AC MACHINES

IV Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEC11	Core	3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Prerequisite: Linear Algebra and Calculus, DC Machines and Transformers

I. COURSE OVERVIEW:

This course deals with the basic theory, construction, operation, performance characteristics and application of electromechanical energy conversion devices such as synchronous and asynchronous machines. It also facilitates the study of the alternating machines which are the major part of industrial drives and agricultural pump sets.

II. COURSE OBJECTIVES:

The 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.

III. COURSE OUTCOMES:

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

CO 1	**Demonstrate** various winding factors, spatially displaced armature windings to generate electro motive force in AC machines.	Understand
CO 2	**Illustrate** electromagnetic laws used for the construction andoperation of synchronous and asynchronous machines.	Understand
CO 3	**Identify** various control strategies for calculating the performanceparameters and voltage regulation of AC machines.	Apply
CO 4	**Demonstrate** the parallel operation of alternators for load sharing under various loading conditions.	Understand
CO 5	**Examine** the behavior of synchronous motor with variable excitation and loadings for calculating armature current, power and power factor	Apply

IV. SYLLABUS:

MODULE-I: THREE PHASE INDUCTION MACHINES (09)

Magnetic fields: Constant magnetic field, pulsating magnetic field, rotating magnetic field; Three phase induction motors: 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. Equivalent circuit; Induction generator: Operation, approximate equivalent circuit, doubly fed induction generator, numerical problems.

MODULE-II: TESTING AND SPEED CONTROL OF INDUCTION MOTORS (09)

Testing: Brake test, no load and blocked rotor test, determination of induction motor parameters from circle diagram, numerical problems. Starting methods of Slip ring and squirrel cage induction motors; Speed control of induction motors, numerical problems.

MODULE-III: ALTERNATORS (09)

Synchronous generators: Introduction, principle of operation, types, constructional features, integral slot and fractional slot windings, distributed and concentrated windings, winding factors, basic synchronous machine model, circuit model of a synchronous machine, armature reaction, phasor diagrams.

Voltage regulation: Determination of synchronous impedance, short circuit ratio, leakage reactance, calculation of regulation by synchronous impedance method, MMF, ZPF and ASA methods; Parallel operation, synchronization of alternators; Slip test, numerical problems.

MODULE-IV: SYNCHRONOUS MOTORS (09)

Synchronous motors: Principle of operation, phasor diagrams, 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, and analysis, synchronous condenser.

MODULE-V: SINGLE-PHASE INDUCTION MOTORS (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 of single phase induction motors.

V. 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.

VI. 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
4. M V Deshpande, "Electrical Machines", PHI Learning Private Limited, 3rd Edition, 2011.

VII. WEB REFERENCES:

1. https://www.electrical4u.com
2. https://www.freevideolectures.com

VIII. E-TEXT BOOKS:

1. https://www.freeengineeringbooks.com
2. https://www.pdfdrive.com/textbook-of-electrical-technology-ac-and-dc-machines-d184089760.html