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Aim: Design non inverting buffer, non inverting amplifier, inverting amplifier, non inverting summing amplifier. inverting summing amplifier.

The basic structure

Theory: The basic structure & operation of an op-amp include:

1) Differential amplifier input: The op-amp takes 2 input signals inverting & non inverting. The difference between these inputs is amplified.
2) High gain: Op-amps have a very high open loop gain, meaning even small input differences result in large output voltages.
3) Feed back: Negative feedback is often used to stabilize the op-amp & control its gain.

The ideal op-amp is often assumed to have infinite input impedance, zero output impedance, infinite open loop gain, infinite bandwidth, & 0 offset voltage & current.

Non inverting buffer: This configuration provides unity gain (output voltage equals input voltage). The input signal is connected directly to the non-inverting input & output is taken from pin 6 of the op-amp.

Non inverting amplifier: The input signal is applied to non inverting input & output is amplified without phase inversion. The gain is determined by the ratio of

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feedback resistor to input resistor + 1.

Gain: $1 + \frac{R_f}{R_i}$

Inverting amplifier: The input signal is applied to inverting input through a resistor. The output is amplified & inverted. The gain is the ratio of the feedback resistor to input resistor.

Non inverting summing amplifier: Multiple input signals are applied to the non inverting input through individual resistors. The output is the weighted sum of the input signals with the gain for each determined by the ratio of feedback to input resistors.

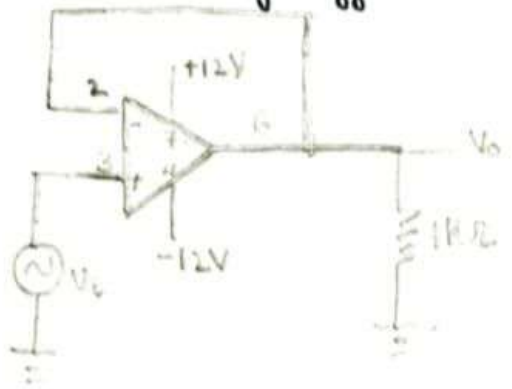
Inverting summing amplifier: Multiple input signals are applied to the inverting input through individual resistors. The output is the negative weighted sum of the input signals.

Procedure:

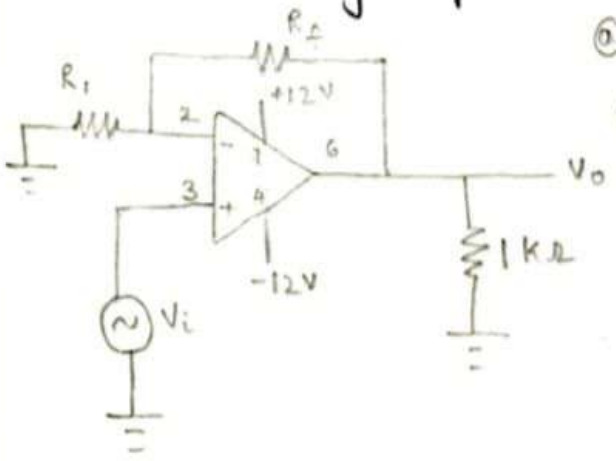
1) Connect & rig up the circuits as shown in the diagrams.
2) Plot output waveforms.

Circuit diagrams.

2a) Non inverting buffer



2b) Non inverting amplifier:

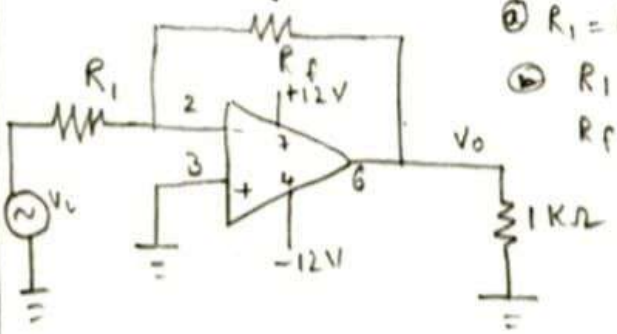


(a) $R_1 = R_f = 2.2K\Omega$

(b) $R_1 = 2.2K\Omega$

$R_f = 4.7K\Omega$

2c) Inverting amplifier:

