

NOTE: Attempt any five questions. Assume suitably missing data, if any.

x-x-x

- Q1. A power transistor has its switching wave-shape as shown in Figure-1. If the average power loss in the transistor is limited to 300 W, find the switching frequency at which this transistor can be operated.

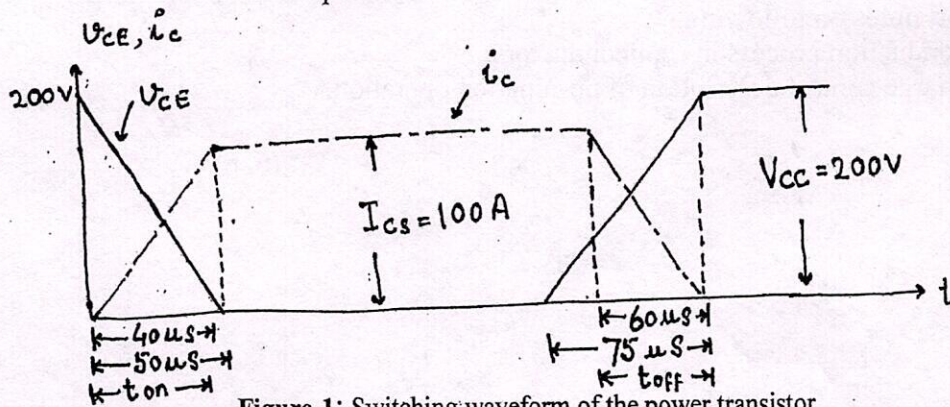


Figure-1: Switching waveform of the power transistor.

(10)

- Q2.a. Explain the static characteristics of  $n$ -channel Power Metal-oxide-semiconductor Field-effect transistor with the help of its basic circuit diagram. (6)
- b. Clearly indicate the turn-on and turn-off state in static output characteristics of the same. (1)
- c. Also, explain the dynamic turn-on process in its switching characteristics with appropriate wave-form. (3)
- Q3.a. Explain the working of an insulated gate bipolar transistor with help of approximate and exact equivalent circuit representations. (5)
- b. Only write the equation for on-state voltage drop across it. (1)
- c. Explain in detail the dynamic turn-off characteristics of the same. (4)
- Q4. A thyristor operating from a peak supply voltage of 400 V has the following specifications:  
Repetitive peak current,  $I_p=200$  A,  $(dv/dt)_{max}=50A/microseconds$ ,  
 $(dv/dt)_{max}=200V/microseconds$ .  
Choosing a factor of safety for  $I_p$ ,  $(di/dt)_{max}$ , and  $(dv/dt)_{max}$ , design a suitable snubber circuit. The minimum value of load resistance is 10 ohms. (10)

(2)

**Q5.** Explain the dynamic turn-on and turn-off processes of a Gate Turn-off thyristor with the help of appropriate wave-form representations. **(10)**

**Q6.a.** With the help of suitable waveform representations, clearly explain the reverse recovery characteristics of the power diode.

**b.** And hence, derive the term peak inverse current,  $I_{RM}$  in terms of stored charge,  $Q_R$  for the same. **(06, 04)**

**Q. 7.** Explain safe operating areas of power transistor and insulated gate bipolar transistor. **(5+5)**

**Q8.** Write short notes on following:

a. Conduction process in semiconductors.

b. Charge control description of pn-junction operation.

**(5, 5)**

x-x-x