Seventh Semester B.E. Degree Examination, June/July 2017
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. Obtain an expression for the equivalent load torque and equivalent moment of inertia for loads rotational and translational motion. **(10 Marks)**
   b. List essential parts of electrical drive. Enumerate advantages of an electric drive system. **(06 Marks)**
   c. Define active load torque and passive load torque. Give examples. **(04 Marks)**

2 a. Explain the following classes of motor duty with necessary diagram showing variation of load, electrical losses and temperature with respect to time. Also mention the cyclic duration factor for each case.
     i) Intermittent periodic duty with starting and braking and
     ii) Continuous duty with starting and braking. **(10 Marks)**
   b. A 3-phase, 50KW, 6-pole, 960rpm induction motor has a constant load torque of 300 N-m and at wide intervals additional torque of 1500 N-m for 10seconds. Calculate :
     i) The weight of the fly wheel used for load equalization, if the motor torque were not to exceed twice the rated torque and the radius of gyration is 0.9mm ii) the time taken after removal of additional load before the motor torque becomes 700N-m.
     Assume that the induction motor operates at that portion of the slip torque characteristic, which is linear. **(10 Marks)**

3 a. With a neat circuit and graph, explain the regenerative, dynamic and plugging type of braking system for separately excited DC shunt motor. **(12 Marks)**
   b. A DC shunt motor has an armature resistance of 0.2Ω and field winding resistance of 120Ω. Following magnetization characteristics was measured at 1000 rpm.

Field current, A	0.2	0.3	0.4	0.5	0.75	01	1.5	2.0
Basic emf, Y	80	120	150	170	200	220	245	263

   Motor is holding an overhauling load at 50 N-m by self-excited dynamic braking. Calculate value of R_B, when motor is required to hold overhauling load at 900 rpm. **(08 Marks)**

4 a. The rating of motor when subjected to a duty cycle of 18 minutes on certain load and 30 minutes on load is 140 KW. Find the cooling time constant when the heating time constant of a 100 KW motor is 90 minutes. Assume that the losses are proportional to square of load. **(04 Marks)**
   b. With dynamic equivalent circuit, explain the transient analysis of separately excited motor with armature control. **(06 Marks)**
   c. Explain he multi-quadrant of DC separately excited motor fed from fully controlled rectifier for the following schemes : i) single phase fully controlled rectifier with a reversing switch and ii) dual converter. **(10 Marks)**

PART – B

5   a. A squirrel cage induction motor is to be fed from a non-sinusoidal supply. It is preferred to use a motor with large leakage reactance. Why? **(06 Marks)**
    b. Explain the reverse voltage braking of an induction motor. **(05 Marks)**
    c. A 3-phase, 440V, 50Hz, 6-pole, Y-connected induction motor has the following parameters refereed to the stator : Rs 0.5Ω, R_r = 0.6Ω, X_s = X_r^1 = 1Ω stator to rotor turns ratio is 2. If the motor is used for the regenerative braking, determine :
        i) Maximum over hauling torque it can hold and the range of speed in which it can safely operate
        ii) The speed at which it will hold a load with a load torque of 160 N-m. **(09 Marks)**

6   a. Explain the working of voltage source inverter fed (VSI) induction motor drives showing the waveform for stepped wave inverter and PWM inverter. Also explain the dynamic braking operation of VSI induction motor drives. **(11 Marks)**
    b. A 440V, 50Hz, 970rpm, 6-pole, Y-connected, 3-ϕ wound rotor induction motor has following parameters referred to the stator R_s = 0.1Ω, R_r^1 = 0.08Ω, X_s = 0.3Ω, x_r^1 = 0.4Ω. The stator to rotor turns ratio is 2 motor speed is controlled by static schertibus drive. Drive is designed for a speed range of 25% below the synchronous speed. Maximum value of firing angle is 165° : calculate :
        i) Transformer turns ratio
        ii) Torque for a speed of 780 rpm and α = 140°. **(09 Marks)**

7   a. What is meant by the term "Pull-in" in case of synchronous motor? Bring out the differences between true synchronous mode and self – controlled mode. **(04 Marks)**
    b. With relevant circuit diagram and equation explain the type of braking utilized for synchronous motor. **(06 Marks)**
    c. Explain why the load commutated inverter fed synchronous motor drive is found suitable for high speed and high power application. **(10 Marks**

8   a. Explain briefly the 04 points to be noted about the widely used method to start the synchronous motor. **(04 Marks)**
    b. What are the requirements of the drive in case of reversing hot rolling steel mills? **(06 Marks)**
    c. Classify the drives used in cement industry. Explain briefly the driving motor used in the cement industry for different operation. **(10 Marks)**

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