

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020

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 the classification of power semiconductor switching devices, on the basis of control characteristics. (08 Marks)
 - b. Explain different types of power converter systems with circuit and waveforms. (08 Marks)
 - c. Draw symbol and characteristics of the following devices: i) SITH ii) SIT (04 Marks)
2.
 - a. Using transient model of BJT, explain switching characteristics of power transistor. (10 Marks)
 - b. The collective clamping circuit in Fig.Q2(b) has $V_{CC} = 100\text{ V}$, $R_C = 1.5\ \Omega$, $V_{d_1} = 2.1\text{ V}$, $V_{d_2} = 0.9\text{ V}$, $V_{BE} = 0.7\text{ V}$, $V_B = 15\text{ V}$ and $R_B = 2.5\ \Omega$, $\beta = 16$. Calculate:
 - i) Collector emitter clamping voltage V_{CE}
 - ii) Collector event without clamping

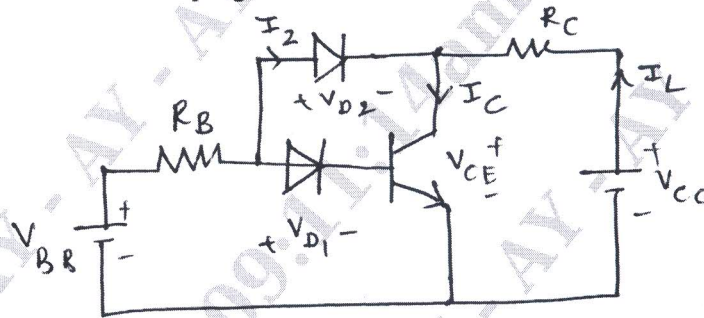


Fig.Q2(b)

- c. Compare the features of BJT and MOSFET. (06 Marks)
3.
 - a. Using two transistor analogy, derive an expression for anode event of a SCR. (08 Marks)
 - b. Briefly explain dynamic turn-ON and turn-off characteristics of SCR. (08 Marks)
 - c. If the latching event of SCR shown in Fig.Q3(c) is 4 mA, find the minimum width of gate pulse required to turn-ON SCR.

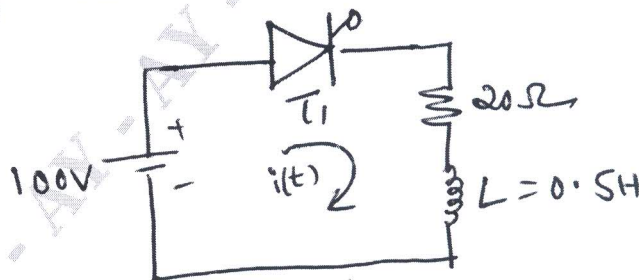


Fig.Q3(c)

(04 Marks)

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. The converter circuit shown in Fig.Q4(a) has resistive load of R and delay angle is $\alpha = \frac{\pi}{2}$, determine:
- Rectifier efficiency
 - Form factor FF
 - Ripple factor RF
 - Transformer utilization factor TUF
 - PIV of thyristor.

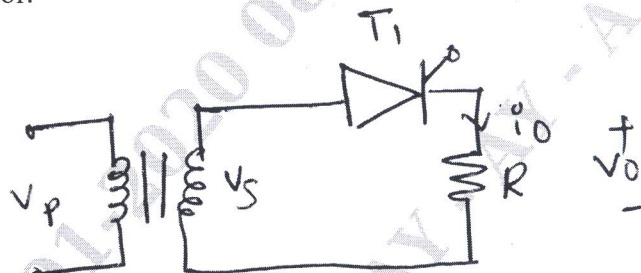


Fig.Q4(a)

(10 Marks)

- b. Explain with neat circuit and waveform, single phase full converter with R-load. Derive equation for V_{DC} and V_{rms} . (10 Marks)

PART - B

- 5 a. Explain the principles of self commutation circuit with necessary circuit and waveform. Derive equation for capacitor voltage and current. (10 Marks)
- b. The commutation circuit in Fig.Q5(b) has $C = 30 \mu F$ and inductance $L = 4 \mu H$. The initial capacitor voltage is $V_D = 200 V$. Determine the circuit turn-off time t_{off} if load current I_m is (i) 250 A (ii) 50 A.

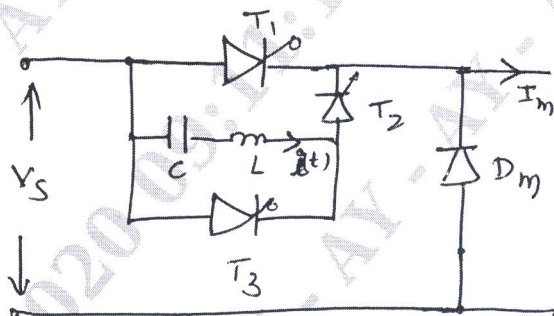


Fig.Q5(b)

(10 Marks)

- 6 a. Explain the basic principles of phase angle controller with neat circuit and waveform. Derive equations for RMS and average output voltage. (10 Marks)
- b. Explain with circuit and waveform, single phase bidirectional controller with resistive loads. Derive equation for RMS output. (10 Marks)
- 7 a. Explain with circuit and waveform, principles of step down chopper with R-load. Derive equation for output voltage. (10 Marks)
- b. Mention the classification of choppers. Briefly explain each type. (10 Marks)
- 8 a. Explain with circuit and waveform, single phase bridge inverter. (10 Marks)
- b. Explain with circuit and waveform, single phase current source inverter. (10 Marks)
