Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2024

Subject Code:2140906 Date:20-07-2024

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.**

Q.1	**(a)**	Derive the maximum starting torque condition for three phase induction motor.	**03**
	(b)	Explain production of rotating magnetic field in poly-phase induction motor.	**04**
	(c)	A no-load test conducted on a 30 hp, 835 r/min, 440 V, 3-phase, 60 Hz squirrel-cage induction motor yielded the following results: No-load voltage (line-to-line): 440 V No-load current: 14 A No-load power: 1470 W Resistance measured between two terminals: 0.5 Ω The locked-rotor test, conducted at reduced voltage, gave the following results: Locked-rotor voltage (line-to-line): 163 V Locked-rotor power: 7200 W Locked-rotor current: 60 A.	**07**
Q.2	**(a)**	Explain working principle of Isolated Induction Generator.	**03**
	(b)	Briefly explain double cage induction motor.	**04**
	(c)	Explain the torque slip characteristics of a three-phase induction motor and describe the significance of stable and unstable region.	**07**
		OR	
	(c)	List the types of starters for a 3 Phase Induction Motor. Explain any two starters in brief.	**07**
Q.3	**(a)**	Derive the emf equation of an alternator.	**03**
	(b)	Define voltage regulation and explain any one method in case of an alternator.	**04**
	(c)	Find the mechanical power output at a slip of 0.05 of the 185 W, 4 pole, 110 v, 60 Hz single phase motor. Whose constants are as given below: Resistance of the stator main winding – 1.86-ohm Reactance of the stator main winding – 2.56-ohm Magnetizing reactance of the stator main winding – 53.5 ohm Resistance of rotor at standstill – 3.56 ohm Reactance of rotor at standstill – 2.56 ohm	**07**
		OR	
Q.3	**(a)**	Explain with reason why synchronous motor is not self-starting.	**03**
	(b)	Describe the effect of armature reaction in case of a synchronous generator.	**04**
	(c)	A 250 W, 230 v, 50 Hz capacitor start motor has the following constant for the main and auxiliary windings: Main winding impedance = (4.5+ j 3.7) ohm Aux. winding impedance = (9.5 + j 3.5) ohm Determine the value of the starting capacitor that will place the main and auxiliary winding currents in quadrature at starting	**07**
Q.4	**(a)**	What is hunting? How to minimize it?	**03**
	(b)	Explain double field revolving theory and its application to single phase AC motors.	**04**
	(c)	A 1000 kva, 3300 V, 3 phase, star connected alternator delivers full load current at rated voltage at 0.8 p.f lagging. The resistance and synchronous reactance of the machine per phase are 0.5 ohm and 5 ohms respectively. Estimate the terminal voltage for the same excitation and same load current at 0.8 p.f leading.	**07**

OR

Q.4	**(a)**	Define the pitch factor and distribution factor in case of synchronous motor.	**03**
	(b)	Briefly explain V-curves of synchronous motor.	**04**
	(c)	From the following test results, determine the voltage regulation of a 2000 V, 1 phase alternator delivering a current of 100 A at (1) unity p.f, (2) 0.8 leading p.f and (3) 0.7 lagging p.f. Test results: Full load current of 100 A is produced on short circuit by a field excitation of 2.5 A. An e.m.f of 500 V is produced on open circuit by the same excitation. The armature resistance is 0.8 ohm.	**07**
Q.5	**(a)**	Justify the statement "Commutator acts as a frequency converter for the Schrage motor".	**03**
	(b)	Explain the construction and working of universal motor.	**04**
	(c)	Draw the schematic diagram and explain the construction and working of shaded pole single phase motor.	**07**

OR

Q.5	**(a)**	Explain the construction and working of Repulsion motor.	**03**
	(b)	Define slip. Write the equation of slip. What is the range of full load slip of induction motors?	**04**
	(c)	Explain concept of linear induction motor. Also give relative advantage and disadvantage.	**07**

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