Year / Semester: II B. Tech. IV Semester   **Regulation: R23**
Subject and Code: Induction and Synchronous Machines (23EEE242)

SYLLABUS

UNIT-1: 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 conditions– rotor power input, rotor copper loss and mechanical power developed and their inter-relationship –equivalent circuit – phasor diagram, Applications.

UNIT -2: PERFORMANCE OF 3-PHASE INDUCTION MOTORS:

Torque equation – expressions for maximum torque and starting torque – torque-slip characteristics – double cage and deep bar rotors – No load, Brake test 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.

UNIT-3: SINGLE PHASE MOTORS:

Single phase induction motors – constructional features – double revolving field theory, Cross field theory – equivalent circuit- starting methods: capacitor start capacitor run, capacitor start induction run, split phase & shaded pole, AC series motor, Applications.

UNIT-4: 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.

UNIT-5: 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, Applications.

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Max Marks: 10

S. No.	CO	Questions	BT
Unit I: 3-PHASE INDUCTION MOTORS			
1	1	Explain the construction and principle of operation of 3-phase induction motor with neat sketch.	L4
2	1	Elaborately explain how a rotating magnetic field is produced in the air-gap between stator and rotor of a three phase induction motor.	L3
3	1	Define the term slip and explain its importance in obtaining rotor current frequency	L4
4	1	Draw the power flow diagram of a 3phase induction motor and explain each stage?	L3
5	1	Explain the principle of operation of 3-phase induction motor and explain how the rotating magnetic field is produced by 3-phase currents.	L5
6	1	Derive an expression for the torque of an induction motor and obtain the condition for maximum torque.	L4
S. No.	CO	Questions	BT
Unit II: PERFORMANCE OF 3-PHASE INDUCTION MOTORS			
1	2	Derive the value of maximum starting and maximum running torque of a three phase induction motor.	L4
2	2	A 3-phase, 400V star connected induction motor has a star connected rotor with a stator to rotor turn ratio of 6.5. The rotor resistance and standstill reactance per phase are 0.05ohm and 0.25ohm respectively.	L3
3	2	Explain the tests required to be performed to obtain the data for the circle diagram	L4
4	2	Explain in detail the construction of circle diagram of an induction motor	L3
5	2	Illustrate the phenomenon of cogging and crawling in induction motor.	L5
6	2	Explain the operation of induction machine as a generator with neat diagram.	L4
7	2	Explain the methods of starting of induction motor with neat sketches.	L3
8	2	Explain the speed control of induction motor from stator side.	L3
9	2	Why starters are necessary for starting induction motors? What are the various types of starters? Explain star-delta type starter in detail.	L3
S. No.	CO	Questions	BT
Unit III: SINGLE PHASE MOTORS			
1	3	Explain the operation of single phase induction motor using double field revolving theory.	L4
2	3	Explain the operation of split-phase induction motor with neat diagram.	L3
3	3	Explain the working principle of single phase induction motor.	L4

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES
(AUTONOMOUS)

QUESTION BANK

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4	**3**	Explain with a neat diagram the following types of single phase induction motor. (i). Capacitor start, (ii). Capacitor start and capacitor run induction motor.	**L3**

S. No.	CO	Questions	BT
Unit IV: SYNCHRONOUS GENERATOR			
1	**4**	Describe with neat sketches the constructional details of a salient pole type alternator.	**L4**
2	**4**	Explain clearly the ZPF (potier triangle) method of determining the regulation of an alternator.	**L3**
3	**4**	Explain EMF method of determining the regulation of an alternator.	**L4**
4	**4**	List the methods used to predetermine the voltage regulation of synchronous machine and explain the MMF method.	**L3**
5	**4**	Derive emf equation of an alternator. Also derive the expressions for distribution factor and pitch factor.	**L5**
6	**4**	Explain the term armature reaction. Explain armature reaction at lagging power-factor load in a synchronous generator.	**L4**
7	**4**	Describe a method of synchronizing the three-phase alternator to infinite bus bar with relevant circuit diagram.	**L3**
8	**4**	Explain the two-reaction theory of salient pole synchronous machine.	**L5**
9	**4**	What is synchronizing power of an alternator? Derive an expression for synchronizing power between the two alternators connected in parallel	**L4**
10	**4**	Explain the determination of direct and quadrature axis synchronous reactance by using slip test.	**L3**
11	**4**	State and explain the condition for parallel operation of alternators.	**L3**

S. No.	CO	Questions	BT
Unit V: SYNCHRONOUS MOTOR			
1	**5**	Explain briefly about the V and inverted V curves and mention its significant.	**L4**
2	**5**	Explain the effect of changing field current excitation at constant load.	**L3**
3	**5**	Describe the various methods of starting the synchronous motor	**L4**
4	**5**	Derive the expression for power developed in a synchronous motor. Also find the condition for maximum power developed	**L3**