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10EE45

Fourth Semester B.E. Degree Examination, June/July 2014
Power Electronics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Mention and explain the different types of power electronic converter systems and also specify the form of input and output with wave forms. **(12 Marks)**

b. With neat sketch explain the operation of H.V.D.C power transmission systems. **(08 Marks)**

2 a. With necessary waveforms explain the switching characteristics of an I.G.B.T. **(10 Marks)**

b. In the bipolar transistor circuit shown in Fig.Q.2(b), B varies between 10 to 60. The load resistance $R_C = 5\Omega$, $V_{CC} = 100V$, $U_{BB} = 8V$, if $V_{CE(sat)} = 2.5V$ and $V_{BE(sat)} = 1.75V$, calculate: i) The value of R_B that results in saturation with an overdrive factor of 20; ii) The forced B value; iii) Power loss in the transistor. **(10 Marks)**

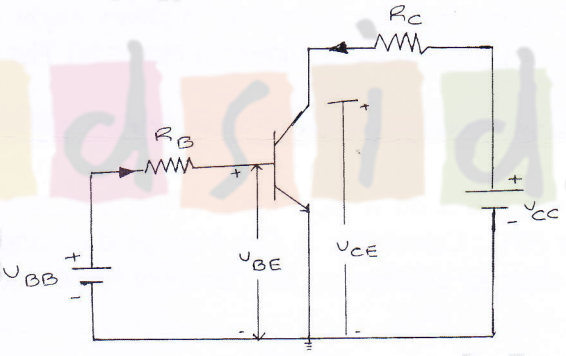

Fig.Q.2(b)

3 a. With the help of two transistor model derive an expression for the anode current of a thyristor. **(08 Marks)**

b. For the circuit shown in Fig.Q.3(b) if the latching current is 4mA, calculate the minimum width of gate pulse required to properly turn on the SCR. **(04 Marks)**

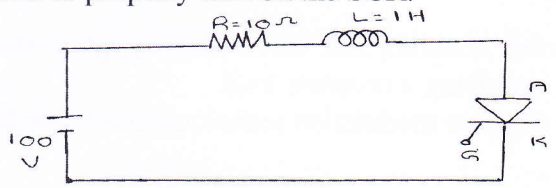

Fig.Q.3(b)

c. With circuit diagram and wave forms explain the working of U.J.T. triggering technique of SCR. **(08 Marks)**

4 a. With circuit diagram and wave forms explain the resonant pulse commutation. **(12 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.

b. Circuit of Fig.Q.4(b) employing class C commutation has V_S = 200V, R_1 = 10Ω and R_2 = 100Ω. Calculate: i) Peak value of current through thyristor T_1; ii) The value of capacitor C if each thyristor has turn off time of 40 μ sec. Consider factor of safety as 2; ii) Sketch the thyristors voltage wave forms for one complete cycle. **(08 Marks)**

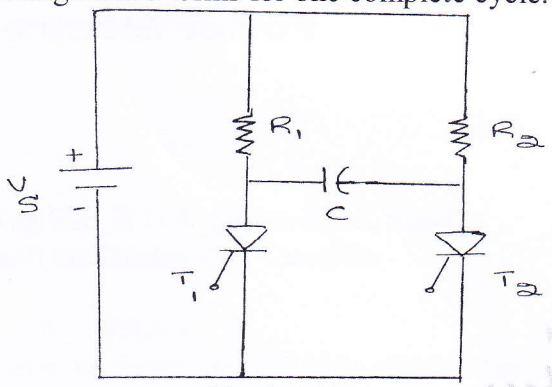

Fig.Q.4(b)

PART – B

5 a. With circuit diagram and wave forms explain the operation of a three phase full wave controlled rectifier with resistive load. And also derive the equation for average value of output voltage. **(12 Marks)**

b. A single phase half wave controlled rectifier supplies a purely resistive load of 10Ω, from a 230V, 50Hz supply. If the average output voltage is 75% of the maximum possible value of the d.c. output voltage. Calculate: i) Delay angle of thyristors; ii) R.M.S. value of output voltage; iii) RMS value of output current; iv) The input power factor. **(08 Marks)**

6 a. With circuit diagram and quadrant operation, explain four quadrant choppers. **(10 Marks)**

b. In the circuit shown in Fig.Q.6(b) the supply voltage is 240V. The voltage drop across the switch when it is on is V_S = 1.5V. If the load resistance is R = 15Ω, f = 1.2 KHZ and duty cycle is 60%. Calculate: i) The average d.c. output voltage; ii) the r.m.s. output voltage; ii) The chopper efficiency; iii) The input resistance of the chopper. **(10 Marks)**

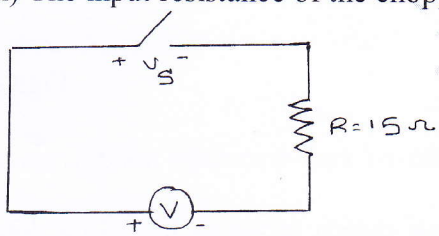

Fig.Q.6(b)

7 a. With circuit diagram and wave forms explain the operation of a single phase full bridge inverter supplying a resistive load. **(10 Marks)**

b. Explain any two modulation techniques available for voltage control a single phase inverter. **(10 Marks)**

8 a. With circuit diagram and wave forms explain the operation of a bidirectional controller with RL load. **(10 Marks)**

b. A single phase full wave a.c. voltage controller has an input voltage of 230V and a load resistance of 10Ω. The firing angle is 90°. Calculate: i) RMS output voltage; ii) RMS output current; iii) Output power; iv) The input power factor; v) Average thyristor current. **(10 Marks)**

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