EEE602

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2499   **Roll No.** [   ]

B. Tech.

(SEM. VI) THEORY EXAMINATION 2010-11
POWER ELECTRONICS

Time : 3 Hours   *Total Marks : 100*

Note : (1)   Attempt **all** questions.

(2)   All questions carry equal marks.

1.   Attempt any **four** parts :   **(5×4=20)**

(a)   Compare power MOSFET with BTTs.

(b)   Explain switching characteristics of an IGBT.

(c)   Describe with a neat sketch, the effect of gate current on the forward breakover voltage of an S.C.R.

(d)   How does a GTO differ from a conventional thyristor. Give its circuit symbol and static V-I characteristic.

(e)   It is required to operate 250-A S.C.R. in parallel with 350-A SCR with their respective on–state voltage drops of 1.6 V and 1.2 V. Calculate the value of resistance to be inserted in series with each SCR so that they share the total load of 600 A, in proportion to their current rating

(f)   A single phase 230 V, 1 Kw heater is connected across single phase 230 V 50 Hz supply through a diode. Calculate the power delivered to the heater element. Also find input power factor.

2. Attempt any two parts : $(10 \times 2 = 20)$

(a) Discuss the two transistor model of a thyristor. Using this model, describe the various mechanism of turning-on a thyristor.

(b) A current commutated chopper is fed from a d.c. source of 230 V. Its commutating components are $L = 20\ \mu H$ and $C = 50\ \mu F$. If load current of 200 A is assumed constant during the commutation process then compute the following.

   (i) Turn-off time of main thyristor

   (ii) Total commutation interval.

   (iii) Turn-off time of auxiliary thyristor.

(c) What is a dc chopper ? Describe the various types of chopper configuarations with appropriate diagrams.

3. Attempt any two parts : $(10 \times 2 = 20)$

(a) For a single phase one pulse controlled converter system sketch waveforms for load voltage and load currents for :

   (i) R.L load

   (ii) RLE load with free wheeling diode across R.L.

(b) Describe the evolution of 3-phase, six phase diode rectifier from 3-phase, 3-pulse diode rectifier with appropriate circuits and waveforms. Hence derive an expression for the coverage output voltage of a 3-phase, six pulse diode rectifier.

(c) A 3-phase full converter is delivering a constant load current of 50 A at 230 V dc when its input is 3-phase 415 V, 50 Hz. If each thynstor has a voltage drop of 1.1 V when conducting, calculate :

(i) The firing angle delay of SCR.

(ii) The rms current of SCRs

(iii) The mean power loss in each SCRs.

4. Attempt any **two** parts : $(10 \times 2 = 20)$

(a) Explain single phase ac voltage controller with inductive and resistive loads.

(b) A single phase voltage controller has input voltage of 240 V, 50 Hz and a load of R = 15Ω. For a 6 cycles on and 4 cycles off, determine :

(i) rms output voltage

(ii) Input power factor

(iii) Average and rms thyristor currents.

(c) Describe the basic principle of working of single phase to single phase step down cycloconverter for both continuous and discontinuous conductions. Mark the conduction of various thyristors also.

5. Attempt any **two** parts : $(10 \times 2 = 20)$

(a) Discuss the principle of working of a single phase series inverter. What are the advantages and disadvantages of series inverter ?

(b) What is pulse width modulation ? Explain sinusoidal pulse modulation used in P.W.M. inverters. What are the advantages of P.W.M. inverters ?

(c) A single phase bridge inverter feeds power to a load of $R = 12\Omega$ and $L = 0.03H$ from a 400 V dc source. If the inverter operates at a frequency of 50 Hz, determine the power delivered to load for :

    (i)   Square wave operation

    (ii)   Quasi-square wave operation.