1. a)________________Ω (10 pts) b)________________ (5 pts)

2. a)________________ (5 pts) b)________________ (5 pts) c)________________Ω (5 pts)

3. a)________________Ω (5 pts) b)________________ (5 pts)

4. a)________________A (5 pts) b)________________ (5 pts)

5. a)________________Hz (5 pts) b)________________Hz (10 pts)

6. a)________________Hz (5 pts)

7. a)________________F (10 pts)

8. a)________________V (5 pts) b)________________V (5 pts)
a) Assuming $I_{out} = I_b = 10 \, \mu A$, find $R_b$ that maximizes the negative swing at $V_{out}$. 
Assume \( g_m = 10 \, \text{mS}, \; R_s = 50 \, \Omega, \; r_o = 1\, \text{M}\Omega \),

a) What type of feedback is this?

b) What is closed loop \( \frac{V_{out}}{V_{in}} \) gain?

c) What is the output impedance?
3.

a) What is Rout?

b) What is gain vout/vin?
a) What is $I_d3$ (current through $M3$), if $R=20\ \Omega$?

b) Assume $R$ is set so that $I_d3=10\ \mu A$, what is the efficiency of the stage given that $V_{in}$ is set such that output is symmetrical around 0 V?
5. a) Assuming $C_{gs} = 100\ fF, C_{gd} = C_{sb} = C_{db} = 10\ fF, g_m = 10\ mS, r_o = 1\ M\Omega$, what is the –3dB frequency of this circuit?
Assume \( r_o = 1 \text{M}\Omega \), \( g_m = 10 \text{ mS} \).

a) What are the poles and zeros for differential mode gain, \( A_{dm} \)?

b) What are the poles and zeros for common mode gain, \( A_{cm} \)?
a) Assume $\text{gm}=10 \text{ mS}$, $\text{ro} = 1 \text{ M}\Omega$, what is value of $C_c$ so that the phase margin is 45 degrees?
a) If $V_{out} = 0V$, what is the minimum input common mode voltage for which all devices stay in saturation?

b) If $V_{i1} = V_{i2} = 0V$, what is the minimum $V_{out}$ for which all devices stay in saturation?