

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2499

Roll No.

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**B. Tech.**

(SEM. VI) THEORY EXAMINATION 2011-12

**POWER ELECTRONICS**

Time : 3 Hours

Total Marks : 100

**Note :—**(1) Attempt all questions.

(2) All questions carry equal marks.

1. Attempt any four parts :— (5×4=20)
- (a) What are the characteristics of an ideal power-switching device ? Compare switching characteristics of MOSFET and IGBT.
- (b) Define  $\frac{di}{dt}$  and  $\frac{dv}{dt}$  ratings of SCR. How is SCR protected against abnormal conditions ?
- (c) Draw the static V-I characteristics of SCR and explain its modes of operation.
- (d) Explain the significance of latching and holding current.
- (e) A dc supply of 100 V feeds a load resistance of 10  $\Omega$  and an inductance of 5 H through a thyristor. The latching current of thyristor is 50 mA. Find the minimum width of the gate pulse.

- (f) Find the number of thyristors each with a rating of 500 V & 75 A 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%.

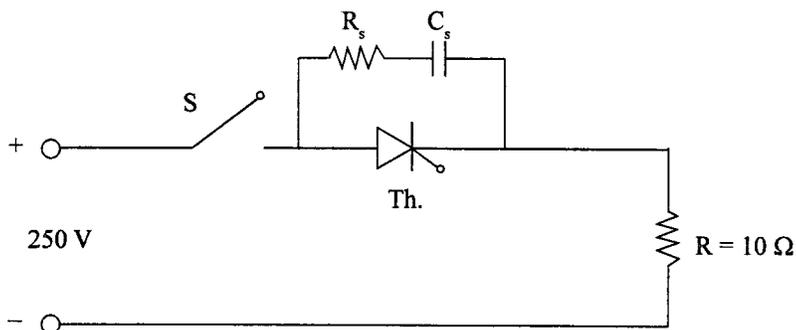
2. Attempt any two parts :— (10×2=20)

- (a) Why does unequal voltage sharing take place among series connected thyristors during steady state and dynamic state ? How is equal voltage sharing obtained in both the states ?
- (b) What do you understand by chopper ? Describe the various types of chopper configurations with appropriate diagram.
- (c) For the ckt shown in Figure below the operating

frequency is 2 kHz and the required  $\frac{dv}{dt}$  is 100 V/ $\mu$ m.

If the discharge current be limited to 100 A, then calculate :

- (i) the value of  $R_s$  and  $C_s$ .
- (ii) the power loss in the snubber.



Figure

3. Attempt any **two** parts :— (10×2=20)

- (a) Discuss the working of 1- $\phi$  full wave ac-dc converter taking into account the effect of source inductance. Draw the output voltage waveform for firing angle of 30°.
- (b) What do you understand by dual converters ? Explain the operation of a 3- $\phi$  dual converter usign circulating current mode of operation. How are firing angles of two converters controlled ?
- (c) A single-phase full converter operates with 220 V, 50 Hz ac input and supplies output load consisting of R-L load with very high inductance drawing level load current 10 A and operated at firing angle of 30°. Find :
  - (i) RMS supply current
  - (ii) Fundamental component of input current
  - (iii) Input displacement factor
  - (iv) Harmonic factor
  - (v) Power factor.

4. Attempt any **two** parts :— (10×2=20)

- (a) Describe 1- $\phi$  ac voltage controller with inductive and resistive loads. Describe an expression for output voltage.
- (b) Describe the basic principle of working of 1- $\phi$  to 1- $\phi$  step-down cycloconverter for both continuous and

discontinuous conduction. Make the conduction of various thyristor also.

- (c) Show that the fundamental rms value of per-phase output voltage of low-frequency for an m-pulse cycloconverter is given by

$$V_{ov} = V_{ph} \left( \frac{m}{\pi} \right) \sin \left( \frac{\pi}{m} \right).$$

Also express  $V_{ov}$  in terms of voltage reduction factor.

5. Attempt any two parts :— (10×2=20)

- (a) Describe the operation of a 1- $\phi$  full bridge inverter. Draw waveshapes of output current when :
- (i) load is pure resistive.
  - (ii) load is pure inductive.
  - (iii) load is R-L-C underdamped.
- (b) Differentiate between the working of voltage source and current source inverters. Explain the working of a 1- $\phi$  series inverter.
- (c) The 1- $\phi$  quasi-square wave bridge inverter operates from a DC supply of 200 V at a frequency of 100 Hz and feeds a resistive load of 10  $\Omega$ . Calculate
- (i) Duration of ON period if the rms value of the load voltage is 100 V
  - (ii) Peak supply current
  - (iii) Average (DC) supply current.