LAB REPORT

Electronics Lab III
(ELC 3910)

Experiment No.: 7

S. No:	**1 2**
F. No:	**2 0 E L B 0 8 4**
Name:	**Y U S U F A H M E D K H A N**

Object:

Analysis and Simulation of differential amplifier with passive load. Pot the DC transfer characteristics, transient and frequency response. Measure bandwidth input and output resistance.

Software used: PSpice

Date of performing the experiment: *16/11/2022*

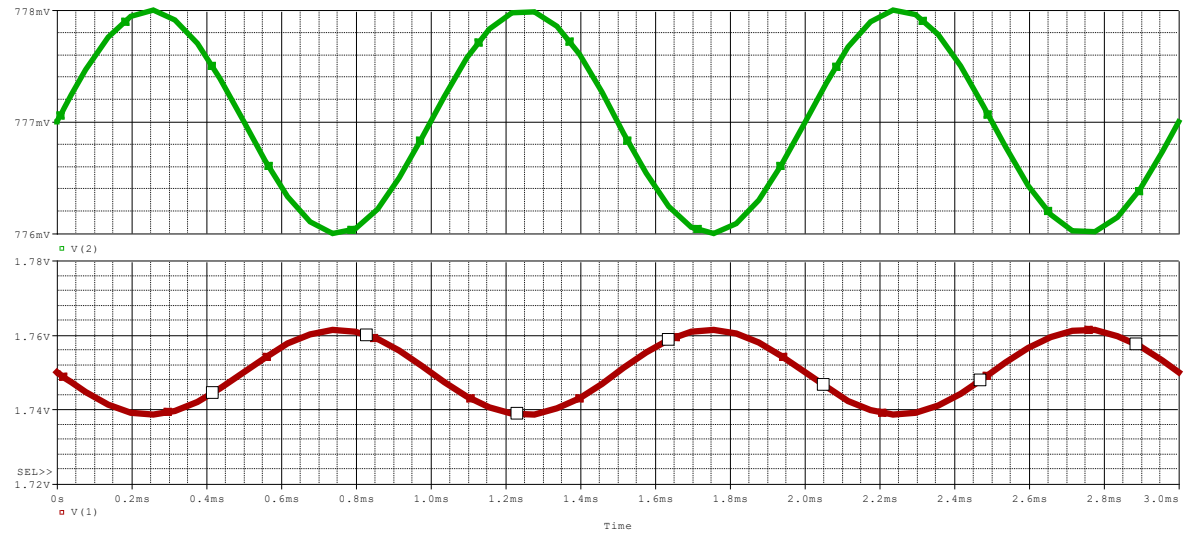
Date of report submission: *23/11/2022*

Experiment 7

Part 1, calculate gain Yusuf Ahmed Khan

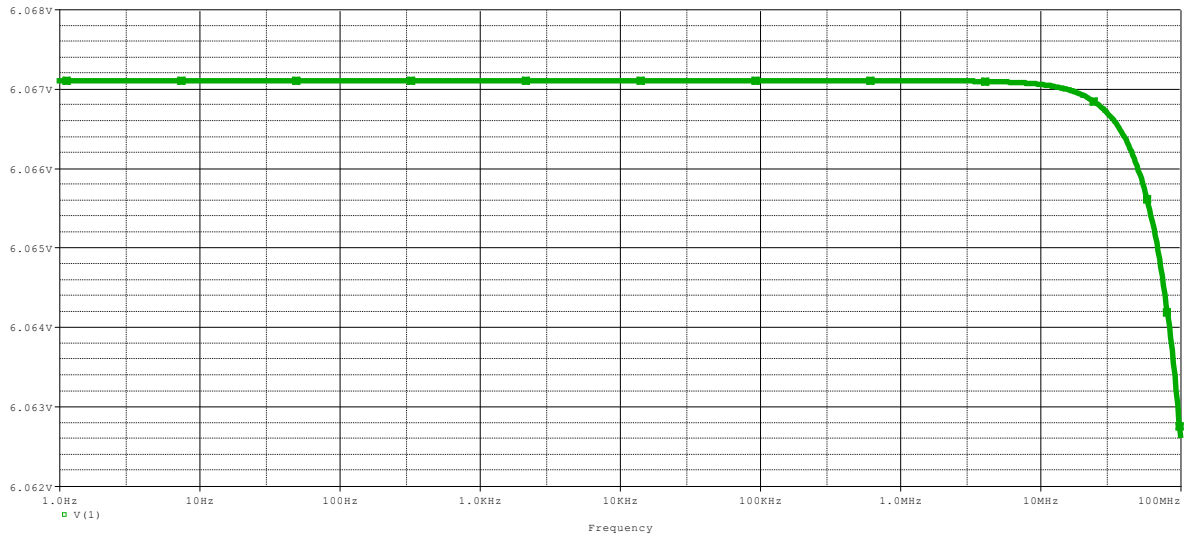
```
* Yusuf Ahmed Khan
* Differential amplifier, part 1, calculate gain
VDD 6 0 3.5V
Vin_p 2 0 SIN(777M 1MV 1K)
Vin_n 4 0 SIN(777M -1MV 1K)
R1 6 1 4.375K
R2 6 5 4.375K
IREF 3 0 0.8MA

M1 1 2 3 0 MN W=50U L=0.7U
M2 5 4 3 0 MN W=50U L=0.7U

.MODEL MN NMOS (                                LEVEL   = 3
+TOX      = 7.9E-9              NSUB     = 1E17          GAMMA    = 0.5827871
+PHI      = 0.7                 VTO      = 0.5445549     DELTA    = 0
+UO       = 436.256147          ETA      = 0             THETA    = 0.1749684
+KP       = 2.055786E-4         VMAX     = 8.309444E4    KAPPA    = 0.2574081
+RSH      = 0.0559398           NFS      = 1E12          TPG      = 1
+XJ       = 3E-7                LD       = 3.162278E-11  WD       = 7.046724E-8
+CGDO     = 2.82E-10            CGSO     = 2.82E-10      CGBO     = 1E-10
+CJ       = 1E-3                PB       = 0.9758533     MJ       = 0.3448504
+CJSW     = 3.777852E-10        MJSW     = 0.3508721      )

.TRAN 0.1U 3M
.TF V(1,5) Vin_n
.OP
.PROBE
.END
```

```
****     SMALL-SIGNAL CHARACTERISTICS

      V(1,5)/Vin_n =  1.029E+01
      INPUT RESISTANCE AT Vin_n =  1.000E+20
      OUTPUT RESISTANCE AT V(1,5) =  8.450E+03

          JOB CONCLUDED
**** 11/16/22 16:00:09 ****** PSpice 17.2.0 (March 2016) ****** ID# 0 ********
 * Yusuf Ahmed Khan

 ****     JOB STATISTICS SUMMARY
```



