Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME SEMESTER – I EXAMINATION – SUMMER 2017

Subject Code: 2710709 **Date:11/05/2017**

Subject Name: Electrical Drives

Time:02:30 p.m. to 05:00 p.m. **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Explain the various components of the load torque with suitable example and their effect on requirements of an electric drive.	**07**
	(b)	Derive the criteria for judging the steady state stability of an electric drive	**07**
Q.2	**(a)**	What is the significance of controlled fly-wheeling? Explain the continuous current mode of operation for motoring and regenerative braking for separately excited DC motor fed from 1-phase fully controlled rectifier when operating in fly-wheeling mode.	**07**
	(b)	Draw and explain the speed-torque characteristics of a 3-phase fully controlled rectifier drive. Also find the expression for no-load speed. List the assumptions if any	**07**
		OR	
	(b)	Explain the role of current control scheme and various methods of it for rectified controlled DC motors Derive an expression for the critical speed _mc of a separately excited DC motor fed from a single-phase half-controlled rectifier	**07**
Q.3	**(a)**	A separately excited DC machine is fed from a 1-phase half controlled rectifier bridge. Draw the waveforms representing the output voltage and current of the converter (inputs to machine) when the machine is operating in Motoring mode. Discuss these modes in brief.	**07**
	(b)	Derive the following equation for a voltage source fed induction motor operating with constant V/f ratio: $$T = \frac{3}{\omega_{mc}}\left[\frac{V_{rated}^2 R_{r'}/(ks)}{\left(\frac{R_r'}{k}+\frac{R_r'}{ks}\right)^2+\left(X_r'+X_s\right)^2}\right]$$ where the notations have usual meanings. Also draw the speed torque characteristics for different values of k, where $k < 1$.	**07**
		OR	
Q.3	**(a)**	Discuss the steps that must be followed to obtain the speed-torque characteristics of a current-source fed induction motor.	**07**
	(b)	What is Dual converter? Draw and explain how the circulating current is controlled in dual converter with simultaneous control.	**07**
Q.4	**(a)**	Which harmonics are dominant in the output voltage of a six-step inverter? Discuss the effects of these harmonics on the performance of an induction	**07**

		machine fed from a six-step inverter.	
	(b)	Write a brief note on current controlled PWM inverters as a means to control the speed control of AC motors.	07
		OR	
Q.4	(a)	How the operation of an induction motor fed from current source is different than that when fed with a voltage source? Draw the speed-torque characteristics for both the cases on the same plot.	07
	(b)	Explain working of six step inverter	07
Q.5	(a)	With neat diagram explain a closed-loop speed control employing indirect current control scheme for an induction motor fed from voltage source inverter. The scheme should also have a provision for regenerative braking	07
	(b)	Show the scheme of static Scherbius drive used for slip power recovery control of an induction motor. State the limitations of the method. What is the significance of transformer in this control scheme?	07
		OR	
Q.5	(a)	An induction motor is controlled using VVVF drive. Discuss how the following varies in the field weakening mode with respect to the variation in frequency (i) Terminal voltage (ii) Maximum Torque(iii) Maximum power (iv) Slip speed (iv) Stator current Show the relevant mathematical analysis.	07
	(b)	Derive the equation of torque for a wound field salient pole synchronous motor operating from a voltage source of constant frequency. Hence, draw the torque-angle characteristics for the same.	07

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