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10EC73

Seventh Semester B.E. Degree Examination, June/July 2015
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. What is power electronics? State the applications of power electronics. **(06 Marks)**
   b. Give symbol, characteristics features of the following devices:
      i) IGBT   ii) TRIAC   iii) GTO   iv) MCT. **(08 Marks)**
   c. What are the peripheral effects of power electronic equipments and mention the remedies. **(06 Marks)**

2 a. Compare IGBT, MOSFET and BJT's. **(04 Marks)**
   b. What is the need of a base drive control in a power transistor? Explain proportional and anti-saturation control. **(08 Marks)**
   c. With the necessary waveforms, explain the switching characteristics of a power MOSFET. **(08 Marks)**

3 a. Explain the two transistor model of SCR and derive the formula
      $$I_A = \frac{\alpha_2 I_G + I_{CBO_1} + I_{CBO_2}}{1 - (\alpha_1 + \alpha_2)}.$$ **(06 Marks)**
   b. With a neat sketch, explain turn-off characteristics of SCR. **(06 Marks)**
   c. Design the snubber circuit elements R_S and C_S connected across the SCR, given that $\frac{dv}{dt}(max) = 180V/\mu s$ and $\frac{di}{dt}(max) = 45A/\mu s$. An inductor L = 0.1H and a resistance $R << R_S$ are in series with the SCR with a 300V, DC applied to the circuit. **(08 Marks)**

4 a. With a neat diagram and waveforms, explain the principle of single phase full converter purely resistive load. Derive the expression for voltage output and rms output voltage. **(10 Marks)**
   b. For the converter shown in Fig.Q.4(b) has a purely resistive load of R and the delay angle is $\alpha = \pi/2$ determine: i) the rectification efficiency; ii) the form factor; iii) ripple factor (RF); iv) the TUF; v) PIV of thyristor. **(10 Marks)**
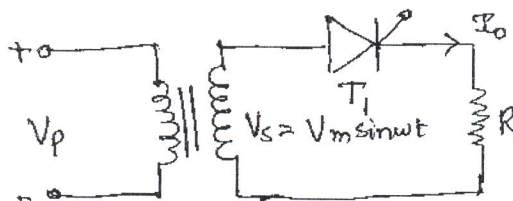

Fig.Q.4(b)

PART – B

5 a. Explain the self commutation with the help of neat sketch and obtain the expression for the capacitor voltage and current. **(08 Marks)**
   b. Compare natural and forced commutation. **(04 Marks)**
   c. With the necessary circuit diagram and waveforms, explain the operation of a complimentary commutation. **(08 Marks)**

6 a. What are the application of AC voltage controller? **(04 Marks)**
   b. With the help of circuit diagram explain the operation of single phase AC regulator using ON-OFF control. Derive the expression for rms value of load voltage. **(08 Marks)**
   c. A single phase AC voltage controller with R-L load has the following details. Supply voltage = 230V, 50Hz, R = 4Ω and WL = 3Ω, calculate:
      i)   The control range of firing angle.
      ii) The maximum value of RMS load current.
      iii) The maximum power and power factor.
      iv) The maximum values of average and RMS thyristor current. **(08 Marks)**

7 a. Give the classification of choppers. Explain class E-chopper with circuit and quadrant diagram. **(06 Marks)**
   b. With the help of neat circuit diagram and waveforms. Explain the working principle of a step-up chopper. **(06 Marks)**
   c. A step down chopper is operating at a frequency at 2kHz from a 250V dc source to supply a load resistance of 12Ω. The time constant of the load circuit is 10ms. If the average load voltage is 150V, calculate: i) The ON-time t_{ON} of the chopper; ii) The average and rms values of load current and iii) the peak to peak ripple current. **(08 Marks)**

8 a. What do you mean by inverters? Explain the principle operation of 1-ϕ half bridge inverter. **(08 Marks)**
   b. Write and explain the performance parameter of an inverter. **(06 Marks)**
   c. With a neat, circuit diagram explain the variable DC link inverter. **(06 Marks)**

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