

(3 Hours)

[Total Marks: 80]

**N.B.:** (1) Question No. 1 is **compulsory**.(2) Answer any **three** from the remaining **five** questions.(3) **Assume** suitable **data** if necessary and justify the same.(4) **Figures** to the **right** indicate the marks.

1. (a) State and explain the application of controlled rectifier and Inverter. [5]  
 (b) Once SCR is triggered gate loses its control. Why? [5]  
 (c) Explain the principal of operation of power IGBT. [5]  
 (d) Write short note on protection of SCR. [5]
2. (a) Define and explain any two-commutation circuit along with the difference between them. [10]  
 (b) Explain the constructional detail of MOSFET with equivalent circuit and discuss its characteristics. [10]
3. (a) Draw a neat circuit and explain the working of full wave fully controlled 3-phase bridge circuit with resistive load. Draw the corresponding input and output voltage waveforms. Also obtain the expression for output voltage. [10]  
 (b) Explain 1-phase semi controlled rectifier with RL load with and without freewheeling diode. [10]
4. (a) Explain with circuit diagram and waveforms 3 phase bridge inverter for 180° conduction mode. [10]  
 (b) Discuss the different method of Harmonic reduction. [10]
5. (a) Explain with a neat circuit diagram and relevant waveforms the working of BUCK-BOOST regulator and derive the expression for output voltage filter capacitance and filter inductance. [10]  
 (b) A BUCK- Converter has an input voltage of  $E_{dc}=14V$ . The required average output voltage is  $E_o=6V$  and the peak to peak output ripple voltage is 15mV. The switching frequency is 30kHz. If the peak to peak ripple current of inductor is limited to 0.6 A. Determine: (a) the duty cycle  $\alpha$ , (b) the filter inductance L, and (c) the filter capacitor C. [10]
6. (a) Explain in detail with circuit diagram and waveforms, single phase step up cycloconverter. [10]  
 (b) Explain single phase bidirectional AC voltage controller with R-L load. [10]