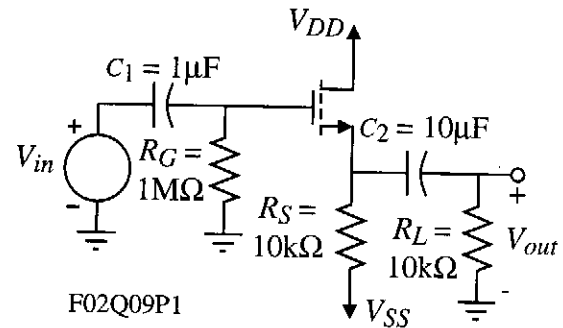# QUIZ NO. 9 - SOLUTION

(Average Score = 6.2/10 for only those who took the quiz.)
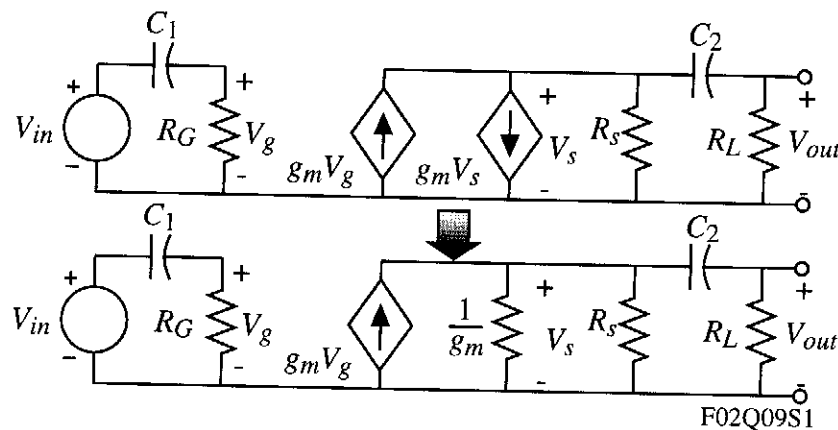
1.) If the g_m of the MOSFET is 0.1mA/V, find the midband gain and the location of all zeros and poles of the circuit shown.

2.) If the amplifier above has two zeros at the origin and a pole at -1 rads/sec and -4 rads/sec., what is the lower -3dB frequency in Hz?

Solution

F02Q09P1

1.) Small-signal model:

F02Q09S1

$$\frac{V_{out}}{V_{in}} = \left(\frac{g_m (1/g_m)\|R_s}{(1/g_m)\|R_s + R_L + \frac{1}{sC_2}} \times R_L \right) \left(\frac{R_G}{R_G + \frac{1}{sC_2}} \right) = \left(\frac{5k}{15k + \frac{1}{sC_2}} \right) \left(\frac{1M}{1M + \frac{1}{sC_1}} \right)$$

$$= \left(\frac{1}{3} \right) \left(\frac{s}{s + \frac{1}{15k\, C_2}} \right) \left(\frac{s}{s + \frac{1}{1M\, C_1}} \right) = \left(\frac{1}{3} \right) \left(\frac{s}{s + 6.67} \right) \left(\frac{s}{s + 1} \right)$$

∴ MGB = 0.333, two zeros at 0 rads/sec. and poles at -1 rad/sec and -6.67 rads/sec.

2.) $\omega_L \approx \sqrt{p_1^2 + p_2^2 - 2(z_1^2 + z_2^2)} = \sqrt{1^2 + 4^2 - 2(0)} = \sqrt{17} = 4.123$ rads/sec.

∴ $f_L = \frac{4.123}{6.28} = 0.656\,\text{Hz}$