



[4459] – 163

Seat No.	
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**T.E. (Electrical) (Semester – I) Examination, 2013
(2008 Course)
POWER ELECTRONICS**

Time : 3 Hours

Max. Marks : 100

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

SECTION – I

1. a) What are dv/dt and di/dt ratings of SCR ? What happens if these ratings are exceeded ? How SCR can be protected for such conditions ? **6**
- b) Define latching and holding current of SCR. **4**
- c) A load of resistance 25Ω and inductance of 0.5 H is fed from dc supply of 90 V through a thyristor switch with latching current of 15 mA and fired by triggering pulse of $40 \mu \text{ sec}$ duration. Find if the thyristor will turn on and operate. **8**

OR

2. a) Draw turn off characteristics of SCR and explain. What are turn off methods of SCR ? **9**
- b) Explain various triggering methods of SCR. Which is most preferred ? Explain UJT triggering with neat circuit diagram. **9**

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3. a) Explain working of single phase fully controlled bridge converter and its modes of operation. Sketch waveforms for load voltage, load current, thyristor voltage for $\alpha = 45^\circ$ and $\alpha = 135^\circ$ assuming continuous conduction. Draw the control characteristic of rectifier. **10**

b) What is the effect of source inductance on operation of a single phase full bridge rectifier and the output voltage ? Write expression for output voltage considering overlap interval. (Derivation not needed). **6**

OR

4. a) Explain working of 3 phase half wave controlled rectifier (Midpoint M – 3) feeding resistive load with associated waveforms. **8**

b) A single phase fully controlled bridge converter feeds R-L load from a 230 V ac supply at $\alpha = 30^\circ$. Assume constant load current of 10 A. Find average output voltage, RMS output voltage, Form factor and Ripple factor. **8**

5. a) Draw a neat circuit for single phase ac regulator feeding inductive load. Draw output voltage and current waveforms. Write expression for rms output voltage. What is the condition for firing angle for output voltage control ? **10**

b) Explain working of TRIAC used as light dimmer switch with neat circuit diagram. **6**

OR

6. a) Draw V-I characteristics of TRIAC and explain its operating modes. Which quadrants are preferred ? Why ? **8**

b) Explain working of two stage sequence control using ac regulator. Draw suitable waveforms. **8**

SECTION – II

7. a) Draw output and transfer characteristics of MOSFET and explain the terms : **8**

- i) Pinch off voltage
- ii) Threshold voltage
- iii) Transconductance
- iv) Turn on and turn off chara.

b) Explain turn on and turn off process in MCT. State its Merits. **8**

OR



8. a) Draw and explain transfer characteristics and output characteristics of IGBT. What is SOA ? 8
- b) Compare BJT, MOSFET and IGBT. 8
9. a) What is “Duty Cycle Control” of a chopper ? How PWM and FM control is used ? Compare. 8
- b) The dc Chopper to 100V dc source supplies an inductive load of 40 mH in series with 5Ω resistance. A freewheeling diode is connected across the load. The load current varies between 10 A to 12 A. Find the time ratio (T_{ON}/T_{OFF}) of chopper. If the frequency is doubled what will effect on ripple current content ? 10
- OR
10. a) How Class A and Class B choppers are modified to get step up or step down chopper as a class C chopper explain in detail with circuit diagram and waveforms. 10
- b) Explain working of type A chopper feeding RL load with help of neat circuit diagram. Draw the output voltage and current waveforms. Derive expression for average output voltage. 8
11. a) With the help of neat circuit diagram and W/Fs, explain the operation of 3 ϕ MOSFET based voltage source inverter with resistive load (180° conduction mode). 10
- b) Compare between VSI and CSI. 6
- OR
12. a) What is the need of controlling o/p voltage of an inverter ? Explain briefly and compare various methods employed for the control of o/p voltage in inverter. 8
- b) Explain sinusoidal pulse width modulation used in inverters. Show four pulses per half cycle of O/P voltage. 8
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