

**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  $\beta$  in the range of 12 to 75. If  $V_{cc} = 40\text{ V}$ ,  $R_c = 1.5\ \Omega$ ,  $V_B = 6\text{ V}$ ,  $V_{CE(sat)} = 1.2\text{ V}$  and  $V_{BE(sat)} = 1.6\text{ V}$  and  $R_b = 0.7\ \Omega$ . Calculate: (i) Overdrive factor ODF (ii) Forced  $\beta_F$  (iii) Total power dissipation( $P_T$ ) (07 Marks)

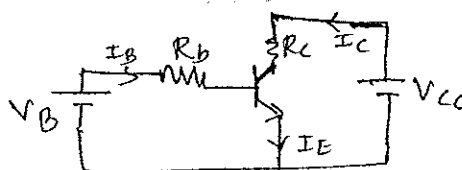


Fig.Q2(a)

- 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  $I_{g(min)} = 0.1\text{ mA}$  and  $V_{g(min)} = 0.5\text{ V}$ . The diode is silicon and the peak amplitude of the input voltage is 24 volts. Determine the triggering angle  $\alpha$  for  $R = 100\text{ k}\Omega$  and  $R_{min} = 10\text{ k}\Omega$ . (04 Marks)

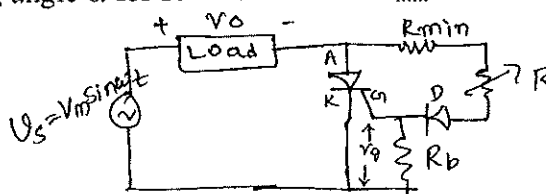


Fig.Q3(c)

- d. A SCR has a  $di/dt = 50\text{ A}/\mu\text{sec}$  and  $dv/dt = 150\text{ V}/\mu\text{sec}$ . 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  $10 \Omega$  load from  $230\text{V}$ ,  $50 \text{ Hz}$  supply at a firing angle of  $30^\circ$ . 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  $V_s = 200 \text{ V}$ ,  $R = 10 \Omega$ ,  $C = 5 \mu\text{F}$  and  $V_c(t = 0) = V_s$ . Also derive the equations used. (06 Marks)

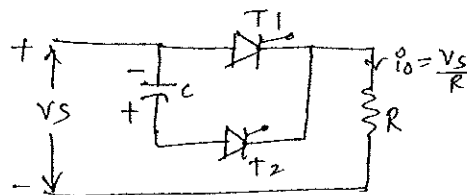


Fig.Q5(c)

- 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  $1 \phi$  half wave ac voltage controller has an input voltage of  $120 \text{ V}$ ,  $60 \text{ Hz}$  and a load resistance of  $10 \Omega$ . The firing angle of thyristor is  $60^\circ$ . 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  $1 \phi$  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  $200 \text{ V}$ , load resistance is  $20 \Omega$ . Consider the voltage drop of  $4 \text{ V}$  across chopper when it is ON. For a duty cycle of  $0.6$ , calculate (i) Average and rms value of output voltage. (04 Marks)

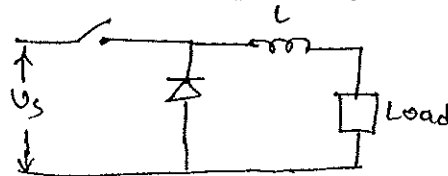


Fig.Q7(b)

- 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)

\* \* \* \* \*