QUIZ NO. 8  
(Average = 6.7/10 of those taking the quiz)

a.) If the $g_m$ of the MOSFET is 0.1mA/V, find the midband gain and the location of all zeros and poles of the circuit shown.

b.) If the amplifier above has two zeros at the origin and a pole at –10 rads/sec and –40 rads/sec., what is the lower –3dB frequency in Hz?

Solution

a.) It is worthwhile to spend some effort in simplifying the small-signal model as follows:

Thus, the MBG = \( \left( \frac{g_m R_D R_L}{R_D + R_L} \right) \left( \frac{1}{1 + g_m R_S} \right) = (0.5)(1/1) = 0.4545 \text{ V/V} \)

There are two zeros at \( s = 0 \) and two poles:

\[
p_2 = C_2(R_D + R_L) = 50 \text{ rads/sec. and}
\]

\[
p_1 = \frac{-g_m}{C_1(1 + g_m R_S)} = \frac{-0.1 \times 10^{-3}}{10 \times 10^{-6}(1+0.1)} = -9.09 \text{ rads/sec.}
\]

b.) \( \omega_L = \sqrt{p_1^2 + p_2^2 - 2(z_1^2 + z_2^2)} = \sqrt{10^2 + 40^2 - 2(0)} = \sqrt{1700} = 41.23 \text{ rads/sec.} \)

\( : \quad f_L = \frac{41.23}{6.28} = 6.56 \text{ Hz} \)