2002 SCHEME

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EE82

Eighth Semester B.E. Degree Examination, Dec.09-Jan.10
Industrial Drives and Applications

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. What is an electric drive? Mention the advantages of electric drives over other types of drives. **(06 Marks)**

b. Draw the speed torque characteristics of a DC shunt motor. Also draw the modified characteristics. **(06 Marks)**

c. A 400 V, 15 KW, DC shunt motor takes 42 A and runs at a speed of 1200 rpm. The shunt field resistance is 200 Ω. Assume that the load torque varies as square of speed. Assume that the maximum efficiency occurs at rated load. Calculate the resistance to be connected in series with the armature to reduce the speed to 1000 rpm. **(08 Marks)**

2 a. With the help of quadrantal diagram, explain the four quadrant operation of a motor driving a hoist load. **(07 Marks)**

b. With the help of characteristics, explain the reverse current braking of DC shunt motor. **(05 Marks)**

c. A 220 V DC shunt motor having an efficiency of 88% drives a hoist having an efficiency of 75%. Calculate the current drawn from the supply to raise a load of 400 kg at 2.5 m/sec. What resistance must be added to the armature circuit in order to lower the load at 2.5 m/sec using rheostatic braking? Assume that the efficiency of the hoist and the DC machine remain the same as before. **(08 Marks)**

3 a. Explain how DC dynamic braking is achieved in 3 phase Induction motor. Obtain an equivalent circuit for the same in terms of equivalent AC current source. **(10 Marks)**

b. A 500 V, 3 phase, 50 Hz, 8 pole, star connected Induction motor has the following parameters perphase referred to stator. $r_1 = r_2' = 0.13\Omega$; $x_1 = x_2' = 0.6\Omega$. The full load slip is 5%. The machine is to be braked from full load by i) Plugging and ii) DC rheostatic braking with DC fed into two of its terminals. In both cases, a resistance of 1.5 Ω/phase (referred to stator) is inserted in rotor circuit. Determine initial braking torque in each case. Determine also the DC excitation required in case of DC rheostatic braking. **(10 Marks)**

4 a. With usual notations, derive an expression for the temperature rise of an electric drive. **(08 Marks)**

b. A motor has a thermal heating time constant of 45 minutes when the motor runs continuously on full load, its final temperature rise is 80°C.

i) What would be the temperature rise after 1 hour; if the motor runs continuously on full load?

ii) If the temperature rise on 1 hour rating is 80°C, find the maximum steady state temperature rise at this rating. **(04 Marks)**

c. Select a motor for driving an equipment having the load cycle given below, based on RMS torque.

i) For the first 10 secs, the torque is constant at 41 kg m

ii) For the next 30 seconds, the torque drops uniformly from 38 kg m to 17 kg m.

iii) For the last 46 seconds, the torque is constant and is equal to 8 kg m.

Assume the over load factor as 1.7 **(08 Marks)**

5 a. Derive an expression for the short time rating of an electric drive in terms of its continuous rating. **(06 Marks)**

b. The 10 minutes rating of a motor used in domestic mixer is 200 watts. The heating time constant is 40 minutes and the maximum efficiency occurs at full load. Determine the continuous rating of the motor. **(04 Marks)**

c. A 50 KW, 3 phase 440 V, 50 Hz, 1440 rpm cage induction motor has constant loss to variable loss at full load in the proportion of 1:3. Its rated temperature rise is 55°C and its heating and cooling time constants are 40 and 60 minutes respectively. Find the intermittent rating if periodic loads of half hour duration are applied at an interval of half – hour. **(10 Marks)**

6 a. What is the criterion for steady state stability of an electric drive? Starting from fundamentals, derive a relationship between load torque and motor torque for steady state stability. **(08 Marks)**

b. A weight of 500 kg is being lifted up at a uniform speed of 1.5 m/sec by a winch driven by a motor running at a speed of 1000 rpm. The moment of inertia of the motor and winch are 0.5 and 0.3 kg m^2 respectively. Calculate the motor torque and the equivalent moment of inertia, referred to the motor shaft. In the absence of weight, motor develops a torque of 100 N-M when running at 1000 rpm. **(04 Marks)**

c. Obtain the equilibrium point and determine the steady state stability for the following values of motor and load torques. $T_M = (1 + 2\ W_m)$ and $T_L = 3\sqrt{W_m}$, where W_m is the speed of the motor. **(08 Marks)**

7 a. Explain in detail, the types of drives used in machine tools. **(08 Marks)**

b. Explain clearly the types of drives used in paper mill. What are the requirements of paper mill drives? Give reasons. **(12 Marks)**

8 a. Derive an expression for the crest velocity of a traction motor drive, in case the run is in the form of Trapezoidal speed time curve. **(08 Marks)**

b. Analyse the suitability of series motors for traction duty. **(04 Marks)**

c. An electric train has an average speed of 50 kmph between two stations 2 km apart on a level track. The acceleration and retardations are 2 and 4 kmphps respectively. Determine the specific energy consumption. The train resistance is 40 N/T; combined efficiency of transmission gears and motors is 70% and the effect of rotational inertia 10%. **(08 Marks)**

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