



This exam measure the following ILOS (a.19, b.15, c.15, and c.17)

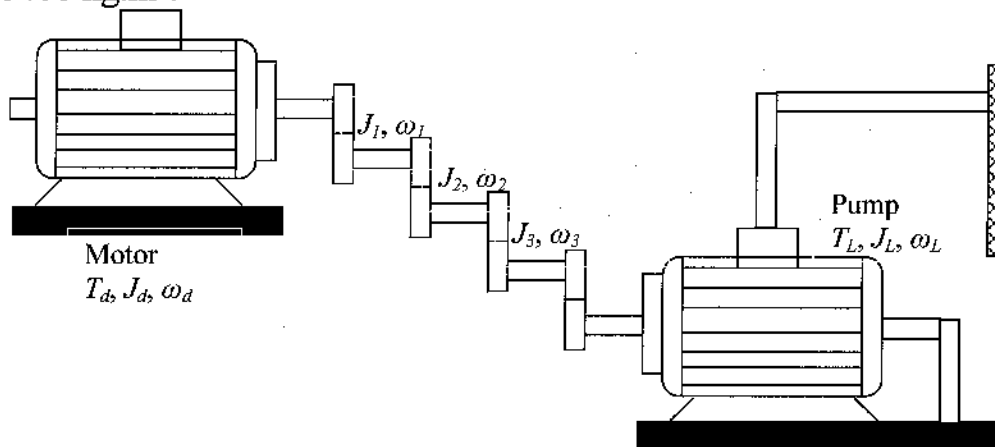
Please, answer all of them; assume any missing data; manage your time.

Q1:

(15 Marks)

a) What is the main Difference between VSD and Gearbox? [5 Marks]

b) A pump torque of 6000 N.m is supplied by an electrical motor through gears of ratios 2:4:8:16. The speed of the motor is 960 rpm, as shown in the following figure. Find the pump torque referred to motor shaft if the efficiency of each gear is 85%. Find the power required by the load and power input to the motor if the efficiency is 88%. Also find the equivalent moment of inertia referred to motor shaft. Where $J_d = 100 \text{ kg.m}^2$, $J_1 = 40 \text{ kg.m}^2$, $J_2 = 160 \text{ kg.m}^2$, $J_3 = 640 \text{ kg.m}^2$, $J_L = 6400 \text{ kg.m}^2$.



[10 Marks]

Q2:

(15 Marks)

(a) How you can select the electrical motor for certain load at non standard mode of operation. [5 Marks]

(b) A motor has a thermal time constant of 45 minutes. When the motor runs continuously on full load, its final temperature rise is 80°C. (i) What is the temperature rise after 1 hour if the motor runs continuously on full load? (ii) If the temperature on one hour rating is 80 °C, find the maximum steady state temperature at this rating. (iii) How much time does the motor take in its temperature to rise from 50 °C to 80 °C if it is working at its 1 hour rating? [10 Marks]

Q3:

(20Mark)

(a) What is meant by counter current braking? [5 Marks]

(b) A 400 V, 25 h.p., 45 r.p.m., d.c. shunt motor is braked by plugging when running on full load. Determine the braking resistance necessary if the maximum braking current is not to exceed twice the full-load current. Determine also the maximum braking torque and the braking torque when the motor is just reaching



zero speed. The efficiency of the motor is 74.6% and the armature resistance is 0.2Ω . [15 Marks]

Q4: (20 Marks)

(a). Draw and explain the chopper rheostatic brake circuit and its wave forms

[10 Marks]

(b) A separately excited dc motor is supplied from 220 V, 50 Hz source through a single phase half wave controlled converter, its field is fed through 1 phase seminconveter with zero degree firing angle delay. Motor resistance $R_a = 0.5 \Omega$ and motor constant $= 0.5 \text{ V. sec./rad}$. For rated load torque 10 N.m. at 1000 rpm and for continuous ripple free currents determine the firing angle delay of the armature converter. [10 Marks]

Q5: (20 Marks)

(a) State three methods of controlling the speed of the squirrel cage induction motor. Mention the advantages and disadvantages of each method. Support your answer with speed-torque and speed-current curves in each case. [5 Marks]

(b) 380V, two-poles, 50Hz, Y-connected induction motor has an inductive reactance of 2.64Ω and a stator resistance of 0.034Ω . The rotor resistance referred to the stator is 0.05Ω . The motor is driving a constant-torque load of 70 N.m at speed of 3000 RPM. Assume that this torque includes the rotational components. Calculate the maximum and minimum setting frequency of the variable frequency drive (VFD) if the maximum allowed current of the motor is 115% of the motor starting current? [15 Marks]

With our best wishes

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