Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 3 – EXAMINATION – SUMMER 2026

Subject Code: BE03009021 **Date: 22/06/2026**

Subject Name: ELECTRICAL MACHINES I

Time: 02:30 PM TO 05:00 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)**	Compare core type and shell type transformer.	**03**
	(b)	Explain construction and working of shaded pole single phase motor.	**04**
	(c)	Explain the procedure to construct the circle diagram of three-phase induction motor. Also, discuss how the losses, efficiency and slip of three-phase induction motor are calculated at full load condition using circle diagram.	**07**
Q.2	**(a)**	Explain cogging and crawling in case of three-phase induction motor.	**03**
	(b)	Derive the EMF equation of a transformer.	**04**
	(c)	Draw the vector diagrams and winding connections for the following transformer connections. (a) Dz6 (b) Yz11 (c) Yd11	**07**
		OR	
Q.2	**(c)**	Derive an expression for saving of copper when auto transformer is used compared to Two winding transformer.	**07**
Q.3	**(a)**	Why single phase induction motor not self started?	**03**
	(b)	Derive condition for maximum efficiency for single phase transformer.	**04**
	(c)	The following are the test results of a 100 KVA, 1100/440 V, single phase transformer. O.C. test: with normal primary voltage, 500W S.C. test: 40 V, 850 W when secondary winding is shorted and full load current flowing. Find the full load efficiency and regulation when the power factor is 0.8 lagging.	**07**
		OR	
Q.3	**(a)**	Write advantages and application universal motor.	**03**
	(b)	State the condition for parallel operation of three phase transformer.	**04**
	(c)	A 40 kVA, single phase transformer has 400 turns on primary and 100 turns on secondary. The primary is connected to 2000V, 50 Hz supply. Determine: (i) The secondary voltage on open circuit (ii) The current flowing through the two wingdings on full load (iii) The maximum value of flux.	**07**
Q.4	**(a)**	Give comparison of squirrel cage and wound rotor motors.	**03**
	(b)	Explain the purpose and working of Buchholz relay for three phase transformer.	**04**
	(c)	List out the methods of speed control of three-phase Induction Motor. Explain any one in detail.	**07**
		OR	
Q.4	**(a)**	Give the comparison of induction motor and induction generator.	**03**

	(b)	Why tapping are provided in three phase transformer, differentiate the No-Load and On-Load tap chaging.	**04**
	(c)	Draw the exact and approximate the equivalent circuit of three phase induction motor refer to the stator side	**07**
Q.5	**(a)**	Explain the double field revolving theory.	**03**
	(b)	What do you understand by energy efficient three phase induction motor? Differentiate with normal three phase induction motor.	**04**
	(c)	Explain the scott connection of three phase transformer with appropriate application of it.	**07**

OR

Q.5	**(a)**	Draw and explain the equivalent circuit of single phase induction motor.	**03**
	(b)	Draw and explain the speed-torque characteristic of three phase induction motor for the external connected rotor resistance (for R, 2R, 3R. 4R).	**04**
	(c)	Explain different cooling arrangements for three phase transformer.	**07**

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