INDUCTION AND SYNCHRONOUS MACHINES

Course Code	23EE3402	Year	II	Semester(s)	II
Course Category	Professional Core	Branch	EEE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	1.Basic Electrical and Electronics Engineering 2.Electrical Machines-I
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	**Understand** the basic concepts of three phase induction motors, single phase motors and synchronous machines. (L2)
CO2	**Apply** the basic knowledge to obtain the desired parameters and performance characteristics of three phase induction motors and single phase motors. (L3)
CO3	**Apply** the basic knowledge to obtain the desired parameters and performance characteristics of synchronous machines. (L3)
CO4	**Analyze** the concepts of torque equation, testing techniques and speed control methods of three phase induction motor and single phase motors. (L4)
CO5	**Analyze** the mathematical concepts of voltage regulation finding methods and parallel operation of synchronous machines(L4)
CO6	**Capability** to understand the concepts of three phase induction motors, single phase motors and synchronous machines and submit a report.

				Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2	3												2	1
CO3	3												2	1
CO4		3											2	1
CO5		3											2	1
C06									3	3			2	1

SYLLABUS		
Unit No.	Contents	Mapped CO
I	**3-phase induction motors:** Construction of Squirrel cage and Slipring induction motors– production of rotating magnetic field – principle of operation – rotor emf and rotor frequency – rotor current and power factor at standstill and during running	CO1 CO2 CO4 CO6

	conditions– rotor power input, rotor copper loss and mechanical power developed and their inter-relationship –equivalent circuit – phasor diagram	
II	**Performance of 3-Phase induction motors:** Torque equation – expressions for maximum torque and starting torque – torque-slip characteristics – double cage and deep bar rotors – Brake test, No load and Blocked rotor tests – circle diagram for predetermination of performance- methods of starting –starting current and torque calculations - speed control of induction motor with V/f control method, rotor resistance control and rotor emf injection technique –crawling and cogging – induction generator operation.	CO1 CO2 CO4 CO6
III	**Single Phase Motors:** Single phase induction motors – constructional features – double revolving field theory, Cross field theory – equivalent circuit- split phase motor, capacitor start motor, capacitor start capacitor run motor & shaded pole motor, AC series motor.	CO1 CO2 CO4 CO6
IV	**Synchronous Generator:** Constructional features of non-salient and salient pole type alternators- armature windings – distributed and concentrated windings – distribution& pitch factors – E.M.F equation –armature reaction – voltage regulation by synchronous impedance method – MMF method and Potier triangle method –two reaction analysis of salient pole machines -methods of synchronization- Slip test – Parallel operation of alternators.	CO1 CO3 CO5 CO6
V	**Synchronous Motor:** Synchronous motor principle and theory of operation – Effect of excitation on current and power factor– synchronous condenser –expression for power developed –hunting and its suppression – methods of starting.	CO1 CO3 CO5 CO6

Learning Resources
Text Books
1. Dr. P. S Bimbhra, Electrical Machinery,7/e -Khanna Publishers,2018
2. I.J. Nagarath and D.P. Kothari, Electric Machines, 4/e, McGraw Hill, 2010.
Reference Books
1. J.B.Gupta, Electrical Machines, S.K.Kataria & Sons publications. 2. M.G.Say, The Performance and Design of A.C.Machines, ELBS and Pitman & Sons. 3. Abhijit Chakrabarti and Sudipta Debnath, Electrical Machines, 1/e, Mc Graw Hill,2015.
E- Resources
https://nptel.ac.in/courses/108/105/108105131