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10EC73

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 $V_{CC} = 40$ V and input voltage to the base circuit $V_B = 6$ V, if $V_{CE(sat)} = 1.2$ V, $V_{BE(sat)} = 1.6$ V and $R_B = 0.7\ \Omega$. Determine

(i) Over Drive Factor (ODF)
(ii) The forced β and
(iii) Power loss in the transistor P_T. **(08 Marks)**

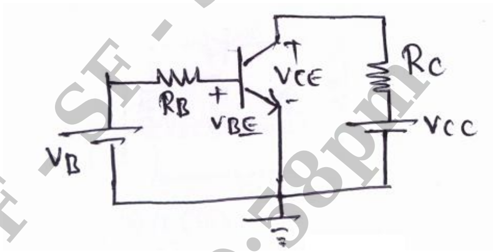

Fig. Q2 (b)

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 $V_{BB} = 20$ V, $\eta = 0.6$, $V_D = 0.8$ V, $I_P = 10$ A, $V_V = 2$V and $I_V = 10$ mA. The frequency of oscillation is 100 Hz. The triggering pulse width should be 50 μsec when C = 1 μF. **(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)**

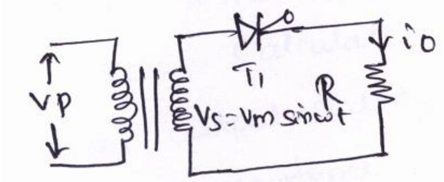

Fig. Q4 (b)

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 Ω, input ac voltage is 230 V, 50 Hz. The input supply transformer has a turns ratio of 1 : 1. If the thyrisotr 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 Ω , 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)**

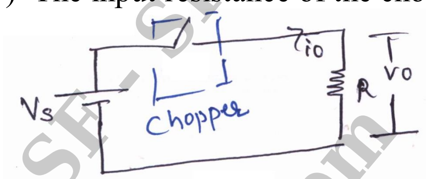

Fig. Q7 (b)

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 Ω 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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