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06EE45

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)**

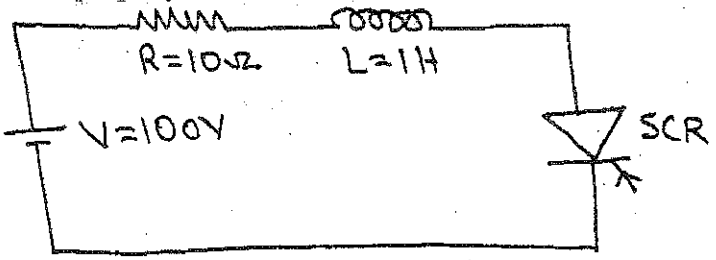

Fig. Q3(c)

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.

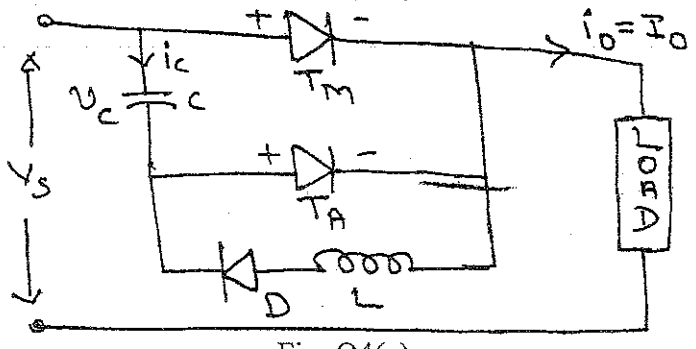

Fig. Q4(c)

(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 $\alpha = \frac{\pi}{4}$. 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)**

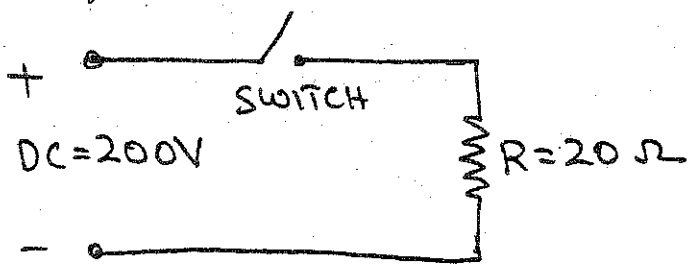

Fig. Q7(a)

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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