

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.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  $V_a - I_g$  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  $50\mu s$  with duty cycle 0.2 –

[ersahilkagyan.com](http://ersahilkagyan.com)

- (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 RL load ( $R = 100\Omega$ ,  $E = 50V$ ). Determine the current through  $100\Omega$  load, if the thyristors are triggered at  $30^\circ$ . 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  $500\mu H$ .

Q.5 The single phase half bridge inverter has a resistive load of  $10\Omega$  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  $120^\circ$  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  $R = 10\Omega$  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.