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

PAPER ID : 121603 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. VI) THEORY EXAMINATION 2013-14

POWER ELECTRONICS

Time : 3 Hours *Total Marks : 100*

Note :– Attempt **all** questions.

1. Attempt any **four** parts of the following : **(4×5=20)**

   (a) What are the characteristics of ideal power-switching devices ? Compare characteristics of MOSFET and IGBT.

   (b) What are the primary and secondary breakdowns in semiconductor devices, differentiate between them ?

   (c) Obtain the expression of input power factor for a single-phase half wave controlled rectifier feeding a purely resistive load.

   (d) List specifications of power electronic switches.

   (e) A dc supply of 100 V feeds a load resistance of 10 ohm 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) The voltage and current ratings in a particular circuit are 5 kV and 100 A. Thyristors with ratings of 1000 V and 150 A are available. Minimum derating factor is 20%. Calculate the **number of series connected thyristors** required to handle the given source voltage and current.

2. Attempt any **two** parts of the following : **(2×10=20)**

(a) What do you understand by chopper ? Describe the various types of chopper configurations with appropriate diagrams.

(b) Discuss the two transistor model of a thyristor. Using this model, describe the various mechanisms of turning on a thyristor.

(c) A complementary commutation circuit operates from a dc supply of 200 Volts and has resistance $R_1 = R_2 = 10\ \Omega$, commutating capacitor $C = 10\ \mu F$. Sketch the thyristor voltage waveform for one complete cycle of operation, when the two thyristors T_1 and T_2 in the circuit are triggered periodically one after the other. Calculate :

(i) Peak transient repetitive on state thyristor current that flows, at the instant of triggering the thyristor device

(ii) The circuit turn-off time.

3. Attempt any **two** parts of the following : **(2×10=20)**

(a) Discuss the single phase dual converter under circulating current conduction mode of operation and derive the expression for inductor voltage.

(b) Explain operation of single phase fully controlled bridge converter feeding a highly inductive load and draw its relevant output voltage and current waveforms.

(c) A single phase full wave (bidirectional) ac voltage controller has resistive load $R = 10\ \Omega$ and the rms input voltage, $V_s = 230$ V, 50 Hz. The thyristor switch is on for $n = 25$ cycles and is off for $m = 75$ cycles. Determine :

(i) the rms output voltage V_o

(ii) the input power factor

(iii) the average and rms currents of thyristors.

4. Attempt any **two** parts of the following : **(2×10=20)**

(a) Describe 1-ϕ ac voltage controller with resistive and inductive loads. Describe an expression for output voltage.

(b) Discuss the principle of working of a single phase series inverter. What are the advantages and disadvantages of series inverters ?

(c) A single phase full wave ac controller operates from 230 V, 50 Hz mains and feeds a resistive load whose value varies between 1.15 ohms and 2.30 ohms. Calculate :

(i) RMS current rating of each SCR

(ii) Average current rating of each SCR

(iii) The maximum load power for $\alpha = \pi/4$.

5. Attempt any **two** parts of the following : **(2×10=20)**

(a) Describe the basic principle of working of $1-\phi$ to $1-\phi$ step-down Cycloconverter for both continuous and discontinuous conductions. Make the conduction of thyristor also.

(b) What do you mean by VSI and CSI ? Describe with neat circuit diagram, single phase auto sequential commutated CSI.

(c) For a single phase bridge inverter operating with a dc input voltage of 200 volts, calculate the amplitudes of the first three lower order harmonics in the voltage waveform.