Registration No:

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AR-18

M.TECH 1ST SEMESTER EXAMINATIONS(BACK), NOV/DEC 2019
Branch: PE, MPEPC1010
ELECTRIC DRIVE SYSTEM

Time: 3 Hours   Max Marks : 70

The figures in the right hand margin indicate marks.

PART-A   (10 X 2=20 MARKS)

1. Answer the following questions.
   a. Draw the block diagram of an electric drive.
   b. How experimentally moment of inertia of a motor is determined?
   c. Why the slip power recovery scheme is suitable mainly for drives with low speed range?
   d. What are the requirements of closed loop control of electric drives?
   e. Why a motor of smaller rating can be selected for a short time duty?
   f. What is regenerative braking?
   g. Why variable frequency control in Induction motor below the rated frequency is carried out at rated air gap flux by maintaining (V/f) ratio constant at the rated value?
   h. On which factors coefficient of adhesion depends?
   i. What are the advantages of static rotor resistance control?
   j. What is true synchronous mode of control in synchronous motor?

PART-B   (5 X 10=50 MARKS)

Answer any five questions from the following.

2.
   a. A motor has heating time constant of 60 min and a cooling time constant of 90 min. Calculate the motor rating for the following duty cycles:
   (i)Short-time periodic duty cycle consisting of 100kW load for 10 minutes followed by no load period long enough for the motor to cool down.
   (ii) Intermittent periodic duty consisting of 100kW loadperiod of 10 min and no load period of 10 min. Assume loss to be proportional to (power) ^{2}.
   b. Explain the four quadrant operation of a low speed Hoist with suitable diagrams.

3.
   a. Explain the operation of a Phase-Locked-Loop (PLL) control.
   b. A 400 volt, 750 rpm, 70 amp dc shunt motor has an armature resistance of 0.3 ohm. When running under rated conditions, the motor is to be braked by plugging with the armature current limited to 90 amp. 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.
   a. Describe relative merits and demerits of four quadrant dc drives employing non-circulating and circulating current dual converters.
   b. A 220 V, 750 rpm, 200A separately excited motor has an armature resistance of 0.05 ohm. Armature is fed from a three phase 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.
   a. What are the drawbacks of rectified-fed dc drives?
   b. A 230 V, 1200 rpm, 15 A, separately excited motor has an armature resistance of 1.2 ohm. Motor is operated under dynamic braking with chopper control. Braking resistance has a value of 20 ohm.
       (i)   Calculate duty ratio of chopper of motor speed of 1000 rpm and braking torque equal to 1.5 times rated motor torque.
       (ii)   What will be the motor speed for duty ratio of 0.5 and motor torque equal to its rated torque?

6.
   a. Draw and Explain Speed control of Induction motor by stator voltage control and mention its advantages & disadvantages.
   b. A 3-phase, delta connected, 6 pole, 50 Hz,400 V, 925 rpm squirrel-cage induction motor has the following parameters:

   Rs= 0.2 ohm, Rr'= 0.3 ohm, Xs = 0.5 ohm, Xr'= 1 ohm

   The motor is fed from a voltage source inverter with a constant V/f ratio from 0 to 50 Hz and constant voltage of 400 V above 50 Hz frequency.

   (i) Determine the breakdown torque for a frequency of 100 Hz as a ratio of its value at 50 Hz.

   (ii) Calculate the motor torque at 30 Hz and a slip speed of 60 rpm.

7.
   a. An electric train weighing 500 tonnes climbs up-gradient with G=8 and following speed-time curve:
       a. uniform acceleration of 2.5 km/hr/sec for 60sec
       b. constant speed for 5min
       c. coasting for 3 min
       d. Dynamic braking at 3 km/hr/sec to rest

   The train resistance is 25 N/tonne, rotational effect 10% and combined efficiency of transmission and motor is 80%. Calculate specific energy consumption.
   b. Derive the expression for Tractive Effort and torque per motor for an electric train.

8. Write short Notes on
   a) Drives in Cement Mill
   b) Plugging of separately excited D.C. motor

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