EC42

USN

NEW SCHEME

Fourth Semester B.E. Degree Examination, Dec.06 / Jan.07
Electronics and Communication Engineering
Power Electronics

Time: 3 hrs.] [Max. Marks:100

Note: *1. Answer any FIVE full questions.*

1 a. Give a list of Power Electronic circuits for different input / output requirements. **(05 Marks)**

b. Discuss the peripheral effects of Power Electronics equipments. **(05 Marks)**

c. With model and waveforms, explain how the internal capacitances of the transistor influence the switching characteristics of the transistor. **(10 Marks)**

2 a. Explain the anti saturation control technique used to improve the switching speed of a power B.J.T. **(06 Marks)**

b. Discuss methods of providing isolation of gate/base circuits from power circuits. **(06 Marks)**

c. A transistor switch of Fig Q2 (c) has β in the range of 8 to 40. Calculate

i) The value of R_B that results in saturation with an overdrive factor of 5.

ii) The forced β_f and

iii) The power loss in the transistor. **(08 Marks)**

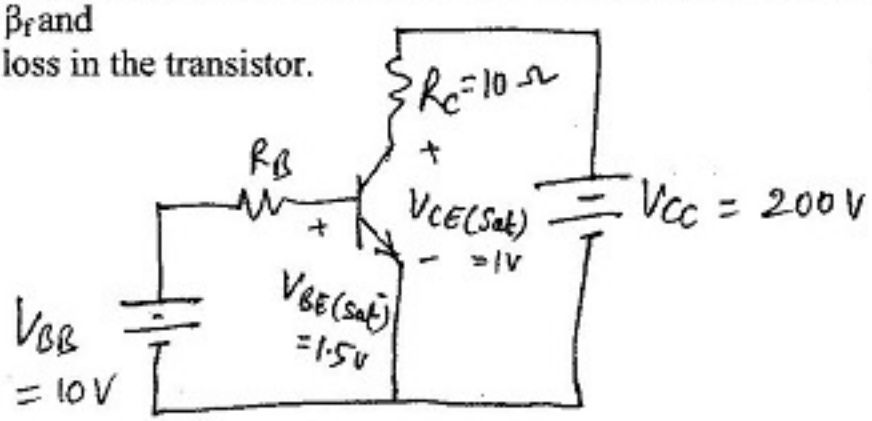

Fig Q2 (c)

3 a. Explain the principle of operation of an SCR using two transistor model. **(06 Marks)**

b. What is the need for protection of thyristors. Explain how thyristors are protected against high $\frac{di}{dt}$ and high $\frac{dv}{dt}$. **(07 Marks)**

c. A string of series connected thyristors is to with stand a dc voltage of 16 kV. The maximum leakage current and recovery charge differences of the thyristors are 10 mA and 100 μC respectively. The derating factor for steady-state and transient voltage sharings are 20%. For a maximum steady state voltage sharing of 1 kV. Determine

i) The steady state voltage sharing resistance R for each thyristor and

ii) The transient voltage capacitance C_1 for each thyristor. **(07 Marks)**

a. What is forced commutation? Discuss the following forced commutation techniques.
   i) Self commutation.
   ii) Impulse commutation. **(14 Marks)**

b. Obtain proper values of the commutating components for the circuit shown in Fig. Q4 (b). The load current to be commutated is 5 A, turn off time is 50 μsec. Supply voltage is 100 V, SCR_2 holding current is 2 mA. Derive the equation used. **(06 Marks)**

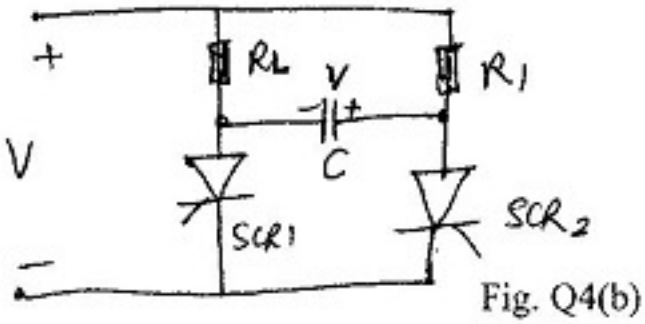

Fig. Q4(b)

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

b. Explain why short duration gate pulses are not suitable for bidirectional ac voltage controllers with inductive loads. **(03 Marks)**

c. A 1φ full wave ac voltage controller supplies a resistive load of R = 10 Ω from an input voltage Vs = 200 V, 60 Hz. The delay angles of the thyristors are equal, $\alpha_1 = \alpha_2 = \frac{\pi}{2}$. Determine
   i) The rms output voltage.
   ii) The input p.f and
   iii) Average current of thyristors
   iv) Rms current of thyristors. **(07 Marks)**

a. With the help of relevant waveforms, explain the working of a 1φ full converter assuming continuous current operation. Derive expressions for average and rms output voltages. **(10 Marks)**

b. With necessary waveforms explain the working of a 3φ half wave converter. Obtain expressions for average and rms output voltages. **(10 Marks)**

a. Explain the principle of operation of a step-up chopper. **(06 Marks)**

b. With the help of necessary mode equivalent circuits and waveforms, explain the operation of an impulse commutated chopper. **(14 Marks)**

a. What are inverters? Explain the working of an half bridge inverter with necessary waveforms. What is the function of the feed back diodes? **(10 Marks)**

b. Explain how the output voltage of a 1φ inverter is controlled using sinusoidal P.W.M technique. **(10 Marks)**