



Course Related Program Competencies: A1, B2, B3, C1, C2, and C3.

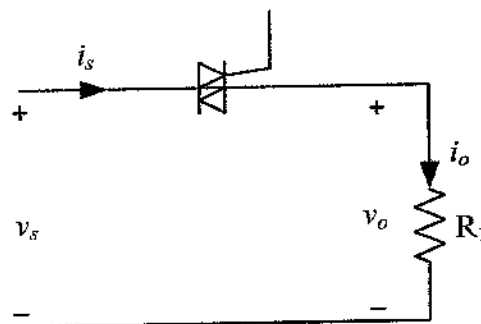
Answer the following THREE questions: In each question, draw the circuit diagram and necessary waveforms and write the necessary equations to clarify your answer

First question: (30 Marks):

(a) Explain the principle of operation Three-phase/three-phase cycloconverter. Discuss the main differences between cycloconverter and the inverter. (10 Marks)

(b) A single phase full wave ac voltage controller shown in the following figure working on ON-OFF control technique has supply voltage of 230V, RMS 50Hz, load = 50Ω. The controller is ON for 40 cycles and OFF for 30 cycles. Calculate:

1- ON & OFF time intervals, 2- RMS output voltage, 3- Input P.F., 4- Average and RMS triac currents, and 5- If the triac is replaced by (4 diodes one thyristor) topology, find Average and RMS thyristor currents (20 Marks)



Second question: (30 Marks):

(a) Analyze the performance of 120 conduction three phase inverter. Describe your answer with the suitable wave forms. (10 Marks)

(b) The single-phase half-bridge inverter in has a resistive load of $R = 2.4 \Omega$ and the dc input voltage is $V_s = 48 \text{ V}$. Determine (a) the rms output voltage at the fundamental frequency V_1 (b) the output power P_o , (c) the average and peak currents of each transistor, (d) the peak reverse blocking voltage V_{BR} of each transistor, (e) the total harmonic distortion THD, (f) the distortion factor DF, and (g) the harmonic factor and distortion factor of the lowest-order harmonic. (20 Marks)

Third question: (30 Marks):

(a) Discuss in detail the five classes of DC choppers and describe their applications. (10 Marks)

(b) A buck regulator has an input voltage of 15 V. The average output voltage 5 V and the average load current 0.5 A. The switching frequency is 25 kHz. If the installed inductor has inductance 150 μH and the installed capacitor has capacitance 220 μF , determine (1) the duty cycle, (2) the ripple current of inductor, (3) the peak current of inductor, and (4) the ripple voltage of filter capacitor. (20 Marks)