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EE82

Eighth Semester B.E. Degree Examination, Dec. 07 / Jan. 08
Industrial Drives and Applications

Time: 3 hrs. Max. Marks:100

Note :1. ***Answer any FIVE full questions.***
2. ***Assume missing data, if any, suitably.***

1 a. Explain the block diagram of an Electric drin. **(05 Marks)**

b. What are the advantages of an Electric drin? **(05 Marks)**

c. A 220 V, 10 kW, 1200 rpm shunt motor has full load efficiency of 85%. The field resistance and armature resistane an 110 Ω and 0.25 Ω respectively. Neglect rotational losses and armature reaction. Calculate the value of the resistance required to be inserted in series with armature to reduce the speed to 900 rpm when

i) The load torque is constant regardless of speed.

ii) The load torque varies as the square of the speed. **(10 Marks)**

2 a. Explain the speed torque characteristic of DC shunt motor on four quadrant system with a variable resistance in the field circuit. **(08 Marks)**

b. A 230 V, 21 amps, 1000 rpm DC shunt motor has an armature resistance of 0.05 Ω and a field resistance of 230 Ω. The magnetization curve for the machine is given by the following data:

I_f (field current)	0.2	0.4	0.6	0.8	1.0	1.2	1.4
E.M.F at 1000 rpm (E)	50	100	150	190	219	235	245

Calculate the speed and torque developed by the motor with full load current under each of the following conditions:

i) No external resistance is included.

ii) A resistance of 0.05 Ω is connected in series with armature and

iii) A resistance of 110 Ω is connected in series with the field winding. **(12 Marks)**

3 a. Neglecting the stator resistances and leakage reactance, show that for a three phase induction motor,

$$\frac{T}{T_m} = \frac{2}{\left[\frac{S}{S_m} + \frac{S_m}{S}\right]}$$

where S_m – slip at maximum torque T_m

S – slip at any torque T. **(12 Marks)**

b. A 400 V, 3 phase, 50 Hz, 4 pole squirrel cage induction motor has the following equivalent circuit parameters.

$\gamma_1 = 0.1\Omega$, $X_1 = 0.4\Omega$, $\gamma_2' = 0.1\Omega$ $X_2' = 0.4\Omega$, $X_m = 14.0\Omega$. The motor was operating on full load at slip = 0.05, when the two stator terminal were suddenly interchanged. Calculate the primary current and the braking torque immediately after application of plugging. **(08 Marks)**

4 a. Explain the different methods of speed control applied for squirrel cage induction motor. **(10 Marks)**

b. The rotor of a 6 pole, 50 Hz, slip ring induction motor has a resistance of 0.2 Ω per phase and runs at 960 rpm on full load. Calculate the resistances per phase to be inserted in the motor circuit such that speed is reduced to 8000 rpm. The torque being

i) The same as before and

ii) Proportional to square of the speed. **(10 Marks)**

5 a. Define the continuous duty, short time duty and intermittent periodic duty cycles. **(06 Marks)**

b. Explain how the rating of a motor can be selected for a continuous duty variable load based on the equivalent current method. **(06 Marks)**

c. Plot the load curves and select the proper motor for the following intermittent duty:

i) $P_1 = 35$ kW for $t_1 = 3$ sec.

ii) $P_2 = 17$ kW for $t_2 = 20$ sec.

iii) $P_3 = 35$ kW for $t_3 = 2$ sec.

iv) $P_4 = 13$ kW for $t_4 = 15$ sec.

Between the operating periods (ii) and (iii), then is a pause of $t_{c1} = 37$ sec and at the end of the cycle then is another phase $t_{c2} = 40$ sec. **(08 Marks)**

6 a. Explain the dynamic braking employed for a DC shunt motor. **(06 Marks)**

b. What is heating time constant and explain how the rating of the motor is effected by the temperature rise. **(08 Marks)**

c. A motor has a thermal heating time constant of 30 minutes, when the motor runs continuously on full load, its final temperature rise is 80°C.

i) What would be the temperature rise after are hour if the motor runs continuously on full load.

ii) How long the motor will take for a temperature rise from 50°C to 80°C if it is working at its are hour rating. **(06 Marks)**

7 a. Explain the various drives used in the industry of paper manufacture. **(10 Marks)**

b. Derive the expansion for tractive effort for propelling a train. **(10 Marks)**

8 Write short notes on any four of the following:

a. Suitability of AC series motor for traction.

b. Supply system used in electric traction

c. Four quadrant operation of motor having a hoist load.

d. Rotor resistance variation in step ring induction motor.

e. Cement mill drives. **(20 Marks)**

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