Seventh Semester B.E. Degree Examination, Dec.2014/Jan.2015
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. What is an electric drive? Mention the factors which decide the choice of electrical drive. **(07 Marks)**

b. Explain the load equalization for fluctuating loads in drives. **(07 Marks)**

c. A drive has following parameters:
$J = 10$ kg-m^2, $T = 15 + 0.05$ N N-m and $T_\ell = 5 + 0.06$ N 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 in braking is given by $T = -10 - 0.04N$ N-m. Calculate time taken by the drive to stop. **(06 Marks)**

2 a. What are the load torque components? Define active and passive load torques. **(06 Marks)**

b. Explain the standard classes of motor duty with diagrams. **(08 Marks)**

c. A motor has a continuous rating of 100 kW. The heating and cooling time constants are 50 min and 70 min respectively. The motor has a maximum efficiency at 80% full-load and is employed in an intermittent periodic load cycle consisting of a load period of 10 min followed by a no-load period of 10 min. Calculate the value of the load in kW during the load period. **(06 Marks)**

3 a. Explain the plugging of separately excited D.C. motor and draw its speed-torque characteristics. **(08 Marks)**

b. Explain single phase half-controlled rectifier control of d.c. separately excited motor with continuous and discontinuous conduction. **(12 Marks)**

4 a. Explain the rectifier control of d.c. series motor and draw its speed-torque curves. **(07 Marks)**

b. Explain the dynamic braking of separately excited motor by chopper control. **(06 Marks)**

c. A 220 V, 600 rpm, 500 A separately excited motor with armature resistance of 0.02 Ω is fed from a 3-phase fully controlled rectifier. A three-wire three phase a.c. source with a line voltage of 440 V, 50 Hz is available. A star-delta connected transformer is used to feed the armature so that motor terminal voltage equals rated voltage when converter firing angle is zero.
  i) Calculate transformer turns ratio and
  ii) Determine the value of firing angle for rated torque and 400 rpm. **(07 Marks)**

PART – B

5 a. Explain the operations of induction motor with unbalanced rotor impedances. **(06 Marks)**

b. Explain the ac dynamic braking of induction motor for two-lead connection. **(06 Marks)**

c. A star-connected, 3-phase, 50 Hz, 6 pole, slip-ring induction motor has the following data:
Rating: 400 V, 50 kW, 960 rpm and $R_1 = 0.08\Omega$, $R_2 = 0.1\Omega$, $X_1 = X_2 = 0.3$ Ω, $J = 10$ kg-m^2.
Motor is to be stopped from its no-load speed under reverse voltage braking operation.
  i) Find the value of external resistance to be inserted in rotor circuit so that the braking process will take minimum time and
  ii) Find energy loss in the motor. **(08 Marks)**

1 of 2

6 a. Explain the variable frequency control of an induction motor and draw the speed torque curves. **(08 Marks)**

b. Explain with diagrams, the static rotor resistance control of an induction motor. **(07 Marks)**

c. What are the relative advantages and disadvantages of CSI and VSI drives? **(05 Marks)**

7 a. Explain the pull-in process in the operation synchronous motor fed from fixed frequency supply. **(06 Marks)**

b. Explain with block diagram, closed loop speed control of load commutated inverter synchronous motor drive. **(07 Marks)**

c. A 3-phase, 5 kW, 440 V, 50 Hz, 4-pole, star-connected synchronous motor has stator winding resistance of 0.2 Ω, synchronous reactance of 8 Ω and a rated field current of 1 A. Motor is operated under regenerative braking with its terminals connected to a bus having rated motor voltage. Field current is adjusted so that motor operates at rated current and unity power factor. Calculate braking torque, torque angle and field current. **(07 Marks)**

8 a. Explain the modes of variable frequency control of synchronous motor. **(06 Marks)**

b. Explain with diagrams, screw-down operation in a rolling mill drive. **(07 Marks)**

c. With schematic, explain the wire section in a paper mill drive and mention the types of motors used in paper mill drive. **(07 Marks)**