Faculty of Engineering & Technology
Electrical & Computer Engineering Department

ENEE2103

PreLab#08

Multistage Amplifier

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Section : 5

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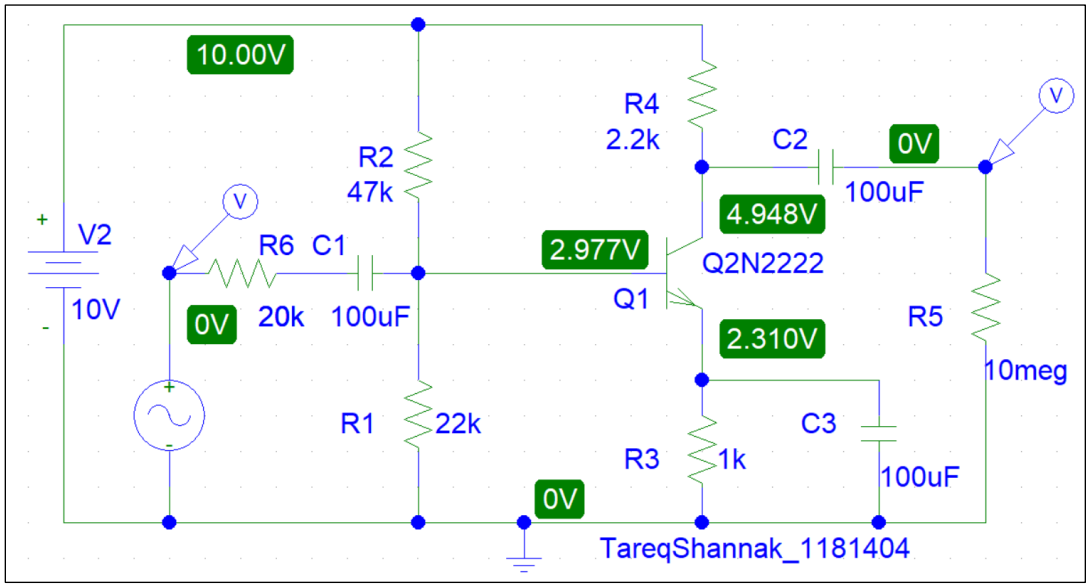
Multistage Amplifier Design

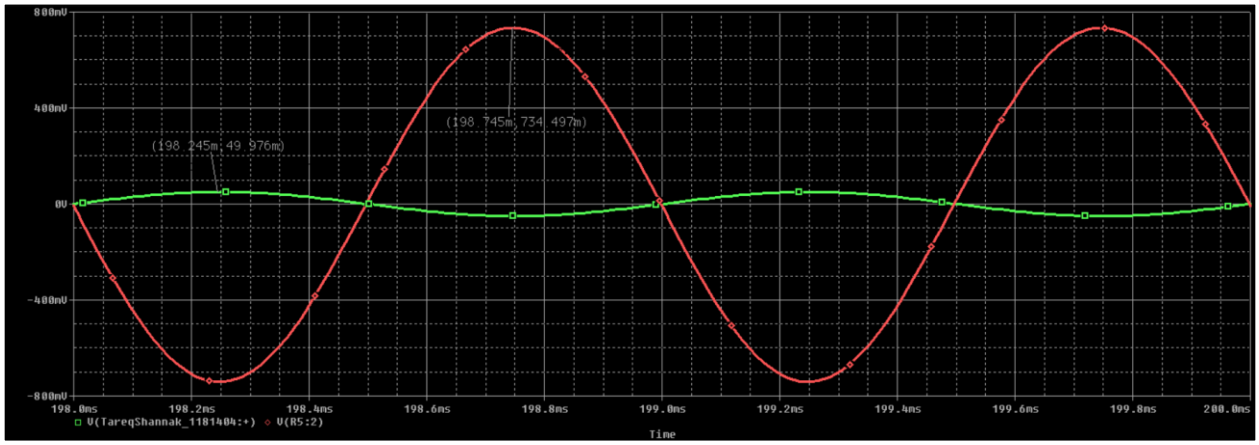
First Stage



Measure the quiescent voltage of the collector, the emitter and base with respect to ground.

