MEPE-201

M.E./M.Tech., II Semester

Examination, June 2013

Solid State Controllers of Drives

Time : Three Hours

Maximum Marks : 70

Note: Attempt any five questions. Each question carry equal marks. Assume suitable data if needed.

1. a) Discuss using a block diagram, a scheme used for developing firing scheme for a single-phase half controlled rectifier.
   b) Derive an expression for the average output voltage in terms of the rms value of the source voltage for a three-phase half-wave controlled rectifier.

2. a) List the advantages of a micro-processor controlled drive. Also list some industrial applications in which such drives are widely used.
   b) Explain how a microprocessor must interface with power electronics control to make a drive system.

3. a) Explain the working principle of sine PWM. Using single-phase half bridge inverter.
   b) Draw the circuit diagram of a three-phase current-driven inverter using power MOSFETs and explain its working.

4. a) Explain field oriented control. Using a block diagram for the speed control of three-phase induction motor.
   b) Discuss the methods by which semiconductor devices may be power used to control speed of dc drives.

5. a) Draw following circuits for feeding synchronous motor
      i) 6-pulse thyristor bridge rectifier - GTO based VSI.
      ii) 12-pulse thyristor bridge rectifier - IGBT based CSI.
   b) A three-phase fully controlled bridge converter is operated as load commutated inverter to feed a battery power of 15kw from a 400V DC to AC synchronous motor of, 3-phase, 415V(L-L) rms, 50Hz, A large inductor is included in series with battery which has a resistance of 0.5Ω. Calculate d.c. link current power loss in battery resistance, thyristor rms current power factor and firing angle of thyristor.

6. a) Draw the block diagram of a four quadrant mechanical sensorless induction motor drive and write expressions used in modelling and control algorithm.
   b) Draw the block diagram of vector controlled. Wound field three-phase synchronous motor drive.

7. a) Explain volts/hertz control for variable speed operation of induction motor.
   b) Describe direct torque control scheme used for induction motor drive.

8. Write short notes on any two:
   a) Self control mode of wound rotor synchronous motor drive.
   b) Control scheme for switch reluctance motor.
   c) Chopper fed DC motor drive.