ONE TIME EXIT SCHEME

USN [   ]   **10EC73**

Seventh Semester B.E. Degree Examination, April 2018
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 briefly different types of power electronic circuits. **(06 Marks)**
   b. Discuss peripheral effects of power electronics equipments. **(06 Marks)**
   c. Explain the SCR characteristics (V-I) with the help of a circuit connection. Also define holding current and latching current. **(08 Marks)**

2 a. Compare power MOSFET and bipolar junction transistor. **(05 Marks)**
   b. Explain the proportional and anti saturation base drive control methods. **(06 Marks)**
   c. For a BJT circuit shown in Fig.Q2(c), if $V_{BE(sat)}$ = 1.5V, $V_{CE(sat)}$ = 1.2V , β = 25V, V_{CC} = 100V, R_C = 10 Ω and R_B = 20 Ω , find (i) the minimum value of V_{BB} = required to ensure transistor saturation and (ii) the ON-state power loss P_T in the transistor. **(05 Marks)**
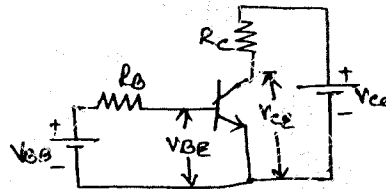   d. Write a brief note on isolation of gate and base driver. **(04 Marks)**

Fig.Q2(c)

3 a. With two transistor model explain switching action of thyristor. Derive an expression for anode current. **(10 Marks)**
   b. For the circuit shown in Fig.Q3(b), V_s = 200 V with load resistance of R = 5 Ω. The load and stray inductances are negligible and the thyristor is operated at a frequency of f_s = 2 kHz. If the required dv/dt = 100V/µs and the discharge current is to be limited to 100 A. Determine (i) the values of R_s and C_s (ii) the snubber loss and (iii) the power rating of the snubber resistor. **(10 Marks)**
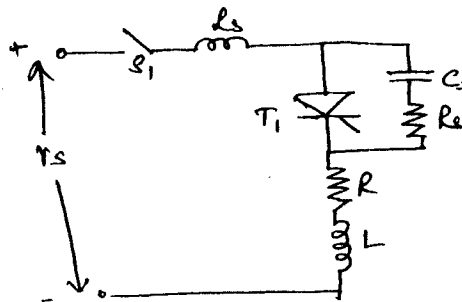

Fig.Q3(b)

4 a. With the necessary circuit and waveforms, explain the principle of operation of single phase full converter with R-L load. Derive an expression for the RMS and average output voltage. **(08 Marks)**

   b. With a neat circuit diagram and waveforms, explain the principle of operation of 1ϕ dual converter, with and without circulating current. **(10 Marks)**

   c. Explain the role played by the free wheeling diode in converters with R-L load. **(05 Marks)**

PART – B

5 a. Distinguish between natural and forces communication with examples. **(04 Marks)**

   b. With neat circuit diagram and waveform explain the working of complimentary commutation. **(08 Marks)**

   c. For the Auxiliary communication circuit shown below Fig.Q5(c), compute the value of commutation capacitor 'C' and commutating inductor 'R' for the following data:
      $E_{dc} = 50$ V, $I_{L(max)} = 50$ A, t_{off} of $SCR_1 = 30$ μs, chopping frequency f = 500 Hz and the load voltage variation required is 10% to 100%. Assume 50% tolerance on turn-off time of SCR_1. **(08 Marks)**

6 a. Describe the 1ϕ full wave AC voltage controller with resistive load. Derive the equation for the average output voltage and RMS output voltage. **(10 Marks)**

   b. Find the performance parameters of a 1ϕ FW controller with R-L load. The input rms is $V_s = 120$ V, 60 Hz. The load is such that L = 6.5 mH and R = 2.5 Ω. The delay angles of the thyristors are equal $\alpha_1 = \alpha_2 = \pi/2$. Determine, if $\beta = 220°$.
      (i) the conduction angle of thyristor T_1, δ
      (ii) the rms output voltage V_0
      (iii) the rms output current I_0
      (iv) the average current of the thyristor I_A.
      (vi) the input PF. **(10 Marks)**

7 a. Explain the principle of step-down chopper. Derive the average, rms voltage and the output power for it. **(06 Marks)**

   b. The dc converter has R = 10Ω and the input voltage is V = 220V. When the converter switch remains on its voltage drop is $V_{ch} = 2V$ and the chopping frequency is f = 1 kHz. If the duty cycle is 50% determine:
      (i) the average o/p voltage V_0
      (ii) the rms o/p voltage v_0
      (iii) the converter efficiency
      (iv) the effective input resistance R_i of the converter. **(08 Marks)**

   c. Explain the operation of a step down chopper with R-L load. Also derive an expression of peak-peak output ripple current. **(06 Marks)**

8 a. Explain single phase half bridge inverter with R-load, with necessary circuit diagram and waveforms. Derive the equation for rms output voltage. **(08 Marks)**

   b. Explain the performance parameters of inverters. **(08 Marks)**

   c. Give the classification of inverter based on the connection of thyristors and commutating components. **(04 Marks)**

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Q. No. 5 c.

For the Auxiliary communication circuit shown below Fig.Q5(c), compute the value of commutation capacitor 'C' and commutating inductor 'R' for the following data:

E_{dc} = 50 V, $I_{L(max)}$ = 50 A, t_{off} of SCR_1 = 30 μs, chopping frequency f = 500 Hz and the load voltage variation required is 10% to 100%. Assume 50% tolerance on turn-off time of SCR_1.
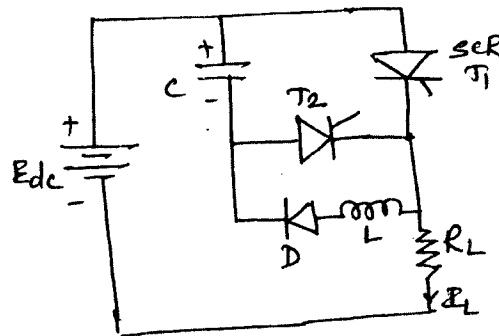
(08 Marks)

Fig.Q5(c)