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10EC73

Seventh Semester B.E. Degree Examination, June/July 2016
Power Electronics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Explain the different types of power electronic converter circuits with neat circuit diagram and input and output waveforms. Also mention its application. **(08 Marks)**

b. Write the symbol and characteristic features of the following devices:
(i) BJT (ii) TRIAC (iii) GTO (iv) MOSFET. **(08 Marks)**

c. Discuss the peripheral effects of power electronic converters. Also write the remedies. **(04 Marks)**

2 a. For the circuit shown in Fig.Q2(a), the BJT is specified to have β in the range of 12 to 75. If V_{cc} = 40 V, R_c = 1.5 Ω, V_B = 6 V, $V_{CE(sat)}$ = 1.2 V and $V_{BE(sat)}$ = 1.6 V and R_b = 0.7 Ω. Calculate: (i) Overdrive factor ODF (ii) Forced B_f (iii) Total power dissipation(P_T) **(07 Marks)**

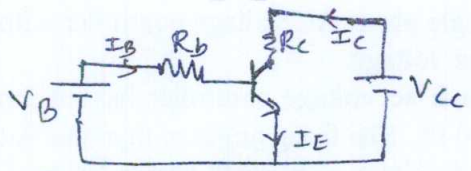

Fig.Q2(a)

b. With the transient model of MOSFET explain switching characteristics. **(06 Marks)**

c. What is the need for isolation for gate drive circuits? Discuss the different methods of providing isolation of gate drive circuits from power circuits. **(07 Marks)**

3 a. Explain the V-I characteristics of SCR by clearly indicating different states on characteristics. Also explain different modes of operation. **(06 Marks)**

b. With two transistor analogy of a thyristor obtain the equation for anode current. **(06 Marks)**

c. An SCR employs an R-triggering as shown in Fig.Q3(c) with $I_{g(min)}$ = 0.1 mA and $V_{g(min)}$ = 0.5 V. The diode is silicon and the peak amplitude of the input voltage is 24 volts. Determine the triggering angle α for R = 100 kΩ and R_{min} = 10 kΩ. **(04 Marks)**

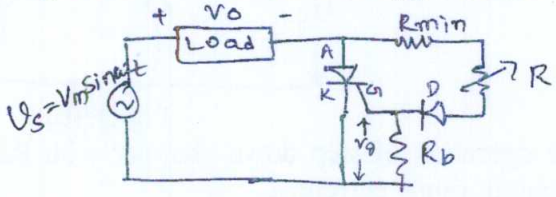

Fig.Q3(c)

d. A SCR has a di/dt = 50 A/μsec and dv/dt = 150 V/μsec. It operates on a 100 V, calculate the snubber circuit elements using approximate expressions. **(04 Marks)**

4 a. With necessary circuit and waveforms explain the principle of operation of single phase semiconverter. Also derive an expression for the average output voltage. **(06 Marks)**

b. With neat circuit diagram explain the operating principle of dual converter with and without circulating current. **(08 Marks)**

c. A single phase half wave controlled rectifier is used to supply power to 10 Ω load from 230V, 50 Hz supply at a firing angle of 30°. Calculate (i) average output voltage (ii) effective output voltage (iii) average load current. **(06 Marks)**

PART – B

5 a. What is the necessary condition for successful commutation of SCR? Compare between forced and natural commutation. **(06 Marks)**

b. With necessary circuit and waveforms explain the working of complementary commutation. Also perform circuit analysis. **(08 Marks)**

c. For the impulse commutated thyristor of circuit Fig.Q5(c), determine the turn-off time of the circuit, if V_s = 200 V, R = 10 Ω, C = 5 μF and $V_c(t = 0) = V_s$. Also derive the equations used. **(06 Marks)**

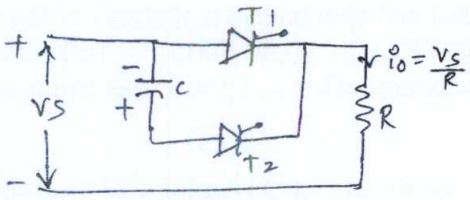

Fig.Q5(c)

6 a. With the help of neat circuit and relevant waveforms explain the working of ON-OFF control, for single phase AC voltage controller with resistive load. Also derive an expression for RMS output voltage. **(08 Marks)**

b. A 1 ϕ half wave ac voltage controller has an input voltage of 120 V, 60 Hz and a load resistance of 10 Ω. The firing angle of thyristor is 60°. Find
(i) RMS output voltage (ii) Input power factor (iii) Average input current. **(08 Marks)**

c. What is the problem caused by sharp single pulse triggering in a 1 ϕ AC voltage controller when the load is inductive? How can this be solved? **(04 Marks)**

7 a. Briefly explain the classification of choppers with circuit, waveforms and quadrant diagrams. **(08 Marks)**

b. For the chopper shown in below Fig.Q7(b), DC source voltage is 200 V, load resistance is 20 Ω. Consider the voltage drop of 4 V across chopper when it is ON. For a duty cycle of 0.6, calculate (i) Average and rms value of output voltage. **(04 Marks)**

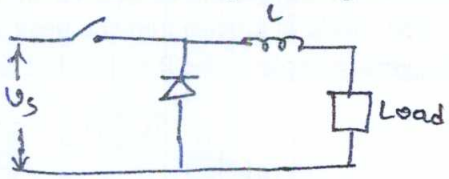

Fig.Q7(b)

c. Explain the operation of step down chopper with RL load. Also derive an expression of peak-peak output ripple current. **(08 Marks)**

8 a. Explain the principle of single phase half bridge inverter with suitable circuit and waveforms. **(10 Marks)**

b. Explain the performance parameters of inverter. **(04 Marks)**

c. Explain principle of working of variable DC link inverter. Also mention advantages and disadvantages. **(06 Marks)**

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