

ONE TIME EXIT SCHEME

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10EC73

Seventh Semester B.E. Degree Examination, April 2018
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. 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 $V_{BE(sat)} = 1.5V$, $V_{CE(sat)} = 1.2V$, $\beta = 25V$, $V_{CC} = 100V$, $R_C = 10 \Omega$ and $R_B = 20 \Omega$, 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)

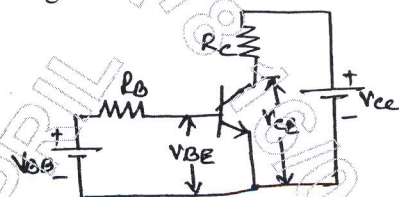


Fig.Q2(c)

- 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 $R = 5 \Omega$. The load and stray inductances are negligible and the thyristor is operated at a frequency of $f_s = 2 kHz$. If the required $dv/dt = 100V/\mu s$ 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)

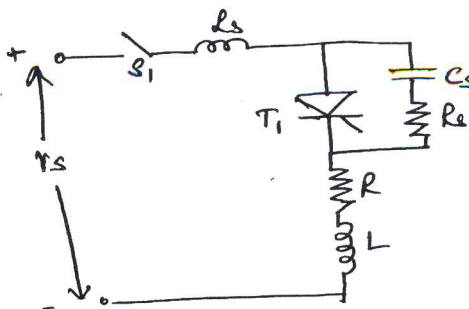


Fig.Q3(b)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 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 1 ϕ 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 forced commutation with examples. (04 Marks)
- b. With neat circuit diagram and waveform explain the working of complimentary commutation. (08 Marks)
- c. For the Auxiliary commutation circuit shown below Fig.Q5(c), compute the value of commutation capacitor 'C' and commutating inductor 'R' for the following data:
 $E_{dc} = 50 \text{ V}$, $I_{L(max)} = 50 \text{ A}$, t_{off} of $SCR_1 = 30 \mu\text{s}$, chopping frequency $f = 500 \text{ Hz}$ 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 1 ϕ 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 1 ϕ FW controller with R-L load. The input rms is $V_s = 120 \text{ V}$, 60 Hz. The load is such that $L = 6.5 \text{ mH}$ and $R = 2.5 \Omega$. The delay angles of the thyristors are equal $\alpha_1 = \alpha_2 = \pi/2$. Determine, if $\beta = 220^\circ$.
- (i) the conduction angle of thyristor T_1 , δ
 - (ii) the rms output voltage V_o
 - (iii) the rms output current I_o
 - (iv) the average current of the thyristor I_A .
 - (v) 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 $R = 10\Omega$ and the input voltage is $V = 220\text{V}$. When the converter switch remains on its voltage drop is $V_{ch} = 2\text{V}$ and the chopping frequency is $f = 1 \text{ kHz}$. If the duty cycle is 50% determine:
- (i) the average o/p voltage V_o
 - (ii) the rms o/p voltage v_o
 - (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)