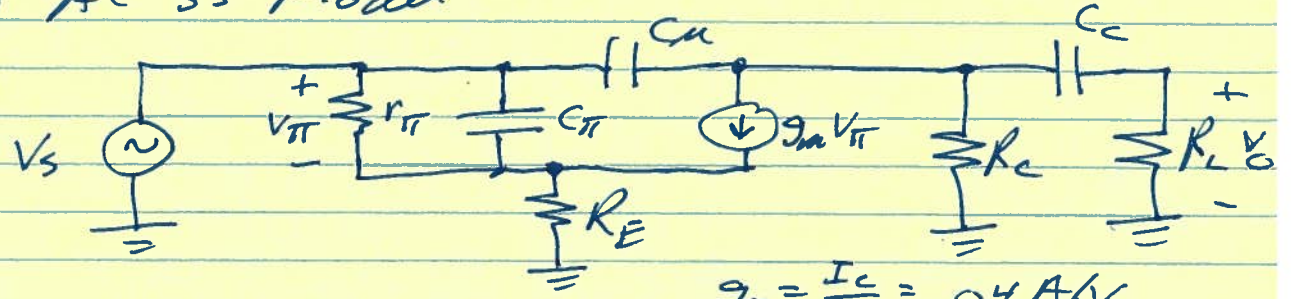
a.) $I_C = 1mA$ $V_E = -.7V$ $V_C = 10V$

b.) AC SS Model



$g_m = \frac{I_C}{V_T} = .04\ A/V$

$r_\pi = \frac{\beta}{g_m} = 2.5K\Omega$

c.) $A_m = \frac{-\beta[R_L \| R_C]}{r_\pi + R_E(1+\beta)} = -1.8\ V/V$

d.) $A_m \approx \frac{-R_L \| R_C}{R_E} = -20\ V/V$ (for $\beta \to \infty$)

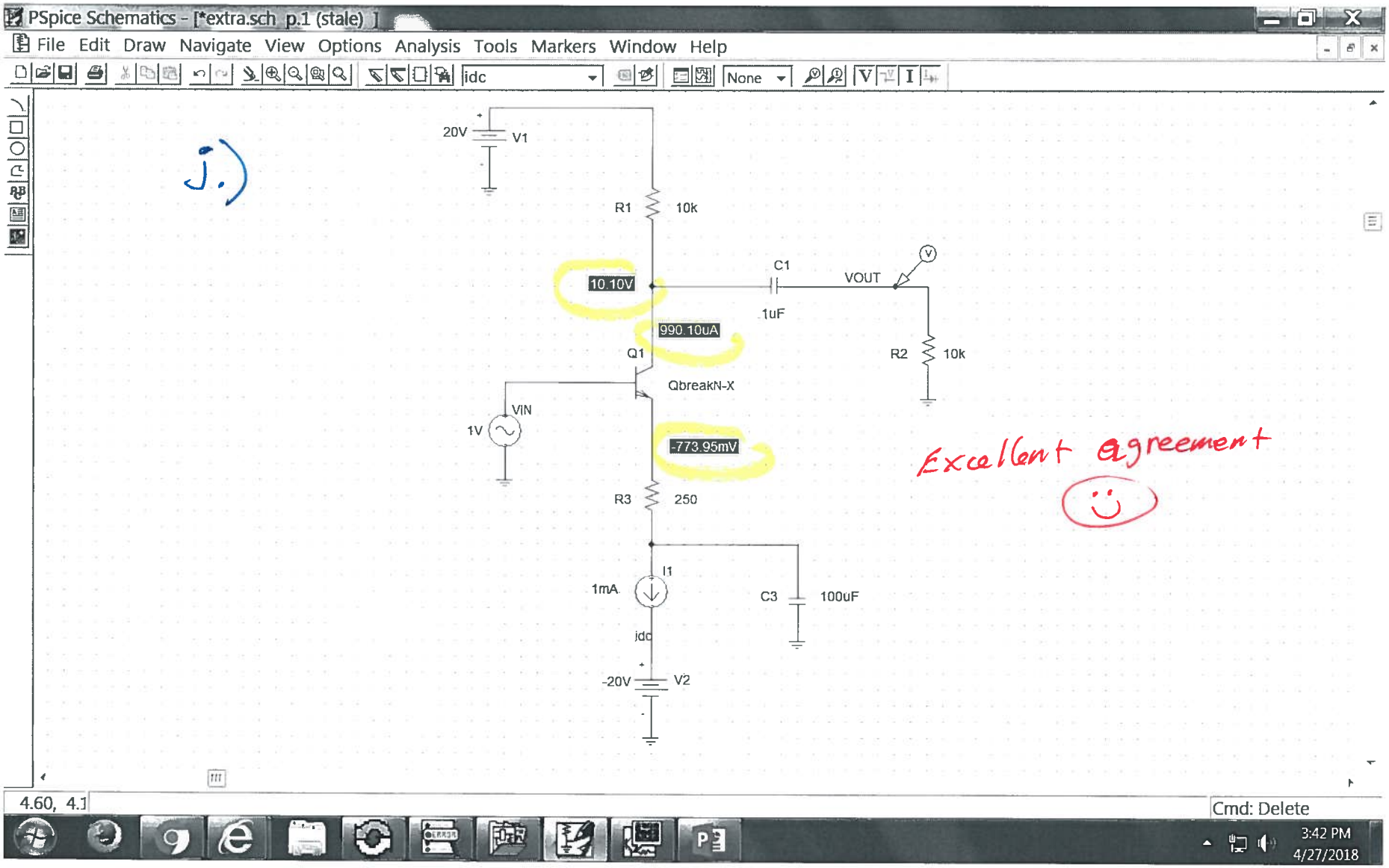
e.) $R_{in} = \frac{V_T}{I_T} = r_\pi + R_E(1+\beta) = 27.75\ K\Omega$

