COLLEGE OF ENGINEERING & TECHNOLOGY
Department of Electronics and Communications
Course: Microelectronics circuits

Sheet 1: MOSFET Differential Pair Amplifier

1. For a differential pair amplifier,k(W/L) = 4 mA/V^2 , V_t = 0.5 V, I = 0.4 mA, and R_D = 2.5 KΩ.
    a. Calculate V_{ov}
    b. Calculate V_{gs}
    c. What is the highest value of Vcm for which Q1 and Q2 remains in saturation
    d. If I requires a minimum voltage of 0.4 V to operate, what is the lowest value allowed for V_s and hence V_{cm}
    e. For V_{cm} = 0, calculate V_s, i_{D1}, i_{D2}, v_{D1}, and v_{D2}

2. Problem # 7.1 (Sedra)

From problem 2 to 6 Let
k(W/L) = 3 mA/V^2 , V_t = 0.7 V, I_{ss} = 0.2 mA, V_{DD} = V_{SS} = 2.5V, and R_D = 5 KΩ

3. For a differential pair amplifier, calculate
    a. The value of vid that causes Q_1 to conduct the entire current I_{ss}
    b. v_{D1} and v_{D2}
    c. The differential output voltage.

4. For a differential pair amplifier, calculate the differential voltage gain. Where g_m = 14 ms and RD = 360 Ω.

5. Design a differential pair amplifier for voltage gain of -5 and a power budget of 2 mW subjected th the condition that the stage following the differential pair requires an input CM level of at least 1.7 V.

6. For a differential amplifier, calculate the value of vid that corresponds to each of the following situations
    a. i_{D1} = i_{D2} = 0.1 mA
    b. i_{D1} = 0.15 mA and i_{D2} 0.05 mA
    c. i_{D1} = 0.2 mA and i_{D2} = 0
    d. i_{D1} = 0.05 mA and i_{D2} = 0.15 mA
    e. i_{D1} = 0 and i_{D2} = 0.2mA