

**5E3123**

Roll No. : \_\_\_\_\_

Total Printed Pages : **4****5E3123****B. Tech. (Sem. V) (Main/Back) Examination, December - 2013****Electrical Engineering****5EE1 Power Electronics - III (Common with Electrical & Electronics)**

Time : 3 Hours]

[Total Marks : 80

[Min. Passing Marks : 24

*Attempt any five questions. Selecting one question from each unit.  
All questions carry equal marks. Schematic diagrams must be  
shown wherever necessary. Any data you feel missing suitably  
be assumed and stated clearly. Units of quantities used /  
calculated must be stated clearly.*

Use of following supporting material is permitted during examination.

(Mentioned in form No. 205)

1. \_\_\_\_\_ **NIL** \_\_\_\_\_2. \_\_\_\_\_ **NIL** \_\_\_\_\_**UNIT - I**

- 1 (a) Explain and draw the switching characteristics of Power MOSFET.
- (b) Explain principle of operation of Thyristor using Two-Transistor model.

**OR**

- 1 (a) Explain and draw the switching characteristics of the power IGBT.
- (b) Write various factors which influences the turn-off time of thyristor. Explain how the turn-off time can be minimized ?



## UNIT - II

- 2 (a) Explain the series operation of thyristor. How SCRs suffer from unequal voltage distribution across them during their turn-on and turn-off processes ?
- (b) Explain how SCR is protected against high  $dv/dt$ .

OR

- 2 (a) Explain in detail RC Full Wave triggering circuit for thyristor along with circuit diagram and related waveforms. rtuonline.com
- (b) Find the number of thyristors each with a rating of 500 V and 75A required for each branch of a series-parallel combination for a circuit for a total voltage and current rating of 7.5 kV and 1 kA. Assume derating factor of 14%.

## UNIT - III

- 3 (a) Describe working of a single-phase two quadrant converter with RL load through the waveforms of supply voltage, load voltage, load current and voltage across thyristor. Also, derive expressions for load voltage and input power factor.
- (b) A 220 V, 50 Hz, one-pulse SCR controlled converter is triggered at a firing angle of  $60^\circ$  and the load current extinguishes at an angle of  $220^\circ$ . Find the circuit turn off time, average output voltage and the average load current for  $R = 7 \text{ ohms}$  and  $L = 3\text{mH}$ .

OR



- 3 (a) A single-phase dual converter is operated from a 200 V, 50 Hz supply and the load resistance is  $R = 20$  ohms. The circulating inductance is  $L_r = 50$  mH; delay angles are  $\alpha_1 = 50^\circ$  and  $\alpha_2 = 130^\circ$ . Calculate the peak circulating current and the peak current of converter1.
- (b) Explain principle of operation of single-phase dual converter without circulating current in detail. rtuonline.com

#### UNIT - IV

- 4 (a) Describe the working of a single-phase two-pulse semi converter with RL load through the waveforms of supply voltage, load voltage, load current and voltage across thyristor. Also, derive expressions for load voltage and input power factor.
- (b) Explain Pulse width modulation control technique of power factor improvement along with circuit diagram and waveforms.

#### OR

- 4 (a) A single phase full converter is supplied from 220 V, 50 Hz source. If load resistance  $R = 8$  ohms and source has an inductance of 1.5 mH for a firing angle delay of  $60^\circ$  determine :
- Average output voltage
  - The angle of overlap.
- (b) Explain Sinusoidal Pulse width modulation control technique of power factor improvement along with circuit diagram and waveforms.



## UNIT - V

- 5 (a) Explain Voltage commutated chopper along with circuit diagram and waveforms.
- (b) Explain working principle of type-C Chopper along with circuit diagram and waveforms.

OR

- 5 (a) Describe the working of buck-boost regulator along with relevant circuit diagram and waveforms.
- (b) Derive the expressions for steady-state maximum and minimum current for type-A chopper.

