Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 710709N **Date: 05-12-2014**

Subject Name: Electrical Drives

Time: 10:30 am - 01:00 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)** Derive the criteria for judging the steady state stability of an electric drive. **07**

(b) Draw and explain block diagram of an electric drive and significance of each block. **07**

Q.2 **(a)** Explain how the ratings of converter are affecting the performance of drive during transient and equilibrium operation. **07**

(b) Draw and explain the speed-torque characteristics of series motor under dynamic braking mode. The magnetization curve of a dc series motor when running at 600 rpm is given by: **07**

Current	Amp	20	30	40	50	60	70	80
emf	Volt	215	310	381	437	485	519	550

The total resistance of the motor is 1 Ω.

When connected for dynamic braking against a load giving a torque of 300 N-m, the motor speed is restricted to be 450 rpm. How much resistance must be connected across motor terminals?

OR

(b) Derive the following equation for a voltage source fed induction motor operating with constant V/f ratio: **07**

$$T = \frac{3}{\omega_{ms}}\left[\frac{V_{rated}^2 R_{r'}/(ks)}{\left(\frac{R_r'}{k}+\frac{R_r'}{ks}\right)^2+\left(X_r'+X_s\right)^2}\right]$$

where the notations have usual meanings. Also draw the speed torque characteristics for different values of k, where $k < 1$.

Q.3 **(a)** Explain various loss components in a dc motor drive. Also mention the condition for which the total drive loss becomes the least. **07**

(b) Explain various modes of operation of 1-phase fully-controlled rectifier-fed separately excited motor for regenerative braking with the help of neat sketch indicating status of devices and parameters unambiguously. **07**

OR

Q.3 **(a)** The CLC converts the motor speed-torque characteristic from a constant speed to a constant torque characteristic. Justify and explain with analytical support in context of dc motor drives. **07**

(b) Enlist and explain the merits, demerits and applications of dynamic braking and composite braking in context of dc drive system. **07**

Q.4 **(a)** With neat diagram explain a closed-loop speed control employing slip-speed control scheme for an induction motor fed from voltage source inverter. **07**

	(b)	Why an Induction motor fed by current source must be operated on the portion of the speed-torque characteristics that is generally considered statically unstable? Justify your answer with relevant discussion and characteristics.	**07**

OR

Q.4	**(a)**	Explain the principle of operation of a Static Scherbius drive. Also discuss the possible modes of operation with the scheme.	**07**
	(b)	Discuss the steps that must be followed to obtain the speed-torque characteristics of a current-source fed induction motor.	**07**
Q.5	**(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 machine fed from a six-step inverter.	**07**
	(b)	From the viewpoint of better torque to current ratio and higher efficiency, justify that VVVF method is superior to that of Stator voltage control method for controlling the speed of an induction motor. Produce the relevant characteristics and mathematical analysis for the justification.	**07**

OR

Q.5	**(a)**	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**
	(b)	For a doubly fed wound rotor induction motor, discuss the sub synchronous motoring and sub-synchronous braking operation.	**07**

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