

05/01/2024

Lab - 1

Page No.:

Date:

YOUVA

Time response of RC

Sol: a) Observations: $t_1 - t_2 = 192 \mu s - 100 \mu s$

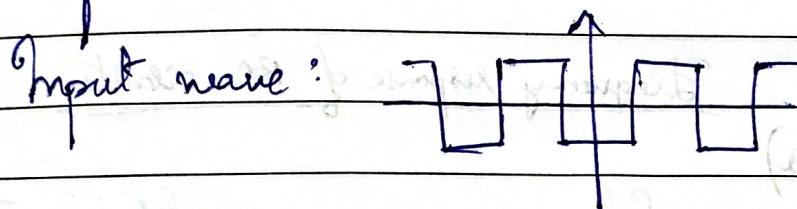
Observed Time constant = ~~$100 \mu s$~~ = $92 \mu s$

Calculated time constant = $(10^3 \Omega) (10^{-7} F)$
= $100 \mu s$.

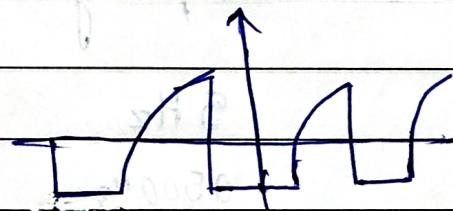
|Error| = $8 \mu s$.

Reason: external noise and mismatch
in resistor value.

Waveforms:

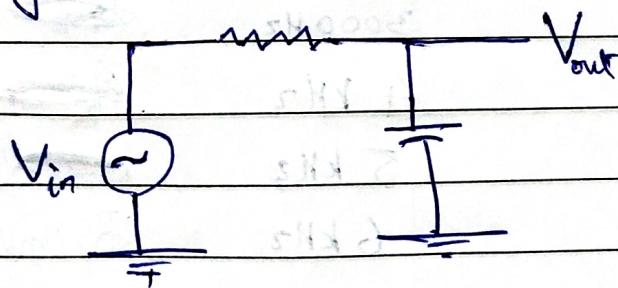


Output wave:



Explanation of op waveform: $V_c = V_o (1 - e^{-t/RC})$

Circuit diagram:



b) Observed bandwidth = $10.85 \text{ kHz} / 2\pi = 1.73 \text{ rad/s}$

Theoretical bandwidth = $10 \text{ kHz} / 2\pi = 1.59 \text{ rad/s}$

|Error| = ~~0.14 rad/s~~ 0.14 rad/s

Reason: External noise and
mismatch in resistor values.

c) Rise time: ~~312 μs~~ 124 μs
Fall time: ~~298 μs~~ 160 μs

Using 'measure' functionality:

Rise time: 122 μs

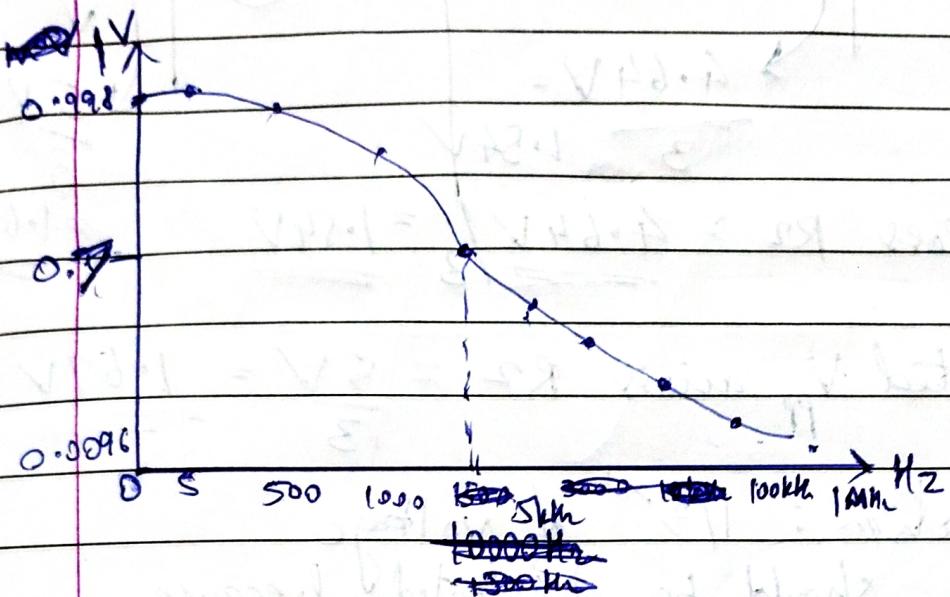
Fall time: 127.8 μs

Frequency response of RC circuits

Sol. 2] a)

