GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering - SEMESTER - III EXAMINATION - WINTER 2025

Subject Code: BE03009021   **Date: 17-12-2025**

Subject Name: Electrical Machines I

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
Q.1	**(a)** Derive the EMF equation for single-phase transformer	**03**
	(b) List out the conditions require to fulfill for parallel operation of the single-phase transformers.	**04**
	(c) Determine the parameters to draw the equivalent circuit of transformer having below given data 100/200 volts, 50 Hz, single-phase open circuit test (O.C. test)- 100 volts, 0.4 Amp, 20 watts conducted from LV side Short circuit test (S.C. test) - 15 volts, 5 amp, 42.5 watts conducted from HV side	**07**
Q.2	**(a)** Discuss star-star connection of three phase transformers.	**03**
	(b) Discuss Auto transformer.	**04**
	(c) Discuss and analyze the Scott connection of the transformers.	**07**
	OR	
	(c) Discuss comparative analysis of different cooling systems used for cooling of transformers.	**07**
Q.3	**(a)** Discuss the phasor diagram of transformer operating at lagging power factor.	**03**
	(b) Discuss online tap changer of the transformer.	**04**
	(c) Discuss the torque-slip characteristic of an induction motor.	**07**
	OR	
	(a) Analyze the term "All day efficiency " for single-phase transformer.	**03**
	(b) Discuss any two protective devices used for the protection of transformer	**04**
	(c) Discuss cogging and crawling of an induction motor.	**07**
Q.4	**(a)** Discuss the working principle and types of construction of transformers.	**03**
	(b) Analyze the effect of rotor resistance on the starting toque of the induction motor.	**04**

(c)	How to determine (i) output line, (ii) torque line, and (iii) Power scale from the circle diagram of three-phase induction motor.	**07**

OR

(a)	Discuss different types of losses occurred in transformer.	**03**
(b)	Derive the condition for the maximum running torque for induction motor.	**04**
(c)	An induction motor has below mentioned data	**07**

Three-phase, 50 Hz, slip= 0.03, synchronous speed of stator magnetic field is 750 rpm, useful torque (shaft torque) is of the order of 192 Nm.

Determine (i) rotor frequency, (ii) speed of rotor, (iii) number of poles, and output power.

Q.5 (a)	Discuss the classification of single phase AC motors.	**03**
(b)	Discuss the different power stages of an induction motor.	**04**
(c)	Discuss shaded pole single phase induction motor.	**07**

OR

(a)	Discuss equivalent circuit of single-phase AC motor.	**03**
(b)	Discuss the effect of change in supply voltage on torque slip characteristic of an induction motor.	**04**
(c)	Discuss capacitor start and capacitor run type single-phase induction motor.	**07**

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