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		

I. COURSE OVERVIEW:

This course is intended to train the students on alternating current machines. It provides hands-on experience by conducting various direct and indirect tests on transformers, synchronous and asynchronous machines to analyse the characteristics of AC machines and separate various losses. This course also enables to develop skills to select, install, operate, and maintain various types of ACmachines and transformers

II. OBJECTIVES:

The course should enable the students to:

I The elementary experimental and modeling skills for handling problems with electrical machines in industries and domestic applications.

II The operation of AC machines and its role in power transmission and generating stations.

III The automation concepts through programmable logic controllers to control the speed andstarting current.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Select** suitable testing strategies for evaluating the performance characteristics of transformers.	Apply
CO 2	**Determine** the performance parameters of induction motor by conducting direct and indirect tests.	Evaluate
CO 3	**Explain** the parallel operation of alternators for load sharing under various loading conditions.	Evaluate
CO 4	**Distinguish** the synchronous impedance and ampere turns methods forthe computation of voltage regulation of an alternator.	Analyze
CO 5	**Estimate** the voltage and current swings in salient pole alternator for determination of direct and quadrature axis reactance.	Evaluate
CO 6	**Apply** programmable logic controllers for limiting the starting current of poly phase induction motors.	Apply

IV. SYLLABUS:

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. A E Fitzgerald and C Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. P S Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
3. I J Nagrath and D P Kothari, "Electric Machines", McGraw Hill Education, 2010.
4. A S Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.

Reference Books:

1. A E Fitzgerald, Charles Kingsley JR., Stephen D Umans, "Electric Machinery", McGraw- Hill, 6th Edition, 1985.
2. M G Say, "Alternating Current Machines", Pitman Publishing Ltd, 4th Edition, 1976.
3. P C Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.
4. S K Bhattacharya, "Electrical Machines", TMH publication, 2nd Edition, 2006.

Web References:

1. https://www.electrical4u.com
2. https://auto.howstuffworks.com
3. https://www.studyelectrical.com
4. https://www.electricaleasy.com

E-Text Books:

1. https://www.freeengineeringbooks.com
2. https://bookboon.com
3. https://www.jntubook.com