

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2735

Roll No.

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**B.Tech.**

(SEM. VII) ODD SEMESTER THEORY EXAMINATION 2012-13

**ELECTRIC DRIVES**

Time : 3 Hours

Total Marks : 100

*Note : Attempt all questions.*

1. Attempt any **four** parts : **(5×4=20)**
  - (a) Describe the functions of basic elements in a drive.
  - (b) Define the components of friction torque.
  - (c) Enumerate the advantages and disadvantages of group drive, individual drive and multimotor drive.
  - (d) A 250 V dc series motor has an armature resistance of  $0.4 \Omega$ . From its magnetization curve at 480 rpm, the armature voltage is 125 V at 40 A of field current when running as a motor. Determine the speed at which it will run while drawing a current of 40 A. Determine the torque developed by the motor at this speed.
  - (e) A 440 V, 50 Hz, 6 pole, Y-connected induction motor has following parameters per phase referred to stator :  $R_s = R_r' = 0.3 \Omega$ ,  $X_s = X_r' = 1.0 \Omega$ ,  $X_m = 40 \Omega$ ,  $S_{fc} = 0.05$ . Calculate (i) motor current and torque at full load slip (ii) maximum torque.

2. Attempt any **two** parts :

**(10×2=20)**

- (a) Explain in detail how a motor operating a crane works in all the four quadrants with neat diagram.
- (b) A motor has a heating time constant of 90 mins and a cooling time constant of 120 mins and final steady-state temperature rise on full-load of 60°C. The motor has repeated load cycle of full load for 30 mins followed by stationary period of 30 mins. Determine the maximum and minimum temperatures. Also determine the overload on the motor that can be allowed on this cycle such that the maximum temperature rise does not exceed the permissible value of 60°C.
- (c) A motor equipped with a flywheel has to supply a load torque of 600 N-m for 10 sec followed by a no load period long enough for the flywheel to regain its full speed. It is desired to limit the motor torque to 450 N-m. What should be the moment of inertia of the flywheel ? The no-load speed of the motor is 600 rpm and slip 8% at torque of 400 N-m. Assume the motor speed-torque characteristic to be a straight line in the range of operation. Motor has an inertia of 10 Kg-m<sup>2</sup>.

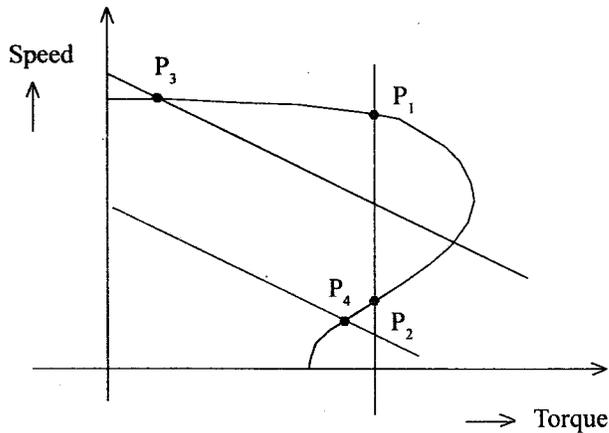
3. Attempt any **two** parts :

**(10×2=20)**

- (a) Derive the condition for steady state stability of an electric drive from the dynamic equation. Also explain the energy loss during starting of a motor.
- (b) (i) State different types of electric braking applied to induction motor. Explain each in detail.  
(ii) What is transient stability in a drive ? How it can be reduced ? What are the factors which cause transient instability ?

- (c) The figure shows a motor lifting a load by means of a winch. The weight lifted is 1500 kg at a velocity of 0.75 m/s. The motor runs at a speed of 1000 rpm. The inertia of the winch drum and motor are 1.8 Kg-m<sup>2</sup> and 3.6 Kg-m<sup>2</sup> respectively. Calculate :

- (i) the load torque of the system referred to motor shaft



- (ii) the stability at operating points  $P_1$ ,  $P_2$ ,  $P_3$  and  $P_4$ .

4. Attempt any two parts : (10×2=20)

- (a) A separately excited dc motor is fed from a 3- $\phi$  six pulse fully controlled bridge converter. The motor develops its full load torque at a rated speed of 1800 rpm taking a current of 60 A from a 400 V supply. Determine the rms value of supply voltage if the motor runs at its rated conditions for  $\alpha = 0$ . What is the range of firing angles for a speed control of 1800 to 900 rpm. The armature resistance is 0.5  $\Omega$ .

- (b) What are the strategies of a chopper controlled dc motor drive ? Explain the operation of two quadrant chopper fed dc shunt motor with suitable waveforms.
- (c) Write short notes on :—
  - (i) harmonics in dc motor current
  - (ii) dual converter fed separately excited dc motor drive.

5. Attempt any **two** parts : **(10×2=20)**

- (a) (i) Explain the VSI based induction motor drive with proper waveforms. Also, derive the expression of fundamental line voltage using Fourier analysis.
  - (ii) What is self control scheme of synchronous motor drive ? Explain in brief.
- (b) What are the two methods of slip power recovery scheme ? Differentiate between the two methods with their merits and demerits.
- (c) Write short notes on :—
  - (i) Brushless dc motor.
  - (ii) Factors affecting selection of a drive.