Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
Power Electronics

Time: 3 hrs.   Max. Marks:100

Note: Answer any FIVE full questions, selecting at least TWO questions from each part.

PART – A

1 a. Give the definition of power electronics. Explain the relationship of power electronics to power, electronics and control. Mention any four applications of PE. **(06 Marks)**

   b. With the circuit diagram, input and output waveforms, explain the control characteristics of:
   (i) SCR   (ii) GTO   (iii) BJT   (iv) MOSFET   **(08 Marks)**

   c. What are the advantages of static power converters? Mention the peripheral effects of such static converters. **(06 Marks)**

2 a. Draw the transient model of BJT and explain the switching characteristics of power transistor. **(10 Marks)**

   b. The bipolar transistor in Fig.Q2(b) is specified to have β in the range 8 to 40. The load resistance is $R_C = 11 \ \Omega$. The dc supply voltage is $V_{CC} = 200$ V and the input voltage to base circuit is $V_B = 10$ V if $V_{CE(sat)} = 1.0$ V and $V_{BE(sat)} = 1.5$ V. Find:
   (i)   The value of R_B that results in saturation with an over drive factor of 5.
   (ii)   The forced β_f
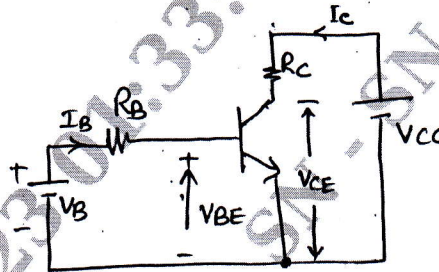   (iii) The power loss P_T in the transistor

Fig.Q2(b)   **(06 Marks)**

   c. Compare the BJT and MOSFET. **(04 Marks)**

3 a. Sketch the V-I characteristics of an SCR and explain two transistor model of a thyristor and derive anode current expression. **(10 Marks)**

   b. With the help of neat circuit diagram and waveforms, explain RC firing circuit used with half controlled rectifier. **(06 Marks)**

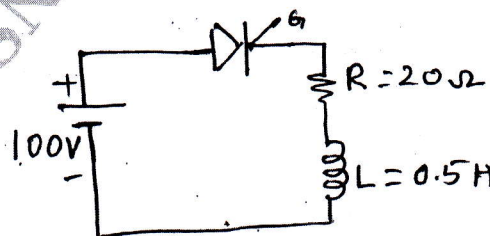   c. The latching current shown in Fig.Q3(c) is 50 mA. The duration of gate pulse is 50 μsec. Will the thyristor get fired?

Fig.Q3(c)   **(04 Marks)**

4 a. With a neat circuit diagram and waveforms, explain the working of a single phase full converter feeding highly inductive load. Derive the expression for the average output voltage and rms output voltage. **(10 Marks)**

b. If the converter of Fig.Q4(b) is as shown, has purely resistive load of R and the delay angle is $\alpha = \dfrac{\pi}{2}$, determine:
   (i) The rectification efficiency
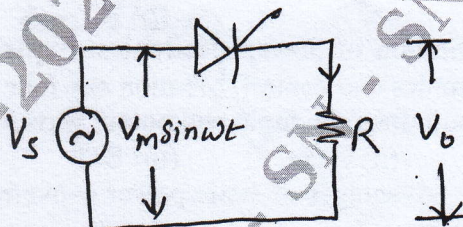   (ii) The form factor
   (iii) The ripple factor

Fig.Q4(b) **(10 Marks)**

PART – B

5 a. What is forced commutation? With the help of neat diagram and relevant equations, explain the operations of self commutation circuit. **(10 Marks)**

b. Explain the complementary commutation with the help of neat circuit and waveforms. Also determine the circuit turn-off time, t_{off}, if the load resistance of $R_1 = R_2 = R = 5\Omega$, capacitance $C = 10$ µf and supply voltage $V_S = 100$ V. **(10 Marks)**

6 a. With the help of circuit diagram, explain the operation of single phase full wave controller using ON-OFF control. Derive the expression for rms value of load voltage. **(10 Marks)**

b. Explain the single phase bidirectional AC voltage controller with resistive load with waveform. Also discuss single phase full wave controller with one thyristor. **(10 Marks)**

7 a. With neat circuit diagram, explain the principal of operation of step up chopper. **(08 Marks)**

b. Give the classification of Choppers. Explain briefly with relevant circuit diagrams. **(12 Marks)**

8 a. What do you mean by inverters? Explain the principle of operation of single phase half inverter. **(08 Marks)**

b. Explain the performance parameters of an inverter. **(06 Marks)**

c. With neat circuit, explain the variable DC link inverter. **(06 Marks)**

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