Roll No. [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ] Total No. of Pages : 03

Total No. of Questions : 09

B.Tech.(EE/EEE) (Sem.–5th)

POWER ELECTRONICS

Subject Code : EE-309

Paper ID : [A0417]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.

SECTION-A

1. **Answer briefly :**

(a) Give two functional differences between full wave RC firing circuit and UJT firing circuit. Sketch the circuit schematic for both the firing circuits.

(b) An SCR during its turn-on has the following data:

Anode Voltage	600V	0V
Anode Current	0A	100A

During the turn-on time of 5 μsec, the anode current and anode voltage vary linearly. If the triggering frequency is 100Hz, find the average power loss in the thyristor.

(c) Three series connected SCRs provided with static and dynamic equalizing circuits have to withstand an off-state voltage of 8KV. The static equalizing resistance is 8KΩ and dynamic equalizing circuit has R_C = 40Ω & C = 0.06μF. These three SCRs have leakage currents of 25mA, 23mA and 22mA respectively. Determine voltage across each SCR in the off-state and the discharge current of each capacitor at the time of turn-on.

(d) What is the need for controlling the voltage an inverter?

(e) A separately excited DC motor fed from a develops full load torque at 1500 rpm when armature takes 50A at 400V DC and has an of 0.5 ohms. Calculate the supply voltage firing angles required to give speeds betwe at full load torque.

(f) What is the effect of source-inductance on phase full converter?

(g) What are the causes of failure of line commu

(h) Sketch circuit symbol of TRIAC and DIAC features and one application in each case.

(i) Sketch output voltage waveform of single pha of step up cyclo-converter with frequency ra

(j) Define forward break-over voltage and peak i to SCR.

SECTION-B

2. A purely resistive load of 20 ohms is connect pulse controlled converter. Converter is operate connected to 400V, 50 Hz AC source. If it average output voltage of 50% of the maximu determine:

(a) mode of current conduction and firing angle

(b) average and rms value of output current

(c) average and rms value of thyristor current

(d) rectification ratio

(e) input power factor.

3. Discuss the working of load commutated inverter

How can a step up chopper be used for DC motors?

5. A voltage commutated chopper has the follo I_{cp} = 1.8 times the load current, main SCR turn-o safety = 2 and load current = 180A. Determine t inductor and capacitor, maximum capacitor volta current.

6. A three phase voltage source bridge inverter is feeding star connected balanced resistive load. Sketch the waveforms for line output voltage, output phase and line current, source current. Also derive the expression for rms value of load voltage, rms value of fundamental component of load voltage. Assume each device conducts for 180°.

SECTION-C

7. In a single phase to single phase cyclo-converter the input voltage is 192V, 50Hz. The load resistance is 2 ohms and load inductance is 20mH. The frequency of the output voltage is 1/3 of supply frequency. And firing angle delay is 120°. Find

   (a) rms output voltage.

   (b) rms value of thyristor current.

   (c) input power factor.

   (d) Sketch the output voltage waveform.

8. (a) Show that the output voltage for single pulse modulated inverter is expressed

$$v_0 = \sum_{n=1,3,5...}^{\alpha} \frac{4V_S}{n\pi} \sin\frac{n\pi}{2} \sin nd \sin n\omega t$$

   where 2d is pulse width and Vs is dc supply voltage and n is order of harmonic.

   (b) For type A chopper connected to RLE load, derive the expression for minimum and maximum values of load current in terms of source voltage, load resistance R and E etc. And show that maximum value of ripple current is inversely proportional to chopping frequency and circuit inductance.

9. (a) Describe the working of single phase dual converter with appropriate waveforms. Derive expressions for the average output voltage and the circulating current.

   (b) A single phase dual converter is fed from 230V, 50 Hz source. The load is R= 30 ohm and current limiting reactor has L = 0.05H. For firing angle of 30°, calculate peak value of circulating current and peak value of currents in both the converters.