Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 6 – EXAMINATION – SUMMER 2026

Subject Code: 3160919 **Date: 01/06/2026**

Subject Name: Electric Drives

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)**	Define the shunt, series and separately excited DC motor with connection diagram.	**03**
	(b)	List the stator and rotor parameters of three phase induction motor and label them in approximate equivalent circuit diagram.	**04**
	(c)	Discuss the advantages and disadvantages of drive control over conventional motor control.	**07**
Q.2	**(a)**	Derive the equation of torque developed by separately excited dc motor.	**03**
	(b)	Analyze the effect of rotor resistance variation on speed torque curve of induction motor.	**04**
	(c)	Evaluate the torque speed curve of induction motor with diagram in context of applied voltage and applied frequency variation.	**07**
		OR	
Q.2	**(c)**	Compare the constant torque and constant power region of DC motor operation on T-ω and P-ω characteristic plane.	**07**
Q.3	**(a)**	State the functions of current controller in DC motor control.	**03**
	(b)	Determine the dynamic behavior of the DC drive from the torque balance equation.	**04**
	(c)	Analyze the slip power recovery system with diagram in context of efficiency improvement of three phase induction motor.	**07**
		OR	
Q.3	**(a)**	State the principle and applications of scalar control of induction motor.	**03**
	(b)	Show that the SVPWM technique has 15% higher DC bus utilization than the SPWM technique.	**04**
	(c)	Analyze how the rotor resistance influence the starting and running performance of wound rotor induction motor in context of starting torque and power factor.	**07**
Q.4	**(a)**	Define CCM and DCM in context of DC-DC buck converter.	**03**
	(b)	How to apply the TRC and CLC methods for output voltage control of chopper fed DC drive?	**04**
	(c)	Explain the operation of class C chopper with circuit diagram and waveforms.	**07**
		OR	
Q.4	**(a)**	State the voltage, current and power polarity in four quadrant chopper with quadrant diagram and application of each quadrant.	**03**

	(b)	Apply the cyclo-converter to half the speed of 50 Hz single phase induction motor drive.	**04**
	(c)	Explain the working of three phase VSI with circuit diagram and waveforms of line voltage and phase voltage.	**07**
Q.5	**(a)**	Model the chopper as gain with switching delay and write it's transfer function.	**03**
	(b)	Analyze the specific torque-speed characteristics of centrifugal fan and pump.	**04**
	(c)	Explain with block diagram the inner current loop and outer speed loop applied to DC drive.	**07**

OR

Q.5	**(a)**	State the limitations of field weakening method applied to induction motor.	**03**
	(b)	Analyze the relationship between slip, back EMF, and motor torque during a load-induced speed drop.	**04**
	(c)	Explain with block diagram how the DC link inverter used for three phase Variable Voltage Variable Frequency control of induction motor.	**07**

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