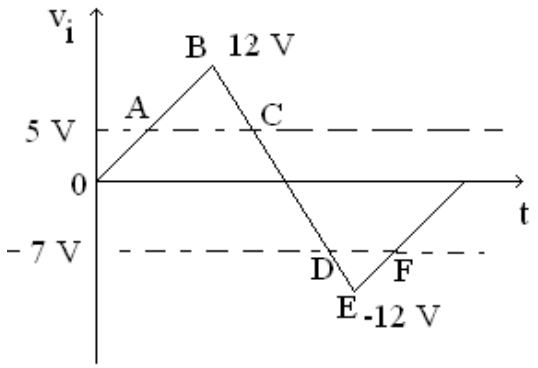
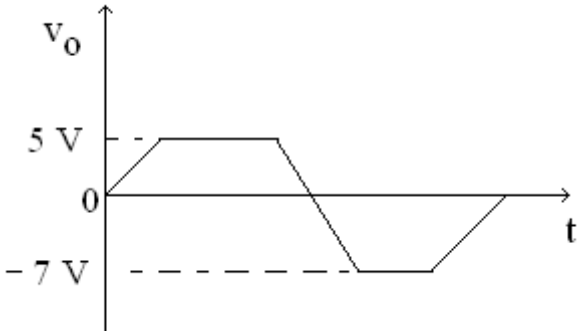
EE101 (BASIC ELECTRONICS)
SOLUTION TO LONG ASSIGNMENT-1

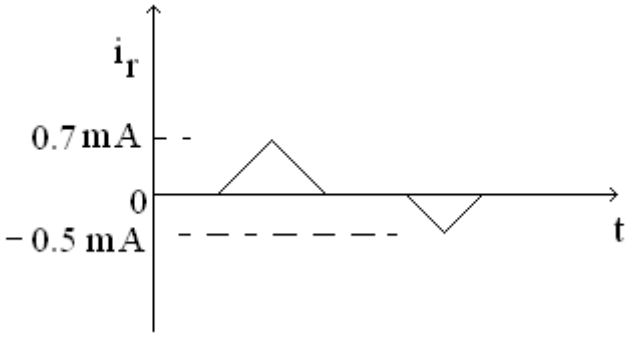
Solution-1: As shown in the figure below, diode D1 conducts during the portion of the input waveform A-B-C [v_i >5V (0.7V+4.3V)] and D2 conducts during the portion of the input waveform D-E-F [v_i <-7V (-(0.7V+6.3V))].



Both the diodes do not conduct during the remaining portions of the input waveform. Whenever both the diodes are OFF, $v_0=v_i$. When D1 is ON, v_o=5V and when D2 is ON, output is v_o=-7V. The output waveform is shown below:

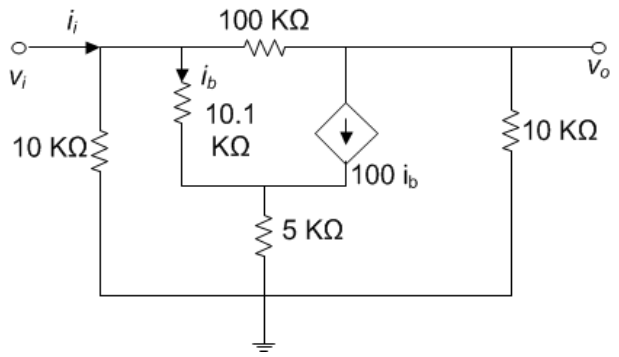


Whenever both the diodes are OFF, there is no current flow through the $10\,\mathrm{k}\Omega$ resistance. Current flows through the resistance when either D1 or D2 is ON. The corresponding current waveform is shown in the figure below.



Solution-2:

(a)



(b) $v_i = 10.1i_b + 101i_b(5) = 515.1i_b$

$$\frac{v_o - v_i}{100} + 100i_b + \frac{v_o}{10} = 0 \qquad 0.11v_o - 0.01v_i + \frac{100}{515.1}v_i = 0$$

$$0.11v_o = -0.184v_i$$

$$Gain = \frac{v_o}{v_i} = -1.674$$

(c) $i_i = \frac{v_i}{10.1} + i_b + \frac{v_i - v_o}{100}$ where $i_b = 0.00194v_i \quad v_o = -1.674v_i$

$$i_i = v_i\left(0.1 + 0.00194 + 0.01 + 0.01674\right) = 0.12868v_i$$

$$Z_i = \frac{v_i}{i_i} = 7.77\ \text{K}\Omega$$

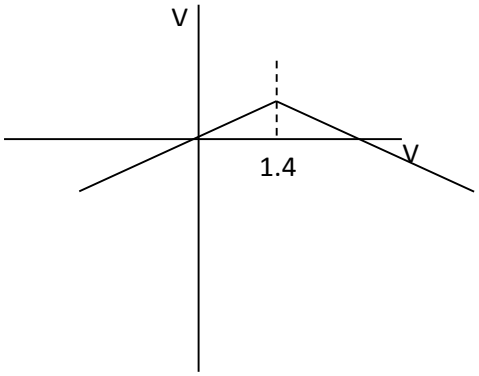
Solution-3: $V_- = V_+ = 0.5V_I$

Diode OFF for $V_I - 0.5V_I < 0.7V$ or $V_I < 1.4V$

Diode ON for $V_I \geq 1.4$ V

When diode is OFF (i.e. for $V_I < 1.4V$) $V_O = 0.5V_I$

When diode is ON (i.e. for $V_I \geq 1.4$ V)



$$\frac{V_I - 0.5V_I - 0.7}{R} = \frac{0.5V_I - V_O}{2R}$$

$$V_I - 1.4 = 0.5V_I - V_O$$

$$V_O = 1.4 - 0.5V_I$$

Solution-4: Loop currents are: i=0.58 A, i1= 6.74 A and i2 = -2.02 A. Voltage across the 40 Ω resistor, V= (0.58+2.02) x 40 = 104 V (Ans)

Solution-5: Vth = 0 V and Rth = - 7.5 Ω

Solution-6: a. 2 A, b. 4 V, c. 0 A/s , d. 20 V/s , e. 0 A, f. 12 V

Solution-7: The source frequency = f = $10^4/(2\pi)$ = 1592 Hz (approx.). For obtaining a maximum output voltage of 100 V, Vs = 5Vo = 500 V (max).

Solution-8: a. 367.8 W, b. 207.8 W, c. 160 W, d. 0 W, e. 0 W