

Course No.	Course Name	L-T-P-Credits	Year of Introduction
EE232	Electrical Machines Lab - I	0-0-3-1	2016

Course Objectives

To learn the working and testing methods of DC machines and transformers.

List of Exercises/Experiments:

Part A – DC Machines

1. Open circuit characteristics of DC shunt generator

Objectives:

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

2. Load test on DC shunt generator

Objectives:

- Determine the external & internal characteristics
- Deduce the armature reaction curve

3. Load test on DC compound generator

Objectives:

- Determine the external characteristics cumulative compound condition
- Determine the external characteristics differential compound condition

4. Brake test on DC shunt motor

Objectives:

Plot the following characteristics

- Efficiency Vs Output
- Line current Vs Output
- Speed Vs Output
- Speed Vs Torque
- Line current Vs Torque

5. Brake test on DC series motor

Objectives:

Plot the following characteristics

- Efficiency Vs Output
- Line current Vs Output
- Speed Vs Output
- Speed Vs Torque
- Line current Vs Torque

6. Swinburne's test on a DC shunt machine

Objectives:

Predetermine the armature current and percentage efficiency when the machine operates as a motor and as a generator for various load conditions and plot efficiency Vs output curves.

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. O.C. & S.C. tests on the single phase transformer

Objectives:

Predetermination of the following

- a) Efficiency at different load conditions and different power factors
- b) Regulation at different load conditions and different power factors
- c) Equivalent circuit referred to HV and LV sides
- d) UPF load at which efficiency is maximum
- e) Power factors at which regulation is maximum and zero
- f) Regulation vs. power factor curves

11. Load test on the single phase transformer

Objectives:

- a) Determination of the efficiency at different load conditions and unity power factor
- b) Determination of the regulation at different load conditions and unity power factor
- c) Plot efficiency vs. output & regulation Vs output curves

12. Separation of losses in a single phase transformer

Objectives:

Separate the hysteresis & eddy current losses at different voltages & different frequencies keeping V/f constant & plot losses vs. frequency curves. Hence

- i) Separate the hysteresis & eddy current losses at normal voltage & different frequencies & plot losses vs. frequency curves
- ii) Separate the hysteresis & eddy current losses at normal frequency & different voltages & plot losses vs. voltage curves.

13. Sumpner's test

Objective:

- a) Predetermination of efficiency at different load conditions and power factors
- b) Predetermination of regulation at different load conditions and power factors
- c) Plot efficiency vs. output & regulation vs. power factor curves
- d) Obtain the equivalent circuit referred to LV & HV sides

14. Scott connection of single phase transformers

Objectives:

Determine the efficiency at different load conditions when

- a) Main transformer alone loaded
- b) Teaser transformer alone loaded
- c) both transformers loaded under balanced conditions
- d) both transformers loaded under unbalanced conditions
- e) Plot efficiency vs. output curves for each case.

15. Parallel operation of 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 measurements

16. Three phase connection of single phase transformers

Objectives:

- a) Determine the polarity of single phase transformers
- b) Connect three single phase transformers in star-star configuration
- c) Connect three single phase transformers in star-delta configuration
- d) Determine the transformation ratio in the above cases

17. O.C. & S.C. tests on the Three phase transformer

Objectives:

Predetermination of the following

- a) Efficiency at different load conditions and different power factors
- b) Regulation at different load conditions and different power factors
- c) Equivalent circuit referred to HV and LV sides

18. Load Test on V connected Transformers

Objectives:

Connect two single phase transformers in V-V connection and conduct a load test to plot the efficiency curve.

Out of the above experiments, minimum twelve experiments should be done in lab taking at least six experiments from both Part A and Part B.

Expected outcome:

After the successful completion of the course, the students will be able to test and validate DC generators, DC motors and transformers

After the successful completion of this course, the students will be able to

1. Analyse the characteristics of different dc generators
2. Separate the losses in dc motors
3. Analyse the performance of different types of dc motors
4. Determine the performance characteristics of single phase transformers
5. Compare the performance of transformers in different modes of operations and connections

Text Book:

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, 2008.