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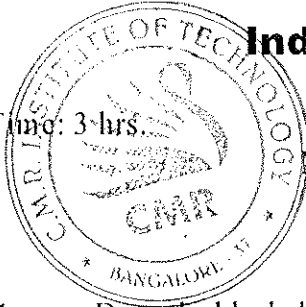
Seventh Semester B.E. Degree Examination, June/July 2016

Industrial Drives and Applications

Time: 3 hrs.

Max. Marks: 100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.



PART – A

- 1
 - a. Draw the block diagram of electrical drive system and what are the functions of each block? (07 Marks)
 - b. Explain the nature and classification of load torques. (06 Marks)
 - c. A drive has following parameters: $J = 10 \text{ kg-m}^2$, $T = 15 + 0.05 N, \text{N-m}$ and $T_t = 5 + 0.06 N, \text{N-m}$, where N is the speed in rpm. Initially the drive is working in steady state. Now the drive is braked by electrical braking. Torque of the motor is given by $T = -10 - 0.04 N, \text{N-m}$. Calculate the time taken by the drive to stop. (07 Marks)

- 2
 - a. Derive the thermal model of motor for heating and cooling and draw the heating and cooling curves. (07 Marks)
 - b. Derive the expression for over load factor of motor operating with intermittent periodic duty. (06 Marks)
 - c. A drive consisting of semiconductor converter fed d.c. motor, runs according to the following duty cycle:
 - i) Acceleration from standstill to 1000 rpm in 10 sec at uniform acceleration.
 - ii) Running at 1000 rpm and 800 N-m torque for 8 sec.
 - iii) Braking from 1000 rpm to standstill in 10 sec at uniform deceleration.
 - iv) Remains idle for 20 sec.
 Determine torque and power ratings of the machine. Assume forced cooling and constant field current. Given $J = 100 \text{ kg-m}^2$. (07 Marks)

- 3
 - a. With diagrams and characteristics, explain the dynamic braking of a d.c. motor. (06 Marks)
 - b. Derive the speed-torque equation of dc separately excited motor controlled by a single phase fully controlled rectifier for discontinuous conduction and draw the waveforms. (07 Marks)
 - c. A 250 V dc shunt motor has an armature resistance of 0.05Ω and with rated field excitation has a back emf of 245 V at a speed of 1200 rpm. It is coupled to an overhauling load with a torque of 200 N-m. Determine the lowest speed at which the motor can hold the load by regenerative braking. (07 Marks)

- 4
 - a. Explain the multi-quadrant operation of dc separately excited motor fed from a fully controlled rectifier with a reversing switch. (07 Marks)
 - b. Explain the generative braking of d.c. separately excited motor by chopper control. (06 Marks)
 - c. A 230 V, 1200 rpm, 15 A separately excited motor has an armature resistance of 1.2Ω . Motor is operated under dynamic braking with chopper control. Braking resistance has a value of 20Ω . Calculate the duty ratio of chopper for motor speed of 1000 rpm and braking torque equal to 1.5 times rated motor torque. (07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.

PART – B

- 5 a. Explain the operation of induction motor with unbalanced rotor impedances. (06 Marks)
 b. Derive the equations for time required for stopping and time required for speed reversal by plugging when induction motor running on no-load. (07 Marks)
 c. A 3 phase, 440 V, 50 Hz, 6-pole, Y-connected induction motor has following parameters referred to stator:
 $R_s = 0.5 \Omega$, $R'_r = 0.6\Omega$, $X_s = X'_r = 1 \Omega$. Stator to rotor turns ratio is 2. Motor is running on no-load. The plugging is used to stop the motor. Determine the maximum braking current, and initial and final braking torques when no braking resistance is used. (07 Marks)
- 6 a. Explain the variable frequency control of an induction motor from voltage sources.(10 Marks)
 b. A 440V, 50 Hz, 4 pole, 1415 rpm, delta connected squirrel cage induction motor has the following parameters:
 $R_s = 0.6 \Omega$, $R'_r = 0.8\Omega$, $X_s = 0.5 \Omega$, $X'_r = 0.6 \Omega$ and $X_m = 15 \Omega$. Motor is fed from a current source inverter at a constant flux. Determine:
 i) Motor torque, speed and current when operating at 40 Hz and rated slip speed, and
 ii) Inverter frequency and stator current for the rated motor torque and a motor speed of 1000 rpm. (10 Marks)
- 7 a. Explain: i) Starting and ii) pull-in with respect to operation of synchronous motor drive from fixed frequency supply. (10 Marks)
 b. A 3 phase, 10 kW, 440 V, 0.8 rated p.f. (lagging), 50 Hz, 4 pole, star-connected permanent magnet synchronous motor has negligible stator resistance and synchronous reactance of 10Ω . Motor is braked by dynamic braking. What will be the braking torque at 750 rpm when $R_B = 5 \Omega$? (10 Marks)
- 8 a. With neat diagrams, explain the different processes involved in paper mill. (10 Marks)
 b. With neat line diagram of a cement mill, explain the various drive functions. (10 Marks)

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