V_{B1}	2.977V
V_{E1}	2.310V
V_{C1}	4.948V
V_{CE1}	2.638V

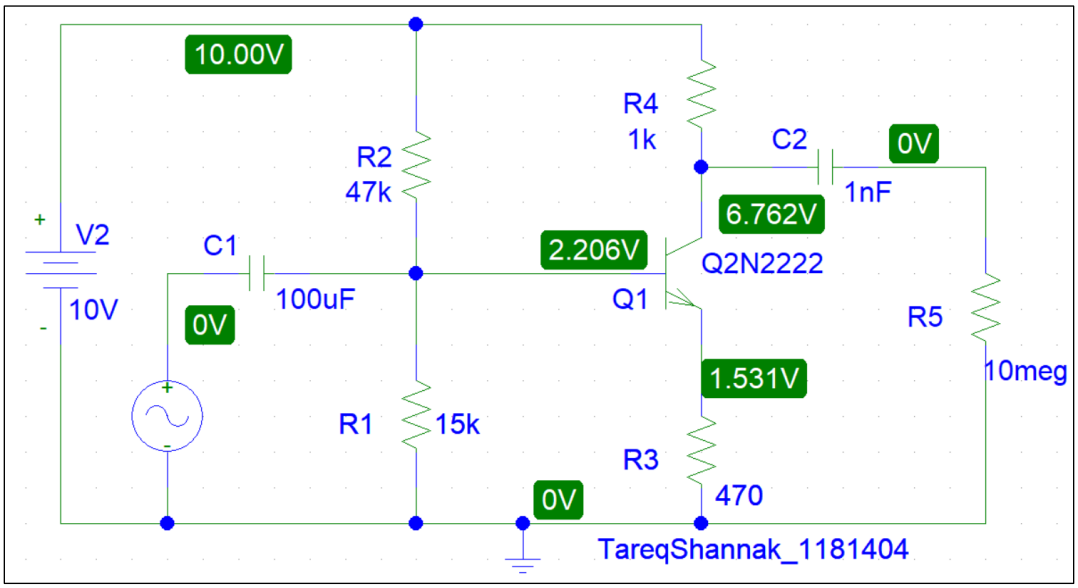
Adjust the generator output to $100mV_{p\text{-}p}$ at f = 1 kHz. Measure the input and output from the first stage.



$$V_i = 49.976\,mV, V_0 = -734.497\,mV$$

$$Voltage\ Gain\ A_{V1} = \frac{V_0}{V_i} = \frac{-734.497\,m}{49.976\,m} = -14.69$$

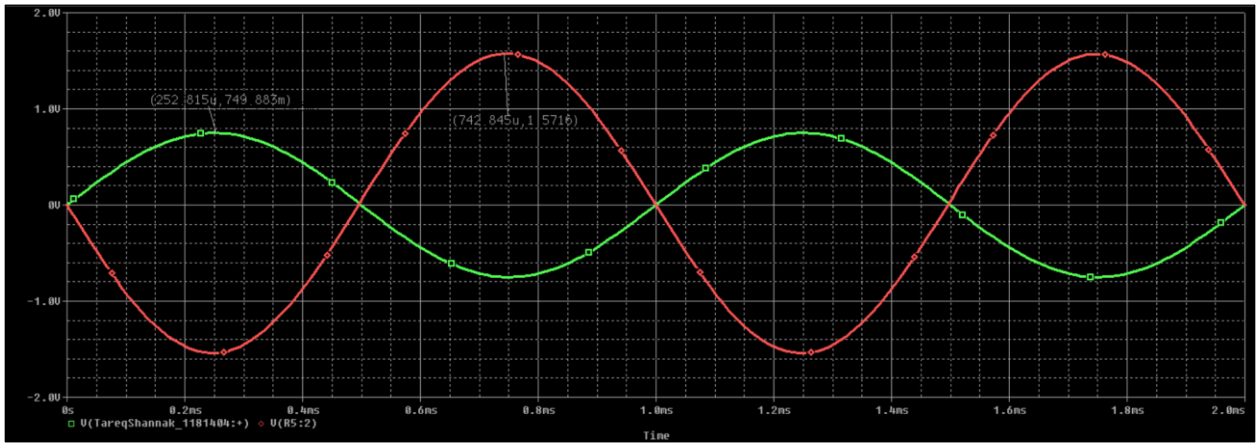
Second Stage



Measure the quiescent voltage of the collector, the emitter and base with respect to ground.

