

**BONAM VENKATA CHALAMAYYA INSTITUTE OF TECHNOLOGY & SCIENCE
(AUTONOMOUS)**

II - B. Tech II-Semester Supplementary Examinations (BR23), Aug - 2025

INDUCTION AND SYNCHRONOUS MACHINES (EEE)

Time: 3 hours

Max. Marks: 70

*Question Paper consists of Part-A and Part-B
Answer ALL the question in **Part-A and Part-B***

PART-A (10X2 = 20M)

	Marks	CO	BL
1. a) What will be the frequency of rotor current of a 12-pole, 60 Hz, 3 phase induction motor which runs at 570 r.p.m?	(2M)	CO1	BL1
b) Construct power stages diagram of a 3-phase induction motor?	(2M)	CO1	BL3
c) Write the functions of starter?	(2M)	CO2	BL1
d) What are the uses of No-load Test & Blocked rotor test?	(2M)	CO2	BL1
e) State the function of centrifugal switch in a single-phase induction motor?	(2M)	CO3	BL2
f) List the applications of single-phase capacitor-start and run type induction motor?	(2M)	CO3	BL1
g) Define voltage regulation of alternator?	(2M)	CO4	BL1
h) Classify various methods used to find out the voltage regulation of an alternator?	(2M)	CO4	BL2
i) Construct cylindrical pole synchronous motor?	(2M)	CO5	BL3
j) What is the use of damper winding in synchronous motor?	(2M)	CO5	BL1

PART-B (5X10 = 50M)

2a. Illustrate the construction of slip ring rotor in 3-phase induction motor with neat diagrams?	5(M)	CO1	BL2
b. Develop the equivalent circuit of a three-phase induction motor?	5(M)	CO1	BL3
(OR)			
3a. Analyze the working principle of a three-phase induction motor. Why does the rotor rotate in the same direction as the rotating magnetic field?	5(M)	CO1	BL4
b. Compare slip ring and squirrel cage induction motors in terms of construction, performance, and applications?	5(M)	CO1	BL4
4a. Explain in detail about torque (vs) slip and torque (vs) speed characteristics of 3-phase Induction Motor?	5(M)	CO2	BL2
b. A 6-pole, 50 Hz, 3-phase induction motor operates with a slip of 5% and produces a maximum torque of 180 kg-m at 815 rpm. If the rotor resistance per phase is 0.48 Ω , calculate the torque developed by the motor?	5(M)	CO2	BL3
(OR)			
5a. Analyze how the circle diagram for a poly-phase induction motor can be drawn from its test data.	5(M)	CO2	BL4
b.	5(M)	CO2	BL2

Illustrate the V/f speed control method of Three phase induction motor?

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| 6a. | Illustrate the working of an A.C. series motor with proper explanation and neat diagrams? | 5(M) | CO3 | BL2 |
| b. | Explain the construction and working of a single-phase capacitor start induction motor with a neat diagram. | 5(M) | CO3 | BL4 |
| (OR) | | | | |
| 7a. | Apply the double-field revolving theory to analyze the torque-slip behavior of a single-phase induction motor. Use this theory to justify the absence of starting torque.? | 5(M) | CO3 | BL3 |
| b. | Apply the double-field revolving theory to show why a single-phase induction motor fails to start by itself? | 5(M) | CO3 | BL3 |
| 8a. | Derive the expression for the EMF induced in an alternator and explain how different parameters like flux, frequency and number of turns affects the EMF induced in an alternator? | 5(M) | CO4 | BL2 |
| b. | Two identical 3-phase synchronous generators are operating in parallel and supplying a total load of 2000 kW at 11 kV with a power factor of 0.86 lagging. If the armature current in the first generator is 100 A at a lagging power factor, calculate the armature current in the second generator and determine the power factor at which each generator is operating? | 5(M) | CO4 | BL3 |
| (OR) | | | | |
| 9a. | Compare the MMF method with the EMF method for voltage regulation of alternators. In what situations is the MMF method more accurate? | 5(M) | CO4 | BL4 |
| b. | A 3 phase 16-pole alternator has the following data: Number of slots=192, conductors/slot =8; coil span 10 slots, speed of the alternator=375 rpm, flux per pole =55 m wB. Calculate phase and line emf voltage? | 5(M) | CO4 | BL3 |
| 10a | Compare the construction, operation, and applications of salient-pole and cylindrical-pole synchronous motors. | 5(M) | CO5 | BL4 |
| b. | Explain the working of a synchronous motor when it operates as a synchronous condenser. Illustrate the explanation with a vector diagram. | 5(M) | CO5 | BL2 |
| (OR) | | | | |
| 11a | Analyze the operation of synchronous motor with variable excitation at constant load. | 5(M) | CO5 | BL4 |
| b. | The input to an 11kV, 3 phase star connected synchronous motor is 60A. The effective resistance and synchronous reactance per phase are respectively 1 Ω and 30 Ω . Solve the power supplied to the motor, and the induced electromotive force for a power factor of 0.8 i) lagging ii) leading | 5(M) | CO5 | BL3 |
