

Fourth Semester B.E. Degree Examination, Dec.2015/Jan.2016
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. With neat circuit diagrams and waveforms, explain the operation of various types of power electronic circuits. (12 Marks)
- b. With a neat sketch, explain the operation of HVDC power transmission system. (08 Marks)

- 2 a. With neat circuit diagram, and switching times, explain switching characteristics of power BJT. (12 Marks)
- b. In the Bipolar transistor circuit shown in Fig. Q2(b), β varies between 8 to 40. The load resistance $R_C = 11 \Omega$, $V_{CC} = 200$ volts, $V_B = 10$ volts. If $V_{CE(sat)} = 1$ volt, and $V_{BE(sat)} = 1.5$ volts, determine : i) The value of R_B such that it results in saturation with ODF of 5, ii) the forced B_f , iii) the power loss P_T in the transistor. (08 Marks)

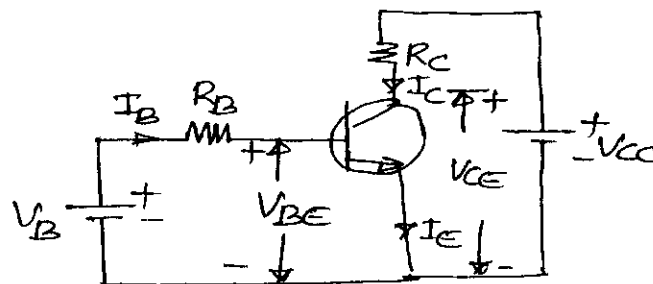


Fig.Q2(b)

- 3 a. Derive an expression for the anode current of thyristor with the help of two transistor analogy. (08 Marks)
- b. With a neat circuit explain the series operation of thyristors. (08 Marks)
- c. A SCR circuit operates from 300 volts DC supply, has series inductance of $4 \mu H$, a resistance of 4Ω and capacitance of $0.2 \mu F$ is connected across the SCR. Calculate the maximum permissible di/dt and dv/dt values. (04 Marks)

- 4 a. With a neat circuit diagram and waveforms, explain the working of self commutation. (08 Marks)
- b. The impulse commutation has $C = 20 \mu F$, $L_1 = 25 \mu H$. The initial capacitor voltage is equal to the input voltage, where $V_0 = V_s = 200$ volts, If the load current I_m is 50 Amps, determine the circuit turnoff time t_{off} . Derive the equations used. (08 Marks)
- c. The complementary commutation circuit has load resistances of $R_1 = R_2 = R = 5 \Omega$, $C = 10 \mu F$ and supply voltage $V_s = 100$ volts. Determine the circuit turnoff time. (04 Marks)

PART – B

- 5 a. With a neat circuit diagram, quadrant and waveforms, explain the operation of single phase controlled thyristor converter with a resistive load. (08 Marks)
- b. With a neat circuit diagram, quadrant and waveforms, explain the working of three phase half-wave converter with a resistive load. (07 Marks)
- c. A single phase semi converter is operated from 120 V rms, 50 Hz AC supply. The load resistance is 10Ω . If the average output voltage is 25% of the maximum possible average output voltage, determine :
- firing angle
 - rms and average output current. (05 Marks)
- 6 a. With a neat circuit diagram and waveform, explain the working of step up chopper. Derive the expression for its average output voltage in terms of duty ratio. (07 Marks)
- b. With a neat circuit diagram, polarities, conducting devices, explain the operation of class – E chopper. (09 Marks)
- c. A step down chopper has a resistive load of 20Ω and the input voltage is $V_s = 220$ volts. When the chopper is on, its voltage drop is 1.5 volts and chopping frequency is 10 KHz. If duty cycle is 80%, determine :
- the average output voltage
 - rms output voltage. (04 Marks)
- 7 a. With a neat circuit diagram and waveforms, explain the operation of single phase full bridge inverter. (06 Marks)
- b. Explain the performance parameters of an inverter. (06 Marks)
- c. With a neat circuit diagram and waveforms, explain 120° mode of operation of a three phase inverter. (08 Marks)
- 8 a. With the help of a schematic circuit and waveforms, explain the principle of ON-OFF control. Mention the equation for output voltage. (08 Marks)
- b. Describe how the power electronic converters produce electromagnetic interference. How this interference is minimized? (08 Marks)
- c. A single phase fullwave AC voltage controller has a resistive load of $R = 10 \Omega$, $V_s = 120$ V (rms). The delay angles of thyristors T_1 and T_2 are equal, $\alpha_1 = \alpha_2 = \alpha = \pi/2$. Determine :
- the rms output voltage V_0 and
 - the input power factor pF. (04 Marks)

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