



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

Time : 3 Hours

Max. Marks : 100

**Instructions :** 1) Answer 3 questions from Section – I and 3 questions from Section – II.

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** indicate **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) Draw gate characteristics of SCR. Explain how value of gate voltage and gate current can be selected. 8

b) Draw and discuss switching characteristics of SCR. 8

**OR**

2. a) Explain UJT pulse firing circuit of SCR. 8

b) Explain over current and thermal protection of SCR. 8

3. a) Explain single phase mid point converter with necessary circuit and waveforms. 9

b) Explain single phase full converter with necessary circuit and waveforms.

Also state advantages and disadvantages over single phase semi converter. 9

**OR**

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4. a) Explain the concept of overlap angle and associated voltage drop in single phase converter. 9
- b) Explain three phase semi controlled converter with necessary circuit and waveforms. 9
5. a) Explain four modes of operation of TRIAC. Also state in which quadrant for which polarities of terminals it is more sensitive. 8
- b) Explain two step single phase ac voltage regulator feeding inductive load with circuit and w/fs. 8

OR

6. a) Explain three phase single step ac voltage regulator feeding resistive load with necessary circuit and waveforms. 8
- b) Explain VI characteristics and construction of DIAC. 8

## SECTION – II

7. a) Explain how choppers are classified. Draw neat circuit and explain working of class C chopper feeding a motor load. 6
- b) A step down chopper has input voltage of 200 V feeding RLE load with  $R = 2 \Omega$ ,  $L = 10 \text{ mH}$  and  $E = 20 \text{ V}$ . The time of chopping cycle is  $1000 \mu\text{s}$  and on time of chopper is  $300 \mu\text{s}$ . Find
- i) Maximum and minimum value of load current.
- ii) Average load current. 10

OR

8. a) For a dc step down chopper, derive expression for :
- i) Average output voltage and current.
- ii) RMS output voltage
- iii) RMS and average chopper device currents.
- iv) Effective input resistance of chopper.

Draw circuit diagram and relevant waveforms. 8

- b) A RLE load is fed from 400 V dc source through a chopper circuit for  $R = 0$ ,  $L = 0.05 \text{ H}$  and duty cycle of 25%. Find chopping frequency to limit maximum load current to 10 A. 8



9. a) Explain working of a  $3\phi$  inverter with  $180^\circ$  mode of conduction for  $3\phi$  star connected resistive load. Draw waveforms of control signals and phase e line voltages. 10
- b) Discuss how output voltage and frequency is controlled in PWM inverters. 8

OR

10. a) Draw neat circuit diagram for  $1\phi$  full bridge inverter feeding inductive load. Explain its operation with help of output voltage and current waveforms. Calculate rms output voltage. What is the function of feedback diodes ? 10
- b) Discuss various PWM techniques used in inverters. How Sinusoidal PWM is used for harmonic elimination ? 8
11. a) Draw and explain construction of MOSFET and its switching characteristics. 8
- b) What is Safe Operating Area (SOA) ? Compare MOSFET and BJT SOA. 8

OR

12. a) State characteristics and advantages of IGBT compared to MOSFET. Explain latch up in IGBT. 8
- b) What is MCT ? Explain its typical characteristics and applications. 8