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10EE74

**Seventh Semester B.E. Degree Examination, June/July 2014**  
**Industrial Drives and Applications**

Time: 3 hrs.

Max. Marks:100

**Note: 1. Answer any FIVE full questions, selecting  
atleast TWO questions from each part.  
2. Any missing data may be suitably assumed.**

**PART – A**

- 1
  - a. What are the advantages of an electric drive? Mention the factors on which choice of an electric drive depends. (07 Marks)
  - b. Explain the components of load torques. (05 Marks)
  - c. A 3-phase, 100 kW, 6-pole, 960 rpm wound rotor induction motor drives a load whose torque varies such that a torque of 3000 N-m of 10 sec. duration is followed by a torque of 500 N-m of duration long enough for the motor to attain steady-state speed. Calculate the moment of inertia of motor-load-flywheel, if motor torque should not exceed twice the rated value. The moment of inertia of motor is 10 kg-m<sup>2</sup>. Motor has a linear speed-torque curve in the region of interest. Also calculate the moment of inertia of flywheel. (08 Marks)
- 2
  - a. Derive the expression for the equivalent load torque and equivalent moment of inertia for loads with translational and rotational motion. (06 Marks)
  - b. Derive the expression of over-loading factor 'K' while selecting the main rating, for intermittent periodic duty. (06 Marks)
  - c. A 50 kW, 3-phase, 440V, 50Hz, 1440 rpm, squirrel cage induction motor has constant loss to variable loss at full-load in proportion of 1:3. Its rated temperature rise is 55°C and its heating and cooling time constants are 40min and 60min respectively. Find: i) The half-hour rating and ii) The intermittent rating, if periodic loads of half-hour duration are applied at an interval of half-hour. (08 Marks)
- 3
  - a. Explain the reverse voltage braking with diagrams of D.C. separately excited motor. (07 Marks)
  - b. Explain the operation of single phase half controlled rectifier control of separately excited d.c. motor, for continuous conduction. (08 Marks)
  - c. A 230V, 870rpm and 100A separately excited d.c. motor has an armature resistance of 0.05Ω. It is coupled to an overhauling load with a torque of 400N-m. Determine the speed at which motor can hold the load by regenerative braking. (05 Marks)
- 4
  - a. With a neat circuit diagram and waveforms, explain the chopper control of series motor. (10 Marks)
  - b. A 230V, 960rpm and 200A separately excited d.c. motor has an armature resistance of 0.02Ω. The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230V. Assuming continuous conduction.
    - i) Calculate duty ratio of chopper for motoring operation at rated torque and 350rpm and
    - ii) If maximum duty ratio of chopper is limited to 0.95 and maximum permissible motor current is twice the rated, calculate maximum permissible motor speed obtainable with field weakening and power fed to the source. (10 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 effect of unbalanced rotor impedances on the induction motor performance. (05 Marks)
- b. With neat diagrams, explain the a.c. dynamic braking with two-lead connection of a wound rotor induction motor. (07 Marks)
- c. A 400V, 3-phase, 50Hz, 4-pole, Y – connected, squirrel cage induction motor has following parameters referred to stator:  $R_1 = 0.1\Omega$ ,  $R_2 = 0.1\Omega$ ,  $X_1 = X_2 = 0.4\Omega$ ,  $X_m = 14\Omega$ . The motor was operating on full-load at slip of 0.05, when the two stator terminals were suddenly interchanged. Calculate the primary current and the braking torque immediately after application of plugging. (08 Marks)
- 6 a. With a neat block diagram, explain the closed loop speed control with regenerative braking of an induction motor. (08 Marks)
- b. What is slip-power recovery in an inductor motor? (05 Marks)
- c. A 440V, 50Hz, 6-pole, Y-connected squirrel-cage induction motor has following parameters:  $R_1 = 0.6\Omega$ ,  $R'_2 = 0.3\Omega$ ,  $X_1 = X'_2 = 1\Omega$ . The normal full-load slip is 0.05. the motor is fed from a VSI, which maintains a constant V/f ratio. For an operating frequency of 10Hz, Calculate the breakdown torque as a ratio of its value at the rated frequency. (07 Marks)
- 7 a. Explain the starting and pull-in process in synchronous motor operation from fixed frequency supply. (08 Marks)
- b. Explain the modes of variable frequency control of synchronous motor. (06 Marks)
- c. A 3-phase, 10kW, 440V, 0.8 rated p.f. (lagging), 50Hz, 4-pole, Y-connected PM synchronous motor has negligible stator braking. What will be the braking torque at 750 rpm when braking resistance  $R_B = 5\Omega$ ? (06 Marks)
- 8 a. Explain the reversing and continuous rolling mill drives with selection of motors and their ratings. (08 Marks)
- b. What are the requirements of cement mill motors? (05 Marks)
- c. Explain the selection of motors for different processes and their ratings in paper mills. (07 Marks)

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