

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
EEL202	ELECTRICAL MACHINES LAB I	PCC	0	0	3	2

Preamble : The purpose of this lab is to provide practical experience in operation and testing of DC machines and transformers.

Note : A minimum of **TWELVE** experiments are mandatory out of the fifteen listed.

Prerequisite :

1. Fundamentals of Electrical Engineering
2. D.C Machines and Transformers (Theory)

Course Outcomes: After the completion of the course the student will be able to

CO 1	Analyse the performance of DC motors and DC generators by performing load test.
CO 2	Sketch the Open Circuit Characteristics of a self excited DC shunt generator and check conditions of voltage build up by performing suitable experiment.
CO 3	Develop equivalent circuit and predetermine their regulation and efficiency by performing OC & SC tests on transformer.
CO 4	Analyse the efficiency and regulation of the transformer by performing load test.
CO 5	Analyse the efficiency of a DC machine when working as motor and generator by conducting suitable test.
CO 6	Examine the efficiency by performing Sumpner's test on two similar transformers.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	2	-	-	-	-	3	2	-	3
CO 2	3	3	2	2	-	-	-	-	3	2	-	3
CO 3	3	3	2	2	-	-	-	-	3	2	-	3
CO 4	3	3	2	2	-	-	-	-	3	2	-	3
CO 5	3	3	2	2	-	-	-	-	3	2	-	3
CO 6	3	3	2	2	-	-	-	-	3	2	-	3

Assessment Pattern

Marks distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance:	15 marks
Continuous Assessment:	30 marks
Internal Test (Immediately before the second series test) :	30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work	15 Marks
(b) Implementing the work/Conducting the experiment	10 Marks
(c) Performance, result and inference (usage of equipment and troubleshooting)	25 Marks
(d) Viva voce	20 marks
(e) Record	5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified Laboratory Record. The external examiner shall endorse the record.

Course Level Assessment Questions

Course Outcome 1 (CO1):

- 1) Conduct a brake test on the given DC series motor and plot its electrical characteristics and speed versus armature current curve.
- 2) Plot the load characteristics of the given differentially compounded DC generator by conducting suitable experiments.
- 3) Plot the electrical and mechanical characteristics of the given DC shunt motor by conducting suitable experiments.

Course Outcome 2 (CO2):

- 1) Predetermine the OCC of the given D.C shunt generator when running at 80% rated speed and also find the critical resistance at rated speed.
- 2) Plot the OCC of the D.C shunt generator at its rated speed and obtain its critical resistance and critical speed. Also obtain the additional resistance required in the field circuit for generating rated voltage on no load.

Course Outcome 3(CO3):

- 1) Predetermine the per phase equivalent circuit of the 3 phase transformer referred to low voltage side by conduction suitable experiments. Also compute its KVA corresponding to maximum efficiency.
- 2) Predetermine the maximum efficiency of the given single phase transformer at upf by conducting suitable experiment. Also compute its full load regulation at upf.

Course Outcome 4 (CO4):

- 1) Plot the regulation and efficiency curves of the given 1-phase transformer by conducting a suitable experiment.
- 2) Plot the regulation and efficiency curves of the given 3-phase transformer by conducting a suitable experiment.

Course Outcome 5 (CO5):

- 1) Conduct a suitable test on the given DC shunt machine and predetermine the efficiency curve of the machine both as motor and as generator

Course Outcome 6 (CO6):

ELECTRICAL AND ELECTRONICS ENGINEERING

- 1) Conduct a suitable test on two similar 1-phase transformers and predetermine its efficiency at full load and 0.8 pf lagging.
- 2) Conduct a suitable test on two similar 1-phase transformers and predetermine its efficiency at half load and UPF.

LIST OF EXPERIMENTS

PART A- DC MACHINES

1. Open Circuit Characteristics of a DC Shunt Generator

Objectives:

- a) Predetermine the OCC at different speeds
- b) Determine the critical field resistance
- c) Obtain maximum voltage built up with given shunt field
- d) Obtain critical speed for a given shunt field resistance

2. Load Test on a DC Shunt Generator

Objectives:

- a) Determine the external & internal characteristics of the given DC Shunt Generator

3. Brake Test on a DC Shunt Motor

Objectives:

Plot the following characteristics

- a) Performance characteristics
- b) Electrical characteristics
- c) Mechanical characteristics.

4. Brake Test on a DC Series Motor

Objectives:

Plot the following characteristics

- a) Performance characteristics
- b) Electrical characteristics
- c) Mechanical characteristics.

5. Load Characteristics of a DC Compound Generator

Objectives:

- a) To plot the load characteristics of the given DC Compound generator when cumulatively compounded.
- b) To plot the load characteristics of the given DC Compound generator when differentially compounded

6. Swinburne's Test on a DC Shunt Machine*Objectives:*

- a) To predetermine the efficiency of a D.C. shunt machine when the machine operates as a motor and as a generator for various load conditions
- b) To plot the efficiency curves of the given DC machine.

7. Hopkinson's test on a pair of DC machines*Objectives:*

Determination of the efficiency of the given dc shunt machine working as a motor and generator under various load conditions.

8. Retardation test on a DC machine*Objectives:*

- a) Separation of hysteresis, eddy current, friction & windage losses
- b) Find the moment of inertia of the rotating system

9. Separation of losses in a DC shunt motor*Objectives:*

- a) Separation of hysteresis, eddy current, friction & windage losses
- b) Plot the losses vs speed curves

PART B - TRANSFORMERS**10. OC & SC Tests on a Single Phase Transformer***Objectives:*

- a) To pre-determine the regulation and efficiency of the given single phase transformer at different loads and power factors
- b) To obtain the equivalent circuit of the given transformer
- c) To plot regulation vs power factor curves
- d) To determine the power factors at which regulation is zero

11. Direct Load Test on a Single Phase Transformer*Objectives:*

- a) To determine the efficiency of the given transformer at unity power factor at different loads
- b) To determine the regulation of the given transformer at unity power factor at different loads
- c) To plot the efficiency vs output and regulation vs output curves

12. Separation of Constant losses of a Single Phase Transformer

Objectives:

- a) To separate hysteresis and eddy current losses of a single phase transformer, keeping V/f constant.
- b) To plot losses vs. frequency curves, by separating the hysteresis and eddy current losses at normal voltage and different frequencies.

13. Sumpner's Test

Objectives:

- a) To predetermine efficiency at different loads and power factors
- b) To predetermine regulation at different loads and power factors
- c) To determine the equivalent circuit

14. Parallel Operation of two dissimilar Single Phase Transformers

Objectives:

- a) To determine the load sharing of each transformer by their equivalent impedances.
- b) To verify the load sharing by actual measurement.

15. OC & SC Tests on a Three Phase Transformer

Objectives:

- a) To predetermine the efficiency at different load conditions and power factors.
- b) To predetermine the regulation at different power factors.
- c) To develop the per phase equivalent circuit.

Reference Books

1. Bimbra P. S., Electrical Machinery, 7/e, Khanna Publishers, 2011.
2. Theraja B. L., A Textbook of Electrical Technology, S. Chand & Company, New Delhi,