



**T.E. Electrical (Semester – I) Examination, 2011**  
**POWER ELECTRONICS (New)**  
**(2008 Pattern)**

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) Explain the significance of  $\frac{dv}{dt}$ ,  $\frac{di}{dt}$ ,  $i^2 t$  rating of SCR. 6
- b) Draw gate drive circuit for GTO. Discuss switching characteristics and give comparison between SCR and GTO. 10

OR

2. a) Draw gate characteristics of SCR. Explain how value of gate voltage and gate current can be selected. 8
- b) Explain and compare R and RC firing circuit for SCR. 8
3. a) Explain three phase semi converter feeding RL load with freewheeling diode. Draw output voltage and current waveforms for  $\alpha = 45^\circ$  and  $\alpha = 90^\circ$ . What is requirement of circuit for continuous conduction. 10
- b) Explain single phase dual converter. Draw waveforms for output voltage at  $\alpha = 30^\circ$  and  $\alpha = 120^\circ$ . Comment on mode of operation of  $1\phi$  dual converter at  $30^\circ$  and  $120^\circ$ . 8

OR

P.T.O.



4. a) Explain single phase two pulse mid point converter. Draw necessary waveforms for  $\alpha = 45^\circ$ . 6

- b) Explain single phase two pulse bridge converter feeding RL load with free wheeling diode. Draw output voltage waveforms at  $\alpha = 60^\circ$ . 6

- c) Explain  $3\phi$  dual converter. Also state the difference between circulating and non-circulating mode of operation. 6

5. a) For circuit shown sketch the waveforms for two cycles of supply voltage, supply current, load voltage and load current for a firing angle of about  $45^\circ$  for the two thyristors.

In case diode  $D_4$  gets open circuited, draw load current waveforms. 8

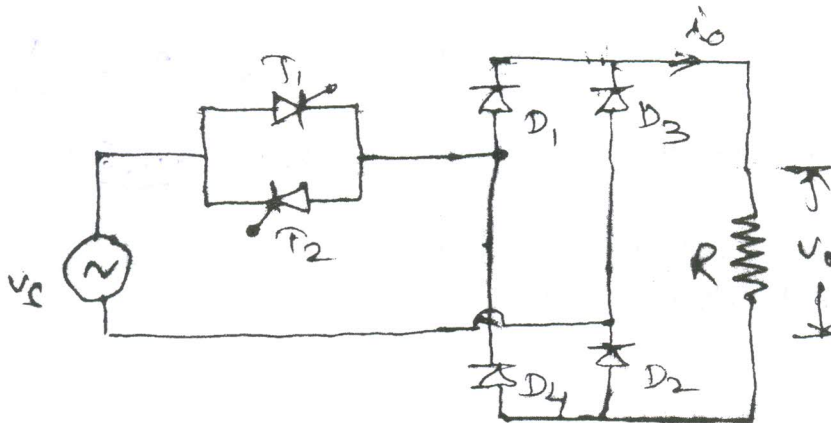


Fig. Que. 5a)

- b) Describe the working of a two stage sequence control of voltage controllers for R load. What is the advantage of this controller over  $1\phi$  full wave voltage controller. 8

OR

6. a) Explain four mode of operation of TRIAC and also describe the triggering circuit using DIAC. 8
- b) Discuss various technique adopted for protection of TRIAC and DIAC. 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.

- b) What are the gate drive requirements of MOSFET and IGBT ? 8

OR

8. a) Explain switching characteristic of IGBT and compare MOSFET and IGBT. 8

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

9. a) 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

- b) What is “Duty Cycle Control” of a chopper ? How PWM and FM control is used ? Compare. 8

OR

10. a) Explain working of class E chopper feeding a motor load with help of circuit diagram. 8

- b) A chopper is feeding inductive load with  $R = 4\Omega$  and  $L = 6\text{ mH}$  from 200 V source at 50% duty operating at frequency of 1 KHz. Find :

- i) Minimum and maximum load current
- ii) Maxi. peak to peak ripple in load current
- iii) Average load current. 8



11. a) Explain working of single phase transistorised bridge inverter to supply variable voltage variable frequency output. How frequency can be controlled ? Draw output voltage and current waveforms for inductive load. **9**
- b) What are the techniques used for control of harmonics in output voltage of 3 phase inverter ? Explain. **9**

OR

12. a) Explain working of 3 phase transistorised bridge inverter feeding a 3 phase resistive star connected load with  $120^\circ$  mode of conduction. Draw relevant waveforms for control signals and output voltages (line voltage). **10**
- b) Explain sinusoidal PWM technique used in inverter circuits. What is the significance of modulation indices and pulse number for control of output voltage ? **8**
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