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

PAPER ID : 2061 Roll No. | | | | | | | | | | |

B.Tech.

(SEM VI) EVEN SEMESTER THEORY EXAMINATION 2009-2010

POWER ELECTRONICS

Time : 3 Hours *Total Marks : 100*

Note : *Answer all questions.*

1. Solve **any four** parts of the following : **(4x5=20)**

(a) Describe with neat diagram the working of a depletion type p-channel MOSFET. Also draw its transfer characteristics.

(b) Define turn-on and turn-off time as applied to thyristor. Also discuss what would happen to thyristor if a forward voltage is applied to the thyristor soon after its reverse recovery current drops to zero value ?

(c) Discuss the two-transistor analogy applied to thyristor.

(d) The SCR has V_g-I_g characteristics given as $V_g = 1.5 + 8I_g$. In a certain configuration, the gate voltage consist of rectangular pulses of 12 V and of duration 50 μs with duty cycle of 0.2.

(i) Find the value of R_g series resistor in gate circuit to limit peak power dissipation in the gate circuit to 5 W.

(ii) Calculate average power dissipation in gate circuit.

(e) Discuss the switching characteristics of IGBT with the help of neat circuit diagram and relevant waveforms.

(f) Draw the V-I characteristics of a TRIAC and explain its working principle.

2. Solve **any two** parts of the following : **(2x10=20)**

(a) The voltage rating of a particular circuit is 3.2 kV. SCR with voltage rating of 60 V are available. Calculate the number of SCRs required to be connected in series. Also design the static equalizing circuit for the above series connection if the maximum blocking current of the SCRs at the rated voltage is 6 mA.

(b) Discuss with neat circuit, the working of a four quadrant chopper with R-L-E load.

(c) For a type A chopper circuit, following conditions are given : E_{dc}=220 V, chopping frequency=500 Hz, duty ratio α=0.3, and R=1 Ω, L=3 mH, and E_b=23 V. Compute the followings :

(i) Check whether the current is continuous or not.

(ii) Average output current.

(iii) Maximum and minimum value of steady-state output current.

3. Solve **any two** parts of the following : **(2x10=20)**

(a) A single phase semiconverter delivers power to RLE_b load with R=5Ω, L=10 mH and E_b=80 V. The ac source voltage is 230 V, 50 Hz. For a continuous conduction, find the average value of output current for firing angle delay of 50°.

If the main SCR T_2 is damaged and open circuited, find the new value of average output current on the assumption of continuous conduction.

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

(c) Discuss single phase dual converter under circulating current conduction mode of Operation and derive the expression for Inductor voltage.

4. Solve **any two** parts of the following : **(2x10=20)**

(a) A single phase full wave ac controller is connected to R-L load. Discuss its working when power factor angle is more than load power factor angle. Illustrate your answer with suitable waveforms.

(b) A single phase full wave controller is used to control the power from a 2300 V ac source into a load circuit of 2.3Ω resistance and 2.3Ω inductive reactance. Determine :

(i) The control range.

(ii) Maximum rms line current.

(iii) The maximum power and power factor.

(c) Discuss with neat circuit diagram three phase to single phase cycloconverter with R-L load. Also draw the output voltage waveforms.

5. Solve **any two** parts of the following : **(2x10=20)**

(a) Describe with neat circuit diagram and relevant waveform three phase bridge inverter under 120° conduction of a thyristor for balanced delta connected resistive load. Also discuss the advantage of 120° over 180° conduction.

(b) What is current source inverter ? Describe with neat circuit diagram, single phase auto sequential commutated current source inverter.

(c) What is the need for controlling the voltage at the output terminal of a inverter ? Describe briefly and compare the various methods employed for the control of output voltage of the inverter.

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