USN | 1 | MV | 10 | EC | 107 | 10EC73

Seventh Semester B.E. Degree Examination, Dec.2013/Jan.2014
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 circuit diagram, and control characteristics of GTO, MCT and BJT. **(06 Marks)**

b. What are power Electronic circuits? Explain any two of them with circuit, input and output waveforms. **(06 Marks)**

c. What are the peripheral effects of power electronic equipments and mention the remedies? **(05 Marks)**

d. What are the applications of power MOSFET's? **(03 Marks)**

2 a. Mention the merits and demerits of power MOSFET's. **(04 Marks)**

b. Draw the transient model of BJT and explain the switching characteristic of bipolar transistor. **(08 Marks)**

c. What is the need of base drive control and in a power transistor? Explain anti saturation control. **(08 Marks)**

3 a. Explain the two transistor model of thyristor and derive an expression for anode current interms of current amplification factor and leakage current. **(08 Marks)**

b. For the thyristor circuit shown in Fig.Q.3(b), the SCR has a latching current of 50mA and is fixed by a pulse of length 50μsec. Show that without resistance R, the thyristor will fail to remain on, when the firing pulse ends and then find the maximum value of R to ensuring firing. **(06 Marks)**

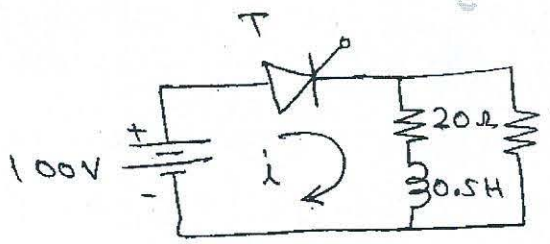


Fig.Q.3(b)

c. Design a UJT relaxation trigger circuit for SCR with V_{BB} = 20V, η = 0.6, I_p = 10μa, V^v = 2V and I_V = 10mA. The frequency of oscillation is 100Hz and triggering pulse width should be 50μsec. **(06 Marks)**

4 a. With the circuit and waveform, explain the operation of a single phase semi converter with inductive load. **(08 Marks)**

b. A single phase full converter is operated from a 120V, 60Hz supply. The load current with an average of I_a is continuous with negligible ripple current. If the delay angle is $\alpha = \frac{\pi}{3}$, calculate: i) Harmonic factor; ii) Displacement factor; iii) Power factor. **(07 Marks)**

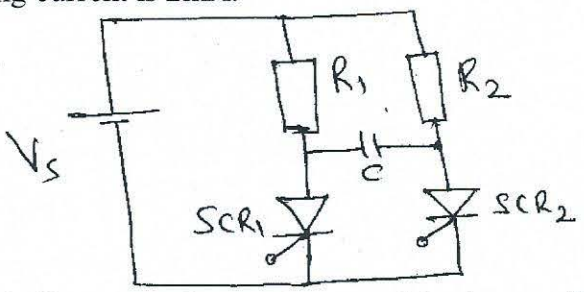
c. What are the advantages of 1 - ϕ dual converter operation with circulating current. **(05 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – B

5 a. Compare natural and forced commutation. **(05 Marks)**

b. Determine the proper values of the commutating components for the circuit shown in Fig.Q.5(b). The load current to be commutated is 5A, turn off time is 50μsec, supply voltage is 100V and SCR_2 holding current is 2mA. **(07 Marks)**



c. With the necessary circuit diagram and waveform, explain the operation of a complementary commutation. **(08 Marks)**

6 a. What are the applications of AC voltage controller? **(04 Marks)**

b. For the AC voltage controller shown in Fig.Q.6(b), calculate the average power in the lad if the thyristor firing angle is fixed at 45° with respect to supply voltage. Derive the necessary equation. **(08 Marks)**

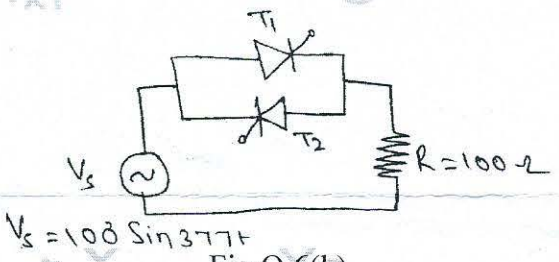


Fig.Q.6(b)

c. Explain the operation of a 1-ϕ controller with inductive loads and derive the expression of rms value of the output voltage. **(08 Marks)**

7 a. What are the applications of DC choppers? **(04 Marks)**

b. A DC chopper has a resistive load of 20Ω and input voltage 220V. When the chopper is on its voltage drop is 1.5V and chopping frequency is 10kHz. If the duty cycle is 80%, determine the average output voltage, rms value of the output voltage and chopper on time. **(07 Marks)**

c. Explain the operation of a step down chopper with RL load and also derive an expression of peak-peak output ripple current. **(09 Marks)**

8 a. Compare voltage source inverter and current source inverter. **(05 Marks)**

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

c. The single phase full bridge inverter has a resistive load of R = 24Ω and the DC input voltage of V_s = 48V. Determine:
   i) Rms output voltage at the fundamental frequency.
   ii) Output power.
   iii) Peak and average currents of each transistor. **(09 Marks)**

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