f.) $R_{out} = R_C = 10K\Omega$

g.) $\omega_L = \frac{1}{\tau_{C_C}} = \frac{1}{(R_C + R_L)C_C} = 500\ rad/sec$

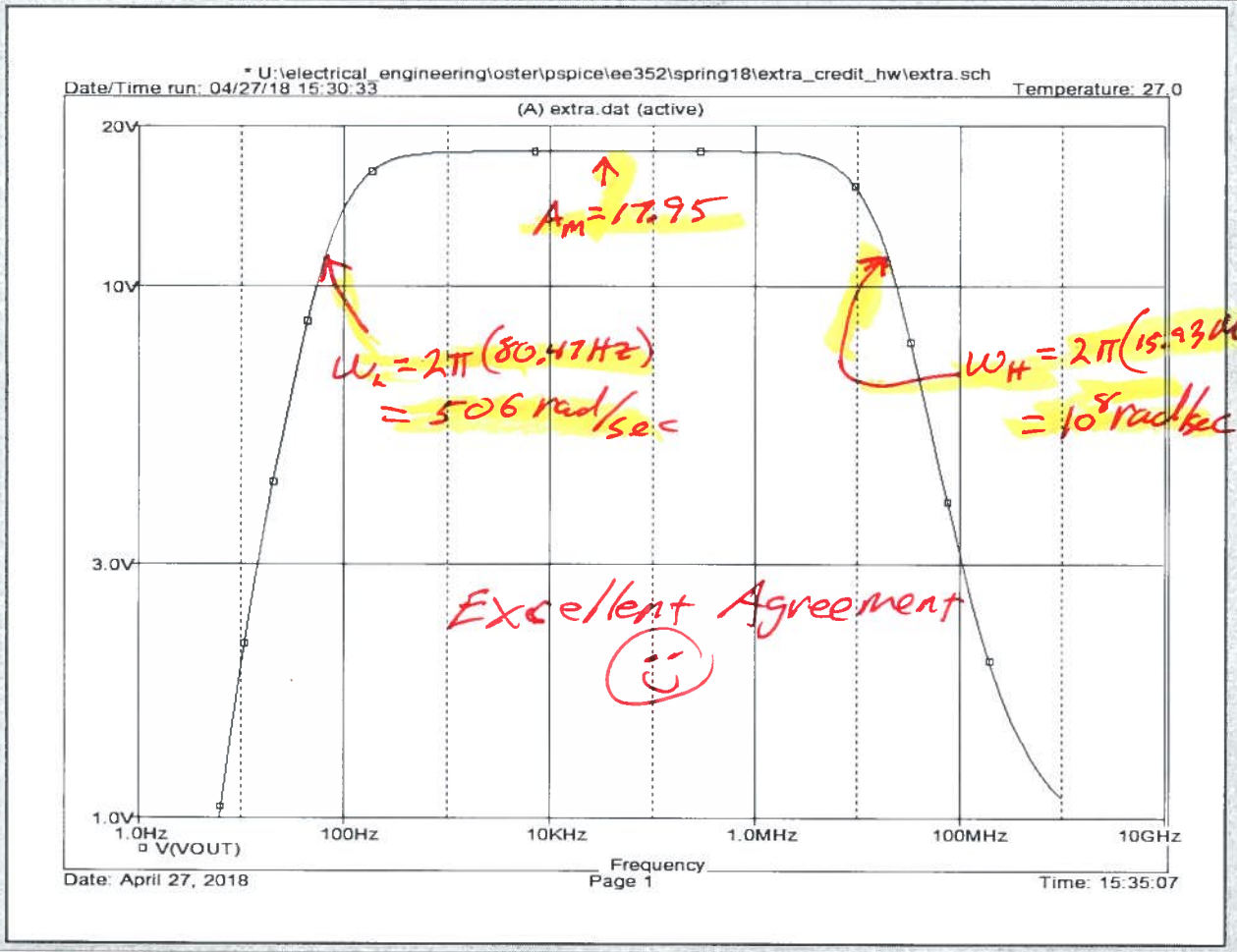
h.) $\omega_H = \frac{1}{\tau_{C_\mu}} = \frac{1}{(R_C \| R_L)C_\mu} = 10^8\ rad/sec$

