THE UNIVERSITY OF TEXAS AT ARLINGTON

COMPUTER SCIENCE AND ENGINEERIG

LABORATORY 3 REPORT

ELECTRONICS LABORATORY

Submitted toward the partial completion of the requirements for CSE 3323-002

Submitted by,

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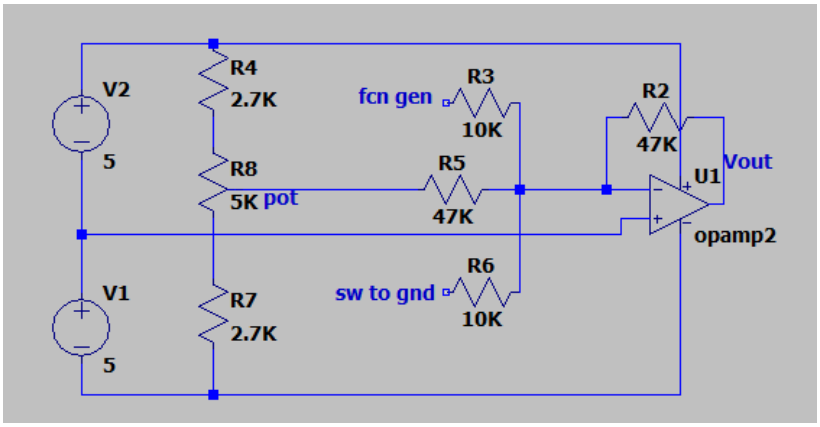
Lab 3: Inverting Summer & Difference Amps

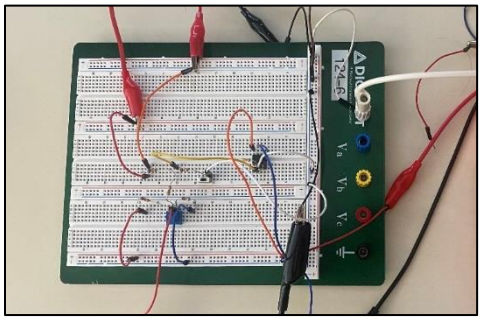
Part 1:

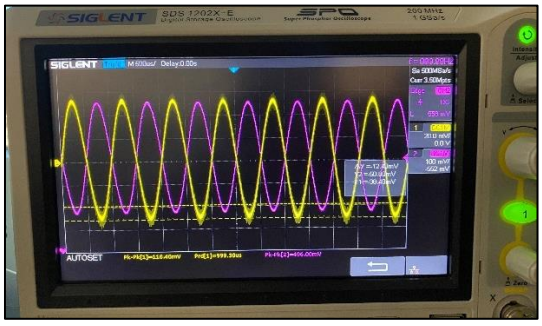
Inverting Summer

Circuit Diagram:



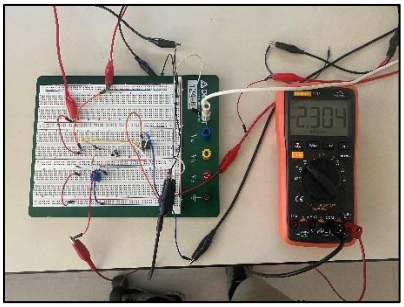
Built Circuit & Output:

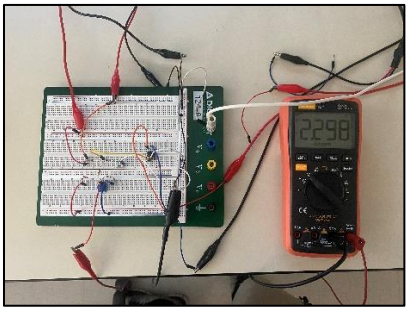




Findings:

1)



