EE82

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NEW SCHEME

Eighth Semester B.E. Degree Examination, May 2007
Electrical & Electronic Engineering
Industrial Drives & Applications

Time: 3 hrs.] [Max. Marks:100

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

1 a. Explain dynamic braking of DC motor. Give its merits and demerits. **(10 Marks)**

b. A 220 V, 970 rpm, 100 A, dc separately excited motor has an armature resistance of 0.05 Ω. It is braked by plugging from an initial speed of 1000 rpm. Calculate

i) Resistance to be placed in armature circuit to limit braking current to twice the full load value.

ii) Braking torque.

iii) Torque when the speed falls to zero. **(10 Marks)**

2 a. How an induction motor can be braked by regenerative approach? Explain with a neat schematic and W-T characteristic. **(10 Marks)**

b. A 3-phase, star connected 440 V, squirrel cage motor has the following equivalent circuit parameters referred to stator: $R_1 = 0.1\ \Omega$, $R_2' = 0.1\ \Omega, X_1 = X_2' = 0.4\ \Omega$. Determine

i) Starting current of the motor when switched direct on line.

ii) The stator current at the start of reverse current braking assuming slip to be 4%. **(10 Marks)**

3 a. Obtain an expression for the temperature rise of an electric motor due to heating. Draw a typical heating curve. **(10 Marks)**

b. The 15 minute rating of a motor used in domestic mixer is 400 W. If the heating time constant is 60 min, determine the continuous rating. Assume that the maximum efficiency of motor occurs at 80% of full load. **(10 Marks)**

4 a. Develop an expression to determine power rating of electric motor using the method of equivalent current for variable load conditions. **(10 Marks)**

b. A horizontal conveyor belt moving at a uniform velocity of 1 m/s transports load at the rate of 50000 kg/hr. The belt is 180 m long and is driven by a 960 rpm motor. Determine the equivalent rotational inertia at the motor shaft. **(10 Marks)**

5 a. Derive an expression for the equivalent load torque and equivalent moment of inertia as referred to motor shaft of a motor-load combination where the load is fed through a gear system. **(10 Marks)**

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5 b. In the mechanism shown, the motor drives the winch drum through 10 : 1 reduction gear. Assuming that the shaft and cable are non elastic, calculate the equivalent inertia of the motor and mechanism referred to motor shaft. **(10 Marks)**

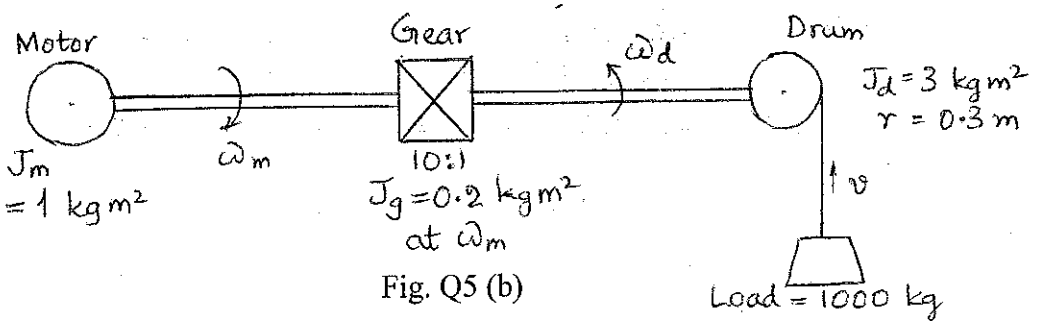

Fig. Q5 (b)

6 a. Describe briefly the process involved in a cement factory. What are the required features of electric drives? What are the drives employed? Explain. **(10 Marks)**

b. What are the different steps followed in a textile industry? Give an account of the electric drives employed with proper reasoning. **(10 Marks)**

7 a. Give a brief idea of simplified speed – time curves for traction application. Obtain an expression for maximum speed for trapezoidal speed-time curve. **(10 Marks)**

b. A train is required to run between two stations 1.6 km apart at an average speed of 43 km/hr. The run is to be made to a simplified quadrilateral speed-time curve. If the maximum speed is to be limited to 64 km/hr, acceleration to 2 km/hr/sec and coasting and braking retardation to 0.16 and 3.2 km/hr/sec respectively, determine the duration of acceleration, coasting and braking periods. **(10 Marks)**

