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10EE45

Fourth Semester B.E. Degree Examination, Dec.2014/Jan. 2015
Power Electronics

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain in brief, the different types of power electronic converter circuits. Also indicate two applications in each case. **(10 Marks)**

b. Discuss the peripheral effects of power electronics equipments. **(05 Marks)**

c. Write a brief note on 'Thyristerised tap changer'. **(05 Marks)**

2 a. Discuss the importance of providing isolation of gate/base drive from power circuit, with circuit diagram. **(08 Marks)**

b. Explain switching characteristics of MOSFET. **(06 Marks)**

c. For the transistor switch of Fig. Q2(c),
   i) calculate forced B_f of transistor
   ii) if β is in the range 8 to 40 calculate the minimum ODF
   iii) obtain the power loss P_T of the transistor. **(06 Marks)**

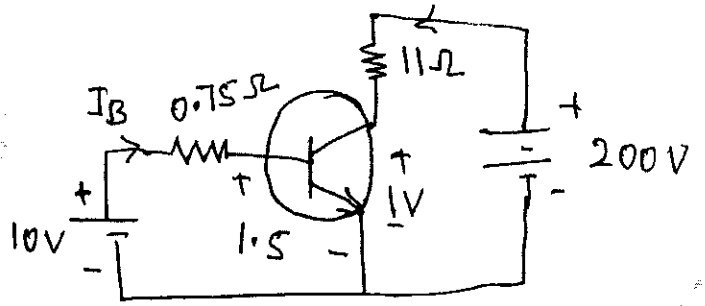

Fig. Q2(b)

3 a. Draw the two transistor model of thyristor and hence obtain the relationship between gate current and anode current before the thyristor comes into conduction using derived expression, explain how a small gate current can trigger the device into conduction. **(08 Marks)**

b. Ten SCR are used in a string to withstand a DC voltage of V_s = 15 KV. The maximum leakage current and recovery charge differences of SCR are 10 mA and 15 μC respectively. Each SCR has a voltage sharing resistance of R = 56 kΩ and capacitance of C = 0.5 μF. Determine: i)The steady state voltage derating factor ii) the transient voltage derating factor. **(08 Marks)**

c. Describe $\frac{di}{dt}$ and $\frac{dv}{dt}$ protection for transistor. **(04 Marks)**

4 a. With necessary circuit diagram and waveforms, explain impulse commutation. **(08 Marks)**

b. With necessary circuit diagram, and waveforms, explain resonant pulse commutation. **(08 Marks)**

c. A complementary commutation circuit shown in Fig. Q4(c) has two SCRS with specified minimum turn – off time t_q = 50 μs, make necessary calculations and state whether the circuit components are correct for satisfactory commutation of SCRS. **(04 Marks)**

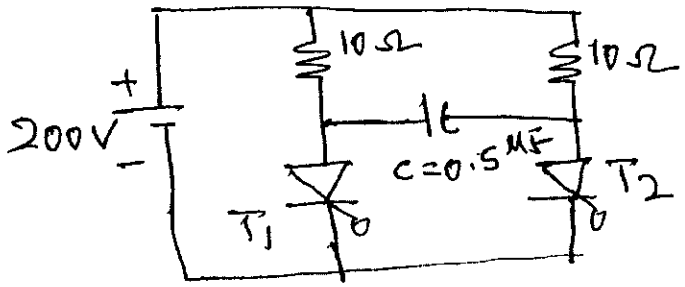

Fig. Q4(c)

PART – B

5 a. What is controlled rectifier? With neat circuit and waveform, explain single phase semi converter for R – L load with free wheeling diode. **(10 Marks)**

b. Explain with a neat diagram and waveforms three phase full wave controlled rectifier with resistive load. **(10 Marks)**

6 a. Explain the classification of chopper with neat circuit diagram and waveform. **(08 Marks)**

b. With a circuit diagram and waveforms of load voltage and load current, discuss the continuous current mode operation of a step down DC chopper with R – L load. **(08 Marks)**

c. A chopper circuit drives an inductive load from 200 V DC supply given the load resistance as 4Ω the average load current as 30A and operating frequency is 400 Hz. Compute the ON and OFF periods of the chopper also determine the duty cycle of the chopper. **(04 Marks)**

7 a. With necessary circuit diagram and waveforms, explain the operation of a single phase full bridge inverter with inductive load. **(07 Marks)**

b. With the help of circuit diagram and waveform, explain the operation of 180° mode of three phase inverter with star connected resistive load. **(06 Marks)**

c. Draw the circuit of a single phase current source inverter employing power switching transistors, sketch the gating signal waveforms and the load current waveform. Explain the operation of the circuit. **(07 Marks)**

8 a. With necessary waveforms, explain the operation of a 1ϕ full wave AC voltage controller with inductive load. Derive expressions for rms output voltage and rms output current. **(10 Marks)**

b. Describe how the power electronic converters produce electromagnetic interference. How is this interference can be minimized? **(08 Marks)**

c. What are the applications of AC voltage controller? **(02 Marks)**

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