

B.E. / B.Tech. Electrical (Electronics & Power) Engineering (Model Curriculum) Semester-VI
TE206 / POWER1 - Power Electronics

P. Pages : 2

Time : Three Hours



GUG/S/25/13880

Max. Marks : 80

- 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. Use of slide rule, Logarithmic tables is permitted.
 5. Non programmable calculator is permitted.

1. a) Explain the following terms with reference to SCR: 8
- i) Forward break over voltage ii) Holding current
- iii) Reverse break down voltage iv) Gate trigger current
- b) Explain with the help of a circuit diagram, how Diac is used as a triggering agent for a Triac. 8

OR

2. a) With the help of a neat diagram, explain the two-transistor analogy of an SCR. 8
- b) Explain MOSFET with reference to construction, characteristic, rating and applications. 8
3. a) A single-phase converter employs two SCR and centre tapped transformer with turn ratio 2:1. The load is inductive ($R = 10\Omega$ and $L = 1\text{mH}$) and delay angle is 40° . Determine the average load voltage and average load current. Supply voltage is 230V at 50Hz. The load current can be assumed to be ripple free. 8
- b) A 230V, 50Hz, one pulse SCR controlled converter is triggered at a firing angle of 40° and the load current extinguishes at an angle of 210° . Find the circuit turn off time, average output voltage and average load current for $L = 2\text{mH}$ and $R = 5\Omega$. 8

OR

4. a) Explain with the help of neat power-diagram and associated waveforms, the operation of a single-phase half-wave-controlled converters with- 8
- i) Resistive load
- ii) Inductive load
- b) Explain the operation of single-phase, half-controlled bridge-converter with resistive load and inductive load with the associated waveforms. Derive the expression for average load voltage, average load current and RMS load voltage. 8
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) A parallel inverter is operating with a resistive load. The commutating components are $C = 2.5\mu\text{F}$, $L = 200\text{mH}$, DC supply voltage is 180V and SCR turn off time is $20\mu\text{ sec}$. Assuming unity turns ratio. Find-
- Load current
 - Whether SCRs will be commutated successfully or not.

OR

6. a) Explain the operation of 3-phase bridge inverter in 120° conduction mode. Draw output phase and line voltage waveforms. 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
7. a) Draw and explain the operation of a class - D chopper. 8
- b) A single-phase bridge type cycloconverter has input voltage of 230V, 50Hz and load of $R = 10\Omega$ output frequency is one-third of input frequency for firing angle delay of 30° , Calculate
- rms value of output voltage
 - rms current of each converter
 - rms current of each thyristor
 - input power factor

OR

8. a) Draw the circuit diagram of Jones chopper. Explain its operation with the relevant waveforms of the voltages and currents. Also explain the process of commutation of the main thyristor. Assume the load as the dc series motor. 8
- b) Explain the working of a four-quadrant chopper with RL Load connected to it. 8
9. a) Draw complete protection scheme for a power semiconductor device and explain the use of each and every component. 8
- b) What are the different methods of triggering SCRs in series? Draw and explain sequential firing circuit for triggering of series connected SCRs. 8

OR

10. 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
