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10EE45

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Power Electronics

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain the various types of power electronic converter circuits. Draw the input and output characteristics. **(10 Marks)**

b. Draw and explain the V-I characteristic of the following power electronic devices:
i) SCR; ii) IGBT; iii) GTO; iv) TRIAC; v) BJT. **(10 Marks)**

2 a. What is the need of a base drive control in a power transistor? Explain anti-saturation control. **(08 Marks)**

b. In the bipolar transistor shown in Fig.Q.2(b) β varies between 5 and 50. The load resistance $R_C = 10\Omega$, $V_{CC} = 180V$, $V_{BB} = 10V$. If $V_{CE(sat)} = 1.0V$ and $V_{BE(sat)} = 1.4V$. Find:
i) The value of R_B that results in saturation with an overdrive factor of 6.
ii) Forced β_F.
iii) Power loss P_T in the transistor. **(06 Marks)**

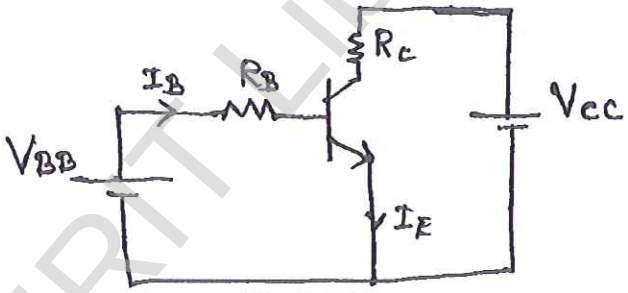

Fig.Q.2(b)

c. Draw and explain the switching characteristics of power MOSFET. **(06 Marks)**

3 a. Derive an expression for the anode current of thyristor with the help of two transistor analogy. **(08 Marks)**

b. A string of thyristor is connected to withstand a d.c. voltage of $V_S = 15kV$. The maximum leakage current and recovery charge difference of thyristor are 10mA and 150μC respectively. A derating factor of 20% is applied for the steady state and transient voltage sharing of thyristor. If the maximum steady state voltage sharing is 1000V. Find:
i) The steady state voltage sharing resistance R for each thyristor and
ii) The transient voltage capacitance C for each thyristor. **(08 Marks)**

c. Differentiate latching current and holding current of a thyristor. **(04 Marks)**

4 a. What is meant by commutation? Differentiate natural and forced commutation. **(06 Marks)**

b. With neat circuit diagram and waveforms explain complimentary commutation. **(10 Marks)**

c. For the commutation circuit shown in Fig.Q.4(c). Calculate the value of the capacitance C to provide the circuit turn-off time of 20μsec. DC source voltage is 100V and current through R_1 and R_2 is 10A. **(04 Marks)**

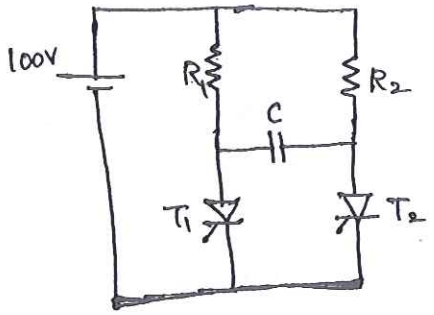

Fig.Q.4(c)

PART – B

5 a. Explain with neat diagram and waveforms, the operation of single phase semi-controlled rectifier feeding resistive load. **(10 Marks)**

b. In a single phase half wave controlled circuit shown in Fig.Q.5(b) with pure resistive load $R = 1\Omega$ and $\alpha = \pi/2$. Determine:

i) Rectification efficiency
ii) Form factor
iii) Ripple factor
iv) Transform utilization factor
v) Peak inverse voltage. **(10 Marks)**

Given $V_s = V_m \sin \omega t$

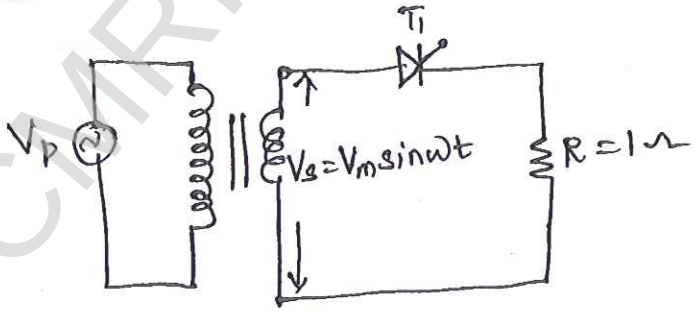

Fig.Q.5(b)

6 a. Explain the various classifications of chopper circuits. **(10 Marks)**

b. With a neat circuit diagram and waveforms, explain the analysis of impulse commutated thyristor chopper. **(10 Marks)**

7 a. Explain the operation of a single phase full bridge inverter supplying a resistive load. **(10 Marks)**

b. Explain: i) Sinusoidal pulse width modulation; ii) Performance parameters of an inverter. **(10 Marks)**

8 a. With the help of neat circuit diagram and waveforms, explain the operation of a bidirectional controller with resistive load. Derive the equation for V_{rms}. **(10 Marks)**

b. Describe the effect of power electronic converters. What are the remedial measures? **(10 Marks)**

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