COURSE CONTENT

ELECTRICAL MACHINES-I LAB								
I Semester: EEE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
2530277	**Core**	0	0	2	1	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 30**				**Total Classes: 30**		
Co requisites: **Electrical Machines – I.**								

Course Overview:

This laboratory course provides practical exposure to the operation, testing, and performance evaluation of DC machines and transformers. Students perform experiments to determine magnetization characteristics, load characteristics, efficiency, and performance curves of DC generators and motors using direct and indirect testing methods. Transformer experiments include open-circuit and short-circuit tests, voltage–current relationship verification, and efficiency determination. The course also introduces simulation tools for modeling DC machines and transformer equivalent circuits, enabling comparison of theoretical and experimental results.

Course Objectives:

1. To understand and identify the procedures for performing magnetization, load, Hopkinson's, Swinburne's, and brake tests on DC machines and OC/SC tests on transformers.
2. To understand and explain the magnetization characteristics, load performance, and efficiency determination of DC generators and motors.
3. To develop the ability to apply test methods for determining performance curves, efficiency, and characteristics of DC machines.
4. To develop skills to analyze experimental data for performance evaluation and efficiency calculations of DC machines and single-phase transformers.
5. To acquire the ability to evaluate the relationships between voltages, currents, and efficiency in three-phase transformers and assess their operational correctness.

Course Outcomes: After Completion of the Course, Students should be able to

1. Identify the procedures for performing magnetization, load, Hopkinson's, Swinburne's, and brake tests on DC machines and OC/SC tests on transformers.
2. Explain the magnetization, load characteristics, and efficiency predetermination methods of DC machines.
3. Apply test procedures for determine the performance and efficiency of DC shunt, series, and compound machines.
4. Analyze the performance curves, efficiency, and characteristics of DC machines and single-phase transformers using experimental data.
5. Evaluate the relationships between voltages and currents in three-phase transformers and assess their operational correctness.

The following experiments are required to be conducted as compulsory experiments:

1. Magnetization characteristics of DC shunt generator (Determination of critical field resistance and critical speed)
2. Load test on DC shunt generator (Determination of characteristics)

3. Load test on DC series generator (Determination of characteristics)
4. Hopkinson's test on DC shunt machines (Predetermination of efficiency)
5. Swinburne's test (Predetermination of efficiency)
6. Brake test on DC compound motor (Determination of performance curves)
7. OC and SC Test on Single Phase Transformer
8. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta- Delta, Delta-star, Star-Star)

In addition to the above experiments, at least any two of the following experiments are required to be conducted from the following list:

1. Brake Test on DC shunt motor (Determination of performance curves)
2. Load Test on DC compound generator (Determination of characteristics).
3. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
4. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
5. Speed control of DC shunt motor
6. Modeling of DC Machine using simulation tools.
7. Equivalent circuit of Transformer using simulation tools.

Proposed open ended experiment:

1. Design and analysis performance of a DC Motor Drive with Chopper Control using digital Simulation.

TEXT BOOKS:

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I.J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

REFERENCE BOOKS:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, "Electrical Machines", Oxford, 2017.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
4. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

ELECTRONIC RESOURCES:

1. **https://nptel.ac.in/**
2. **https://www.allaboutcircuits.com/**
3. **https://electrical-engineering-portal.com/**
4. **https://ocw.mit.edu/**
5. **https://www.mathworks.com/help**

MATERIALS ONLINE:

1. Lab Manual
1. Open-ended experiments