V_{B2}	2.206V
V_{E2}	1.531V
V_{C2}	6.762V
V_{CE2}	5.231V

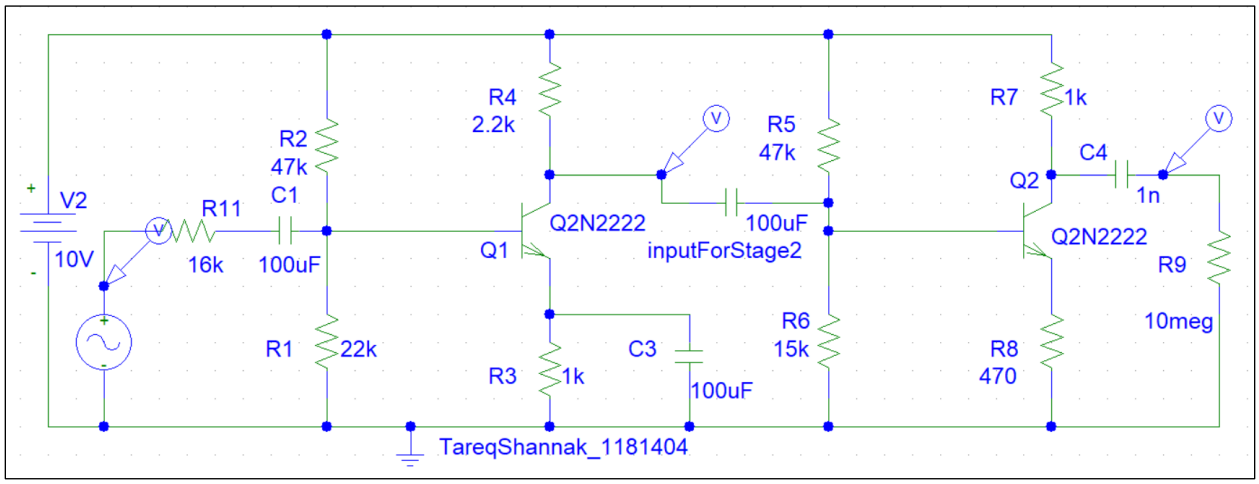
Adjust the generator output to 1.5$V_{p\text{-}p}$ at f = 1 kHz. Measure the input and output from the first stage.



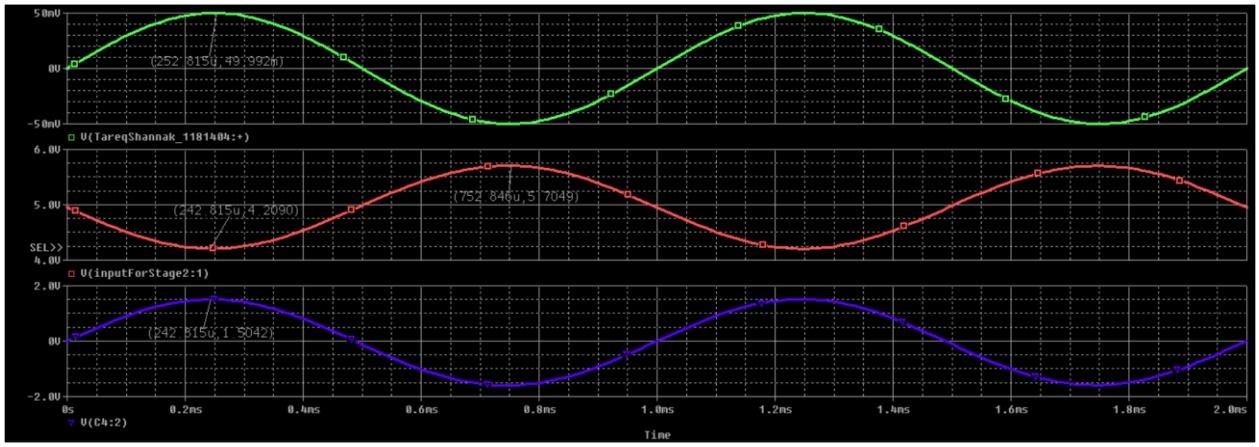
$$V_i = 749.883\,mV, V_0 = -1.5716\,V$$

$$Voltage\ Gain\ A_{V2} = \frac{V_0}{V_i} = \frac{-1.5716}{749.883\,m} = -2.09$$

Connect the Stages



Adjust the generator output to 100 $mV_{p\text{-}p}$ at f = 1 kHz. Measure the input and outputs from both stages.