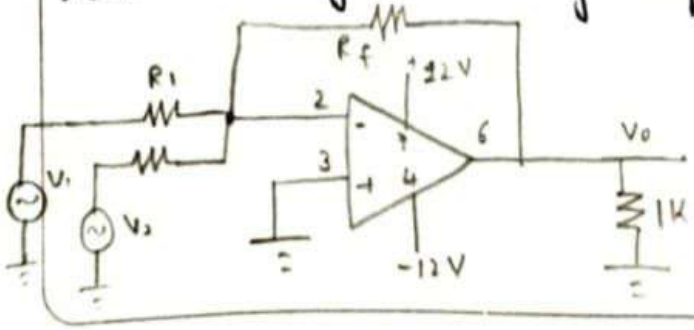


(a) $R_1 = R_f = 2.2K\Omega$

(b) $R_1 = 2.2K\Omega$

$R_f = 10K\Omega$.

2d) Inverting summing amplifier:



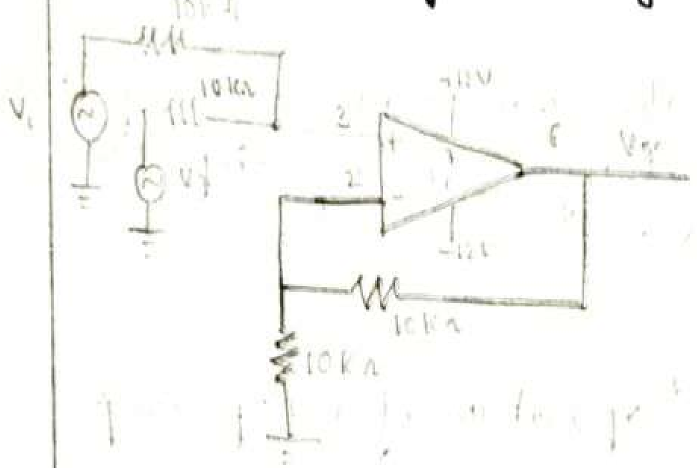
$R_1 = R_2 = R_f = 10K\Omega$

(a) Apply same i/p [sine wave]

(b) One i/p A.C

One i/p D.C

2e) Non inverting summing amplifier:

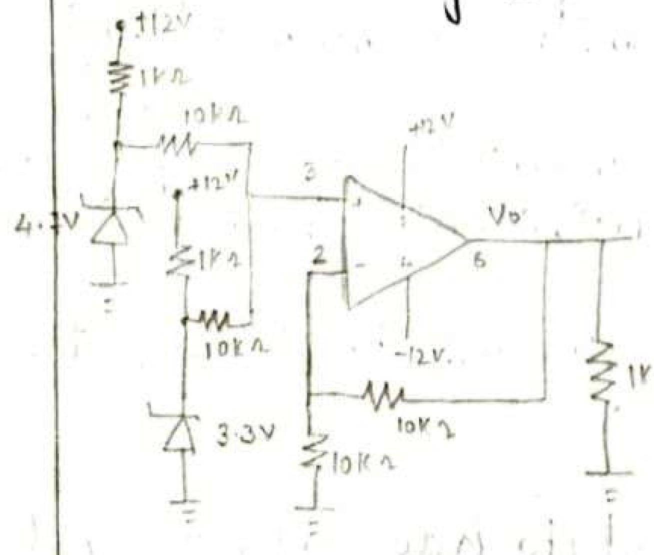


ⓐ Apply same inputs [Sine wave]

