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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: (10 Marks)
 i) SCR; ii) IGBT; iii) GTO; iv) TRIAC; v) BJT.
- 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: (06 Marks)
 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.

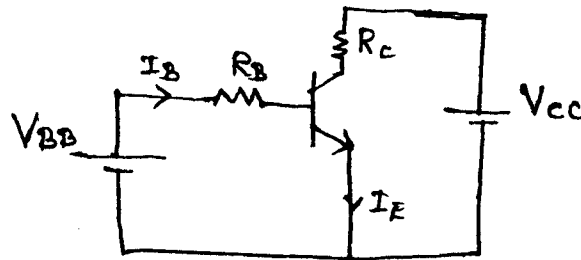


Fig.Q.2(b)

- 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 $150\mu C$ 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: (08 Marks)
 i) The steady state voltage sharing resistance R for each thyristor and
 ii) The transient voltage capacitance C for each thyristor.
- 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)

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

- 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 $20\mu\text{sec}$. DC source voltage is 100V and current through R_1 and R_2 is 10A . (04 Marks)

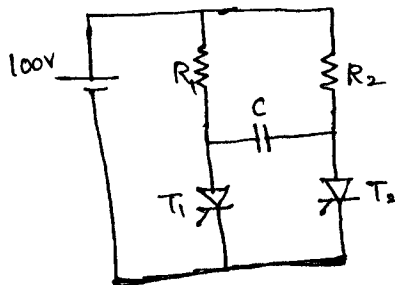


Fig.Q.4(c)

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:
- Rectification efficiency
 - Form factor
 - Ripple factor
 - Transform utilization factor
 - Peak inverse voltage.
- Given $V_s = V_m \sin \omega t$ (10 Marks)

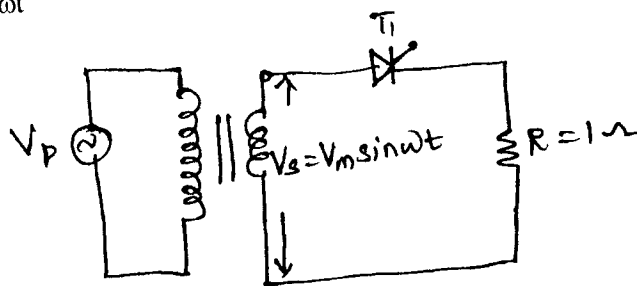


Fig.Q.5(b)

- 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)
