1. Assume the B-E cut-in voltage for the transistor is 0.7 V, the C-E saturation voltage is 0.2 V for every transistor.
   (a) The measured value of $V_C$ is 6.34 V. Determine $I_B$, $I_E$, $I_C$, $V_{CE}$ and $\beta$ for the circuit shown in Figure 1. (10%)
   (b) Consider the circuit shown in Figure 2. Let $\beta = 150$, $R_E = 0.2$ KΩ and $R_C = 1$ KΩ. Find $R_1$, $R_2$ such that the bias is stable and the quiescent output voltage is 0V. (10%)
   (c) Assuming $\beta = 50$, determine $I_{BQ}$, $I_{CQ}$, and $V_{CEQ}$ for the circuit shown in Figure 3. (10%)
   (d) Assume C is short to a-c signal. Determine the voltage gain, and input impedance for the circuit shown in Figure 3. (10%)

2. For the NMOS common-source amplifier shown in Figure 4, the transistor parameters are: $V_{Th} = 2$V, $K_n = 1$ mA/V², and $\lambda = 0$. The circuit parameters are $V_{DD} = 12$V, $R_s = 2$KΩ, $R_D = R_L = 3$KΩ, $R_1 = 300$KΩ, and $R_2 = 200$KΩ.
   (a) Determine the quiescent values of $I_D$ and $V_{DS}$. (5%)
   (b) Find the small-signal voltage gain. (5%)
   (c) Determine the maximum symmetrical swing in the output voltage. (10%)

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Figure 1

Figure 2

Figure 3

Figure 4
3. For the circuit shown in Figure 5, the transistor parameters are:

\[ V_{thD} = 1 \text{V}, \ V_{thL} = -1 \text{V}, \ K_{nD} = 1 \text{mA/V}^2, \ K_{nL} = 0.2 \text{mA/V}^2, \text{ and} \ \lambda_D = \lambda_L = 0.01 \text{V}^{-1}. \] 

Assume the circuit is biased at \( V_{DD} = 5 \text{V} \).

(a) Analyze whether \( M_D \) and \( M_L \) are in saturation region or nonsaturation region when \( V_{GSD} \) increase from 0V to \( V_{DD} \). Draw the voltage transfer characteristic curve. (10%) 

(b) Find \( V_{GSD} \) and \( I_{DQ} \) such that the Q-point is in the middle of the saturation region. (10%) 

(c) Determine the small-signal voltage gain. (5%) 

Remark: \( M_L \) is a N-channel depletion mode MOSFET \( M_D \) is a N-channel enhancement mode MOSFET

Figure 5

4. For the circuit shown in Figure 6, the parameters are: \( R_S = 0.1 \text{K}\Omega, R_1 = 20 \text{K}\Omega, R_2 = 2.2 \text{K}\Omega, R_E = 0.1 \text{K}\Omega, R_C = 2 \text{K}\Omega, C_C = 47 \mu\text{F}, \text{ and } V_{CC} = 10 \text{V}. \) The transistor parameters are \( V_{BE(ON)} = 0.7 \text{V}, \beta = 200, \text{ and } VA = \infty. \)

(a) Determine the corner frequency. (5%) 
(b) Calculate the midband gain. (5%) 
(c) Draw Bode plots for this circuit. (5%)

Figure 6