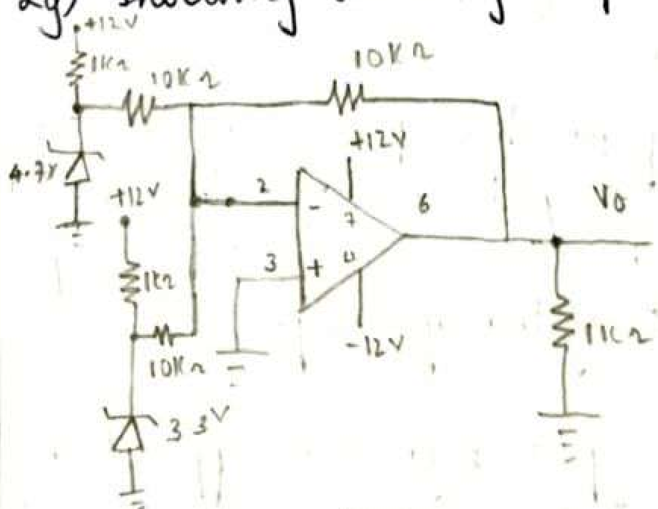
ⓑ One i/p A.C

One i/p D.C

2f) Non inverting summing amplifier using zener diode.

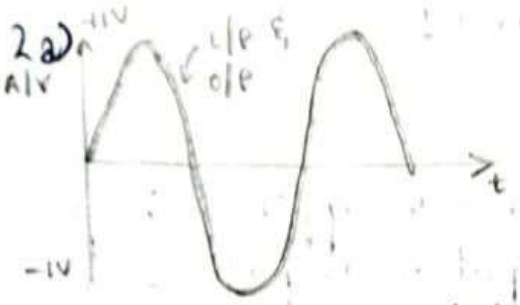


2g) Inverting summing amplifier using zener diode

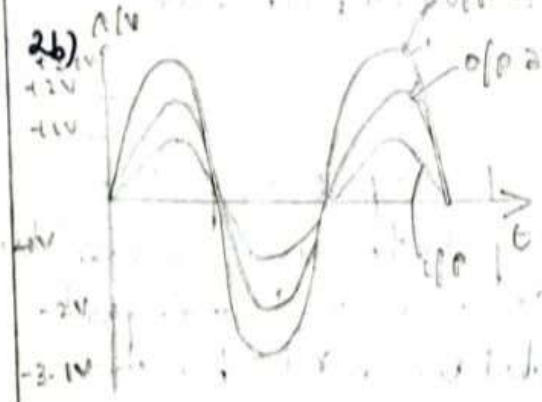


Output waveforms:

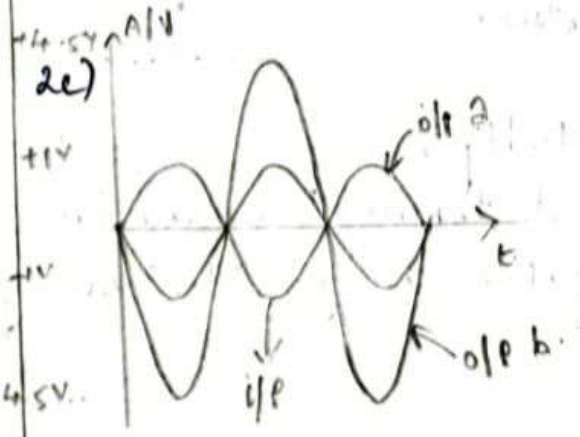
2a)



