PVP 12

Code: EE6T5

III B.Tech - II Semester – Regular Examinations – May 2015

POWER SEMICONDUCTOR DRIVES
(ELECTRICAL & ELECTRONICS ENGINEERING)

Duration: 3 hours Marks: 5x14=70

Answer any FIVE questions. All questions carry equal marks

1. a) Explain the four quadrant operation of an electric drive. 7 M

   b) What are the advantages of electric drives? 7 M

2. a) Draw and explain the operation of multi quadrant operation of single phase fully controlled rectifier fed separately excited D.C motor. 7 M

   b) A 200 V, 875 rpm, 150 A separately excited dc motor has an armature resistance of 0.06Ω. It is fed from a single phase fully-controlled rectifier with an ac source voltage of 220 V, 50 Hz. Assuming continuous conduction, calculate
   i) firing angle for rated motor torque and 750 rpm.
   ii) firing angle for rated motor torque and (-500) rpm.
   iii) Motor speed for $\alpha=160^\circ$ and rated torque. 7 M

3. a) For a three-phase full-wave controlled bridge with resistive load and ideal supply, obtain a value for the load current ripple when $\alpha=60^\circ$ compared with uncontrolled operation. 7 M

b) A three-phase full-wave controlled bridge rectifier contains six ideal SCRs and is fed from an ideal three-phase voltage source of 240V, 50 Hz. The load resistor R=10 Ω is connected in series with a large smoothing inductor. Calculate the average load voltage and the power dissipation at (i) $\alpha = 30^\circ$ (ii) $\alpha = 60^\circ$. 7 M

4. a) Explain the steady state analysis of chopper controlled dc motor drive of separately excited dc motor. 7 M

b) The speed of a separately excited dc motor is controlled below base speed by type –A chopper. The supply voltage is 220 V dc. The armature circuit has $r_a = 0.5\Omega$ and L_a=10mH. The motor constant is K=0.1V/rpm. The motor drives a constant torque load requiring an average armature current of 30A. On the assumption of continuous armature current, calculate (i) the range of speed control and (ii) the range of duty cycle. 7 M

5. a) Draw and explain the operation of slip power controlled Kramer drive for induction motor. 7 M

b) A 440V, 3-ø, 50Hz, 6 pole, 945 rpm, delta connected squirrel –cage induction motor has following parameters referred to the stator. R_s=0.6 Ω, R_r'=0.8 Ω, X_s=0.5 Ω, X_r'=0.6 Ω and Xm=15Ω
Motor is fed from a current source inverter at a constant flux. Determine
i) Motor speed, current and torque when operating at 40Hz and rated slip speed.
ii) Inverter frequency and stator current for the rated motor torque and a motor speed of 1000rpm. 7 M

6. a) Draw and explain the operation of self controlled synchronous motor drive fed from cycloconverter. 7 M

b) A 500kW, 3-ø, 3.3kV, 50Hz, 0.8(Lagging)Power factor, 4-pole, star connected synchronous motor has following parameters: Xs=15Ω, Rs=0, rated field current is 10A. Calculate: 7 M

i) Armature current and power factor at half the rated torque and rated field current.
ii) Field current to get unity power factor at rated torque.
iii) Torque for unity power factor operation at field current of 12.5A.

7. a) Explain hysteresis current controller used in the closed loop operation of DC motor drive? 7 M

b) Derive the transfer functions for current and speed controllers which are used in closed loop-control schemes. 7 M

8. a) Explain in detail Vector control and Direct torque control of induction motor. 7 M

b) Explain in detail transformation from rotating axis to stationary axis. 7 M