$$V_{i1\,p-p} = 49.992\,mV, V_{01\,p-p} = 1.4959V$$

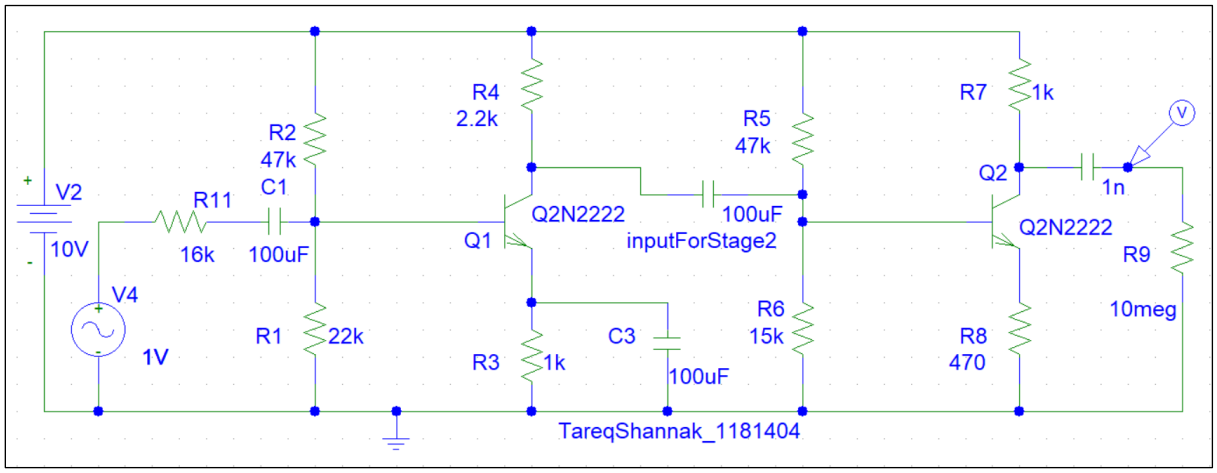
$$V_{i2} = -747.95\,mV, V_{o2} = 1.5042\,V$$

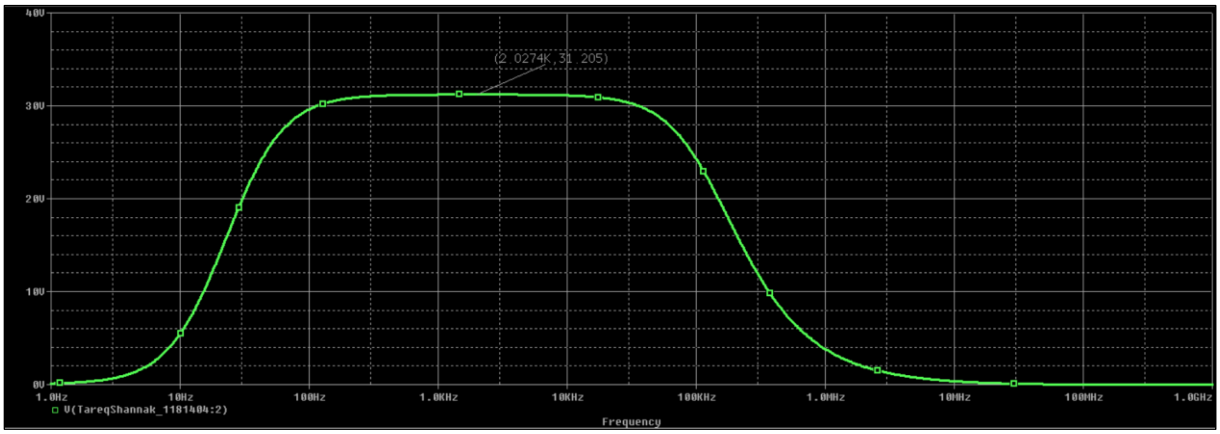
$$Voltage\ Gain\ A_V = \frac{V_0}{V_i} = \frac{1.5042}{49.992\,m} = 30.08 \approx 30$$

$$A_V = A_{V1} \times A_{V2} = -15 \times -2 = 30$$

Frequency Response

We replaced VSIN element by VAC to use AC sweep for simulating the frequency response. Let V_{in} = 1v.





Frequency (Hz)	V_{in}(p-p)	V_{out}(p-p)	A_V	Log (A_V)	20 Log (A_V)
10	2	10.88	5.44	0.7355989	14.71197799
100	2	59.18	29.59	1.471144965	29.4228993
200	2	61.562	30.781	1.488282725	29.7656545
300	2	62.06	31.03	1.491781776	29.83563551
400	2	62.214	31.107	1.492858129	29.85716258
500	2	62.284	31.142	1.4933465	29.86693001
1k	2	62.392	31.196	1.494098912	29.88197823
10k	2	62.242	31.121	1.493053544	29.86107087
30k	2	60.694	30.347	1.482115765	29.64231529
100k	2	49.046	24.523	1.389573598	27.79147196
300k	2	23.492	11.746	1.069889997	21.39779993
400k	2	18.8128	9.4064	0.973423443	19.46846886
500k	2	14.9086	7.4543	0.872406867	17.44813734
700k	2	10.982	5.491	0.739651444	14.79302887
1000k	2	7.6846	3.8423	0.584591271	11.69182542
2000k	2	3.8922	1.9461	0.289165153	5.783303053

From frequency 100Hz to 30kHz, the output voltage for the whole circuit become amplified by 30 (approximately) and this is the plot for the frequency response in dB, the data in this plot resembles the results in the below table.