



## Seventh Semester B.E. Degree Examination, Jan./Feb.2021

### 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. With neat diagram, explain the control characteristics of, (i) SCR (ii) GTO (iii) MCT (iv) IGBT. (08 Marks)
- b. With neat diagram, explain the various types of power electronic circuits. Show their input and output waveforms. (12 Marks)
- 2 a. Draw and explain the switching characteristics of power MOSFET. (06 Marks)
- b. The beta bipolar transistor shown in Fig. Q2 (b) below varies from 12 to 75. The load resistance  $R_C = 1.5 \Omega$ . The dc supply voltage is  $V_{CC} = 40 \text{ V}$  and input voltage to the base circuit  $V_B = 6 \text{ V}$ , if  $V_{CE(sat)} = 1.2 \text{ V}$ ,  $V_{BE(sat)} = 1.6 \text{ V}$  and  $R_B = 0.7 \Omega$ . Determine
  - (i) Over Drive Factor (ODF)
  - (ii) The forced  $\beta$  and
  - (iii) Power loss in the transistor  $P_T$ . (08 Marks)

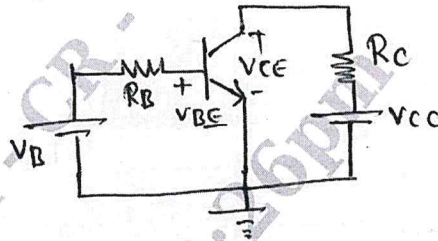


Fig. Q2 (b)

- c. Explain different methods of providing gate and base drive isolation. (06 Marks)
- 3 a. With neat sketch, explain the static characteristic of an SCR. What are the significance of latching current and holding current. (07 Marks)
- b. Design the UJT triggering circuit for SCR. Given  $V_{BB} = 20 \text{ V}$ ,  $\eta = 0.6$ ,  $V_D = 0.8 \text{ V}$ ,  $I_p = 10 \text{ A}$ ,  $V_v = 2 \text{ V}$  and  $I_v = 10 \text{ mA}$ . The frequency of oscillation is 100 Hz. The triggering pulse width should be 50  $\mu\text{sec}$  when  $C = 1 \mu\text{F}$ . (08 Marks)
- c. Explain the different methods to turn on the Thyristors? (05 Marks)
- 4 a. With a neat diagram and waveforms, explain the principle of single phase full wave converter with R-L load. Derive expression for average output voltage and rms output voltage. (10 Marks)
- b. For the converter of Fig. Q4 (b) has a purely resistive load of R and delay angle is  $\alpha = \frac{\pi}{2}$  determine (i) the rectification efficiency (ii) the form factor (iii) the ripple factor (iv) The TUF (v) the PIV of thyristor. (10 Marks)

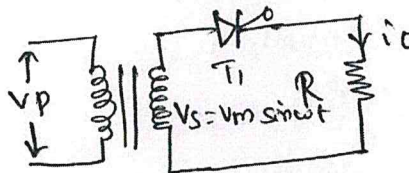


Fig. Q4 (b)

**PART – B**

- 5 a. What is commutation? Explain external commutation and ac line commutation with neat diagram and waveforms. (10 Marks)
- b. With necessary circuit and waveforms explain complementary commutation. Show that circuit turn off time is  $0.693 RC$ . (10 Marks)
- 6 a. With necessary waveforms, explain the operation of single phase full wave controller with R-L load. Derive the expression for rms output voltage and rms output current. (10 Marks)
- b. A single phase half wave ac voltage controller has a load resistance  $R = 50 \Omega$ , input ac voltage is 230 V, 50 Hz. The input supply transformer has a turns ratio of 1 : 1. If the thyristor  $T_1$  is triggered at  $\alpha = 60^\circ$ . Calculate (i) RMS output voltage (ii) Output power (iii) RMS load current (iv) Average load current (v) Input power factor. (10 Marks)
- 7 a. What is chopper? Classify and explain the different types of chopper with help of circuit and quadrant diagrams. (10 Marks)
- b. In the chopper circuit of Fig. Q7 (b) the average output voltage is 109 V. The voltage drop across the chopper switch when it is ON is  $V_{SW} = 2$  V. If the load resistance  $R = 10 \Omega$ ,  $f = 1$  kHz and duty cycle = 50%. Calculate (i) Input voltage (ii) The rms output voltage (iii) Chopper efficiency (iv) The input resistance of the chopper. (10 Marks)

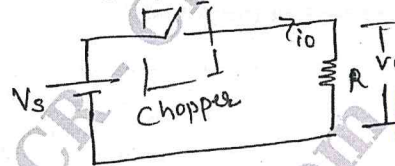


Fig. Q7 (b)



- 8 a. What is inverter? Explain the single phase thyristor current source inverter and variable dc link inverter with neat circuit diagram. (10 Marks)
- b. The single phase full bridge inverter has a resistive load of  $R = 2.4 \Omega$  and the dc input voltage of  $V_s = 48$  V. Determine (i) the rms output voltage at fundamental frequency  $V_{01}$ . (ii) The output power (iii) The average current (iv) Peak current (v) THD. (10 Marks)

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