Frequency	Amplitude
5 Hz	998 mV
500 Hz	896 mV
1000 Hz	800 mV
1500 Hz	720 mV
2000 Hz	700 714 mV
2500 Hz	680 712 mV
3000 Hz	650 710 mV
4 kHz	620 708 mV
5 kHz	600 706 mV
6 kHz	392 mV
7 kHz	368 mV
8 kHz	344 mV
9 kHz	282 mV
10 kHz	208 mV
100 kHz	40 mV
500 kHz	
1000 kHz	

200 kHz	12.8 mV
400 kHz	10 mV
600 kHz	9.8 mV
800 kHz	9.6 mV
1000 kHz	9.6 mV



b) Bandwidth from Bode-plot $\approx 5 \text{ kHz} / 2\pi = 0.796 \text{ rad/s}$

c) Comparing the two bandwidths calculated,
difference $= 1.73 - 0.796$
 $= 0.934 \text{ rad/s}$.

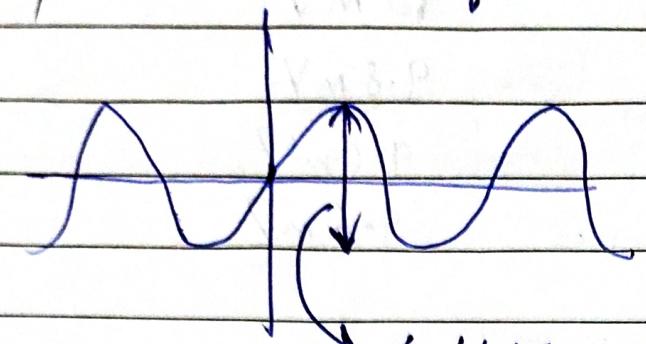
Basics of probing ckt

Sol. 3] a) Measured voltage across R3 = 1 V
Expected " " " = 10 V

b) Measured voltage across R2 = 4 V
Expected " " " = 10 V

c) To probe the ckt correctly,
we will use
digital multimeter.

a) Observed waveform



$$4.64 \text{ V} =$$

$$\frac{1}{3} 1.54 \text{ V}$$

$$V_{pp \text{ across } R_2} = \frac{4.64 \text{ V}}{3} = \underline{\underline{1.54 \text{ V}}} = 1.54 \text{ V}$$

$$\frac{5 \text{ V}}{3}$$

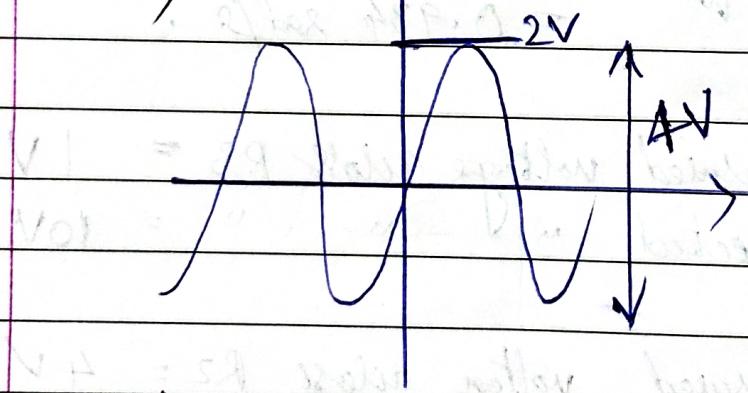
$$\frac{1.67 \text{ V}}{3}$$

$$\text{Expected } V_{pp \text{ across } R_2} = \frac{5 \text{ V}}{3} = \underline{\underline{1.67 \text{ V}}}$$