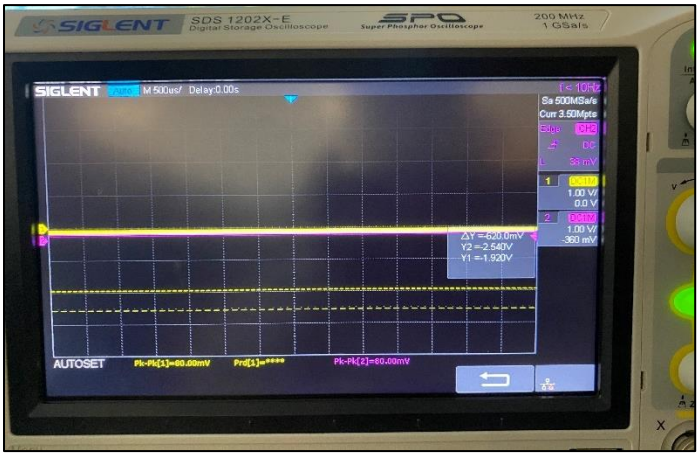


2) Verify small signal gain is -5 for the fcn gen input:

Vo/Vin = 520mV/110mV = -4.7 ~ -5

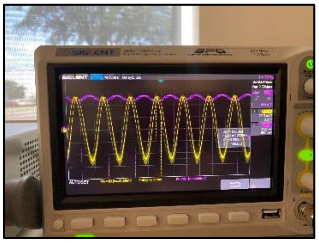
3) Verify small signal gain is -1 for pot input:

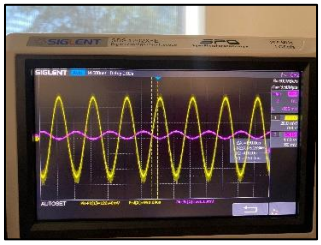
Vo/Vpot_out = 0.0112/-0.011 = -1

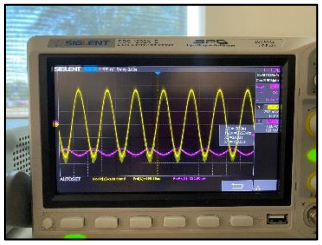


4) Verify that pot output *offsets* the function generator output at op amp output. With function generator set as in step 2, adjust the pot to low, near center, and high outputs.

Low Center High

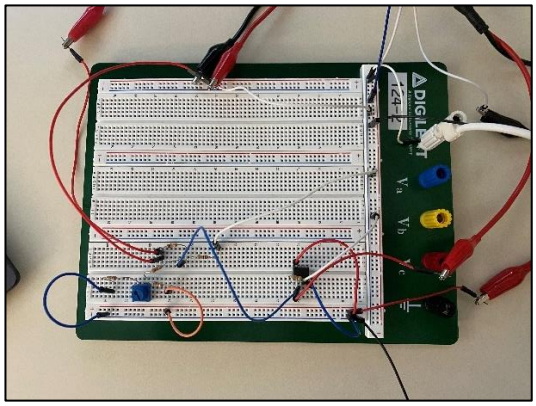


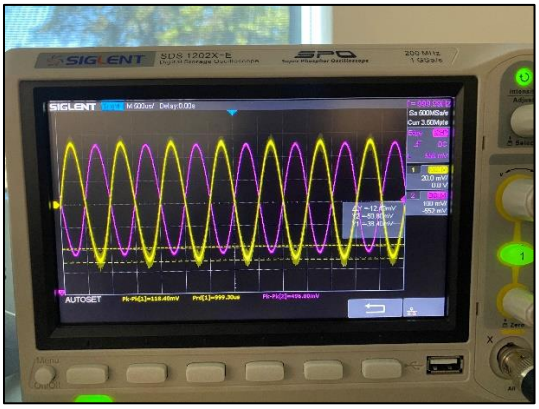




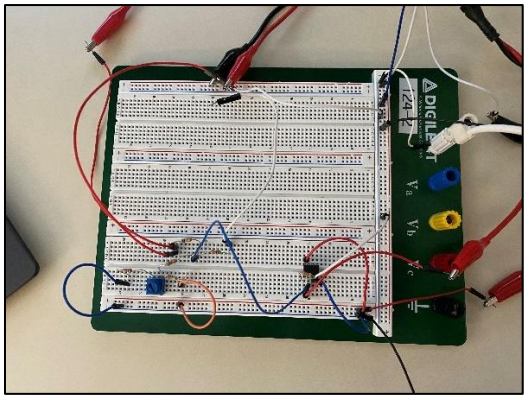
5) Verify that connecting 3rd input to ground (vs open ckt) does not significantly affect gains for other two inputs at low frequency (say 1 KHz).

