USN [| | | | | | | | |]   10EE74

Seventh Semester B.E. Degree Examination, June/July 2015
Industrial Drives and Applications

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, selecting*
atleast TWO questions from each part.

PART – A

1 a. What are the advantages of electric drive system? **(04 Marks)**
   b. Mention the main factors which decide the choice of an electrical drives for a particular application. **(06 Marks)**
   c. A motor drives two loads. The rotational load coupled to the motor through reduction gear with a = 0.1 and efficiency of 90%. The load has a moment of inertia of 10kg/m^2 and a torque of 10N-m. Other load has a translational motion and consists of 1000kg weight to be lifted up at a uniform speed of 1.5 m/sec. The coupling between this load and motor has an efficiency of 85% motor has an inertia of 0.2kg/m^2 and runs at a constant speed of 1420 rpm. Calculate equivalent inertia and torque refereed to the motor shaft and also power developed by the motor **(10 Marks)**

2 a. Derive an expression to determine the power ratings of electric motors for continuous duty for fluctuating and intermittent loads by equivalent current, torque and power methods. **(10 Marks)**
   b. Explain the method of determination of motor rating for short time duty loads. **(06 Marks)**
   c. A constant speed motor has the following duty cycle
      i)   Load rising linearly from 200 to 500kW for 4 minutes.
      ii) Uniform load of 400kW for 2 minutes.
      iii) Regenerative power returned to the supply, reducing linearly from 400kW to 0 kW for 3 minutes, and remains idle for 4 minutes. Calculate the power rating of the motor. Assuming loss to be proportional to (power)^2. **(04 Marks)**

3 a. With circuit diagram and wave forms explain the operation of continuous conduction mode for a single phase half controlled rectifier of separately excited d.c. motor. And also obtain the average output voltage and speed/torque equation. **(10 Marks)**
   b. A 220V, 1500 rpm, 10A separately excited d.c. motor is fed from a single phase fully controlled rectifier with an a.c. source voltage of 230V, 50Hz, Ra = 2Ω. Conduction can be assumed to be continuous. Calculate the firing angles for i) Half the rated motor torque and 500rpm; ii) Rated motor torque and -1000 rpm. **(10 Marks)**

4 a. With circuit diagram and waveforms explain three phase fully controlled rectifier control of separately excited d.c. motor. **(10 Marks)**
   b. A 230V, 1200rpm, 15A 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: i) The duty ratio of chopper for motor speed of 1000rpm and braking torque equal to 1.5 times the rated motor torque; ii) Motor speed for duty ratio of 0.5 and motor torque equal to its rated torque. **(10 Marks)**

PART – B

5 a. Explain the effect of unbalanced voltages and single phasing on the induction motor performance. **(10 Marks)**

   b. A 400V, star connected, 3 phase 6 pole, 50Hz induction motor has following parameters referred to the stator $R_S = R'_r = 1\Omega$, $X_S = X'_r = 2\Omega$. For regenerative braking operation calculate the maximum overhauling torque and range of speed for safe operation. **(10 Marks)**

6 a. With circuit diagram and wave form, explain the operation of voltage source inverter fed induction motor drives. **(10 Marks)**

   b. With circuit diagram and speed/torque curves explain the operation of static Scherbius drive for slip power recovery scheme. **(10 Marks)**

7 a. Explain the operation of synchronous motor from fixed frequency supply. **(10 Marks)**

   b. With circuit diagram, explain the self controlled synchronous motor drive employing load commutated thyristor inverter. **(10 Marks)**

8 a. Classify and explain the drives used in cement industry. **(10 Marks)**

   b. Explain the various stages in paper mill and motors used in various stages. **(10 Marks)**

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