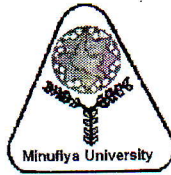


التحضير الكهربي

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Menoufiya University
Faculty of Engineering
Shebin El-Kom
Second Semester Exam.
Academic Year: 2013-2014



Department: Electrical Eng.
Course : Electric Drive
Year: 4th Code: ELE 421
Time Allowed: 3 hours
Date: 31/5/2014 Marks: 100

Answer the following questions:

Question (1)

15-Mark

1.2 State the essential parts of electrical drive. What are the functions of a power modulator?

1.2-An elevator is design to lift 5 persons, each has 75 kg weight, and its empty cage has 125 kg weight. The elevator is being left-up with a uniform speed of 1.2 m/sec. It is driven by a 3-phase induction motor through a transmission system has an efficiency of 90%. The motor has an inertia of 0.2 kg-m² and runs at a constant speed of 950 rpm. Determine the equivalent inertia referred to the motor shaft and the power developed by the motor.

Question (2)

15-Mark

2.1- A 500 tons train travel a down gradient of $G=20$ for 50 sec. during which period its speed is reduced from 150 km/h to 100 km/h by regenerative braking. The tractive resistance is 40N/ton, effect of rotational mass is 10% and efficiency of the drive in regenerative braking is 80%. Calculate the energy returned to the supply.

2.2- An electric bus has a mass of 12 ton is driven by 2 motors, one for each wheel axle and each motor rotates by 1500 rpm. If up-gradient is 20, gear ratio $a=0.2$. Each wheel has a radius of 0.5 m and each has a mass of 150 kg. Calculate the coupling torque and power rating per motor required to accelerate the bus at 5 km/hr/s. Assuming bus resistance to be 30 N/ton of weight.

Question (3)

20-Mark

3.1- The speed of a separately excited dc motor is controlled by a single-phase full-converter. The field circuit is also controlled by a single-phase full converter and the field current is set to the maximum possible value. The ac supply voltage to the armature and field converters is single-phase, 220 V, 50 Hz. The armature resistance is $R_a=0.25 \Omega$, the field circuit resistance is $R_f=175 \Omega$, and the motor voltage constant is $K_v=1.4 V/A-rad/s$. The armature current corresponding to the load demand is $I_a=45 A$, the viscous friction and no-load losses are negligible. The inductances of the armature and field circuits are sufficient to make the armature and field currents continuous and ripple-free. If the delay angle of the armature converter is $\alpha_a=60^\circ$ and the armature current is $I_a=45 A$. Determine the (a) Torque developed by the motor, T_a ; (b) Speed, ω ; and (c) Input power factor of the drive, PF .

P.T.O.

3.2- A 2.8 Kw, 400 V, 50 Hz, 4-pole, 1370 rpm, Y-connected induction motor has the following parameters: $R_s=1.9\Omega$, $R'_r=4.757\Omega$, $X_s=X'_r=3\Omega$. Load characteristics are matched with motor such that the motor runs at 1370 rpm with full voltage across its terminals. The motor is controlled by stator voltage control and load torque is proportional to speed. Calculate the motor terminal voltage and current at half the rated speed. Can the motor be allowed to run continuously at this speed?

Question (4) [14 Marks]

a) Choose the electric motor type and its controller (if needed) which can be used to operate the following loads; (1) Fan of 30 W, 2000 r.p.m. (2) Load of constant torque, 5 horsepower, 720 and 1400 r.p.m. (3) Constant torque load of 250 horsepower, 700 r.p.m. (4) Mixer of 5000-W, 50-r.p.m. [7- Marks]

1- b) How do you can experimentally know the value of rated voltage of three phase wound rotor induction motor, without any data on it. [7- Marks]

Question (5) [18 Marks]

a) Discuss the phase control method of induction servo motor. [7- Marks]

b) A temperature rise test on a three phase induction motor at different values of load power, gives the final steady temperature rise with load power as follows;

Temperature rise ($^{\circ}\text{C}$)	30	36	44	58	78	108	154	200
Load power (KW)	0	3	6	9	12	15	18	20

Deduce the full load motor power when the insulation is;(1) Class B, (2) Class (F) and (3) Class (H), (with ambient temperature of 25°C).

[11- Marks]

Question (6) [18 Marks]

a) Discuss the operation and characteristics of induction tachogenerator. [7- Marks]

b) A 440-V, 2000-r.p.m., DC long compound motor has an armature resistance of 0.01-ohm and a series field resistance of 0.02-ohm. The full load armature current is 40-A. The series field winding reduces the flux of shunt field by 2 % at full load motoring operation. Determine ; (a) the braking resistance which gives a counter current braking armature current of 2 times the full load armature current at 2000-r.p.m. (b) the braking torque. [11- Marks]

Good Luck
