

B.E. Sixth Semester (Electro. & Power. Elect. & Power, Electrical Engg.) (CGS)

10563 : Power Electronics : 6 EP 03 / 6 EL 03 / 6 EE 02

P. Pages : 2

Time : Three Hours



AU - 2756

Max. Marks : 80

- Notes :
1. Due credit will be given to neatness and adequate dimensions.
 2. Assume suitable data wherever necessary.
 3. Diagrams and chemical equations should be given wherever necessary.
 4. Illustrate your answer necessary with the help of neat sketches.
 5. Use of pen Blue/Black ink/refill only for writing the answer book.

1. a) Explain steady state characteristics of power BJT. 7
- b) Explain the methods of turning on the SCR. 7

OR

2. a) What is GTO? Draw its V – I characteristics and explain its construction. Also explain the term 'Black porch current'. 7
- b) Explain the construction and V – I characteristics of DIAC. Explain how DIAC is used to trigger TRIAC. 7
3. a) What is the necessity of connecting SCRs in series? What are the problems associated with series connection of SCRs? How are they eliminated? 7
- b) Explain derating factor. Calculate the number of thyristors to be connected in series and parallel, each with rating of 500V, 75A for total voltage and current rating of 7.5kV and 1000A. Assume derating factor of 14%. 6

OR

4. a) What do you mean by thermal runaway problem? How to overcome this problem in parallel connected SCRs? 7
- b) A 100A SCR is used in parallel with a 200A SCR. Their ON-state drops are 2V and 1.4V resp. Calculate the value of resistance to be connected in series with each SCR if the two SCRs have to share the total load of 250A in proportion to their ratings. 6
5. a) Explain working of single phase dual converter in circulating and non-circulating modes. Differentiate between the two modes. 7
- b) A half controlled single phase bridge is supplied at 230V. Determine the mean load voltage at firing angle of 90° , assuming SCR and diode voltage drops of 1.4V and 0.6V respectively. 6

OR

6. a) Explain with the help of associated waveforms half controlled bridge rectifier with 7
- i) Resistive load
- ii) R-L load.

- b) A single phase fully controlled rectifier supplies an inductive load. Assuming load current is 10A constant, determine the following quantities, if supply voltage is 230V, 50Hz and firing angle is 40° . 6
- i) Average output voltage of rectifier
 - ii) RMS current of load.
 - iii) Supply fundamental RMS current.
7. a) Explain with waveforms, principle of operation of three phase bridge inverter in 180° . 7
- b) Determine commutating components L and C for series inverter operating in frequency range 1kHz to 5kHz. The load resistance may vary from 25Ω to 100Ω . The peak load current is limited to 3A. Supply voltage is 100V. 7

OR

8. a) Explain the operation of single phase transistorized bridge inverter with the help of load voltage and load current waveforms. 7
- b) Obtain the value of commutating components L and C of parallel inverter for an output voltage of 230V, 50Hz and peak load current 1A. The dc input voltage is 30V. Assume turn off time of SCR is $40\mu\text{sec}$. 7
9. a) With the help of diagram explain operation of step up chopper. Prove that output voltage of step up chopper is twice to that of the applied input voltage. 7
- b) With the help of diagram explain operation of AC chopper circuit. Discuss its advantages over AC regulators. 6

OR

10. a) Explain the operating mode of DC chopper employing switch parallel scheme of commutation. Draw the voltage and current waveforms. 7
- b) Explain the operation of a cycloconverter for generating output frequency of $1/3$ of input frequency. 6
11. a) Draw fan speed regulator circuit using DIAC and TRIAC. Also draw the waveforms across fan and TRIAC for minimum speed. 7
- b) Explain the slip power recovery scheme. 6

OR

12. a) With the help of suitable diagram explain speed control of DC shunt motor using asymmetrical half controlled bridge converter. 7
- b) A DC shunt motor operated from single phase half controlled bridge at speed of 1450 rpm has input voltage $330 \sin(314t)$ and back emf 75V. The SCRs are fired symmetrically at $\alpha = \pi/4$ in every half cycle and armature has resistance of 5Ω . Neglecting the armature inductance, calculate average armature current and compute the torque. 6