8 Write short notes on:

a. Quadrantal speed-torque diagram.

b. Ratings of motors.

c. Coefficient of adhesion.

d. Suitability of dc series motor for traction. **(20 Marks)**

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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 base 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 en 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 th temperature rise. **(08 Marks**

c. A motor has a thermal heating time constant of 30 minutes, when the motor run 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 o full load.

ii) How long the motor will take for a temperature rise from 50°C to 80°C if it is workin 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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Eighth Semester B.E. Degree Examination, May/June 08
Industrial Drives and Application

Time: 3 hrs. Max. Marks:100

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

1 a. Define natural characteristic related to dc Shunt – motor, draw natural Rheostatic speed – torque characteristic of dc shunt motor and explain. **(08 Marks)**

b. A 400V, 15 kW dc shunt motor takes 420 amps and runs at a speed of 1200 rpm. The shunt field resistance is 200 Ω. Assume that the load torque values as the square of the speed, neglect iron and friction losses and also the armature reaction effect. Calculate the resistance to be connected in series with the armature to reduce the speed to 1000 rpm, take armature resistance as 0.55 Ω. **(12 Marks)**

2 a. With a neat sketch, explain the method of counter current braking for a dc shunt motor, and also draw its speed – torque characteristic. **(08 Marks)**

b. A 500V, 45kW, 600 rpm dc shunt motor has full load efficiancy of 90%. The field resistance is 200 Ω and the armature resistance is 0.2 Ω. The field current is maintained constant. Armature reaction and brush drop may be neglected. Calculate the rated armature current and hence find the speed under regenerative braking with no external resistance condition at which the machine develops an electromagnetic torque equal to the rated value. **(12 Marks)**

3 a. Explain the process of dynamic braking of a 3 phase induction motor. **(08 Marks)**

b. A 230V, 3 phase, 50Hz, 4 pole 10 amp, 0.85pf, squirrel cage induction motor has a full load rated speed of 1440 rpm. The stator losses amount to 86.16 walts. The total inertia of the motor together with load is 0.0486 kg – m^2. Determine

i) The input power
ii) Power transferred to rotor
iii) Rotor copper loss
iv) Permissible energy in one minute
v) Total energy dissipated in rotor during starting and breaking
vi) Total number of starts and stops, by dol stop by plugging without exceeding allowable temperature risk. **(12 Marks)**

4 a. Derive an expression for power rating of electric motor used in metal shearing lathes for continuous duty and constant load. **(10 Marks)**

b. Plot the load curve and select the proper motor for the following intermittent duty:

i) $P_1 = 35kW$ for $t_1 = 3$ sec
ii) $P_2 = 17kW$ 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 period ii) and iii) there is pause (P = 0) of $t_{c_1} = 37$ sec, at the end of the cycle, there is another pause t_{c_2} = of 40 sec, take standard duty factor of 0.4. **(10 Marks)**

5 a. Explain clearly transients in separately excited dc motor with relevant equation, also dr the characteristic of dynamic response to step change in supply voltage. (10 Marl

b. A three – phase, 415 V, six – pole 50Hz star – connected slip – ring induction motor ha sum of stator and rotor leakage reactance referred to the stator of 1.0 Ω. It is connected t balanced 415V supply and drives a pure inertia load. The moment of inertia of the ro including the load is 10 kg – m^2. The DOL starting is used and the rotor circuit resistan is adjusted so that the motor brings its load form rest to 0.95 of the synchromers speed the shortest possible time. Calculate the minimum time to reach 0.95 of synchrom speed. (10 Marl

6 a. Explain with block diagram the various stages in the reversing hot rolling mills. (08 Mar

b. Give the comparison between line shaft drive and sectional drive related to industr application. (08 Mar

c. What are the different types of driving motors used in cement industry? Explain any o (04 Mar

7 a. Explain tractive effect with a neat sketch. (05 Mar

b. What are the requirements of electric traction? Draw and explain tractive effort a tractive resistance verses train speed characteristic. (10 Mar

c. A suburban electric train has a maximum speed of 65 kmph, the schedule speed includ a station stop of 30 seconds is 43.5 km ph, find the time for actual run when the aver distance between stops is 3 Km. (05 Mar

8 Write notes on:

a. Multi – motor electric drive

b. Quadrantal diagram of N – T characteristic

c. Co – efficient of adhesion

d. D C Rheostatic braking for induction motor (20 Ma

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