

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Figure 1 shows the common-emitter (CE) amplifier. (a) Please sketch the small signal equivalent circuit of the CE amplifier in high-frequency response. (10%) In Fig. 1, to find (b) the midband gain (10%) and (c) the upper 3 dB frequency. (10%) $V_{CC}=V_{EE}=10\text{ V}$, $I=1\text{ mA}$, $R_B=100\text{ k}\Omega$, $R_C=8\text{ k}\Omega$, $R_{sig}=5\text{ k}\Omega$, $R_L=5\text{ k}\Omega$, $\beta_0=100$, $V_A=100\text{ V}$, $C_c=1\text{ pF}$, $f_T=800\text{ MHz}$, and the resistance of Si material in base region, $r_x=50\ \Omega$.

2. The circuit in Fig. 2 implements a complementary output rectifier. (a) Sketch and clearly label the waveforms of v_{o^+} and v_{o^-} . (10%) Assume a 0.7 V drop across each conducting diode. If the magnitude of the average of each output is to be 15 V, (b) find the required amplitude of the sine wave across the entire secondary winding. (5%) (c) What is the PIV of each diode? (5%)

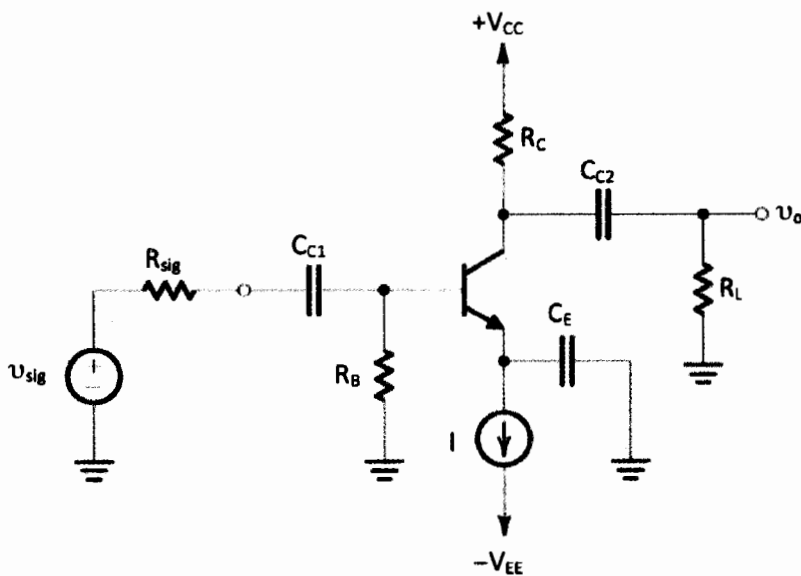


Fig. 1

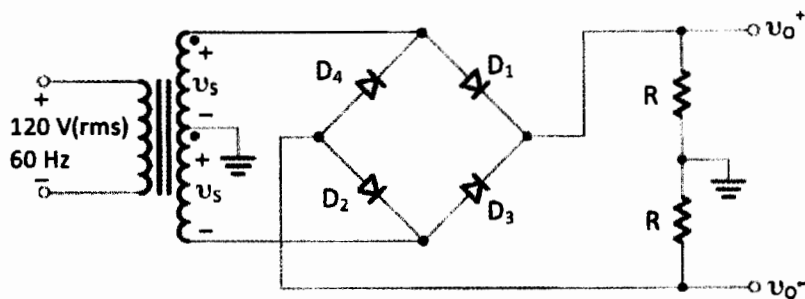


Fig. 2

3. A differential amplifier shows in Fig. 3. Please find the differential gain, the differential input resistance, the common mode gain, common mode rejection ratio, and common mode input resistance. For these transistors, $\beta=100$ and $V_A=100V$. (25%)

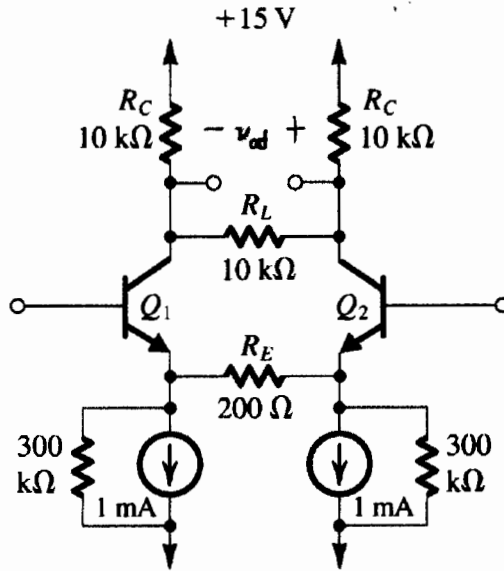


Figure 3

4. Please find the low-frequency gain, the frequency of the pole, and the frequency of zero of the circuit showing in Fig. 4. The DC-bias current is $100\mu A$. For Q_1 , $\mu_n C_{ox} = 90 \mu A/V^2$, $V_A = 12.8 V$, $W/L = 100 \mu m/1.6 \mu m$, $C_{gs} = 0.2 pF$, $C_{gd} = 0.015 pF$, and $C_{db} = 20 fF$. For Q_2 , $C_{gd} = 0.015 pF$, $C_{db} = 36 fF$, and $|V_A| = 19.2 V$. Assume that the resistance of the input signal generator is negligibly small. And for simplicity, assume that the signal voltage at the gate of Q_2 is zero. (25%)

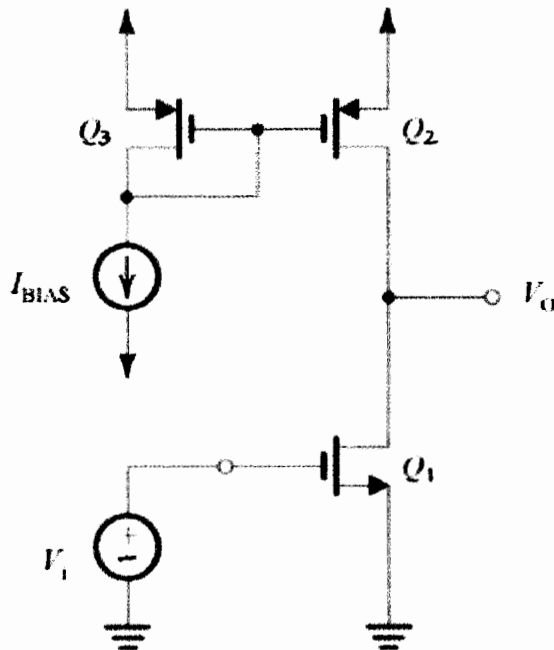


Figure 4