Part 2, frequency response

```
* Yusuf Ahmed Khan
* Differential amplifier, part 2, freq response
VDD 6 0 3.5V
Vin_p 2 0 AC 1V
Vin_n 4 0 AC 1V
R1 6 1 4.375K
R2 6 5 4.375K
IREF 3 0 0.8MA

M1 1 2 3 0 MN W=50U L=0.7U
M2 5 4 3 0 MN W=50U L=0.7U

.MODEL MN NMOS (                                LEVEL   = 3
+TOX      = 7.9E-9              NSUB     = 1E17              GAMMA    = 0.5827871
+PHI      = 0.7                 VTO      = 0.5445549         DELTA    = 0
+UO       = 436.256147          ETA      = 0                 THETA    = 0.1749684
+KP       = 2.055786E-4         VMAX     = 8.309444E4        KAPPA    = 0.2574081
+RSH      = 0.0559398           NFS      = 1E12              TPG      = 1
+XJ       = 3E-7                LD       = 3.162278E-11      WD       = 7.046724E-8
+CGDO     = 2.82E-10            CGSO     = 2.82E-10          CGBO     = 1E-10
+CJ       = 1E-3                PB       = 0.9758533         MJ       = 0.3448504
+CJSW     = 3.777852E-10        MJSW     = 0.3508721          )

*.TRAN 0.1U 3M
.TF V(1,5) Vin_n
.AC DEC 100 1HZ 100MEGHZ

.OP
.PROBE
.END
```



Part 3 bandwidth calculation

```
VDD 6 0 3.5V
Vin_p 2 0 AC 1V
Vin_n 4 0 AC -1V
R1 6 1 4.375K
R2 6 5 4.375K
IREF 3 0 0.8MA

M1 1 2 3 0 MN W=50U L=0.7U
M2 5 4 3 0 MN W=50U L=0.7U

.MODEL MN NMOS (                                LEVEL   = 3
+TOX     = 7.9E-9              NSUB    = 1E17          GAMMA   = 0.5827871
+PHI     = 0.7                 VTO     = 0.5445549     DELTA   = 0
+UO      = 436.256147          ETA     = 0             THETA   = 0.1749684
+KP      = 2.055786E-4         VMAX    = 8.309444E4    KAPPA   = 0.2574081
+RSH     = 0.0559398           NFS     = 1E12          TPG     = 1
+XJ      = 3E-7                LD      = 3.162278E-11  WD      = 7.046724E-8
+CGDO    = 2.82E-10            CGSO    = 2.82E-10      CGBO    = 1E-10
+CJ      = 1E-3                PB      = 0.9758533     MJ      = 0.3448504
+CJSW    = 3.777852E-10        MJSW    = 0.3508721       )

*.TRAN 0.1U 3M
.TF V(1,5) Vin_n
.AC DEC 100 1HZ 1000000MEGHZ

.OP
.PROBE
.END
```