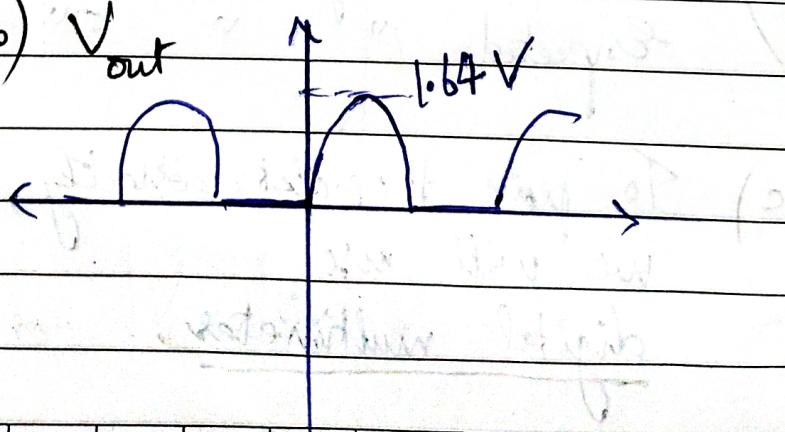
Explanation: $1/3^{\text{rd}}$ of voltage
should be dissipated because
of the voltage divider circuit.

Half-Wave Rectifier

Sol. 4] a) V_i :



b) V_{out}



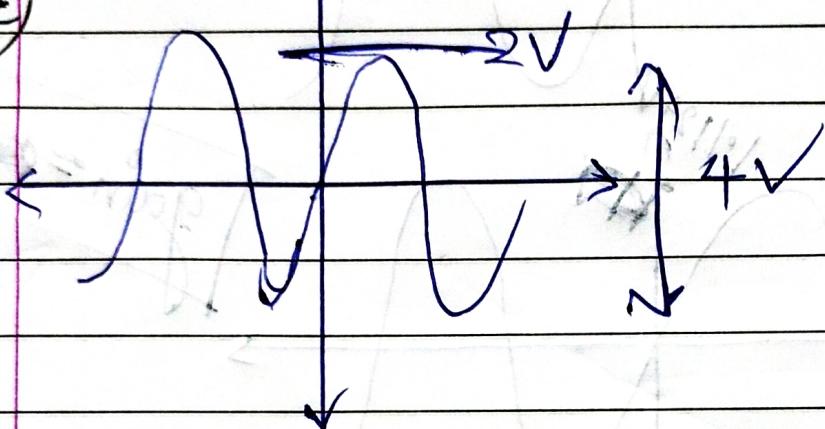
b)

Explanation for reduction in V_{pp} b/w V_i and V_o :

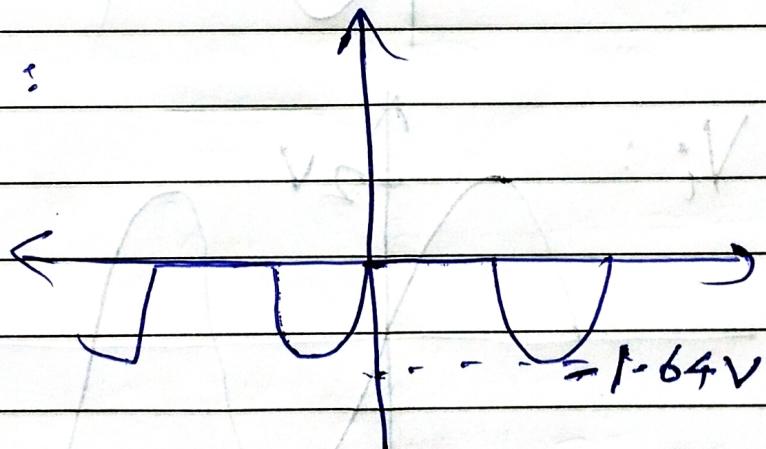
Internal resistance of diode ,

V_i

c)



V_o :

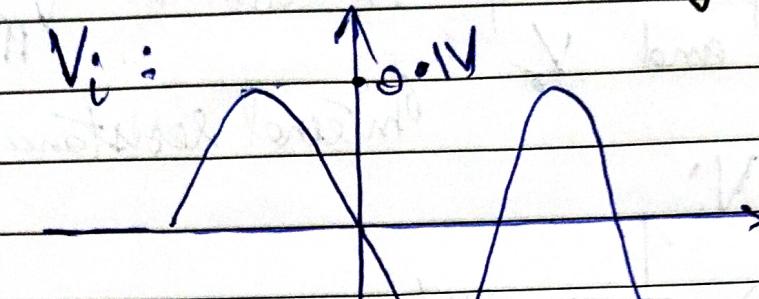


Explanation:

