Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–I(New course)• EXAMINATION – WINTER- 2015

Subject Code: 2714502 Date: 02/01/2016

Subject Name: Solid State DC Drives

Time:2:30 pm to 5:00 pm 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)** Draw the basic block diagram of electric drive system and explain each block. **07**

(b) A 220 V, 1000 rpm, 60A separately excited dc motor has an armature resistance of 0.1Ω. It is fed from a single phase full converter with an ac source voltage of 230 V, 50Hz. Assuming continuous conduction Calculate: **07**

1) Firing angle for rated motor torque at 600 rpm,
2) Firing angle for rated motor torque at (-500) rpm,
3) Motor speed for $\alpha = 150^0$ and half rated torque.

Q.2 **(a)** For type-A dc chopper with RLE load and continuous load current condition, show that the per unit ripple current is maximum when duty cycle is 0.5. Also draw the necessary waveforms and circuit diagram. **07**

(b) Draw circuit diagram, waveform and write the equations for 1-phase full controlled bridge converter, separately excited dc motor drive where current of the armature is assumed to be continuous and FD is connected in anti parallel with the armature of DC motor. **07**

OR

(b) Explain the operation of dc motor in forward motoring and Reverse braking with proper type of chopper. Explain both quadrant operations with appropriate wave forms? **07**

Q.3 **(a)** Draw circuit diagram, waveform and write the equations for 3-phase full controlled rectifier control of separately excited dc motor. **07**

(b) Explain the characteristic of separately excited DC motor for constant torque and constant power drive. **07**

OR

Q.3 **(a)** What is the difference between dynamic braking and regenerative braking? Write down the expressions for the average output voltage for step down and step up chopper**.** **07**

(b) Explain Different types of control strategies for chopper Dives. **07**

Q.4 **(a)** Explain the modeling of separately excited DC motor with speed control loop. Give the limitation of only speed control loop. **07**

(b) A dc series motor is fed from 600V dc source through a chopper. The dc motor has the following parameter r_a=0.004 ohms, r_s=0.06 ohms, k=0.0004Nm/amp^2 The average armature current of 300A is ripple free. For a chopper duty cycle of 60%, determine (1) input power from the source (2) the equivalent input resistance of chopper drive (3) motor speed (4) motor torque. **07**

OR

Q.4 **(a)** Explain the concept of 'Dual Converter'. Using circuit diagram, briefly explain the working of any one type of dual converter, derive necessary condition of firing angles and list the disadvantages of dual converter. **07**

	(b)	Develop a linearized transfer model of DC series motor.	**07**
Q.5	**(a)**	Develop transfer function of speed control of DC motor with PI controller and current control loop.	**07**
	(b)	How does a phase locked loop speed control scheme operate? Where do you use it?	**07**

OR

Q.5	**(a)**	Explain synchronizing firing of circuit, pulse transformer and draw circuit for gate protection.	**07**
	(b)	With neat schematic Block diagram describe the Micro-computer control of 4 quadrant DC drives with flow chart.	**07**

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