

- (2) Attempt any 10 questions.
 (3) **Figures to the right** indicate **full marks**.
 (4) Assume **suitable data** if **required**.
 (5) Illustrate answers with sketches wherever **required**.

1. Explain in brief the following :— 20
- What is latching current, holding current, forward breakover voltage, reverse breakover voltage of a thyristor.
 - State the conditions for getting inversion mode of operation in case of line commutated converters.
 - What are different performance parameters for controlled rectifiers ? Explain their significance.
 - Explain the turn "on" and turn "off" characteristics of SCR.
 - Compare BJT, SCR and IGBT.
2. (a) Explain the full wave ac control using Triac and Diac. Draw waveforms. 10
 (b) Draw and explain the working of 3-phase uncontrolled bridge rectifier with purely resistive load and derive the expression for average output voltage and sketch the input and output waveforms with proper sequence of conducting diodes. 10
3. (a) What is effect of source inductance on the output voltage of full wave controlled rectifier. Obtain an expression for the output voltage with the effect of source inductance. 10
 (b) A 1-phase fully controlled rectifier is operated with a resistive load $R = 10 \text{ ohm}$, the input voltage to the bridge is 230 V. Calculate the following : 10
- Average load voltage
 - Runs load voltage
 - Average and runs load current
 - Form factor and ripple factor the firing angle $\alpha = 60^\circ$
4. (a) Explain the operation of Jones Chopper with waveform across load, and capacitor voltage obtain an expression for circuit turn "off" time available so as to select SCRs with proper turn off time ratings. 10
 (b) The commutating components in a Jones Chopper circuit are $C = 30 \text{ microfarad}$, $L_1 = 60 \text{ microhenry}$ and $L_2 = 60 \text{ microhenry}$. If the supply voltage is 220 V. Find the highest permissible turn off time for the main Thyristor. 10
5. (a) Explain with diagram the working of parallel inverter. Explain the need for feedback diodes and pulse train for firing SCR's draw capacitor and load voltage waveforms. 10
 (b) In the basic series inverter circuit if the component values are $L = 40 \text{ } \mu\text{H}$, $C = 5 \text{ } \mu\text{F}$, $R = 4 \text{ } \Omega$. Calculate the maximum frequency of operation if the total "off time" per cycle of inverter output is 100 μs . 10
6. (a) Draw and explain the variable voltage and variable frequency (V/F) method of speed control for 3-phase squirrel cage induction motor. What is the significance of (V/F) ratio control ? 10
 (b) The speed of 10 hp separately excited dc motor is controlled by a single phase full converter the rated armature current is 40 A. $R_a = 0.3 \text{ ohm}$. the ac supply voltage is 260 V. The motor voltage constant is 0.182 V/rpm. While in motoring action with back emf of 192 volts, the polarity of it is reversed for regenerative action. Calculate (i) Firing angle to keep the motor current at its rated value. (ii) The power feedback to the supply. 10
7. Write short notes on any **three** of the following :— 20
- Ramp and pedestal scheme for triggering SCR circuits.
 - Commutation circuits of SCR
 - IR compensation
 - Cooling methods of power semiconductor devices.