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06EC73

Seventh Semester B.E. Degree Examination, June / July 2013
Power Electronics

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting atleast TWO question from each part.***
2. ***Draw neat diagram and Waveforms, wherever possible.***

PART – A

1 a. What is Power Electronics? Draw a neat block diagram of generalized power converter system. State the applications of power electronics. **(06 Marks)**

b. With neat circuit diagram and waveforms, explain the types of power electronic circuits. **(12 Marks)**

c. Compare General – purpose, Fast recovery and Schokky diodes. **(02 Marks)**

2 a. The maximum junction temperature of a transistor is $T_J = 150^0C$ and the ambient temperature is $T_A = 25^0C$, If the thermal impedances are $R_{JC} = 0.4^0C/W$, $R_{es} = 0.1^0C/W$, and $R_{SA} = 0.5^0C/W$. Calculate i) the maximum power dissipation and ii) the case temperature. **(04 Marks)**

b. With the help of parasitic model and switching model, explain the switching waveforms of n – type (enhancement) MOSFET. **(10 Marks)**

c. Write a note on isolation of gate and base drives. **(06 Marks)**

3 a. Using a two transistor model of thyristor, show that $I_A = \frac{\alpha I_G + I_{CBO1} + I_{CBO2}}{1-(\alpha_1 + \alpha_2)}$. **(06 Marks)**

b. With neat sketch, explain turn – on characteristics of SCR. **(06 Marks)**

c. The input voltage Fig. Q3(c) is $V_s = 200V$ with load resistance of $R = 5\Omega$. The load and stray inductances are negligible and the thyristor is operated at a frequency of $f_s = 2KHz$. If the required dv/dt is 100 V/μS and the discharge current is limited to 100A. Determine i) the values of R_s and C_s ii) the snubber loss, and iii) the power rating of the snubber resistor. **(08 Marks)**

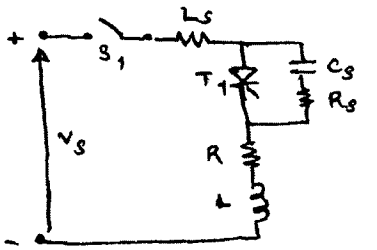

Fig. Q3.c. dv/dt protection circuit

4 a. Discuss the effect of inductance using the 1 - ϕ full converter. **(08 Marks)**

b. What is phase control? Explain the principal of phase control using 1 - ϕ half wave controlled rectifier. **(08 Marks)**

c. Compare circulating and non – circulating mode of operation of dual converter. **(04 Marks)**

PART – B

5 a. A thyristor circuit is shown in fig. Q5(a), if thyristor T_1 is switched on at t = 0, determine the conduction time of thyristor T_1 and the capacitor voltage after T_1 is turned off. The circuit parameters are L = 10μH, C = 50μF and V_s = 200V. The inductor carries an initial current of I_m = 250A. **(10 Marks)**

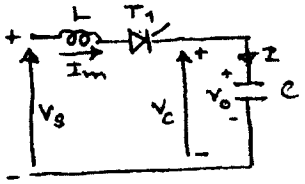

Fig. Q.5a: Self Commutated circuit.

b. What is the principle of complementary commutation? Explain the same with the help of suitable circuit and waveforms. **(10 Marks)**

6 a. What is the principle of on off control? Explain the same with a single phase full – wave controller. **(06 Marks)**

b. Draw a neat sketch of 1 - ϕ AC voltage controller with RL load and explain its working. **(06 Marks)**

c. A single – phase full wave AC voltage controller has a resistive load of R = 10 Ω and the input voltage is V_s = 120V (rms), 60Hz. The delay angles of thyristors T_1 and T_2 are equal $\alpha_1 = \alpha_2 = \pi/2$. Determine i) the rms output voltage V_o ii) the input power factor PF iii) the average current of thyristor I_A and iv) the rms current of thyristor I_R. **(08 Marks)**

7 a. With a neat circuit diagram, explain the operation of a step down chopper and also explain constant frequency and variable frequency operation. Derive an expression for output voltage incase of step down chopper. **(10 Marks)**

b. A step – up chopper with a pulse width of 200μs operating on 200V, dc supply. Calcualte the output voltage, if the blocking period of the device is 50μs. **(02 Marks)**

c. With a neat circuit diagram and quadrant operation, explain class E chopper. **(08 Marks)**

8 a. With a neat circuit diagram, of 1 - ϕ half bridge inverter, explain the principle of operation of an inverter. **(08 Marks)**

b. Write brief note on current source inverter. **(06 Marks)**

c. With the help of circuit diagram and waveforms, explain a variable DC – link inverter. **(06 Marks)**

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