4E1227

Roll No.

Total No of Pages: 4

4E1227

B. Tech. IV - Sem. (Main) Exam., May - 2019

PCC Electrical Engineering

4EE4 – 06 Power Electronics

EE, EX

Time: 3 Hours

Maximum Marks: 120

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 Explain the safe operating areas of an IGBT.

Q.2 What do you mean by commutation of SCR? What are the different classes of forced commutation method?

Q.3 Explain the effect of freewheeling diode. Also justify the statement "Freewheeling diode improves the power factor of the system."

Q.4 Explain the working of single phase fully controlled bridge converter in rectifying mode.

Q.5 Why forced commutation is necessary for Chopper?

Q.6 What are the merits and demerits of voltage commutated chopper?

Q.7 Explain the time ratio control and current limit control of chopper.

Q.8 What are the differences between Series inverter and Parallel inverter?

Q.9 How are inverters classified?

Q.10 Explain 3-d current source inverters.

PART – B

(Analytical/Problem solving questions) [5×8=40]

Attempt any five questions

Q.1 A SCR has a V_g - I_g characteristics given as $V_g = 1.5 + 8\ I_g$. In a certain application, the gate voltage consists of rectangular pulses of 12V and of duration 50μs with duty cycle 0.2 –

(i) Find the value of R_g series resistor in gate circuit to limit the Peak Power dissipation in the gate to 5W.

(ii) Calculate the average power dissipation in the gate.

Q.2 A full wave full converter is having RE load (R = 100Ω, E = 50V). Determine the current through 100Ω load, if the thyristors are triggered at 30°. The converter is connected to a 20V 50Hz source.

Q.3 A Chopper circuit is operating on TRC principle at a frequency of 1 kHz on a 220V d.c supply. If the load voltage is 180V, calculate the conducting and blocking period of thyristor in each cycle.

Q.4 A buck boost converter is operated from a 24V battery and supplies an average load current of 2A. Its switching frequency is 50 kHz. Neglecting diode and switch drop, determine:

(i) Range of duty – cycle variation required to maintain the output voltage at 15V given that the battery voltage ranges from 26V in the fully charged state to 21V in the discharged state.

(ii) The Peak to Peak Choke ripple current for the nominal supply voltage given that the choke value is 500μH.

Q.5 The single phase half bridge inverter has a resistive load of 10Ω and the center tap dc input voltage is 96V. Compute-

(i) RMS value of the output voltage.

(ii) Fundamental component of the output voltage waveform.

(iii) First five harmonics of the output voltage waveform.

(iv) Fundamental Power consumed by the load.

(v) RMS Power consumed by the load.

Q.6 Design a single phase parallel inverter to feed a load at 220V, 50Hz and Peak load current is 2A.

V_{dc} = 40V, Specify the ratings of commutating component.

Q.7 For a three phase bridge inverter operating in 120° conduction mode, determine:

(i) dc voltage for a fundamental line voltage of 415V

(ii) rms line and phase voltage

(iii) Device voltage rating

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[4×15=60]**

Attempt any four questions

Q.1 (a) Explain the working of SCR on the basis of two transistor analogy.

(b) In brief explain turn – on and turn – off switching characteristics of IGBT.

Q.2 A three phase bridge rectifier using diodes, delivers power to a load of R = 10Ω at a dc voltage of 400V. Determine the ratings of the diodes and of the three phase delta – star transformer when TUF = 0.9541.

Q.3 (a) With the help of circuit diagram, explain the working of Step up / Step down Chopper.

(b) Enumerate the merits and demerits of load commutated chopper.