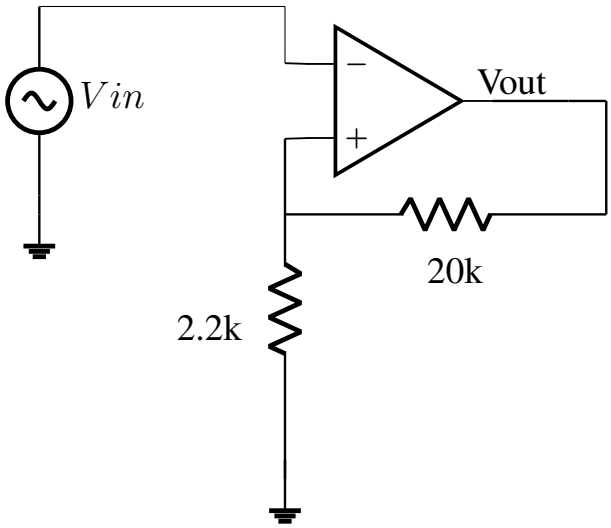
GATE 2022-PH

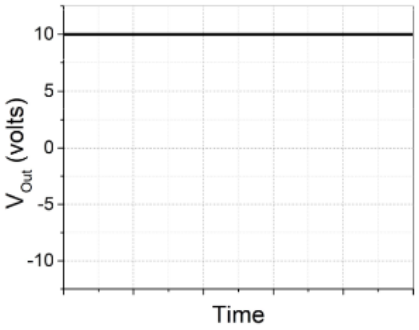
EE23BTECH1205 - Avani Chouhan*

Question : 11

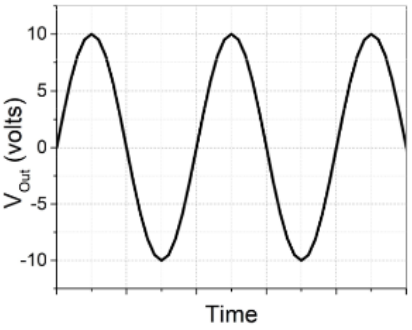
For the Op-Amp circuit shown below, choose the correct output waveform corresponding to the input $V_{\text{in}} = 1.5\sin(20\pi t)$ (in Volts). The saturation voltage for this circuit is $V_{\text{sat}} = \pm 10$ V.



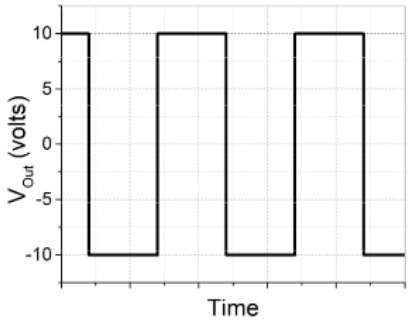
(A)



(B)



(C)



(D)

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Solution:

$$V_{in} = 1.5\sin(20\pi t) \tag{1}$$

$$V_{\text{sat}} = \pm 10\,\text{V} \tag{2}$$

$$I_1 = I_2 \tag{3}$$

$$\frac{0 - V_{\text{in}}}{2.2\,\text{k}\Omega} = \frac{V_{\text{in}} - V_o}{20\,\text{k}\Omega} \tag{4}$$

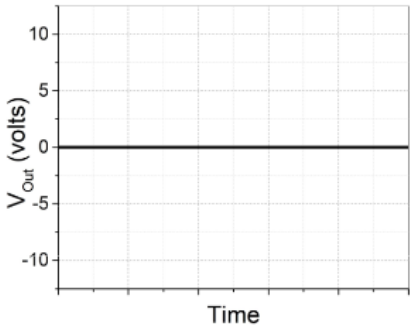
$$\frac{-20}{2.2} = \frac{V_{\text{in}} - V_o}{V_{\text{in}}} \tag{5}$$

$$\frac{-20}{2.2} = 1 - \frac{V_o}{V_{\text{in}}} \tag{6}$$

$$\frac{V_o}{V_{\text{in}}} = 1 + \frac{20}{2.2} \tag{7}$$

$$V_o \sim 10V_{\text{in}} \tag{8}$$

$$V_o = 10 \times 1.5\sin(20\pi t) \tag{9}$$



The Schmitt Trigger circuit has a saturated output, limited between $+V_{\text{sat}}$ and $-V_{\text{sat}}$. The input voltage (V_{in}) increases, exceeding V_{TH}, causing the output to switch to a positive saturation voltage ($+V_{\text{sat}}$). As V_{in} falls below V_{TL}, it returns to a negative saturation voltage.

So, the correct answer is (A).