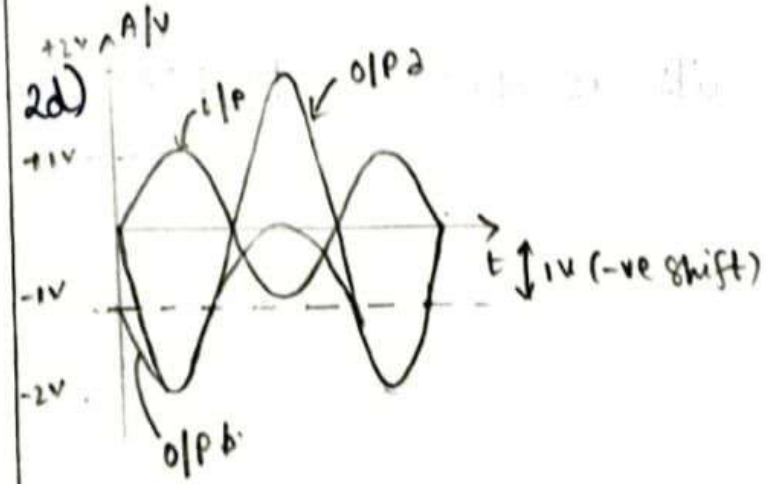
2b)



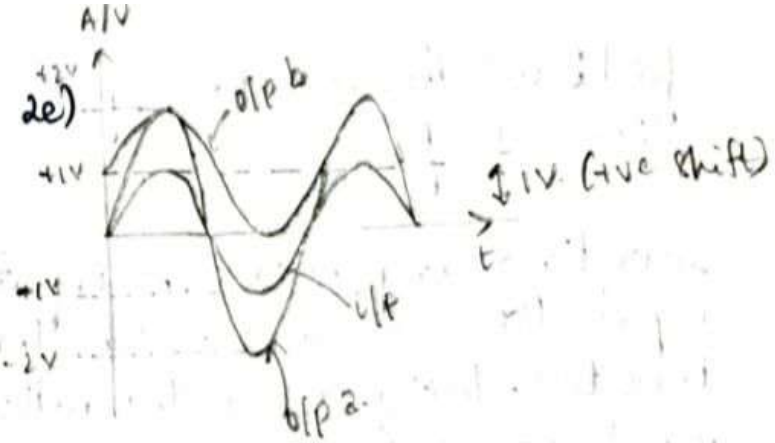
2c)



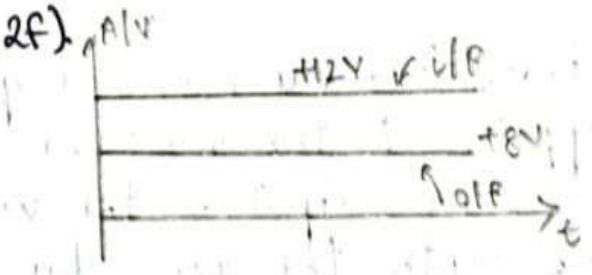
2d)



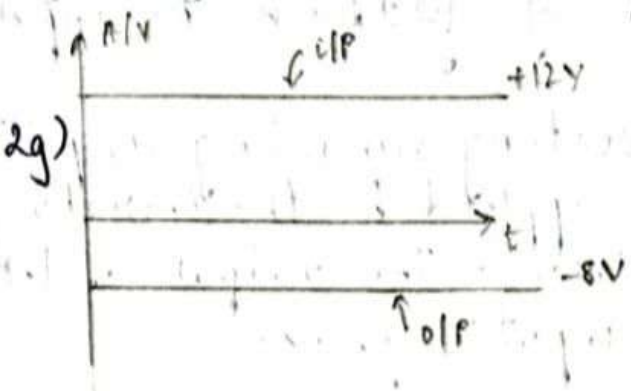
2e)



2f)