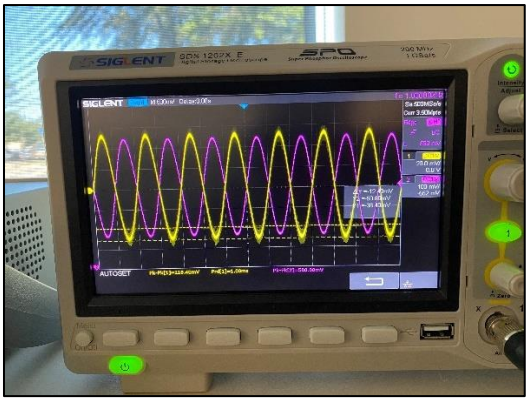
Connected to Ground





Open



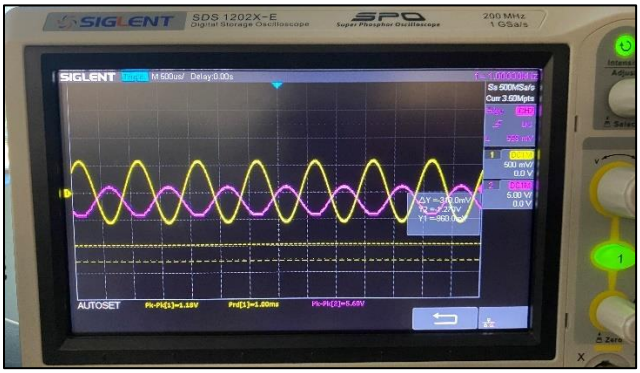


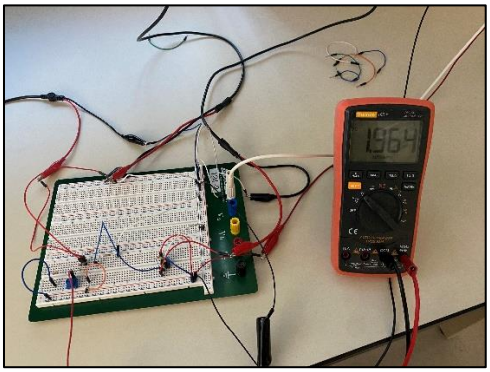
6) How much peak-to-peak output swing do you see at the onset of clipping?

8.6 V

Now offset the output +2V by adjusting the pot. Now how much pk-pk swing can you get at clip onset?

5.6V

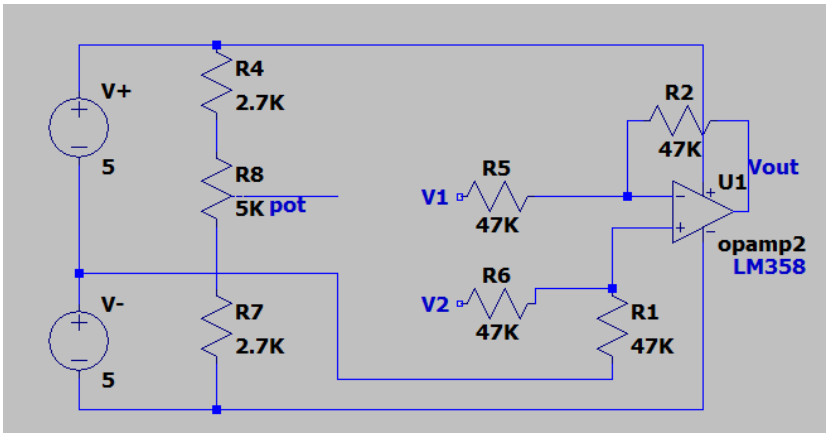




Part 2:

Difference Amps

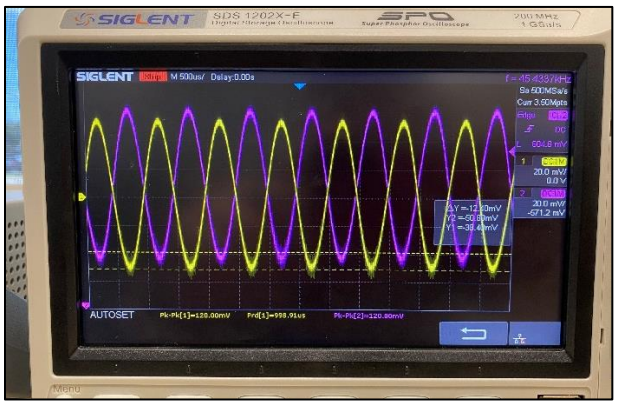
Circuit Diagram:

