Please check that this question paper contains 9 questions and 2 printed pages within first ten minutes.

[Total No. of Questions: 09]   [Total No. of Pages: ....]

Uni. Roll No. ....

Program/ Course: B.Tech./EE   **EVENING**
Semester: 4th
Name of Subject: Power Electronics   **27 JUN 2022**
Subject Code: PCEE-107
Paper ID: 16188

Time Allowed: 3 Hours   **Max. Marks: 60**

NOTE:
1. Parts A and B are compulsory
2. Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3. Any missing data may be assumed appropriately

Section – A   [Marks: 02 each]

1.
   a. Define Latching and holding currents.
   b. List the Industrial applications of choppers
   c. Give at least five applications of phase-controlled rectifiers.
   d. What are the two main types of inverters? Distinguish between them explicitly.
   e. What are the benefits of using freewheeling diode in phase-controlled rectifiers?
   f. What are the disadvantages of the harmonics present in the inverter system?

Section – B   [Marks: 04 each]

2. Describe the need of commutation in thyristor circuits. What are the different methods of commutation scheme? Discuss class B-commutation with help of neat clean circuit diagram as well as waveform.

3. Discuss the principle of operation of DC-DC step up chopper with suitable waveform. Derive an expression for its average DC output voltage.

4. Sketch the diagram and output voltage waveform of a single-phase half bridge Voltage Source Inverter with R load and describe the working.

5. Explain the operation of 1-phase to 1-phase, step down cyclo-converter with power circuit and waveforms.

6. If the half wave-controlled rectifier has a purely resistive load of R and the delay angle is $\alpha = \pi/3$. Determine:

      (A) Rectification Efficiency   (B) Form Factor
      (C) Ripple Factor   (D) Peak Inverse Voltage.

7. A d.c. chopper circuit connected to a 100 V d.c. source supplies an inductive load having 40 mH in series with a resistance of 5 ohm. A freewheeling diode is placed across the load. The load current varies between the limits of 10 A and 12 A. Determine the time ratio of the chopper.

Section – C
[Marks: 12 each]

8. Sketch switching or dynamic characteristics of a thyristor during its turn-on and turn-off processes. Show the variation of voltage across the thyristor and current through it during these two dynamic processes. Indicate clearly the various intervals into which turn-on and turn-off times can be subdivided. Briefly discuss the nature of these curves.

OR

For a SCR the gate cathode characteristics is given by a straight line with a gradient of 16 Volts/Amperes passing through the origin. The maximum turn on time is 4 microsecond and minimum gate current required to obtain this quick turn on is 500 mA. If the gate source voltage is 15 V.

a) Calculate the resistance to be connected in series with SCR gate.

b) Compute the gate power dissipation, given that pulse width is equal to the turn on time and average gate power dissipation is 0.3 W. Also compute the maximum triggering frequency that will be possible when pulse firing is used.

9. Describe McMurray inverter with appropriate voltage and current waveforms. Also explain its modes of operation.

OR

A Step-down DC chopper has a resistive load of a R=15 ohm and input voltage E_{dc}= 200 V. When the chopper remains ON, its voltage drop is 2.5 V. The chopper frequency is 1 kHz. If the duty cycle is 50%, determine:

a) Average output voltage.

b) RMS output voltage.

c) Chopper efficiency.

d) Effective input resistance of chopper.

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