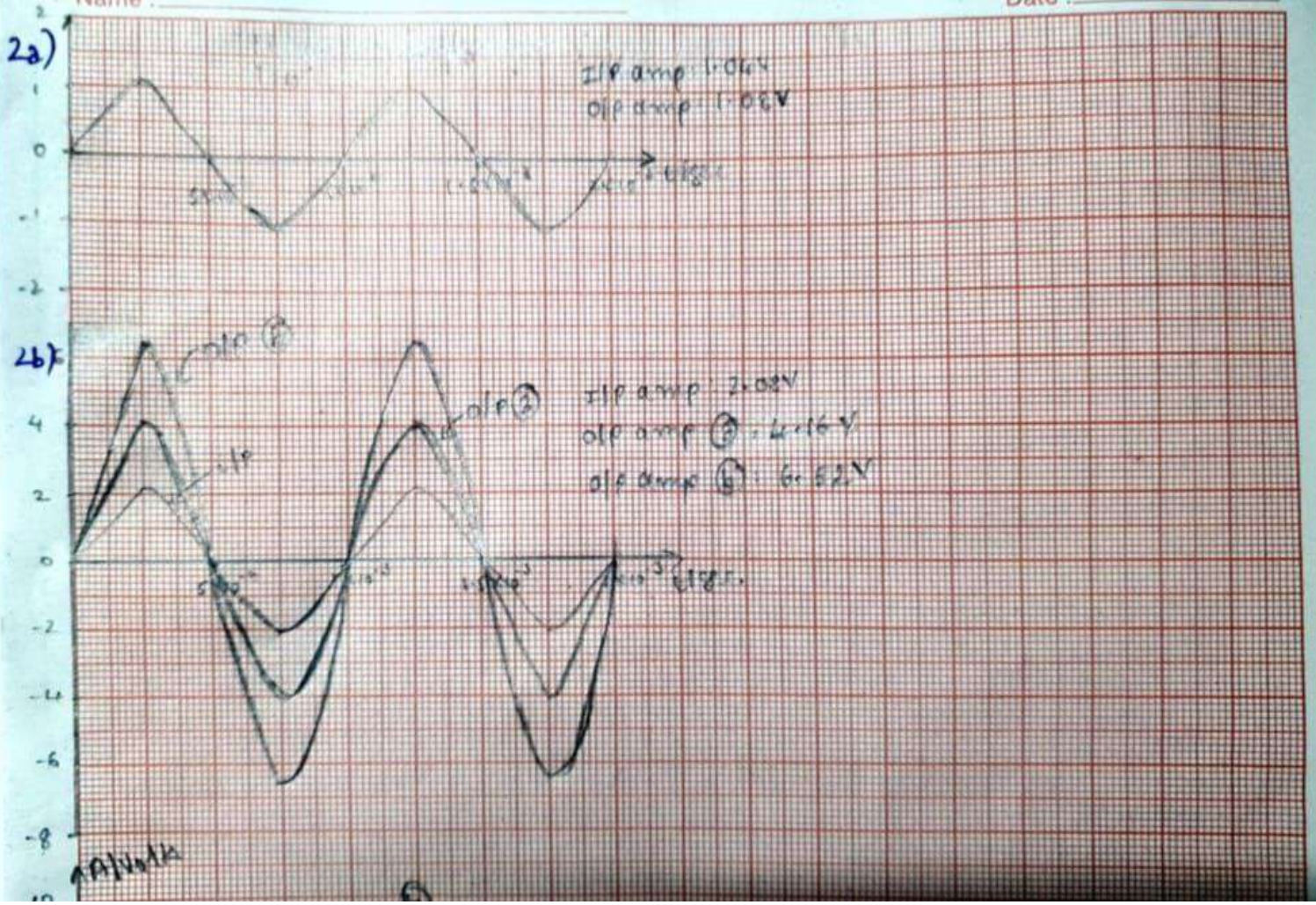
2g)



