology
- Rotational Motion
- Newton's Law, and Power Relationships
- Magnetic Fundamentals
- Faraday's law
- Production of induced force on a wire

Single-Phase Transformers

- Construction
- EMF equation
- Equivalent circuit
- Efficiency calculations and all-day efficiency
- Open circuit and short circuit tests
- Auto-transformer

DC machines

- Construction and Types of DC Machines
- Armature reaction
- Commutation
- The internal generated voltage and induced torque equations
- Winding diagrams-lap and wave winding
- Power flow and losses in DC machines
- Testing of DC machines

DC Motors

- Introduction to DC Motors
- The Equivalent Circuit of a DC Motor
- Separately Excited and Shunt DC Motors

- The Series DC Motor
- The Compounded DC Motor
- Speed control of dc motors
- DC Motor Efficiency Calculations
- Brushless DC motors

DC Generators

- Introduction of DC generators
- The separately excited generator
- The shunt DC generator
- The series DC generator
- The cumulatively compounded DC generator
- The differentially compounded DC generator

AC machines

- Single phase motor-types
- Single-phase induction motors
- Starting Single-Phase Induction Motors
- Speed Control of Single-Phase Induction Motors
- The Circuit Model of a Single-Phase Induction Motor

Introduction to special machines

- Stepper motor
- PMDC motor
- Servo motors