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

PAPER ID : 2731 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. VII) ODD SEMESTER THEORY EXAMINATION 2013-14

ELECTRIC DRIVES

EEE702

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

PAPER ID : 2735 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. VII) ODD SEMESTER THEORY EXAMINATION 2013-14

ELECTRIC DRIVES

Time : 3 Hours *Total Marks : 100*

Note :– Attempt **all** questions.

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

   (a) Describe in detail the various components of load torque. Classify the load torque on the basis of operation. Also give examples of load torque for various torque-speed characteristics of applications.

   (b) Give the advantages of electric drives over mechanical drive; explain each advantage with respect to industrial application.

   (c) In which type of applications four quadrant operation is employed in industries ? Explain in detail the working of such an electric drive.

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

(a) A motor with wound rotor of 6 pole, 50 Hz, 3 ϕ has a flywheel coupled to it shaft. The total moment of inertia of motor-load flywheel is 1000 kg-m^2. Load torque is 1000 N-m of 10 sec duration followed by a no load period which is long enough for the drive to reach its no load speed. Motor has a slip of 3% at a torque of 500 N-m. Calculate :

(i) Maximum torque developed by the motor

(ii) Speed at the end of decelaration period.

(b) Derive the thermal model of motor for heating. A motor is continuously rated at 50 kW. It has a heating time constant of 100 mins. Determine the 1 hr rating of the motor. The motor losses can be expressed as 0.6 full load copper losses + x^2 full load copper loss where x is a load as a fraction of full load.

(c) Classify the ratings of the motor based on its duty. Also enumerate the various methods in detail for the calculation of rating of motor.

A motor has a cyclic loading as given below :

(i) 250 Nm for 15 mins

(ii) 350 Nm for 20 mins

(iii) 100 Nm for 15 mins

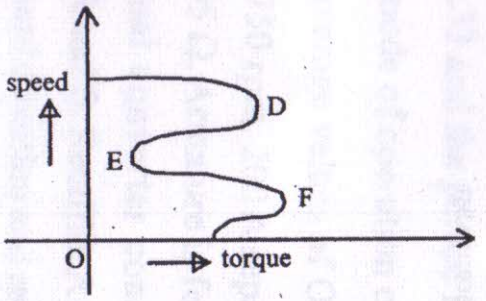
(iv) No load for 10 mins.

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

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

(a) Describe the advantages of electric braking. Classify the electric braking. Also explain mathematically why torque developed due to plugging braking is always greater than dynamic braking.

(b) Speed torque curve of motor under different operations is shown in the figure below. Draw the load curves which will give stable operation with the portions of characteristics marked as DE and EF.



(c) A 400 V, 750 rpm, 70 A dc shunt motor has an armature resistance of 0.3 Ω. When running under rated conditions, the motor is to be braked by plugging with armature current limited to 90 A. What external resistance should be connected in series with the armature ? Calculate the initial braking torque and its value when the speed has fallen to 300 rpm. Neglect saturation.

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

(a) Draw the necessary circuit diagram and waveforms and explain the working of 3-ϕ converter fed dc motor drive with continuous conduction only. Derive the average O/P voltage with motor load.

(b) A dc chopper fed from 150 V feeds a load comprising R = 0.2 Ω, L = 0.1 mH and a back emf of 20 V. The duty cycle is 0.33 and the period is 3 ms. Determine :

(i) the mode of operation of the chopper

(ii) the average values of O/P voltage and current.

(c) A 220 V, 750 rpm, 200 A separately excited dc motor has a Ra = 0.05 Ω. Armature is fed from a 3-ϕ non circulating current dual converter consisting of fully controlled rectifiers A and B. Rectifier A provides motoring operation in the forward direction and rectifier B in reverse direction. Line voltage of ac source is 400 V. Calculate firing angles of rectifiers for the following assuming continuous conduction :

(i) Motoring operation at rated torque and 600 rpm

(ii) Regenerative braking operation at rated torque and –600 rpm.

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

(a) Why the step-power recovery scheme is suitable mainly for drives with a low speed range ? Classify the slip power recovery schemes and explain any one of them.

(b) Why a self controlled synchronous motor is free from hunting oscillations ? Explain how the speed of a synchronous motor can be controlled using VSI fed inverter with requisite waveforms.

(c) Write short notes on :

(i) Switched Reluctance motor

(ii) Active and passive load torques

(iii) Load equalization

(iv) Classification of electric drives.