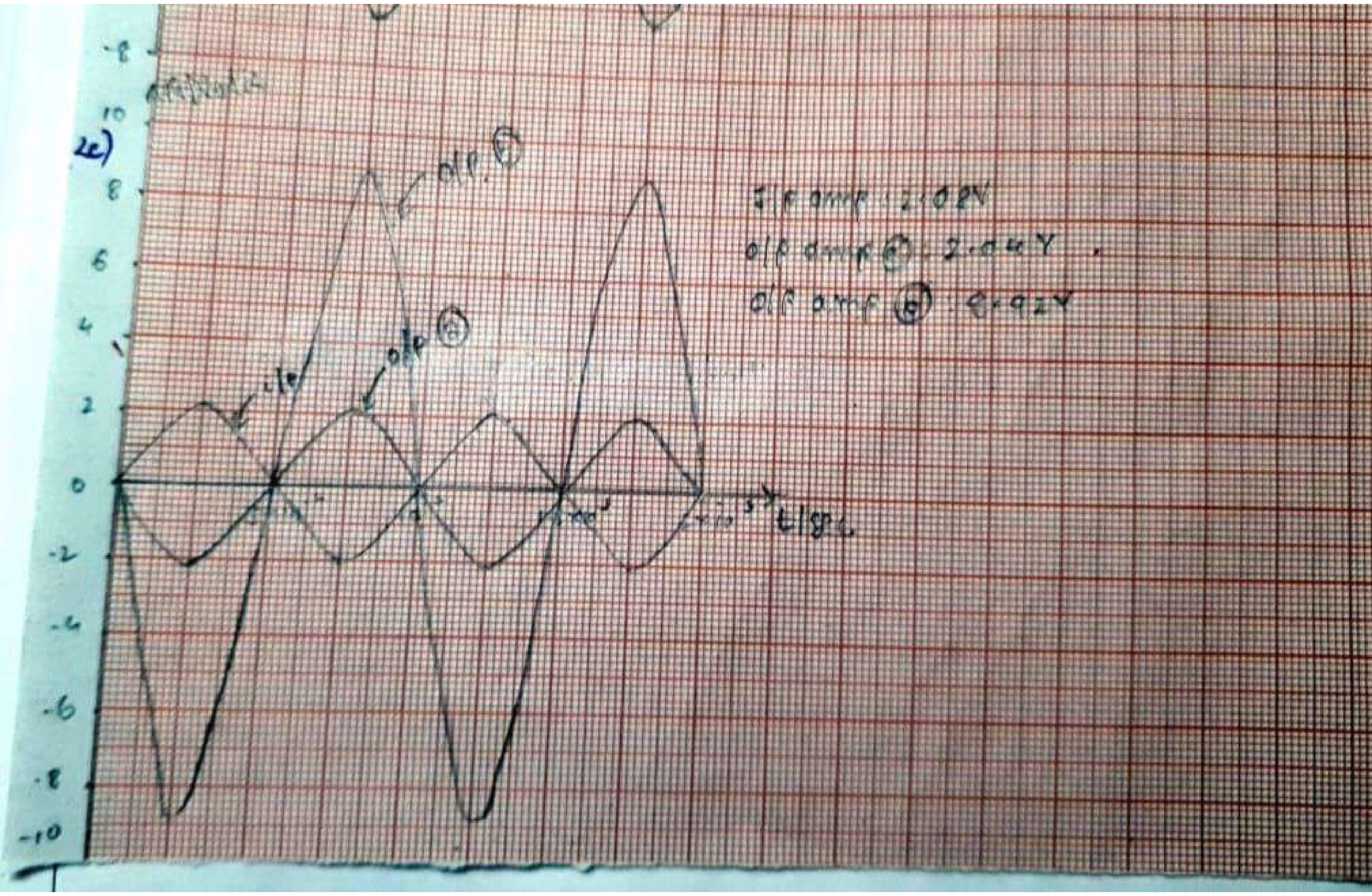
Time period: 10^{-3} sec. Frequency: 1KHz.

Name: Date:

2a)



