II B.Tech – II Semester
(20EE4005) SYNCHRONOUS AND ASYNCHRONOUS MACHINES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

Pre-Requisites: Electrical Engineering Workshop, Basic Electrical Circuits

Course Objectives:

- To impart the basic knowledge of principle of operation and Types of Synchronous and Asynchronous Machines.
- To provide working knowledge on how to develop Phasor Diagrams and Equivalent Circuits for Synchronous and Asynchronous Machines.
- To understand Torque-Slip characteristics of Asynchronous Motors.
- To understand the characteristics of Synchronous and Asynchronous Machines.
- To Highlight the importance of Synchronous and Asynchronous Machines. in Commercial, Domestic, Industrial and Electric Traction Applications.

UNIT–I: Three Phase Induction Motor

Production of Rotating Magnetic Field, basic principle of Operation, Constructional details, Types of rotors, Slip, Emf equation, Phasor Diagram, Equivalent circuit, Torque and Power Expression, Condition for maximum Starting torque and Running Torque, Slip-torque characteristics. Losses, Power Stages in Three Phase Induction Motor, Relationship between Rotor input power, rotor copper losses and rotor Output Power, Efficiency. Double cage and deep bar rotor induction motors and Induction generator.

UNIT-II: Testing, Starting and Speed Control of 3-Phase Induction Motor

No load and blocked rotor tests, Circle diagram. Need for starting, Types of starters, Rotor resistance, Autotransformer and Star-delta starters. Speed control of V/F Method.

UNIT-III: Single Phase AC Motors

Introduction, Double field revolving theory, Equivalent circuit of 1-phase induction motor , Starting and types of single phase motors: Split phase,Resistance start, Capacitor start Motor, Capacitor start & Capacitor run induction motor, Permanent Capacitor Motor, Shaded poleinduction motor, Universal Motors.

UNIT-IV: Synchronous Generators

Principle of Operation, Constructional details, Types of Rotors, Emf equation Synchronous reactance, Phasor Diagrams, Equivalent Circuit, Armature reaction, Voltage regulation, EMF, MMF and ZPF methods, Two reaction theory, Determination of direct and quadrature axis synchronous reactance using Slip test, Operating characteristics Necessity of Parallel operation, conditions for Parallel operation, Procedure for parallel operation.

UNIT-V: Synchronous Motors

Principle of Operation, Starting methods, Phasor diagram, Equivalent Circuit,V and Inverted-V curves, Hunting and Its suppression, Synchronous condenser and Applications.

Course Outcomes:

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

S.No	Course Outcome	BTL
1.	Student will be able to impart the basic knowledge of principle of operation and Types of Synchronous and Asynchronous Machines.	L1
2.	Student will be able provide working knowledge on how to develop Phasor Diagrams and Equivalent Circuits Synchronous and Asynchronous Machines.	L1
3.	Student will be able understand Torque-Slip characteristics of Synchronous and Asynchronous Machines.	L2
4.	Student will be able understand performance characteristics of Synchronous and Asynchronous Machines.	L2
5.	Student will be able Highlight the importance of Synchronous and Asynchronous Machines in Commercial, Domestic, Industrial and Electric Traction Applications.	L2

Correlation of COs with POs& PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2												2	-
CO2		2											2	-
CO3		2											2	-
CO4		2											2	-
CO5	2												2	-

Text Books:

1. Electrical Machinery by Dr. P.S. Bhimbra, Khanna Publishers
2. A Text Book of Electrical Technology, Volume-II, AC and DC Machines by B.L. Theraja and A.K.Theraja.S.Chand Publications
3. The Performance and Design Of Alternating Current Machines by MG Say

Reference Books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth,McGrawHill Publications, 4th edition.
2. Electrical Machines by R.K.Rajput, Lakshmi publications,5thedition.
3. Electrical Machinery by AbijithChakrabarthi and SudhiptaDebnath,McGraw Hill education 2015.