

(Set-L)

B.Tech-5th
Power Electronics

Full Marks : 70

Time : 3 hours

Answer any six questions including Q.No.1

The figures in the right-hand margin indicate marks

1. Answer the following questions : 2×10

- (a) Why turn-off time is greater than turn-on time ?
- (b) How SCR is different from GTO ?
- (c) Differentiate between IGBT and MOSFET.
- (d) What are to be done for dv/dt and di/dt protection of an SCR ?
- (e) Why an inverter grade thyristor is used in an inverter instead of converter-grade one ?

(Turn Over)

- (f) What is the effect on power factor when an free-wheeling diode is connected across load of a half-wave controlled rectifier? Justify with your answer.
- (g) What do you mean by displacement and distortion factor?
- (h) Draw the circuit diagram of a class-D type choppers and its waveforms across various components in the circuit.
- (i) What do you mean by natural commutation?
- (j) What is Electronic ballast? What is its utility?

2. (a) Discuss forward-biased and reverse-bias operation of SCR. 5
- (b) Draw various protection circuit of an SCR and discuss briefly. 5

3. (a) Discuss various protections needed for an SCR. 5
- (b) Derive instantaneous equation of current of a single-phase half-wave controlled rectifier (without free-wheeling diode) when firing angle is less than load angle. Show input and output voltage and current waveforms. 5
4. (a) A single phase fully-controlled bridge rectifier feeding a resistive load at certain firing angle. Derive average output voltage, input power factor, distortion and displacement factor. Show all relevant input and output voltage and current waveforms. 5
- (b) A 220V, 50 Hz single-phase half-controlled bridge is providing ripple free load current at 5 Amp and firing angle of 45 degree. What will be average output voltage, input power factor, Input rms current and displacement ? 5

5. (a) A 220V, 50 Hz single-phase fully-controlled bridge having source inductance of 1mH is providing ripple free load current at 8 Amp and firing angle of 30 degree. What will be average output voltage and overlap angle. 5
- (b) Derive the voltage waveforms of 3-phase fully controlled rectifier feeding resistive load at 60 degree. Show their relevant output voltage waveforms. 5
6. (a) What is chopper? Discuss about its operation at fixed and variable chopping frequency operation. Which one is better and why? 5
- (b) A 250 ~~Hz~~, 50 Hz 1-phase ac regulator feeding "R" load at firing angle of 30 degree. Derive RMS output voltage and draw their waveforms across individual SCRs. 5
7. (a) Discuss SMPS and UPS and differentiate between them. 5
- (b) Draw a 1-phase current source inverter phase voltage and draw their line-voltage and current waveforms. 5

8. Write short notes on any two :

5 × 2

- (i) IGBT construction and operation
- (ii) Auxilliary-commutated type Mc-Murray Bedford inverter
- (iii) Step-down cyclo-converter
- (iv) AC/DC drives speed control.