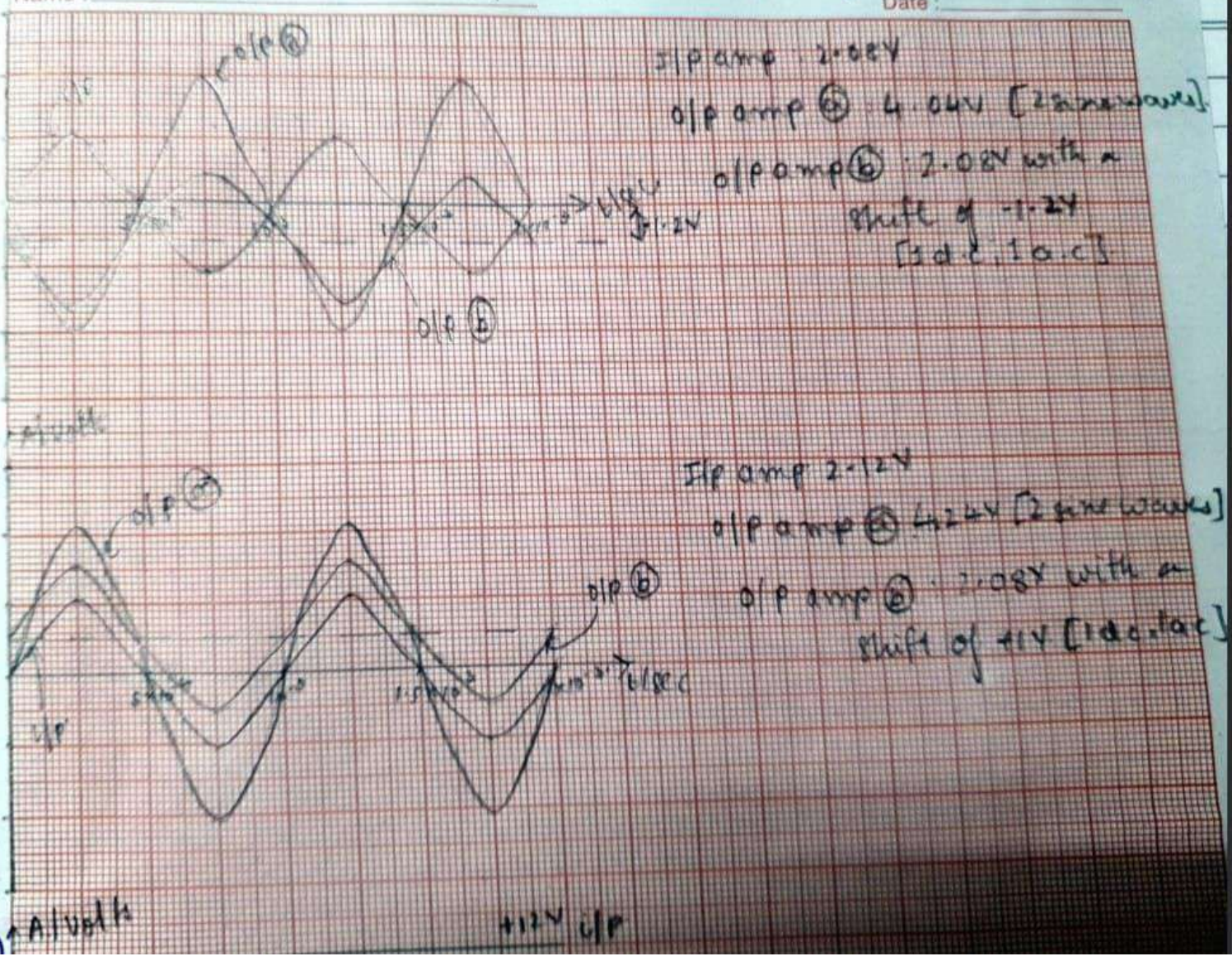
2b)



2c)
o/p (a)
o/p (b)
i/p
t/sec

Time Period: 10^{-3} sec Frequency: 1KHz

Name : Date :



