Solve

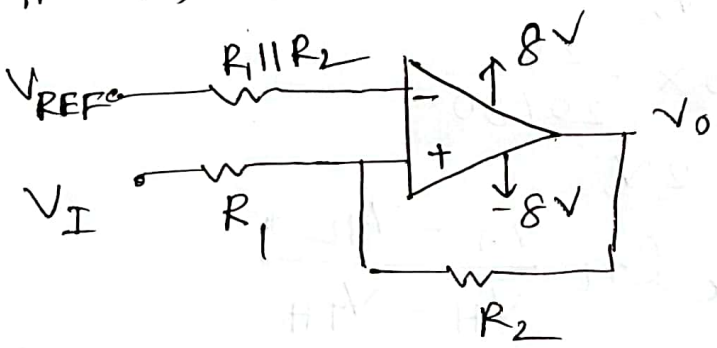
BRAC UNIVERSITY
CSE 350
Quiz-4, Section 13
Fall 2024
Marks: 20

Name: **ID:**

1. Design a Non-inverting Schmitt trigger circuit having a center voltage of 2V and Hysteresis width of 2V. Assume VH = +8V and VL = -8V. Draw the circuit and transfer curve with proper labeling. [10]

$V_S = 2V$, and, $V_{HW} = 2V$

$V_H = +8V$, $V_L = -8$



We know,

$$V_S = \frac{R_1 + R_2}{R_2} V_{REF}, \quad \rightarrow (i) \qquad V_{HW} = 2V_H \frac{R_1}{R_2} \quad \rightarrow (ii)$$

Now, From, (ii),

$$2 = 2 \times 8 \times \frac{R_1}{R_2}$$

$$\frac{R_1}{R_2} = \frac{1}{8}$$

Assuming, $R_2 = 8k\Omega$,

$$\frac{R_1}{8k} = \frac{1}{8} \Rightarrow R_1 = 1k\Omega$$

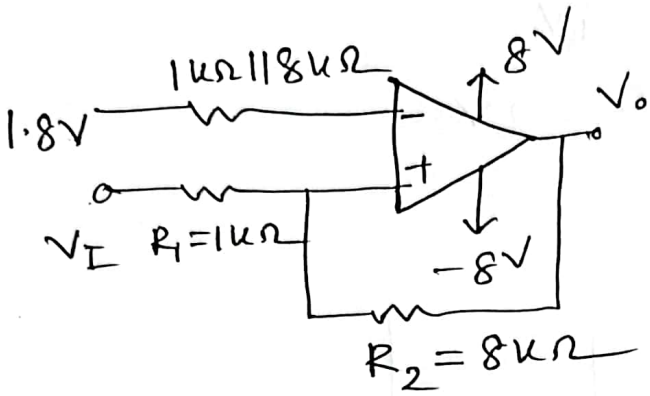
Now, from, Eq (i),

$$2 = \frac{1+8}{8} \times V_{REF}$$

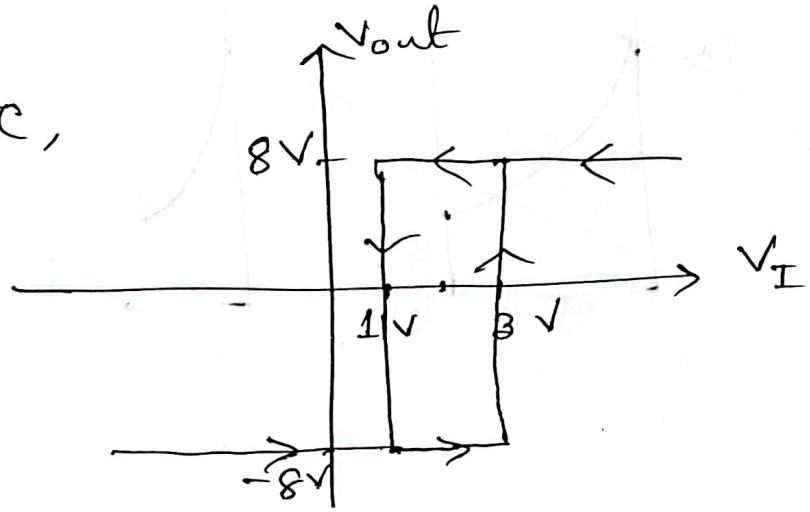
$$\therefore V_{REF} = \frac{16}{9} = 1.8V$$

$V_{TH} = V_S + \frac{V_{HW}}{2} = 3V$, $V_{TL} = V_S - \frac{V_{HW}}{2} = 1V$

circuit,

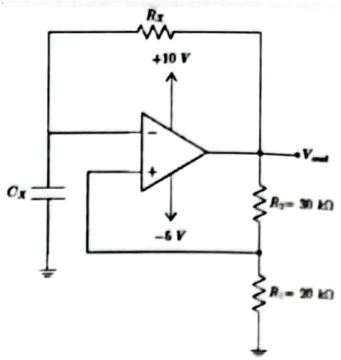


VTC,



2. a) For the given circuit determine the duty cycle. [4]

b) Plot the capacitor voltage (Vx) and output voltage with respect to time on the same graph with proper labeling. [6]



2.a) $R_1 = 20k$, $R_2 = 30k$,

$V_H = 10V$, $V_S = -5V$

$$V_{TH} = 10 \times \frac{20}{20+30}$$

$$= 4V,$$

$$V_{TL} = -5 \times \frac{20}{20+30}$$

$$= -2V,$$

$$T_1 = R_x C_x \ln \frac{V_H - V_{TL}}{V_H - V_{TH}}$$

$$= R_x C_x \ln \frac{10+2}{10-4} = R_x C_x \ln 2$$

$$T_2 = R_x C_x \ln \frac{V_L - V_{TH}}{V_L - V_{TL}}$$

$$= R_x C_x \ln \frac{-5-4}{-5+2} = R_x C_x \ln 3$$

$$DC = \frac{T_1}{T_1 + T_2} \times 100\%$$

$$= \frac{R_x C_x \ln 2}{R_x C_x \ln 2 + R_x C_x \ln 3} \times 100\%$$

$$= 38.7\%$$

2. b) From (a),

$V_H = 10V$, $V_{TH} = 4V$

$V_L = -5V$, $V_{TL} = -2V$