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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. 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) What is IGBT? What are the advantages of IGBT over power BJT and power MOSFET? 8
- b) With the help of a neat diagram, explain the two-transistor analogy for an SCR. 8
3. a) Describe the operation of single-phase one-pulse SCR controlled converter with RLE load through the wave-form of supply voltage, load voltage, load current and voltage across the SCR. 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) Define the following terms- 8
- i) Transformers utilization factor ii) Displacement factor
- iii) Harmonic factor iv) Fundamental power factor

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- 8
- i) Load current
- ii) 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 – E chopper. 8
- b) A dc battery is charged from a constant dc source of 200V through a chopper. The dc battery is charged from its internal emf of 90V to 122V. The battery has internal resistance of 1Ω . For a constant charging current of 10A, compute the range of duty cycle. 8

OR

8. a) Describe the basic principle of working of single-phase-to-single-phase step down cycloconverter with the help of mid-point and bridge-type configurations. 8
- b) Draw the schematics of step-down chopper. Explain its working and derive an expression for output voltage in terms of duty-cycle for a step-down chopper. 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) It is required to operate 250A SCR with their respective on state voltage drops of 1.6V and 1.2V. Calculate the value of resistance to be inserted in series with each SCR so that they share the total load of 600A in proportion to their current rating. 8
