Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER 2012

Subject code: 714502N **Date: 09-01-2013**

Subject Name: Solid State DC 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)**	What are the main factors which decide the choice of DC drive for a given application?	**07**
	(b)	State essential parts of DC drives. What is the current status of DC drives?	**07**
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 antiparallel with the armature of DC motor.	**07**
		OR	
	(b)	When varying speed by field flux control, flux must be varied in small steps only. Why? State and explain how armature current and speed of a dc separately excited motor will be affected by doubling flux with armature voltage and load torque remaining constant.	**07**
Q.3	**(a)**	What factors limit the maximum speeds of field controlled DC motors? A 230 V, 1000 rpm, 105 A separately excited dc motor has an armature resistance of 0.06 ohm. Calculate the value of flux as a percent of rated flux for motor speed of 1500 rpm when load is such that the developed motor power is maintained constant at rated value for all speeds above rated speed.	**07**
	(b)	State and explain the important features of various braking methods of dc motors.	**07**
		OR	
Q.3	**(a)**	Field control is employed for getting speeds higher than rated and armature voltage control is employed for getting speeds less than rated. Why?	**07**
	(b)	Explain why a dc series motor is more suited to deal with torque over loads than other dc motors.	**07**
Q.4	**(a)**	Draw the speed torque characteristic for dynamic braking operation of dc series motor. Why torque becomes zero at finite speed?	**07**
	(b)	A 230 V, 870 rpm, 100 A separately excited dc motor has an armature resistance of 0.05 ohm. It is coupled to an overhauling load with a torque of 400 N-m. Determine the speed at which motor can hold the load by regenerative braking.	**07**
		OR	
Q.4	**(a)**	State and explain the disadvantages of using a motor of wrong rating.	**07**
	(b)	What are the reasons for using load equalization in an electrical drive? Why current sensing is required in electrical drives? What are the common	**07**

methods of current sensing?

Q.5	**(a)**	How does a phase locked loop speed control scheme operate? Where do you use it?	**07**
	(b)	A constant speed drive has duty cycle (i) Load rising from 0 to 400 kW: 5 min. (ii) Uniform load of 500 kW: 5 min (iii) Regenerative power of 400 kW returned to the supply: 4 min. (iv) Remains idle for: 2 min. Estimate power rating of the motor. Assume losses to be proportional to $(\text{power})^2$.	**07**

OR

Q.5	**(a)**	Describe relative merits and demerits of four quadrant dc drives employing non-circulating and circulating current dual converters.	**07**
	(b)	A fully controlled rectifier-fed separately excited dc motor is required to operate in motoring and braking operations in the forward direction. Only one fully controlled rectifier is available. What switching arrangement will be required? Explain.	**07**

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