

(3 Hours)

[Total Marks : 100

- N. B. :** (1) Question No. 1 is **compulsory**.
(2) Attempt any **four** questions from remaining **six** questions.
(3) **Figures** to the **right** indicate **full** marks.
(4) Assume **suitable** data, if **any**.

1. Attempt the following :— 20
- (a) Explain briefly, the 'SOA' rating of the Power Transistors.
- (b) Explain the importance of $\frac{dv}{dt}$ and $\frac{di}{dt}$ rating along with proper protection circuit in case of SCR.
- (c) State the conditions for getting inversion mode operation in case of line commutated converters.
- (d) Explain the need of commutation in thyristor circuits. What is voltage commutation and current commutation ?
2. (a) Explain with neat circuit diagram and associated waveforms the operation of single phase semiconverter with RL load. Derive the expression for average load voltage, average load current and RMS load voltage. 10
- (b) Explain with neat diagram the full wave A.C. phase control using Triac and Diac. Draw waveforms. 10
3. (a) A 3 phase half wave controlled rectifier is operated on a 3 phase A.C. supply with an RMS phase voltage of 230 volts and $f = 50$ Hz. The load resistance $R = 10 \Omega$. For an average output voltage of 40% of the maximum possible output voltage, Calculate :— 10
- (i) Delay angle α
- (ii) RMS and average load currents
- (iii) RMS and average thyristor currents.
- (b) Explain UJT triggering circuit for triggering of 2 SCR's used in full wave controlled rectifier with proper isolation. What is the need of synchronization circuit ? 10
4. (a) Explain with neat circuit diagram the operation of static D.C. circuit breaker. 10
- (b) For a single phase fully controlled bridge rectifier, derive the expression for the following performance factors :— 10
- (i) D.C. Voltage ratio
- (ii) Current distortion factor
- (iii) Harmonic factor
- (iv) Input displacement factor
- (v) Voltage ripple factor.

[TURN OVER

5. (a) Explain the operation of 3 phase fully controlled rectifier with resistive load. Draw the various waveforms for $\alpha = 30^\circ$. 10
- (b) Explain latchup in IGBT. How does latchup take place and how to avoid it ? 10
6. (a) Explain with neat diagram and associated waveforms the operation of auxiliary voltage commutation. 10
- (b) What is half waving effect in case of single phase half wave controlled rectifier with RL load ? 5
- (c) A half wave controlled rectifier is connected to a 120 V source. Calculate the firing angle necessary to deliver 150 W of power to a 10Ω load. 5
7. Write short notes on :— 20
- (a) Soft start method
- (b) Dynamic (Turn ON and Turn OFF) Characteristics of SCR
- (c) Types of cooling of a power semiconductor device.
-