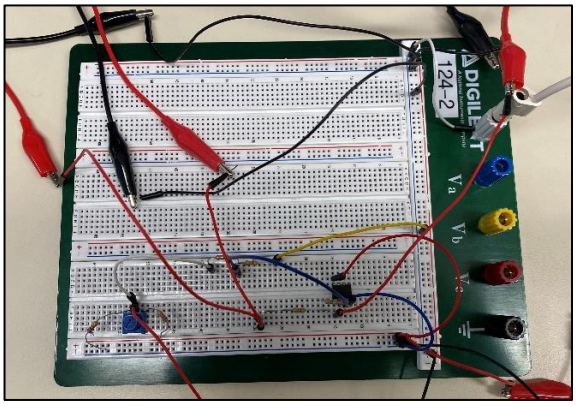


Findings:

1) Demonstrate small signal inverting operation over frequency (G=-1) w V1 as input from fcn_gen, V2 connected to pot.

Vo/Vin = 0.120/0.120 = 1





Determine bandwidth. What did you expect?

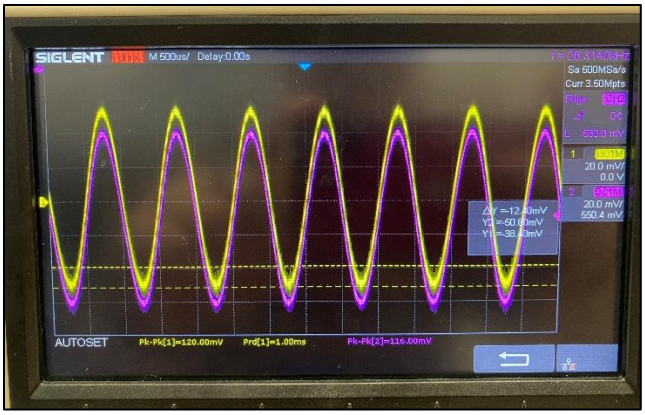
Bandwidth = 600 Hz

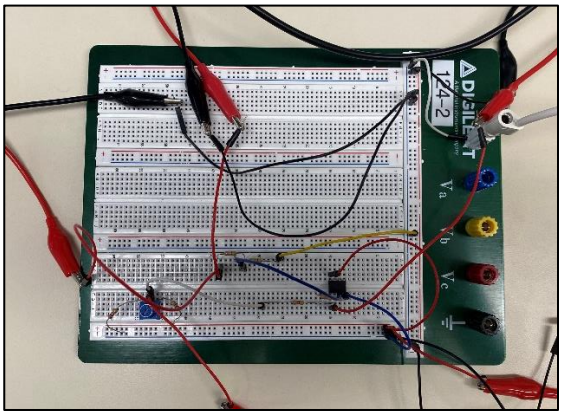
Frequency kHz	Vin	Vout	Gain
1	0.12	0.118	-0.14598
5	0.12	0.116	-0.29447
10	0.12	0.115	-0.36967

15	0.12	0.113	-0.52206
20	0.12	0.116	-0.29447
30	0.12	0.113	-0.52206
50	0.12	0.112	-0.59926
100	0.12	0.111	-0.67717
200	0.12	0.111	-0.67717
500	0.12	0.096	-1.9382
550	0.12	0.085	-2.99525
600	0.12	0.078	-3.74173
700	0.12	0.065	-5.32536
900	0.12	0.049	-7.7797
1000	0.12	0.0372	-10.1728

2) Verify small signal noninverting operation (G = 1) with V2 as input from fcn gen and V1 connected to the pot.

Vo/Vin = 0.116/0.120 = 0.96 ~ 1





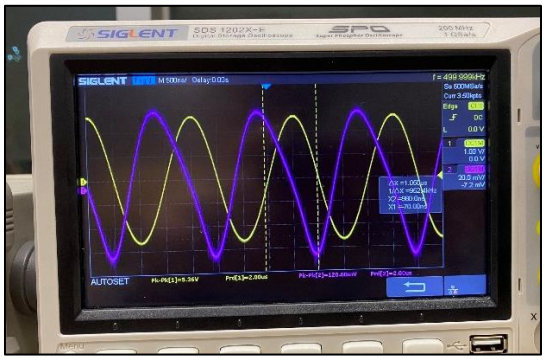
Measure bandwidth. What did you expect?

