EJ – 1198

VI Semester B.E. (E & E) Degree Examination, June/July 2015
(2K11 Scheme)
EE-603 : ELECTRIC DRIVES

Time : 3 Hours Max. Marks : 100

Instruction : *Answer **five** full questions choosing at least **two** full questions from **each** Part.*

PART – A

1. a) Describe the meaning of group, individual and multi-motor electric drives. **6**

   b) Describe the functional blocks of an electric drive having power electronic converter with appropriate block diagram. **6**

   c) Show that the condition for steady-state stability of an electric drive is

   $$\left(\frac{dT_L}{d\omega} - \frac{dT_M}{d\omega}\right) > 0 .$$ **8**

2. a) A 220 V, 970 R.P.M., 100 A separately excited D.C. motor has an armature resistance of 0.05 Ω. It is braked by plugging from an initial speed of 1000 R.P.M. Calculate
      i) additional resistance to be placed in armature circuit to limit the braking current to twice the full load value,
      ii) braking torque, and
      iii) torque when speed has fallen to zero. **10**

   b) Explain speed-torque conventions and multi-quadrant operation of electric drives. **10**

3. a) Explain the working of a closed-loop speed control scheme which is widely used in electrical drives, with relevant block diagram. **10**

   b) Explain the following methods of braking of three-phase induction motors
      i) Regenerative Braking
      ii) Plugging
      iii) Dynamic braking. **10**

P.T.O.

4. a) A 2.8 kW, 400 V, 50 Hz, 4-pole, 1370 R.P.M., Δ-connected squirrel-cage induction motor has the following parameters referred to stator. $R_s = 2\Omega$, $R_r' = 5\Omega$, $X_s = X_r' = 5\Omega$, $X_m = 80\Omega$. Motor speed is controlled by stator voltage control. When driving a fan load it runs at rated speed at rated voltage. Calculate
   i) motor terminal voltage, current and torque at 1200 R.P.M. and
   ii) motor speed, current and torque for the terminal voltage of 300 V. **12**

   b) Explain V/f control of three-phase induction motors. **8**

PART – B

5. a) Explain the working of a brushless D.C. motor with appropriate diagrams. **10**

   b) Explain current source inverter fed synchronous motor drive. **10**

6. a) Describe the operation of a variable reluctance stepper motor. What is microstepping ? **10**

   b) Describe the principle of operation of a switched reluctance motor. What are the differences between this motor and synchronous reluctance motor ? What are the advantages of switched reluctance motor drives over other A.C. motor drives ? **10**

7. a) Explain classes of motor duty as specified in IS : 4722-1968. **10**

   b) A drive consisting of semiconductor converter fed D.C. motor, runs according to the following periodic duty cycle.
   i) Acceleration from standstill to 1000 R.P.M. in 10 Sec. at uniform acceration.
   ii) Running at 1000 R.P.M. and 800 N-M torque for 8 sec.
   iii) Braking from 1000 R.P.M. to standstill in 10 sec at uniform deceleration.
   iv) Remains idle for 20 sec.

   Determine the torque and power ratings of the machine. Assume forced cooling and constant field current J = 100 kg-m^2. **10**

8. a) List the stages in the production of cement. Describe the requirements of electric drives at each stage. **10**

   b) Explain the drive requirements of steel rolling mills. **10**