(3 Hours)   **[Total Marks: 80]**

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

Q1. All the questions carry equal marks. Answer any four.   **[20M]**

   (a) Explain the gate protection circuit of SCR.
   (b) Explain the operation of MOSFET with a neat structural diagram.
   (c) Explain the inverting mode of a converter.
   (d) Give comparison between VSI and CSI.
   (e) Draw the circuit diagram of a Buck - Boost converter with the following waveforms (i) inductor voltage and current (ii) capacitor voltage and current and (iii) output current.

Q2. (a) Explain the structure and static characteristics of SCR.   **[10M]**

   (b) Draw a neat circuit and explain the working of three – phase semi converter with R load. Draw the corresponding input and output voltage waveforms when the firing angle is $60°$.   **[10M]**

Q3. (a) Draw the circuit and explain the working of single – phase dual converter with relevant voltage waveforms.   **[10M]**

   (b) Explain three – phase bridge inverter for $180°$ conduction mode with neat circuit diagram and waveforms.   **[10M]**

Q4. (a) Explain the following PWM techniques: (i) Multiple PWM (ii) Sinusoidal PWM .   **[10M]**

   (b) The buck-boost regulator has an input voltage of 14V. The duty cycle is 0.25 and the switching frequency 25 kHz. The inductance value is 160µH and filter capacitance is 200µF. The average load current is 1.25A. Calculate (i) average output voltage (ii) peak to peak output voltage ripple (ΔVc) (iii) peak to peak ripple current of inductor (iv) critical values of L and C.   **[10M]**

Q5. (a) Explain the working of single – phase ac voltage controller (unidirectional and bidirectional) with R load with relevant waveforms.   **[10M]**

   (b) Explain class C and class D commutation techniques of SCR.   **[10M]**

Q6. (a) A single – phase full converter is connected to 230V, 50Hz source, is feeding a load R = 10Ω in series with a large inductance that makes the load current ripple free. For a firing angle of 45° calculate (i) rectification efficiency (ii) form factor (iii) input power factor. **[10M]**

(b) Mention the applications of MOSFET, IGBT and BJT. **[5M]**

(c) Explain the basic working principle of cycloconverter. **[5M]**