Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 2714502 **Date: 09-01-2015**

Subject Name: Solid State D.C. Drives

Time: 02:30 pm - 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.**

Q.1	**(a)**	Draw circuit diagram, waveform and write the equations for 1-phase full controlled converter, separately excited dc motor drive where current of the armature is assumed to be discontinuous mode.	**07**
	(b)	Explain the armature control and flux control of dc motors and also explain constant torque and constant power operation.	**07**
Q.2	**(a)**	For type-A dc chopper with RLE load and continuous load current condition shows that per unit ripple current is maximum when duty cycle is 0.5. Also draw the necessary waveforms and circuit diagram.	**07**
	(b)	A 220V, 970 rpm, 100 A DC separately excited motor has an armature resistance of 0.05 q. It is braked by plugging from an initial speed of 1000 rpm. Calculate (i) Resistance to be placed in armature circuit to limit braking current to twice the full load value. (ii) Braking torque.	**07**
		OR	
	(b)	A 200 volt, 875 rpm, 150 A separately excited dc motor has armature resistance of 0.06 q, respectively. It is fed from a single phase fully controlled rectifier with an AC source of 220 volt, 50 Hz. Calculate (i) Firing angle for rated motor torque and 750 rpm, (ii) Firing angle for rated motor torque and (-500) rpm, (iii) Motor speed for Ŭ = 160^0 and rated torque.	**07**
Q.3	**(a)**	Describe the working of a single phase semiconverter fed dc separately excited motor with relevant waveforms and expressions. State the assumptions made.	**07**
	(b)	Describe how a four quadrant drive can be obtained from a chopper fed separately excited dc motor.	**07**
		OR	
Q.3	**(a)**	Describe the working of a three phase full converter fed dc separately excited motor with relevant waveforms and expressions.	**07**
	(b)	Describe the regenerative braking of a chopper fed separately excited dc motor. Derive expressions for the minimum and maximum braking speeds for obtaining regenerative braking of the dc motor.	**07**
Q.4	**(a)**	Develop a linearized transfer model of separately excited DC motor.	**07**
	(b)	Explain different types of control strategies for chopper drive.	**07**
		OR	
Q.4	**(a)**	Discuss the control design for a two quadrant chopper circuit.	**07**
	(b)	Describe relative merits and demerits of four quadrant dc drives employing non circulating and circulating current dual converters.	**07**
Q.5	**(a)**	Develop transfer function of speed control of DC motor with PI controller and current control loop.	**07**
	(b)	Write a program flow chart for speed control of DC motor with current control.	**07**
		OR	
Q.5	**(a)**	Explain closed loop speed control scheme for control below and above base speed.	**07**
	(b)	Why PLL is better for speed control of DC motor. Explain basic PLL operation.	**07**