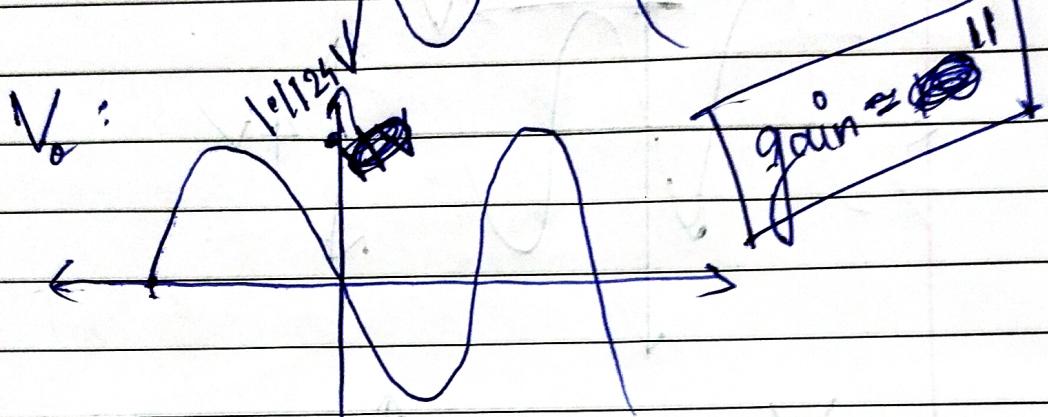
As the polarity of the diode is reversed, for the -ve values of V_i , it gets forward-biased and conducts.

Q1.5] Opamp-based non-inverting amplifier

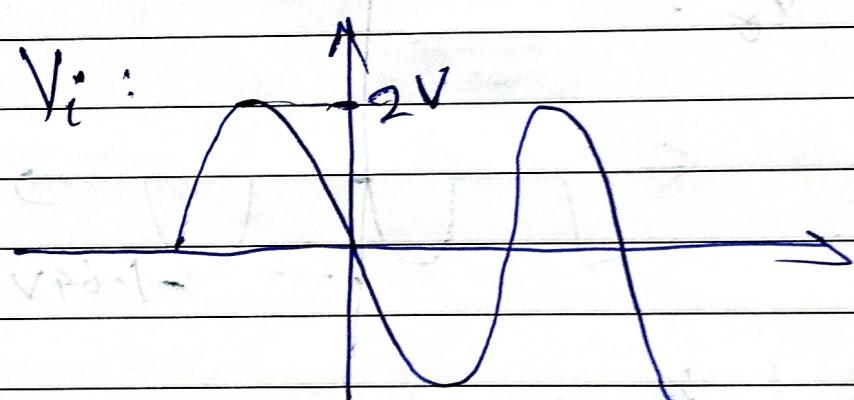
a) $V_i :$



$V_o :$

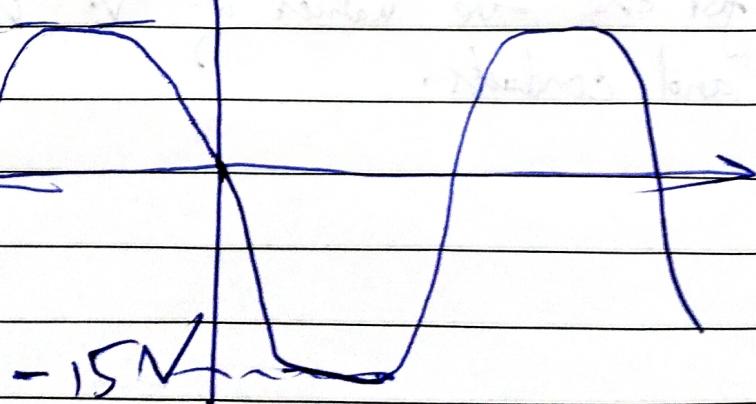


b) $V_i :$



$V_o :$ $V_{out} \propto$

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05/01/24



When $|V_{out}| > 15V$, clipping occurs.