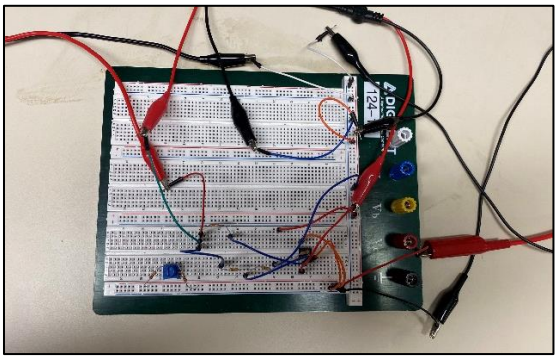
Bandwidth = 600 Hz

Frequency kHz	Vin	Vout	Gain
1	0.12	0.113	-0.52206
5	0.12	0.112	-0.59926
10	0.12	0.112	-0.59926
15	0.12	0.112	-0.59926
20	0.12	0.11	-0.75577
30	0.12	0.11	-0.75577
50	0.12	0.108	-0.91515
100	0.12	0.108	-0.91515
200	0.12	0.108	-0.91515
500	0.12	0.1	-1.58362

550	0.12	0.091	-2.4028
600	0.12	0.08	-3.52183
700	0.12	0.06	-6.0206
900	0.12	0.038	-9.98795
1000	0.12	0.03	-12.0412

3) Measure common mode gain with fcn generator driving both V1 AND V2 (V1=V2). Measure at a few of the same freqs used in step 1.





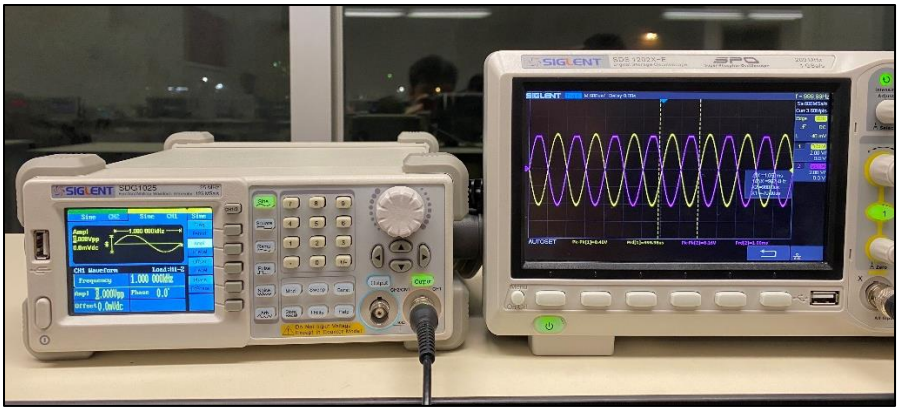
Frequency kHz	Vin	Vout
500	5.32	0.132
520	5.32	0.13
540	5.32	0.124
560	5.4	0.122
580	5.4	0.12
600	5.4	0.118
650	5.4	0.109
700	5.4	0.104
750	5.4	0.1
800	5.4	0.09

4) CALCULATE CMRR (common mode rejection ratio) = 20log(diff gain/C gain) from the CM and diff gain measurements at a few frequencies across the bandwidth.

Frequency kHz	Vin	Vout	CMRR
500	5.32	0.132	17.58852
520	5.32	0.13	17.72113
540	5.32	0.124	18.13157
560	5.4	0.122	18.2728
580	5.4	0.12	18.41638
600	5.4	0.118	18.56236
650	5.4	0.109	19.25147

700	5.4	0.104	19.65933
750	5.4	0.1	20
800	5.4	0.09	20.91515

5) 5) Measure large signal low frequency (1KHz) clip threshold with no offset, driving either V1 or V2.



6) Estimate the op-amp's slew rate limit in V/us starting with low freq output = 6V ppk

Slew Rate = 3.68/11.3 = 0.33