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10EC73

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 V, R_C = 1.5 Ω, V_{d_1} = 2.1 V, V_{d_2} = 0.9 V, V_{BE} = 0.7 V, V_B = 15 V and R_B = 2.5 Ω, β = 16. Calculate:

i) Collector emitter clamping voltage V_{CE}

ii) Collector event without clamping

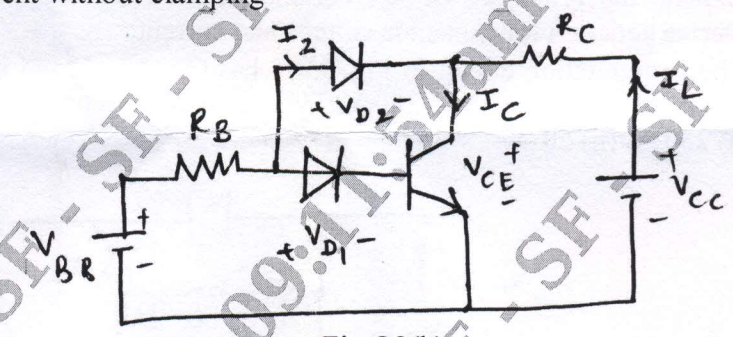

Fig.Q2(b) **(06 Marks)**

c. Compare the features of BJT and MOSFET. **(04 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.

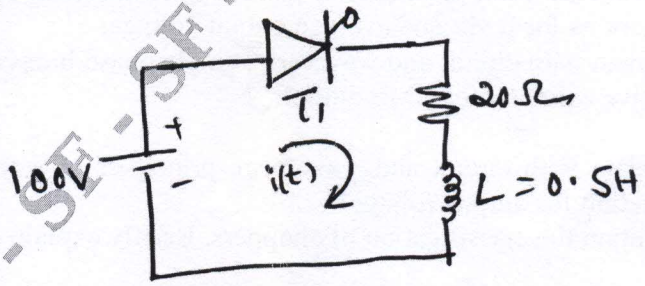

Fig.Q3(c) **(04 Marks)**

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

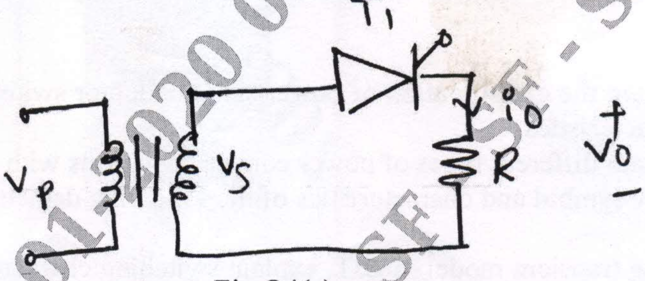

Fig.Q4(a) **(10 Marks)**

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 μF and inductance L = 4 μH. 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.

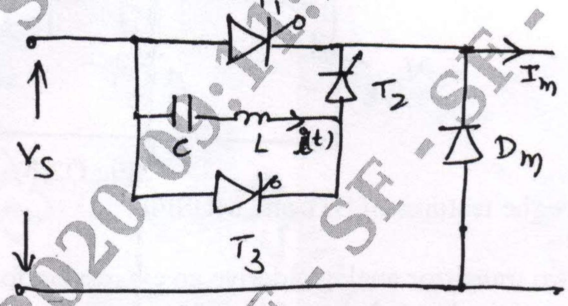

Fig.Q5(b) **(10 Marks)**

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)**

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