

Printed Pages—3

EEE602

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

PAPER ID : 121603 Roll No.

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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.

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2. Attempt any **two** parts of the following : **(2×10=20)**
- What do you understand by chopper? Describe the various types of chopper configurations with appropriate diagrams.
 - Discuss the two transistor model of a thyristor. Using this model, describe the various mechanisms of turning on a thyristor.
 - A complementary commutation circuit operates from a dc supply of 200 Volts and has resistance $R_1 = R_2 = 10 \Omega$, commutating capacitor $C = 10 \mu\text{F}$. 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 :
 - Peak transient repetitive on state thyristor current that flows, at the instant of triggering the thyristor device
 - The circuit turn-off time.
3. Attempt any **two** parts of the following : **(2×10=20)**
- Discuss the single phase dual converter under circulating current conduction mode of operation and derive the expression for inductor voltage.
 - Explain operation of single phase fully controlled bridge converter feeding a highly inductive load and draw its relevant output voltage and current waveforms.
 - A single phase full wave (bidirectional) ac voltage controller has resistive load $R = 10 \Omega$ and the rms input voltage, $V_s = 230 \text{ V}$, 50 Hz. The thyristor switch is on for $n = 25$ cycles and is off for $m = 75$ cycles. Determine :
 - the rms output voltage V_o .
 - the input power factor
 - 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- ϕ to 1 - ϕ 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.