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10EE45

Fourth Semester B.E. Degree Examination, Dec.2013/Jan.2014
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. List the major types of power electronics devices with their symbols, V-I characteristics and applications. **(06 Marks)**

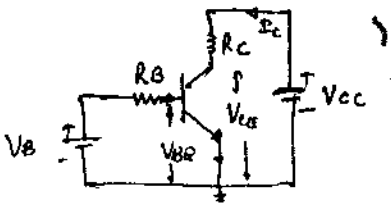
b. Mention and explain the different types of power electronic converter system. Show their input and output waveforms. **(08 Marks)**

c. Write the major industrial applications of power electronic converters circuits. Discuss with diagram of HVDC lines and electric drives. **(06 Marks)**

2 a. Give the basic structure, symbol, static and switching characteristics of power MOSFET. **(08 Marks)**

b. Give the list of base drive control circuits. Explain with a neat diagram of proportional base control. **(06 Marks)**

c. A transistor switch is shown in Fig.Q2(c), has β in the range of 8 to 40. Calculate
(i) The value of RB with an ODF of 5 (ii) The forced β_f and
(iii) The power loss in the transistor.



V_{CC} = 200 V
V_B = 10 V
$V_{CE(sat)}$ = 1 V
$V_{BE(sat)}$ = 1.5 V
R_C = 10 Ω

Fig.Q2(c) **(06 Marks)**

3 a. With neat sketch, explain the static V-I characteristics of an SCR. What are the significance of latching current, holding current and break over voltage. **(08 Marks)**

b. With the help of circuit diagram and waveforms, explain the UJT triggering to turn on the SCR. Write its necessary equations. **(07 Marks)**

c. A SCR circuit operates from 300 V DC supply, has series inductance of 4 μH. A resistance of 4 Ω and capacitance of 0.2 μF is connected across the SCR. Calculate the maximum permissible di/dt and dv/dt values. **(05 Marks)**

4 a. Define commutation. List the types of commutation circuits. Distinguish between natural and forced commutation. **(06 Marks)**

b. With necessary circuit and waveforms, explain the self commutation scheme and give the comparison between self and impulse commutation. **(06 Marks)**

c. For the impulse commutation circuit shown in Fig.Q4(c), V_s = 200V, C = 20 μF and R = 10Ω. Determine the turn-off time t_{off}. Determine the formula used. **(08 Marks)**

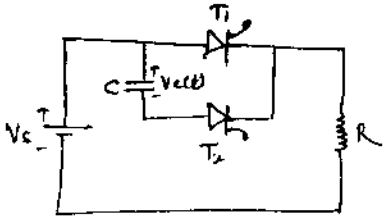


Fig.Q4(c)

PART – B

5 a. Explain the operation of single phase semi-converter with RL load with continuous load current. Derive the expression for average of rms output voltage. **(07 Marks)**

b. Explain the operation of 3ϕ half wave converter with R load. Derive an equation for average output voltage. **(07 Marks)**

c. A single phase fully controlled bridge rectifier is fed from 230 V, 50 Hz supply. The load is highly inductive. Find the average load voltage and current if the load resistance is 10 Ω and firing angle is 45°. Draw the supply current waveform. **(06 Marks)**

6 a. What is chopper? Classify and explain the different types of choppers with the help of circuit and quadrant diagrams. **(10 Marks)**

b. With the help of circuit diagram and waveforms, explain the working principle of step-up chopper. **(05 Marks)**

c. A dc chopper has an input voltage of 200 V and a load resistance of 8Ω. The voltage drop across thyristor is 2V, and chopper frequency is 800 Hz. The duty cycle δ = 0.4. Find i) Average output voltage ii) RMS output voltage iii) chopper efficiency. **(05 Marks)**

7 a. What do you mean by inverters? Explain the principle of operation of 1ϕ half bridge inverter with relevant waveforms having R load. **(06 Marks)**

b. What are the parameters that indicate quality of an inverter? Define all of them. **(06 Marks)**

c. Write a short notes on 1ϕ transistorized current source inverter and give the comparison between VSI and CSI. **(08 Marks)**

8 a. Explain the principle of ON-OFF control. Obtain an expression for rms voltage, rms current and power factor. **(06 Marks)**

b. Give the definition of electromagnetic compatibility. What are its effects on converters and remedial measures? **(07 Marks)**

c. Find the power consumed in the heater element shown in Fig.Q8(c). If both SCRs are triggered with delay angle of 45°.

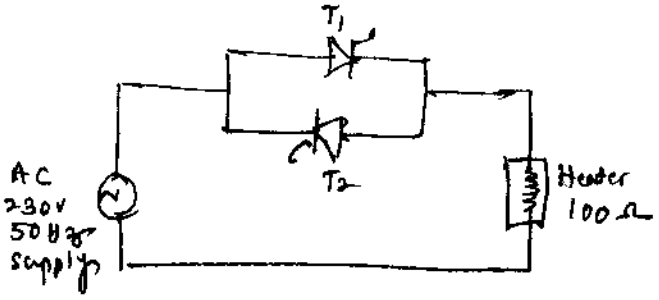


Fig.Q8(c)

In the circuit above, if the load is 2 kW, 230 V, heater and V_0 = 230 V, 50 Hz. Calculate (i) $V_{0(rms)}$ (ii) Power dissipated in heater for α = 45°. **(07 Marks)**

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