Nov-Dec 2010

[3863] – 364

T.E. Electrical (Semester – I) Examination, 2010
POWER ELECTRONICS (New)
(2008 Course)

Time : 3 Hours Max. Marks : 100

Instructions: *1) Answer **any 3** questions from **each** Section.*
*2) Answers to the **two** Sections should be written in **separate** books.*
*3) Neat diagrams must be drawn **wherever** necessary.*
*4) Black figures to the **right** indicates **full** marks.*
*5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*
*6) Assume suitable data, if **necessary**.*

SECTION – I

1. a) Explain following terms in SCR
   i) Latching and holding current
   ii) Forward and reverse blocking voltages
   iii) $\frac{dv}{dt}$ & $\frac{di}{dt}$ rating
   iv) I^2t rating **8**

   b) Draw static and dynamic characteristic of SCR and explain reverse recovery phenomenon. **8**

OR

2. a) Explain latching of SCR using two transistor analogy. How duration of gate pulse is decided ? **8**

   b) What are turn on methods of SCR ? Which is the most preferred method ? Why ? **8**

3. a) Derive expression for average load voltage in a single phase midpoint controlled rectifier feeding resistive load. Draw output voltage and input current waveforms. **8**

   b) Explain the effect of source inductance on output voltage in a single phase bridge rectifier. Write output voltage expression. Which factors contribute to change of voltage ? **8**

OR

P.T.O.

4. a) Draw neat circuit and explain working of single phase fully controlled bridge converter feeding RLE load.
Draw control characteristic and explain modes of operation. **8**

b) For a three phase fully controlled bridge converter, derive average voltage expression for resistive load. What is the condition for continuous conduction of current ? **8**

5. a) Explain VI characteristic of TRIAC. Draw neat circuit diagram to explain TRIAC as a light dimmer switch. **9**

b) How ac regulators are classified ? Explain single phase ac regulator feeding inductive load. Derive expression for rms load voltage. Draw output voltage waveform. **9**

OR

6. a) Explain static on load tap changing of transformer using ac regulators. Draw output voltage waveform using two stages. **9**

b) Explain why
i) Power electronic switches need protection for temperature rise
ii) Power circuit and control circuit need to be isolated from each other
iii) Snubber elements are used with power switching devices. **9**

SECTION – II

7. a) Explain forward bias safe operating area and reverse bias safe operating area of IGBT. **8**

b) Explain construction and operation of MOSFET with neat diagram. **8**

OR

8. a) Why latch up occurs in IGBT ? How to eliminate this latch up ? **8**

b) State advantages and disadvantages of power MOSFET. **8**

9. a) A step up chopper has a supply voltage of 250 V, while the output voltage is 400 V. If the total time period of the chopper is 100 μsec, determine
i) Pulse width of the output voltage
ii) If the pulse width is reduced to $\frac{1}{3}$ for constant frequency operation find the output voltage. **8**

b) Explain four quadrant chopper feeding RLE load in detail. **8**

OR

10. a) What are different output voltage control techniques for chopper ? Explain. **8**

    b) For type A chopper the supply voltage is 250 V, load resistance being 25 Ω for the duty cycle of 40%. Find the average and RMS values of the output voltage and chopper efficiency by taking voltage drop of 2 V across the chopper during 'ON' condition. **8**

11. a) Explain multiple pulse modulation used in inverters. Draw necessary waveforms to obtain four pulse per half cycle of output voltage waveforms. Why multiple pulse modulation is better than single pulse modulation ? **8**

    b) Explain with circuit diagram and waveforms operation of single phase current source inverter. **6**

    c) What are different output voltage control methods for inverter ? **4**

OR

12. a) Explain working of three phase six step voltage source inverter in 120° mode of operation. For star connected load draw output voltage wave forms. Show devices conducting in each step. **10**

    b) Explain single phase full bridge inverter with necessary waveforms. Show the devices conducting in each mode of operation. **8**