i.) $f_T = \frac{g_m}{2\pi[C_\pi + C_\mu]} = 28a\ MHz$


PSpice Schematics - [*extra.sch p.1 (stale)]
File Edit Draw Navigate View Options Analysis Tools Markers Window Help
idc
None
j.)
20V
V1
R1
10k
10.10V
C1
1uF
VOUT
990.10uA
Q1
QbreakN-X
R2
10k
VIN
1V
-773.95mV
R3
250
I1
1mA
idc
C3
100uF
-20V
V2
Excellent agreement
4.60, 4.1
Cmd: Delete
3:42 PM
4/27/2018

extra - OrCAD PSpice A/D Demo - [extra.dat (active)]

Print... | Next Page | Prev Page | Two Page | Zoom In | Zoom Out | Close



Page 1

Freq = 1.000E+09 100%

3:35 PM
4/27/2018

.out file

```
 ****     CIRCUIT DESCRIPTION
** Analysis setup **
.ac DEC 10 1 1000MEG
.OP
.LIB "U:\electrical_engineering\oster\pspice\ee352\spring18
\extra_credit_hw\extra.lib"
V_V1          $N_0001 0 20V
V_V2          $N_0002 0 -20V
I_I1          $N_0003 $N_0002 DC 1mA
R_R3          $N_0003 $N_0004  250
C_C1          $N_0005 VOUT  .1uF
V_VIN          $N_0006 0 DC 0V AC 1V
C_C3          0 $N_0003  100uF
R_R1          $N_0005 $N_0001  10k
R_R2          0 VOUT  10k
Q_Q1          $N_0005 $N_0006 $N_0004 QbreakN-X
.probe
.END

 ****     BJT MODEL PARAMETERS
********************************************************************************
*************
               QbreakN-X
               NPN
          BF   100
         MJE     0
         CJC     2.000000E-12
         MJC     0
          TF   500.000000E-12

**** BIPOLAR JUNCTION TRANSISTORS
NAME          Q_Q1
MODEL         QbreakN-X
BETADC        1.00E+02
GM            3.83E-02
RPI           2.61E+03
RO            1.00E+12
CBE           1.91E-11
CBC           2.00E-12
FT/FT2        2.88E+08
          JOB CONCLUDED
          TOTAL JOB TIME             .05
```

Hand

.04

2.5K

∞

20pF

2pF

289MHz

Excellent agreement