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10EC73

Seventh Semester B.E. Degree Examination, June/July 2017
Power Electronics

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Draw the control characteristics of SCR, GTO and MCT with circuit diagrams and waveforms of control signal and output voltage. **(09 Marks)**

b. What is Schottky diode? Mention its advantages. **(04 Marks)**

c. What are the peripheral effects of power electronic equipment and mention remedies of its. **(07 Marks)**

2 a. Explain the following parameters with respect to switching limits:
(i) Second breakdown (SB).
(ii) Forward –biased safe operating area.
(iii) Power derating.
(iv) Breakdown voltages. **(12 Marks)**

b. Explain proportional and antisaturation control of a base drive. **(08 Marks)**

3 a. For the circuit shown in Fig. Q3 (a) obtain the minimum gate pulse width is required for reliable triggering of the SCR if gated at $\frac{\pi}{3}$ angle in every +ve half cycle. Assume $V_s = 325\sin 314t$ and latching current of 15 mA. **(06 Marks)**

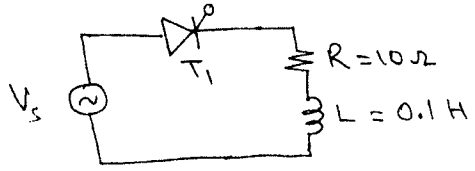

Fig. Q3 (a)

b. Explain the operation of a full wave RC-firing circuit with waveforms. **(08 Marks)**

c. Explain how thyristors are protected against high $\frac{di}{dt}$. **(06 Marks)**

4 a. For the circuit shown in Fig. Q4 (a), find the average load voltage and current if the load resistance is 10 Ω and firing angle is 45°. Assume supply of 230 V, 50 Hz. **(06 Marks)**

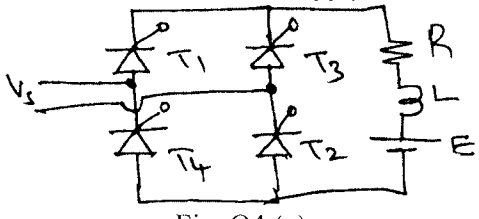

Fig. Q4 (a)

b. Explain the operation of single phase semiconverter with circuit and waveforms. Derive the expression for the average and rms value of the output voltage. (Assume RL-load). **(10 Marks)**

c. What are the advantages of circulating current mode dual converter? **(04 Marks)**

PART – B

5 a. Explain the operation of a self commutation by resonating load and also derive the expression of $i(t) = V_S\sqrt{\frac{C}{L}}\sin\left(\frac{1}{\sqrt{LC}}t\right)$. **(12 Marks)**

b. For the circuit shown in Fig. Q5 (b) the current through R_1 and R_2 is 25 A and turn off time of both SCR's is 40 μsec. Find the value of capacitor for successful commutation. **(04 Marks)**

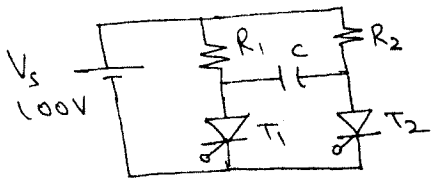

Fig. Q5 (b)

c. Compare natural and forced commutation. **(04 Marks)**

6 a. Explain the operation of a single phase Bi-directional controller with resistive load. Derive the expression of RMS value of the output voltage. **(10 Marks)**

b. A single phase AC voltage controller shown in Fig. Q6 (b) has a resistive load of 10 Ω and input voltage of 120 V, 60 Hz. The delay angle of thyristor T_1 is $\frac{\pi}{2}$. Determine

(i) RMS value of the output voltage.
(ii) Input power factor.
(iii) Average input current. **(07 Marks)**

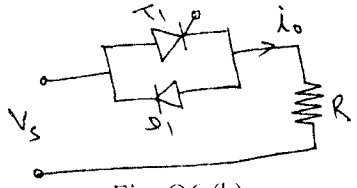

Fig. Q6 (b)

c. Mention the applications of AC voltage controllers. **(03 Marks)**

7 a. Explain the working principles of step down chopper with RL-load. Derive the expression o peak-peak ripple in the load current. **(14 Marks**

b. A step up chopper has input voltage of 220 V and output voltage of 660 V. If th non-conducting time of thyristor chopper is 100 μsec. Compute the pulse width of the outpu voltage. (conduction period). **(06 Marks**

8 a. Explain the following performance parameters of a inverters:
(i) Harmonic factor of nth harmonic.
(ii) Total harmonic distortion.
(iii) Distortion factor. **(06 Marks**

b. Explain the operation of single phase bridge inverters. **(10 Marks**

c. What is inverter? Mention applications of it. **(04 Marks**

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