

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023**

Subject Code:2140906

Date:13-07-2023

Subject Name:AC Machines

Time:10:30 AM TO 01:00 PM

Total Marks:70

**Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
<b>Q.1</b>	(a) Derive the EMF equation of an alternator.	<b>03</b>
	(b) Discuss the methods of starting of Synchronous motor.	<b>04</b>
	(c) Define: slip. Explain torque-slip and torque-speed characteristics of 3 phase Induction Motor.	<b>07</b>
<b>Q.2</b>	(a) Draw phasor diagram (vector diagram) for 3 phase Induction Motor.	<b>03</b>
	(b) Mention types of starters for 3 phase Induction Motor. Explain any one in detail.	<b>04</b>
	(c) Explain procedure to construct circle diagram of Induction Motor. How to determine from circle diagram losses, efficiency and slip at full load condition.	<b>07</b>
<b>OR</b>		
	(c) The rotor resistance and reactance per phase of 4 pole, 50 Hz, 3 phase Induction Motor are $0.025 \Omega$ and $0.12 \Omega$ resp. Find (i) speed at maximum torque (ii) Find the value of additional rotor resistance per phase required to give three-fourth of maximum torque at starting.	<b>07</b>
<b>Q.3</b>	(a) Explain working principle of Induction generator.	<b>03</b>
	(b) Explain cogging and crawling for 3 phase Induction motor.	<b>04</b>
	(c) An 18.65 KW, 4 pole, 50 Hz, 3 phase Induction Motor has a friction and windage losses of 2.5% of the output. The full load slip is 4 %. Calculate for full load (a)the rotor copper loss (b)the rotor input (c)the shaft torque (d)the gross electromagnetic torque.	<b>07</b>
<b>OR</b>		
<b>Q.3</b>	(a) Explain the effect of unbalanced voltages on performance of 3 phase Induction motor.	<b>03</b>
	(b) Explain double cage rotor Induction motor.	<b>04</b>
	(c) A 6 pole ,50 Hz, 3 phase Induction Motor running on full load with 4 % slip develops a torque of 149.3 N. m at its pulley rim. The friction and windage losses are 200 watts and the stator copper and iron losses equal to 1620 watts. Calculate (a)output power (b)rotor copper losses (c) the efficiency at full load.	<b>07</b>
<b>Q.4</b>	(a) Define pitch factor and distribution factor for an alternator.	<b>03</b>
	(b) Explain the determination of direct and quadrature axis synchronous reactance using the slip test.	<b>04</b>
	(c) Explain potier triangle method for determination of voltage regulation of an alternator.	<b>07</b>
<b>OR</b>		
<b>Q.4</b>	(a) Why Synchronous motor is not self starting.	<b>03</b>
	(b) Write short note on Synchronous Condenser.	<b>04</b>

- (c) Explain double field revolving theory in relation to single phase Induction motor and show that it is not self starting. **07**
- Q.5** (a) What is hunting? How to minimize it? **03**
- (b) A 100 KVA, 3000 V, 50 Hz, 3 phase star connected Alternator has effective armature resistance of  $0.2 \Omega$ . The field current of 40 amp. produces short circuit current of 200 amp. and an open circuit emf of 1040 V (line value). Calculate the full load voltage regulation at 0.8 p.f. lagging and 0.8 p.f. leading. **04**
- (c) What is Synchronization? Explain two bright one dark lamp method of synchronization. **07**
- OR**
- Q.5** (a) Explain the necessary modifications in the design to be incorporated to enable satisfactory working of normal DC series motor on a.c. supply. **03**
- (b) Write short note on single phase reluctance motor. **04**
- (c) Explain experimental set up for 'V' curves and inverted 'V' curves of Synchronous motor. **07**

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