



Course Title: Electrical Machines - II

Credit Units:

L	T	P/S	SW/F W	TOTAL CREDIT UNITS
2	1	2	0	4

Course Level: UG

Course Code: ELEC301

Course Objectives:

The objectives of this course are to impart knowledge regarding the theory and application of alternating current machines.

Pre-requisites:

Basics of Electrical Engineering, Circuits & systems

Course Contents/Syllabus:

	Weightage (%)
Module I :Basic concepts of Electrical Machines	
Winding factors, generated e. m. f., m. m. f. of distributed a.c. winding, rotating magnetic field.	10
Module II :Induction Machines	
Constructional features, production of torque, phasor diagram, equivalent circuit, performance analysis, torque-slip characteristics. Testing Running light and blocked rotor test, load test. Effect of rotor resistance, deep bar and double cage induction motor. Generator Operation Starting- Starting methods of squirrel cage and wound rotor induction motor. Speed Control- Various methods of speed control of squirrel cage and wound rotor induction motor. Effects of space harmonics.	35
Module III :Single phase induction motors	
Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split phase starting methods & applications.	20
Module IV :Synchronous Machines	
Constructional features. Cylindrical rotor machine I) Synchronous Generator-Generated e.m.f., circuit model and phasor diagram, armature reaction, synchronous impedance, voltage regulation and different methods for its estimation. I) Synchronous Motor- Operating principle, circuit model, phasor diagram, effect of load. III) Operating characteristics of synchronous machines, V-	35

curves, starting methods of synchronous motors. Salient pole Machine- Two reaction theory, analysis of phasor diagram, power angle characteristics, determination of x_d and x_q . Parallel operation of Alternators-Synchronization and load division.

Student Learning Outcomes:

After completion of this course the students will be able to;

1. Understand theory of induction machines, their speed torque characteristics & speed control.
2. Provide understanding of synchronous motors & synchronous generator, parallel operation of generators and their synchronization.
3. Study effect of load variation on induction as well as synchronous machines.
4. Experimentally find out the responses of different electrical machines under varying conditions.

Pedagogy for Course Delivery:

- Class room Lectures, assignments, Quizes.
- Seminars and discussions
- Practical on the Hard ware and study setups

List of Experiments :

1. To Perform load-test on 3 ph. Induction motor & to plot torque V/S speed characteristics.
2. To Perform no-load & blocked –rotor tests on 3 ph. Induction motor to obtain equivalent ckt. Parameters & to draw circle diagram.
3. To start a 3 phase slip –ring induction motor by inserting different levels of resistance in the rotor ckt. And to plot torque –speed characteristics.
4. Speed control of induction motor using V/f method.
5. To perform no-load & blocked –rotor test on 1 ph. Induction motor & to determine the parameters of equivalent ckt. Drawn on the basis of double revolving field theory.
6. To Perform load –test on 1 ph. Induction motor & plot torque –speed characteristics.
7. To Perform no load & short ckt. Test on 3- phase alternator and draw open ckt. And
8. Short ckt. Characteristics.
9. To find voltage regulation of an alternator by zero power factor (z.p.f.) method.
10. To study effect of variation of field current upon the stator current and power factor
11. With synchronous motor running at no load and draw V & inverted V curves of motor.
12. To measure negative sequence & zero sequence reactance of Syn. Machines

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
75	25	100

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment	End Term Examination
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Components (Drop down)	Attendance	Class Test	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

Lab/ Practical/ Studio Assessment:

	Continuous Assessment/Internal Assessment				End Term Examination		
Components (Drop down)	Performance	Lab file	Viva	Attendance	PR	V	70
Weightage (%)	10	10	5	5	35	35	

Text Reading:

- Electrical Machines by J.B.Guptha. S.K.Kataria & Sons.
- M. G. Say, “ The performance and design of alternating machines”, CBS Publishers
- Electrical Machines – P.S. Bimbira. Khanna Publishers.
- A. E. Clayton & N. M. Hancock, “ The performance and design of direct current machines,” 3 rd edition, pitman, London, 1959.

References:

- A. E. F Fitzgerald, C. Kingsley, & S. D. Umans, “Electric Machinery,” 4th edition, McGraw-Hill, Tokyo 1983. .
- Ashfaq Hussian, “ Electric Machines,” DhanapatRai Publications.
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