

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM  
(AUTONOMOUS)  
II B.Tech II Semester Regular/Supplementary Examinations, May-2024  
INDUCTION AND SYNCHRONOUS MACHINES  
(EEE)**

Time: 3 hours

Max. Marks: 70

**Answer ONE Question from each Unit  
All Questions Carry Equal Marks**

Q. No.	Questions	BTL	CO	Marks
<b>UNIT – I</b>				
1.	a) Describe the construction of a 3-phase cage type induction motor with neat sketch.	K1	CO1	7M
	b) A 3- $\phi$ induction motor is wound for 4 poles and is supplied from 50-Hz system. Calculate (i) the synchronous speed (ii) the rotor speed, when slip is 4% and (iii) rotor frequency when rotor runs at 600 rpm.	K3	CO1	7M
<b>OR</b>				
2.	a) Derive and explain rotating magnetic field in a three-phase induction motor with suitable diagrams.	K2	CO1	7M
	b) In a 6 pole, 3-phase 50 Hz induction motor with star connected rotor, the rotor resistance per phase is $0.3 \Omega$ , the reactance at standstill is $1.5 \Omega$ per phase and an e.m.f. between the slip rings on open circuit is 175V. Calculate: i) Slip at a speed of 960 rpm ii) Rotor e.m.f. per phase	K3	CO1	7M
<b>UNIT – II</b>				
3.	a) What is the purpose of using deep bar cage rotors? Explain the construction and working principle of a deep-bar cage motor.	K2	CO2	7M
	b) A 50-Hz, 8-pole induction motor has F.L. slip of 4%. The rotor resistance/phase = $0.01 \text{ ohm}$ and standstill reactance/phase = $0.1 \text{ ohm}$ . Find the ratio of maximum to full-load torque and the speed at which the maximum torque occurs.	K3	CO2	7M
<b>OR</b>				
4.	a) Explain in detail about torque slip and torque speed characteristics.	K2	CO2	7M
	b) A three phase induction motor has a starting torque of 100% and a maximum torque of 200% of the full-load torque. Determine : i) slip at which maximum torque occurs ii) full-load torque and iii) rotor current at starting in per unit of full-load rotor current.	K3	CO2	7M
<b>UNIT – III</b>				
5.	a) Explain about the double-revolving field theory for single phase induction motors.	K2	CO3	7M
	b) Explain why single-phase induction motor is not self-starting and enlist types of single-phase motors.	K2	CO3	7M
<b>OR</b>				
6.	a) What are the different starting methods of 3-phase induction motor? Explain about any one method.	K2	CO3	7M
	b) Explain the equivalent circuit of a single-phase induction motor with neat sketch.	K2	CO3	7M

## UNIT – IV

7.	a)	What is the necessity of parallel operation of alternators?	K2	CO4	7M
	b)	A 3-phase, 16-pole alternator has a star-connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Wb, Sinusoidally distributed and the speed is 375 r.p.m. Find the frequency rpm and the phase and line e.m.f. Assume full-pitched coil.	K3	CO4	7M
OR					
8.	a)	What is synchronizing power of an alternator? Derive an expression for the Synchronizing power between the two alternators connected in parallel.	K2	CO4	7M
	b)	Find the no-load phase and line voltage of a star-connected 3-phase, 6-pole alternator which runs at 1200 rpm, having flux per pole of 0.1 Wb sinusoidally distributed. Its stator has 54 slots having double layer winding. Each coil has 8 turns and the coil is chorded by 1 slot.	K3	CO4	7M
UNIT – V					
9.	a)	Discuss in detail about starting of synchronous motors with the help of damper windings.	K2	CO5	7M
	b)	A 2000V, 3-phase, 4-pole, Y- connected synchronous motor runs at 1500rpm. The excitation is constant and corresponds to an open circuit voltage of 2000V. The resistance is negligible as compared to a reactance of $3\Omega$ per phase. Determine the power input, power factor and torque developed for an armature current of 200A	K3	CO5	7M
OR					
10.	a)	Derive the equation for power developed in a synchronous motor.	K2	CO5	7M
	b)	A 3 phase , 500 V, synchronous motor draws a current of 50 A from the supply while driving a certain load. The stator is star connected with armature resistance of $0.4 \Omega/\text{ph}$ and a synchronous reactance of $4\Omega/\text{ph}$ . Find the power factor at which the motor would operate when the field current is adjusted to give the line emf of 600V.	K3	CO5	7M