i/p amp : 2.08V

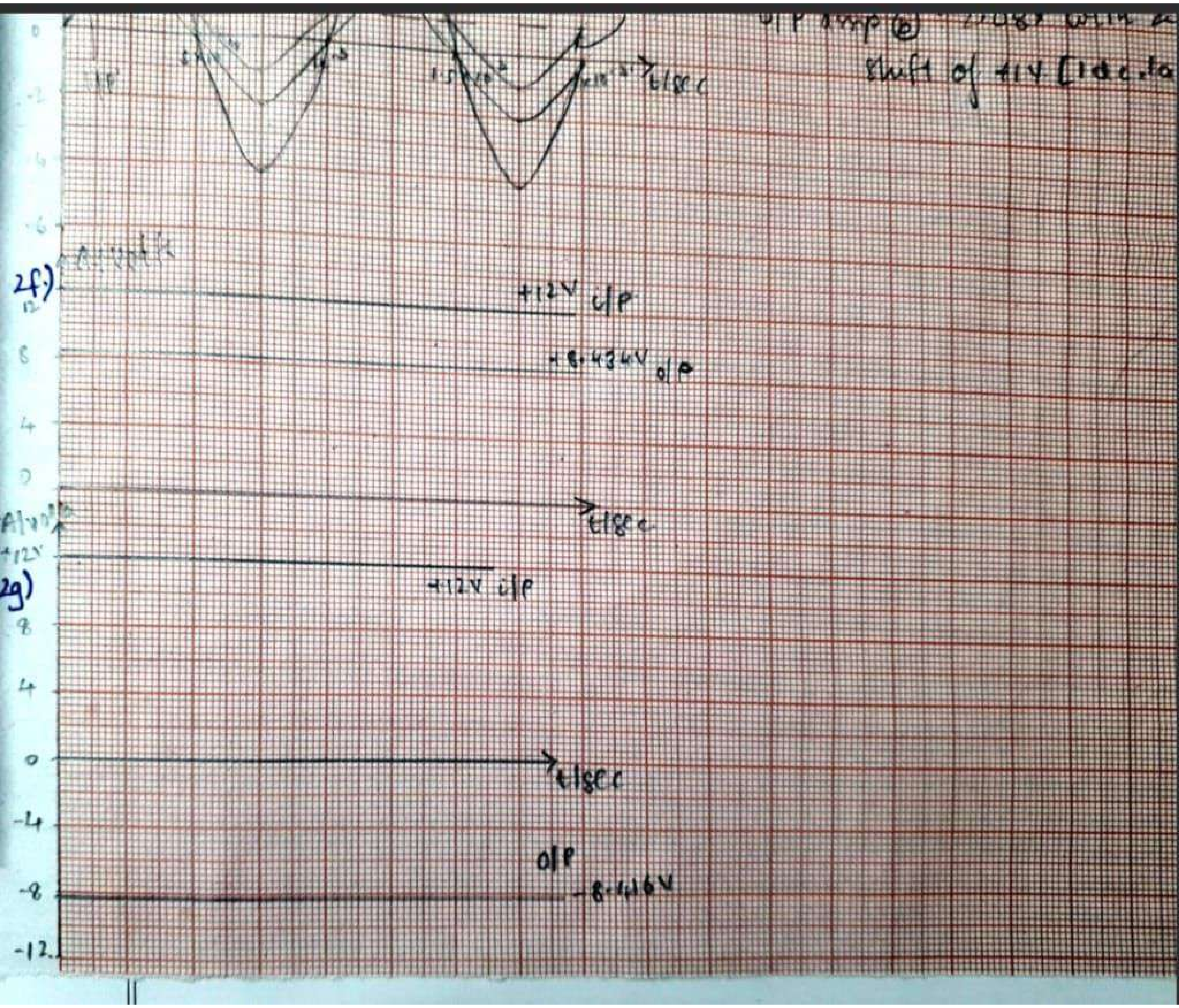
o/p amp ⓐ : 4.04V [2 sine waves]

o/p amp ⓑ : 2.08V with a shift of -1.2V [1 d.c, 1 a.c]

I/p amp 2.12V

o/p amp ⓐ 4.24V [2 sine waves]

o/p amp ⓔ : 2.08V with a shift of +1V [1 d.c, 1 a.c]



shift of +1V (d.c.
t/sec
2f)
+12V i/p
+8.434V o/p
t/sec
+12V
2g)
+12V i/p
t/sec
o/p
-8.416V