ELECTRICAL MACHINES - II

IV Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB15	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

Students will try to learn:

I. The principle of operation and the effect of pulsating, rotating magnetic fields on the working of AC machines
II. The armature winding layouts and concept of armature reaction with phasor diagrams.
III. The staring, speed control methods and equivalent circuit diagram of poly phase and single phase machines.

COURSE OUTCOMES:

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

CO 1 **Relate** spatially displaced armature windings for the generation of various magnetic fields in AC machines
CO 2 **Identify** different types of armature windings and winding factors for calculating induced EMF
CO 3 **Illustrate** the electromagnetic laws for the operation of three phase synchronous and asynchronous machines.
CO 4 **Describe** different tests for calculating the performance parameters of three phase induction motors.
CO 5 **Explain** the fundamental control practices like starting, reversing and speed control strategies for different applications.
CO 6 **Describe** the different methods for the computation of voltage regulation of an alternator.
CO 7 **Demonstrate** the parallel operation of alternators for load sharing under various loading conditions.
CO 8 **Illustrate** the effect of excitation and variation of loads on armature current and power factor.
CO 9 **Demonstrate** the behavior of synchronous motor for estimation of armature current and power factor at different excitations and loading conditions.
CO 10 **Explain** the double revolving, cross field theory for working of the single phase induction motor.
CO 11 **Outline** the performance of single phase induction motor for studying the torque-speed characteristics.
CO 12 **Examine the** operation and control for addressing the real time problems in the field of electrical machines

MODULE-I	PULSATING AND REVOLVING MAGNETIC FIELDS	Classes: 09
Constant magnetic field, pulsating magnetic field, alternating current in windings with spatial displacement, Magnetic field produced by a single winding, fixed current and alternating current. Pulsating fields produced by spatially displaced windings, windings spatially shifted by 90 degrees. Addition of pulsating magnetic fields. Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field		
MODULE-II	**INDUCTION MACHINES**	**Classes: 09**
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. 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, Doubly-Fed Induction Machines, circle diagram, determination of induction motor parameters from circle diagram, problem.		
MODULE-III	**ALTERNATORS**	**Classes: 09**
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.		
MODULE-IV	**SYNCHRONOUS MOTORS**	**Classes: 09**
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.		
MODULE-V	**SINGLE-PHASE INDUCTION MOTORS**	**Classes: 09**
Single phase induction motor: Principle of operation, two reaction theory, equivalent circuit analysis, split phase motor, construction, principle of operation, capacitor start, capacitor run, capacitor start - capacitor run motor, shaded pole motor, torque speed characteristics.		

Text Books :

1. P S Bimbhra, "Electrical Machinery", Khanna Publishers, 1st Edition, 2011.
2. I J Nagrath and D P Kothari, "Electric Machines", McGraw Hill Education, 1st Edition, 2010.
3. J B Guptha "Theory and performance of Electrical machiines", S.K.Kataria & Sons Publishers 14th Edition, 2009.

Reference Books:

1. M G Say, E O Taylor, "Direct Current Machines", Longman Higher Education, 1st Edition, 1985.
2. M G Say, "Performance and design of AC machines", CBS Publishers, 1st Edition, 2002.
3. A E Fitzgerald and C Kingsley, "Electric Machinery", New York, McGraw Hill Education, 1st Edition, 2013

Web References:
1. https://www.electrical4u.com 2. https://www.freevideolectures.com
E-Text Books:
1. https://www.freeengineeringbooks.com 2. https://www.pdfdrive.com/textbook-of-electrical-technology-ac-and-dc-machines-d184089760.html