

4. Answer any **two** parts of the following. (10×2=20)

(a) A motor has a cyclic loading as given below :

250 N-m for 15 minutes

350 N-m for 20 minutes

100 N-m for 15 minutes

No load for 10 minutes

The motor runs at a constant speed of 500 rpm. Determine the rating of a suitable motor.

(b) The temperature rise of an electric motor is 40°C after 1 hr and 60°C after 2 hrs. The motor current is 100 A. Determine approximately its final temperature rise when it works on load cycle of 4 minutes working, 8 minutes rest with a current of 125 A. Neglect the effects of iron losses.

(c) Explain the various classes of duty of electric motor. And discuss how duty is preferred for selection of motor.

5. Answer any **two** parts of the following : (10×2=20)

(a) Why, chopper circuits are preferred over phase-controlled converters? Also explain the working of separately excited dc motor fed from chopper with suitable voltage and current waveform.

(b) Explain the speed control of synchronous motor on variable frequency supply with the help of circuit diagram and waveforms in details.

(c) A 100 hp; 460 V, 60Hz star connected squirrel cage induction motor has the following equivalent circuit parameters :

$$r_1 = 0.06 \Omega, r_2 = 0.35 \Omega, x_1 + x_2' = 0.6 \Omega, X_m = 8 \Omega.$$

The motor drives a fan which requires 100 hp at a speed of 1000 rpm. Determine the firing angles required for a speed range of 200 to 1000 rpm.

P 1000 Pages—4

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

PAPER ID : 2731

Roll No. 091612105

B.Tech.

(SEM. VII) ODD SEMESTER THEORY

EXAMINATION 2012-13

ELECTRIC DRIVES

Time : 3 Hours

Total Marks : 100

Note :- Attempt all **five** questions. Each question carries 20 marks. Assume missing data if any.

1. Answer any **three** parts of the following : (60)

(a) Explain the possible forms of drive motor with suitable justifications.

(b) Differentiate AC drives and DC drives for industrial purpose.

(c) The armature of a dc shunt motor has a resistance of 0.08 Ω. The armature current drawn by the motor at a speed of 1400 rpm is 190 A. The motor drives a load with a torque-speed characteristics given by

$$\tau = 0.65 \omega \text{ N-m where } \omega \text{ is rad/sec.}$$

If the rated voltage of the motor is 230V. Determine the torque and speed of the motor.

Show that in a 3-phase induction motor :

$$\frac{\tau_{dm}}{\tau_d} = \left[ \frac{s/s_m + s_m/s}{2} \right]$$

where  $\tau_{dm}$  is breakdown torque,  $\tau_d$  is the torque at slip  $s$  and  $s_m$  is the slip for  $\tau_{dm}$ .

A 3-phase squirrel cage induction motor has a starting current 8 times the full load current. The full load slip is 4%. Compute the starting torque as a percentage of full load torque of the motor is started as direct-on-line and by star/delta starter.

Answer any two parts of the following : (10×2=20)

Show that the torque to inertia ratios referred to the motor shaft and to the load shaft differ from each other by a factor of N where N is the gear ratio. Show that the torque squared to inertia referred to the motor shaft as load shaft are the same.

Use equal area criterion to estimate the stability of a synchronous motor. Use same to discuss the effects of damper windings on the oscillation of a synchronous motor.

A 500 kW; 10 pole, 50Hz synchronous motor has a torque angle of 35° on full load. Determine the natural frequency of oscillation if the moment of inertia is 1200 kg-m<sup>2</sup>.

Answer any two parts of the following : (10×2=20)

A separately excited dc motor is supplied from a 220V, 50Hz ac mains by a half-wave controlled rectifier. The

motor develops a torque of 25 N-m at a speed of 400 rpm. The motor has a constant of 3.5 V-sec/rad. It has an armature resistance of 0.5 Ω. Determine the firing angle for the rectifier and speed fluctuation of the motor. Assume a casting period of 150° between the pulses.

- (b) A dc series motor is fed from a single-phase fully controlled bridge rectifier. The details of the motor are : rated voltage = 240 V, full load current = 38 A, armature and series field resistance = 0.6 Ω, rated speed = 600 rpm. Determine the firing angle of the rectifier to run the motor driving at 300 rpm while load having a torque-speed characteristics given by :

$$\tau = 0.19 \omega^2$$

Determine the torque developed. Draw the voltage and current waveforms. The controlled rectifier is fed from 240 V, 50Hz single-phase supply.

- (c) Consider a salient pole synchronous motor operating on a variable frequency, variable voltage supply. Neglecting the effects of stator resistance, prove the following based on phaser diagram :

- When the applied voltage is varied in proportion to frequency at constant field current, the motor draws a constant current independent of stator frequency.
- The stator current under these operating conditions is a function of torque angle.