

Course Title	Electric Machines 2
Course Code	EE5311
No. of Credit Hrs (Lecture + Tutorial + Lab)	3 (2+0+1)
No. of Contact Hrs (Lecture + Tutorial + Lab)	4 (2+0+2)
Level-Year	9/10 – 5
Prerequisite (if any)	EE3306

1) Course Objectives:

This course aims at providing the basic knowledge required by practicing engineers for dealing with induction and synchronous machines in order to:

1. Describe construction and the principle of operation of induction and synchronous machines
2. Improve knowledge for the construction and the principle of operation of the three-phase induction and synchronous machines.
3. Acquire information concerning the equivalent circuit and different experimental tests of a three-phase induction and synchronous machines.
4. Help dealing with the power relation and characteristic curves of the three-phase induction and synchronous machines.
5. Enable studying the methods of speed control and starting of induction motor.
6. Enhance thought about the equivalent circuit, starting methods of a single-phase induction motor.
7. Ability to conduct no load and full load tests on transformers/Induction Motor.
8. Ability to perform test on synchronous Machine

2) Expected Learning Outcomes:

1. **Describe and explain** the construction and operating principles of induction and synchronous machines. **PLO1 [1]**
2. **Estimate and apply** experimental test results to determine key parameters of induction and synchronous machines. **PLO3 [6]**
3. **Analyze and differentiate** various methods for controlling the speed and starting of induction and synchronous machines. **PLO2 [2]**
4. **Formulate and solve** mathematical models to calculate voltage regulation and efficiency of synchronous machines. **PLO1 [1]**
5. **Investigate and evaluate** different methods of calculating voltage regulation and performance characteristics of synchronous machines. **PLO3 [6]**
6. **Communicate** findings effectively by preparing structured reports on laboratory experiments. **PLO8 [3]**

3) Course Contents:

1. AC armature windings.
2. Three phase induction motor types, Construction, principles of operation and modes of operation.
3. Equivalent circuit and measurement tests of a three-phase induction motor (I.M).
4. Power balance equations, torque/speed curves of a 3 phase I.M.
5. Speed control methods of a 3 phase I.M.
6. Starting methods of a three-phase induction motor of a 3 phase I.M.
7. Construction of synchronous.
8. Armature reaction, armature leakage reactance and equivalent circuit of cylindrical synchronous machine.

9. Equivalent circuit of salient pole synchronous machine.
10. Voltage regulation for unity, lagging and leading power factor loads.
11. Parallel operation and synchronizing torque.
12. Equivalent circuit of synchronous motors and Synchronous motor starting.
13. V-curves and synchronous condenser.

4) Lab Contents:

1. To measure the performance of 3-phase im by direct loading
2. Brake test on 3-phase induction motor
3. No load & blocked rotor test on 3- ϕ induction motor
4. Regulation of an alternator by synchronous impedance & mmf method
5. Determination of x_d & x_q of a salient pole synchronous machine
6. V & inverted V curves of synchronous motor

5) Teaching Methods:

- Lectures and Discussion
- Videos
- Self-learning
- Laboratory demonstrations

6) Mode of Evaluation: Course Assessment Methods

- Quizzes , Assignment, Homeworks, Reports, Presentations etc.
- Lab Work
- Mid Exam
- Final Exam

Evaluation

No	Assessment Activities *	Percentage
1.	Assignments/Quizzes/HomeWorks/Mini-Projects/Presentations/Reports+Quizzes	15%
2.	Mid Exam	25%
3.	Lab/Tutorial (Lab Exam)	10%
4.	Lab/Tutorial (Lab Reports)	10%
5.	Final Exam	40%

7) Textbook(s):

- P. C. Sen, "Principles of Electric Machines and Power Electronics".
- Stephen J. Chapman, "Electric Machinery Fundamentals".
- B.L. Theraja and A.K. Theraja, "Electrical Technology".

7. References:

- Theodore Wildi, "Electrical Machines, Drives and Power Systems".