

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER– VII EXAMINATION – SUMMER 2026

Subject Code:3170916

Date:29-05-2026

Subject Name: Advanced Electric Drives

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.

	Marks
Q.1 (a) Explain the necessity of vector control using DC drive analogy.	03
(b) Draw the switching patterns for the upper half of the inverter in sector-3 and sector-5 when applying Space Vector Modulation Technique in the under modulation region.	04
(c) Explain the applications of a PWM converter as a line side rectifier. Also mention its advantage over the diode rectifier with a boost chopper.	07
Q.2 (a) Compare the performance and operation of a two-level inverter and a three-level inverter.	03
(b) Differentiate between direct vector control and Indirect vector control.	04
(c) Which Converter is capable of running a DC motor in four quadrants and also as a single-phase inverter? Elaborate its application to run a DC motor in four quadrants.	07
OR	
(c) Draw the block diagram to implement Direct Torque and Flux Control in the Induction Motor. Also explain the motion of stator flux trajectory within the hysteresis band using the inverter voltage space vector and corresponding stator flux vector in time Δt in DTC.	07
Q.3 (a) Draw the block diagram to implement closed loop Scalar v/f control in the induction motor using slip regulation.	03
(b) Explain abc to dq transformation of induction motor variables using the necessary phasor diagram.	04
(c) Enlist the topologies of three level Voltage source inverters. Also explain the working of diode clamped three level inverters with necessary circuit diagram and waveform.	07
OR	
Q.3 (a) Compare the trapezoidal PWM control of CSI and sine PWM control of VSI.	03
(b) From the space vector diagram of adjacent vectors, derive the magnitude of V_a and V_b in the reference vector. Also derive the equations to calculate the switching time of adjacent space-vectors and zero vectors (t_a , t_b and t_0) in space vector modulation.	04
(c) Draw the d^e - q^e equivalent circuit of the synchronous machine and explain the Park model.	07
Q.4 (a) Classify PMSM motors and BLDC motors according to position of rotor and placement of magnets.	03
(b) Draw the block diagram to operate multiple synchronous machines in parallel by v/f control. Also show the variation of voltage, torque and stator flux with speed in this control below and above rated speed.	04
(c) Explain the principle of self control for the control of Synchronous motors.	07

OR

- Q.4 (a)** Draw the block diagram to implement the speed controlled PM - BLDC drive scheme without flux weakening. **03**
- (b)** Compare PMSM motors and PM BLDC motors. **04**
- (c)** Draw and explain the block diagram to implement speed controlled PM synchronous motor drive. **07**
- Q.5 (a)** Differentiate between Radial field SRM and Axial field SRM. **03**
- (b)** With suitable example, elaborate the inductance profile and generation of torque for the switched reluctance machine in motoring mode and regenerative mode. **04**
- (c)** Explain the implementation of torque controller for closed loop torque control of Switched reluctance motor with necessary block diagram. **07**

OR

- Q.5 (a)** Explain the role of JTAG in DSP. **03**
- (b)** Draw the simplified architectural block diagram of DSP. **04**
- (c)** What are the specific applications and features of the following DSP series? **07**
TMS320C2000, TMS320C5000, TMS320C6000
Also enlist various DSPs available in this series.
