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10EC73

Seventh 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 five types of power electronic converter circuits briefly. Also indicate two applications of each type. **(10 Marks)**

b. What are the peripheral effects of power electronics equipments? **(06 Marks)**

c. Give symbol, and characteristic features of the following devices: i) GTO; ii) TRIAC. **(04 Marks)**

2 a. What is the necessity of base drive control in a power transistor? Explain proportional base control. **(08 Marks)**

b. The bipolar transistor of Fig.Q.2(b) is specified to have β in the range 8 to 40. The load resistance is $R_C = 11\Omega$. The dc supply voltage is $V_{CC} = 200V$ and the input voltage to the base circuit is $V_B = 10V$, $V_{CE(sat)} = 1V$ and $V_{BE(sat)} = 1.5V$. Find:

i) The value of R_B that results in saturation with an overdrive factor of 5.

ii) The forced β_f.

iii) The power loss P_T in the transistor. **(08 Marks)**

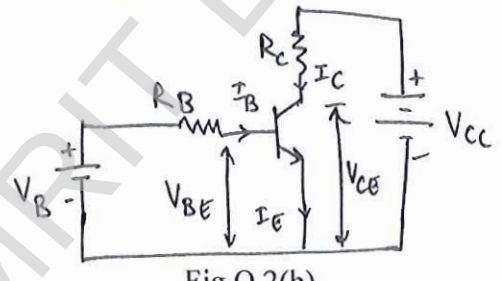

Fig.Q.2(b)

c. Give the comparison between MOSFET and IGBT. **(04 Marks)**

3 a. Draw the two transistor model of a thyristor and derive an expression for the anode current interms of the common base current gain α_1 and α_2 of the transistors. **(10 Marks)**

b. An UJT is used to trigger the thyristor whose minimum gate trigging voltage is 6.2V. The UJT ratings are: $\eta = 0.66$, $I_P = 0.5mA$, $I_V = 3mA$, $R_{B1} + R_{B2} = 5k\Omega$, leakage current = 3.2mA, $V_P = 14V$ and $V_V = 1V$. Oscillator frequency is 2kHz and capacitor $C = 0.04\mu F$. Design the complete circuit. **(10 Marks)**

4 a. With a neat circuit diagram and waveforms, explain the working of a single phase full converter feeding highly inductive load. Derive the expression for the average output voltage and rms output voltage. **(10 Marks)**

b. With a neat circuit diagram and waveforms, explain the principle of operation of dual converter with circulating current. **(04 Marks)**

c. What are the advantages and drawbacks of circulating current mode of operation of a dual converter? **(06 Marks)**

PART – B

5 a. Explain the working of step down choppers with waveforms and derive the equation for output voltage. **(06 Marks)**

b. Explain the working of boost regulator and derive the expression for average output voltage. **(06 Marks)**

c. A buck regulator has an input voltage of 12V. The required average output voltage is 5V at R = 5Ω and peak-to-peak output ripple voltage is 20mV. The switching frequency is 25kHz. If the peak-to-peak ripple current of inductor is limited to 0.8A, determine: i) duty cycle; ii) filter inductance L; iii) Filter capacitance; iv) Critical values of L and C. **(08 Marks)**

6 a. What do you mean by commutation? With necessary circuit and waveforms, explain self commutation scheme. **(10 Marks)**

b. With a neat circuit diagram and waveforms, explain the auxiliary commutation (impulse commutation). **(10 Marks)**

7 a. Explain the working of ON/OFF controllers and derive an expression for output rms voltage. **(06 Marks)**

b. An ACVC is provided with a load of 10Ω, supplied with an AC voltage of 120V, 50Hz with 25 cycles ON and 75 cycles OFF. Calculate the power dissipated in the resistance, rms current in each of the SCR's and average current in each of the SCR's. **(06 Marks)**

c. A single phase full wave AC controller has a load resistance of R = 10Ω and input voltage of 120V, 60Hz. The delay angle for both the thyristors is $\pi/2$. Determine rms value of output voltage, input power factor and average thyristor current. **(08 Marks)**

8 a. Explain single phase half bridge inverter with R-load with necessary circuit diagram and waveforms. Derive the equation for rms output voltage. **(08 Marks)**

b. Explain the performance parameters of inverters. **(08 Marks)**

c. Give the comparison between voltage source inverter and current source inverter. **(04 Marks)**

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