

AC MACHINES

IV Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE007	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45		Tutorial Classes: 15		Practical Classes: Nil			Total Classes: 60	

OBJECTIVES:

The course should enable the students to:

- I. Discuss the construction, working and characteristics of three phase induction motor and synchronous motor.
- II. Illustrate the equivalent circuit and speed control methods of three phase induction motors.
- III. Outline the working and parallel operation of alternators.
- IV. Evaluate synchronous impedance and voltage regulation of synchronous machine.

COURSE LEARNING OUTCOMES (CLOs)

At the end of the course, the student will have the ability to:

1. Understand the principle of operation and constructional features of three phase induction motor.
2. Understand production of torque and modes of three phase induction motor operation
3. Understand the different types of torques, various losses, efficiency and torque- slip characteristics of three phase induction motor operation
4. Describe no-load and blocked rotor test of three phase induction motor for calculating the equivalent circuit parameters.
5. Describe circle diagram of three phase induction motor and concept of induction generator
6. Understand the starting and speed control methods of three phase induction motor
7. Understand the principle of operation and constructional features and different types of armature windings of synchronous alternator
8. Understand the phasor diagrams of alternator on no-load, load and analyze the harmonics and its suppression methods.
9. Describe the different methods for calculating the voltage regulation
10. Understand the concept of parallel operation and slip test
11. Understand the principle of operation, constructional features and starting methods of synchronous motor
12. Describe the importance of power, excitation circles and effect of varying different parameters on synchronous motor performance
13. Understand the concept of constructing V, inverted V curves and synchronous condenser
14. Understand the principle of operation and constructional features of single phase induction motor and starting methods for single phase induction motor
15. Describe the torque-speed characteristics of single phase induction motor and equivalent circuit.
16. Apply the concept of electromagnetic and electrostatic fields to solve real time world applications.
17. Explore the knowledge and skills of employability to succeed in national and international level competitive examinations.

UNIT - I	THREE PHASE INDUCTION MOTORS
Three phase induction motors: Introduction, construction, types of induction motors, slip and frequency of rotor currents, rotor MMF and production of torque, equivalent circuit, power across air gap, torque and power output, torque slip characteristics, generating and braking modes, maximum (breakdown) torque, starting torque, maximum power output, problems.	
UNIT - II	TESTING AND SPEED CONTROL OF INDUCTION MOTORS
Equivalent circuit model: No load test and blocked rotor test, circuit model, starting methods, speed control of induction motors, induction generator, principle of operation, isolated induction generator, circle diagram, determination of induction motor parameters from circle diagram, problems.	
UNIT - III	ALTERNATORS
Synchronous generators: Introduction, principle of operation, constructional features, armature windings, integral slot and fractional slot windings, distributed and concentrated windings, winding factors, basic synchronous machine model, circuit model of a synchronous machine, phasor diagrams, determination of synchronous impedance, short circuit ratio, armature reaction ampere turns and leakage reactance. Voltage regulation: Calculation of regulation by synchronous impedance method, MMF, ZPF and ASA methods, slip test, parallel operation of alternators, synchronization of alternators, problems.	
UNIT - IV	SYNCHRONOUS MOTORS
Synchronous motors: Principle of operation, power developed, synchronous motor with different excitations, effect of increased load with constant excitation, effect of change in excitation with constant load, effect of excitation on armature current and power factor, construction of “V” and inverted “V” curves, power and excitation circles, starting methods, salient pole synchronous motor, phasor diagrams and analysis, synchronous condenser.	
UNIT - V	SINGLE PHASE INDUCTION MOTOR
Single phase induction motor: Principle of operation, two reaction theory, equivalent circuit analysis, split phase motor, construction, principle of operation, capacitor start motor, shaded pole motor, torque speed characteristics.	
Text books	
<ol style="list-style-type: none"> 1. P S Bimbra, “Electrical Machines”, Khanna Publishers, 2nd Edition, 2008. 2. Kothari, “Electrical Machines”, TMH publication, 3rd Edition, 2010. 3. B. L Thereja, A.K Thereja Charles Kingsley JR., Stephen D U mans, “Electric Machinery”, McGraw-Hill, 6th Edition, 1985. 	
References	
<ol style="list-style-type: none"> 1. J B Gupta, “Theory and Performance of Electrical Machines”, S K Kataria & Sons Publication, 14th Edition, 2010 2. M G Say, “Alternating Current Machines”, Pitman Publishing Ltd, 4th Edition, 1976. 3. S K Bhattacharya, “Electrical Machines”, TMH publication, 2nd Edition, 2006. 	