Fourth Semester B.E. Degree Examination, December 2010
Power Electronics

Time: 3 hrs.   Max. Marks:100

Note: *1. Answer any FIVE full questions,*
selecting at least TWO questions from each part.
2. Any missing data may be suitably assumed

PART – A

1 a. What are the advantages of static power converters? Mention the peripheral effects of such static power converters. (08 Marks)
   b. Mention the various types of power semiconductor devices. Draw the V-I characteristics and symbols of any five types. Mention their important applications. (12 Marks)

2 a. With a neat circuit diagram, explain 'anti-saturation' control of base drive for BJT. (10 Marks)
   b. What is the need of isolation between gate /base drive and power terminal of power converter circuits? Explain two methods, with a neat circuit. (10 Marks)

3 a. Using two transistor model, explain how a small gate current can TURN ON a SCR when blocking forward voltage. (12 Marks)
   b. Distinguish between holding current and latching current of thyristor. (04 Marks)
   c. For the circuit below, Fig. Q3 (c), if the latching current is 4 mA, find the minimum width of gating pulse required to properly TURN ON the SCR. (04 Marks)
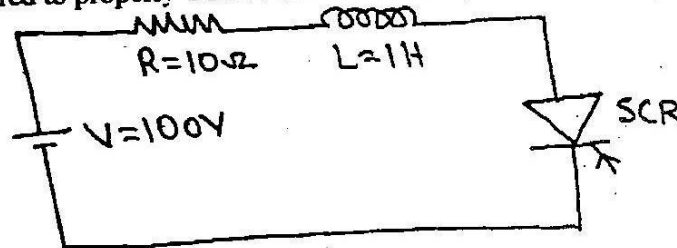

Fig. Q3(c)

4 a. Distinguish between natural and forced commutation and mention the application. (04 Marks)
   b. With the help of circuit diagram and relevant waveforms, explain the working of resonant pulse commutation. (10 Marks)
   c. Circuit of Fig.4(c) illustrates class D commutation. For this circuit $V_S = 230$ V, $L = 20$ μ H and $C = 40$ μf. for a constant load current of 120A, calculate peak value of current through capacitance and also through main and auxiliary thyristors.
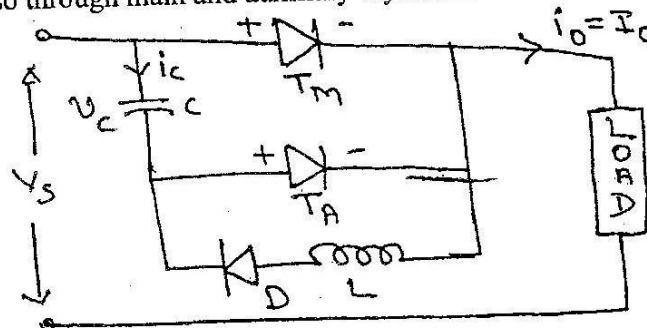

Fig. Q4(c)

(06 Marks)

PART – B

5 a. With the help of a neat circuit diagram and waveform, explain the operation of a bidirectional controller with 'R' load. Derive the equation for $V_{0(RMS)}$. **(10 Marks)**

b. An AC voltage controller has a resistive load of R = 10 Ω and the RMS input voltage is 150 V. The thyristors are switched ON for n = 25 cycles and it is off for m = 75 cycles. Determine : i) RMS output voltage ii) Input power factor. **(05 Marks)**

c. Distinguish between ON-OFF control and phase control of AC voltage controller. Which is the most widely used method? **(05 Marks)**

6 a. Explain the working of a single phase, fully controlled converter with inductive load, with the help of a neat circuit diagram and relevant waveforms. Derive the equation of V_{DC} and V_{RMS}. Assume continuous conduction. **(12 Marks)**

b. A three –phase fully controlled bridge rectifier is operating from a 400 V, 50 Hz supply. The thyristors are fired at $\alpha = \dfrac{\pi}{4}$. There is a free wheeling diode across the load. The load current is maintained constant at 10A and the load voltage is 360 V. Compute :
i) Source inductance L_S ii) Load resistance R. **(08 Marks)**

7 a. Considering the switch to be ideal in the circuit of Fig. Q7(a), determine :
i) Duty cycle k for which the output average DC voltage and RMS voltage are equal
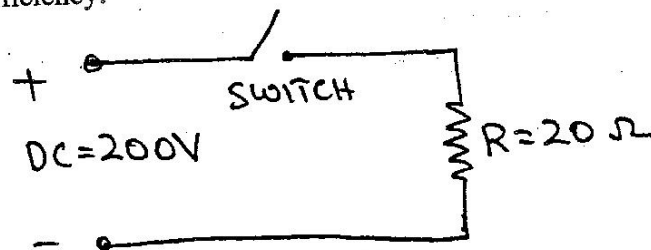ii) The chopper efficiency. **(04 Marks)**

Fig. Q7(a)

b. With a neat circuit and waveforms for continuous conduction mode, explain the working of step down chopper. **(10 Marks)**

c. Draw the circuit of CLASS E four quadrant chopper and mention the devices that provide path for current in the first and third quadrant of operation. **(06 Marks)**

8 a. Briefly explain the performance parameters of an inverter. **(06 Marks)**

b. What are the draw backs of single phase half bridge inverter? Explain the operation of single phase full bridge inverter for resistive load. **(08 Marks)**

c. With relevant waveforms, explain the sinusoidal pulse width modulation in an inverter. **(06 Marks)**

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