B.E. Electrical (Electronics & Power) Engineering (Model Curriculum) Semester - VI
TE206 - Power Electronics

P. Pages : 2

Time : Three Hours

GUG/S/23/13880

Max. Marks : 80

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Notes :
1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
6. Discuss the reaction, mechanism wherever necessary.
7. Answer **any five** questions as per internal given choice.
8. Use of non-programmable calculator is permitted.

1. a) With the help of a neat diagram, explain the two transistor analogy of an SCR. **8**

b) With the help of neat diagram, explain the operation of resistance firing circuit. Also, draw and explain the associated waveforms. Also, for the same circuit, show that firing angle delay is proportional to the variable resistance. **8**

OR

2. a) Explain with the help of a circuit diagram, how Diac is used as a triggering agent for a Triac. **8**

b) Compare SCR, Power BJT, MOSFET and IGBT on the basis of following parameters: **8**
i) Operating frequency ii) Trigger circuit
iii) Drop iv) Snubbers
v) V-I rating vi) Applications

3. a) Derive an expression for the **8**
i) Average load voltage ii) Average load current
iii) RMS load voltage
For single-phase half-controlled converter with resistive load and inductive load

b) Explain the operation of three-phase fully-controlled bridge converter with resistive load. Describe in detail the following modes of operation with associated waveforms- **8**
i) Discontinuous conduction mode ii) Continuous conduction mode

OR

4. a) Explain the operation of single-phase, half-controlled bridge-converter with resistive load and inductive load with the associated waveforms. **8**
Derive the expression for average load voltage, average load current and RMS load voltage.

b) A three phase full-wave converter is operated from a 3-phase Y-connected 208V/50 Hz supply and the load resistance is R=10W. If it is required to obtain an average output voltage of 50% of the maximum possible output voltage, determine: **8**
a) Firing angle a b) Rms and average output currents
c) Average and rms thyristor currents d) Rectification efficiency
e) Transformer utilization factor, and f) Input power-factor (PF)

5. a) With the help of a neat circuit diagram and waveforms, explain the operation of 3-phase bridge inverter with R load. **8**

b) What is the need for controlling the output at the output terminals of an inverter? Discuss briefly and compare the various methods employed for the control of output voltage of inverters. **8**

OR

6. a) Compare between voltage source and current-source inverters. **8**

b) A single-phase half-bridge inverter may be connected to a load consisting of (i) R (ii) RL, and RLC overdamped (iii) RLC underdamped. For all these loads, draw the load voltage and load current waveforms under-steady-state operating conditions. Also, indicate the conduction of the various elements of the inverter-circuit. **8**

7. a) Draw the schematics of step-up chopper. Explain its working and derive an expression for output voltage in terms of duty-cycle for a step-up chopper. **8**

b) A chopper circuit is operating on TRC principle at a frequency of 1 kHz on a 220 V d.c. supply. If the load voltage is 180V, calculate the conducting and blocking period of thyristor in each cycle. **8**

OR

8. a) Draw the schematic of class E chopper and explain the working of the same. **8**

b) A step-down dc chopper has a resistive load of R =15 ohm and input voltage Edc=200V. When the chopper remains ON, its voltage drop is 2.5V. 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
8

9. a) What do you mean by Snubber circuit? Draw and explain the function of each component. **8**

b) What is the necessity of connecting SCRs in parallel? What are the problems associated with parallel connection of SCRs? How are they eliminated? **8**

OR

10. a) What are the different methods of triggering SCRs in series? Draw and explain sequential firing circuit for triggering of series connected SCRs. **8**

b) The voltage and current rating in a particular circuit are 3 kV and 750A. SCRs with a rating of 800V and 175A are available. The recommended minimum derating factor is 15 per cent. Calculate the number of series and parallel units required. Also, obtain the required values of R and C to be used in the static and dynamic equalizing circuits if the maximum forward leakage current for the SCRs is 10mA and $\Delta Q = 20mC$. **8**

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