COMPENSATION

**Goal:**

To construct a simple two-stage OPAMP and observe the results of compensation by,

a) Millers compensation method and
b) Dominant pole compensation method

**Set Up:**

Usually a simple OPAMP has 3 stages as following,
But for simplicity and easiness of operation, we will have just two stages.

First, construct the differential stage,

**Biasing:**

1) Connect the A and B terminals to the ground.

2) Now adjust the \( R_b \) (10 k) pot so that \( X \) and \( Y \) are approximately near 0 volts. Make sure \( X \) is closer to ground rather than \( Y \). Because \( X \) is where we are going to tap the output for this stage.

3) Now disconnect A and B from the ground.
Now add the output amplifier stage, 

![Diagram of the amplifier stage]

**Procedure:**

**Note:** At any stage of the experiment, if you see the output waveform appearing clipped either on positive or negative side, you can always **adjust the bias resistor** $R_b$ to get the unclipped waveform.

**A) WITHOUT COMPENSATION**

1) Connect B to the ground.
2) Input a sine wave of 100mVpp – 100Hz – Zero DC offset at A.
3) Observe the output waveform with respect to ground.
4) Do the frequency sweep from 100Hz to 2 MHz and draw the frequency response and the phase response plots.
B) MILLER'S COMPENSATION METHOD

1) Add the following components between X and the output.

\[ R = 1k \]

\[ X \overset{\text{C = 33pF}}{\longrightarrow} \text{output} \]

Your circuit would now look like,

2) Connect B to the ground.

3) Input a sine wave of 100mVpp – 100Hz – Zero DC offset at A.

4) Observe the output waveform with respect to ground.

5) Do the frequency sweep from 100Hz to 2 MHz and draw the frequency response and the phase response plots.
C) DOMINANT POLE METHOD:

1) METHOD A:

a) Connect a 1000pF capacitor across X and Y.

Now your circuit would look like,

b) Connect B to the ground.

c) Input a sine wave of 100mVpp – 100Hz – Zero DC offset at A.

d) Observe the output waveform with respect to ground.

e) Do the frequency sweep from 100Hz to 2 MHz and draw the frequency response and the phase response plots.
2) METHOD B

a) Load the output with the following elements,

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output
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\[ R = 100 \Omega \]

\[ C = 1000 \text{pF} \]

Now your circuit would look like,

b) Connect B to the ground.

c) Input a sine wave of 100mVpp – 100Hz – Zero DC offset at A.

d) Observe the output waveform with respect to ground.

e) Do the frequency sweep from 100Hz to 2 MHz and draw the frequency response and the phase response plots.
You need to draw the frequency response plot and the phase response plot for each case. You need to turn in all the 6 graphs and from those graphs, fill in the following results.

**RESULTS:**

Without Compensation,

1) The 3-dB point is ___.
2) The unity gain frequency is ___.
3) The phase margin is ___.

With Compensation,

1) The 3-dB point is ___.
2) The unity gain frequency is ___.
3) The phase margin is ___.

With Millers Compensation,

1) The 3-dB point is ___.
2) The unity gain frequency is ___.
3) The phase margin is ____.