

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

- 1、The cut-in voltage for each diode in the circuit shown in Figure 1 is $V_\gamma = 0.7V$. Find I_{D1} , I_{D2} , I_{D3} , and V_A for (a) $R_3 = 14k\Omega$, $R_4 = 24k\Omega$; (b) $R_3 = 3.3k\Omega$, $R_4 = 5.2k\Omega$; and (c) $R_3 = 3.3k\Omega$, $R_4 = 1.32k\Omega$. (15%)

- 2、The clipper circuit shown in Figure 2. Assume that the two diode D_1 、 D_2 shown in the circuit below are ideal diodes ($V_\gamma = 0$ and $r_f = 0$). If the input voltage in the circuit is a sinusoid with peak amplitude of 6V, sketch the V_O (15%)

- 3、The PMOS transistor shown in Figure 3 has $V_{tp} = -1V$, $k_p' = 60\mu A/V^2$, and $W/L = 10$. (30%)
 - (a) Find the range of V_G for which the transistor conducts. (5%)
 - (b) In terms of V_G , find the range of V_D for which the transistor operates in the triode region. (5%)
 - (c) In terms of V_G , find the range of V_D for which the transistor operates in saturation region. (5%)
 - (d) Neglecting channel-length modulation ($\lambda = 0$), find the values of $|V_{ov}|$ and V_G and the corresponding rang of V_D to operate the transistor in the saturation mode with $I_D = 75\mu A$ (5%)
 - (e) If $\lambda = -0.02V^{-1}$, find the value of r_o corresponding to the overdrive voltage determined in (d) (5%)
 - (f) For $\lambda = -0.02V^{-1}$, and for the value of V_{ov} determined in (d), find I_D at $V_D = +3V$ and at $V_D = 0V$; hence, calculate the value of the apparent output resistance in saturation. (5%)

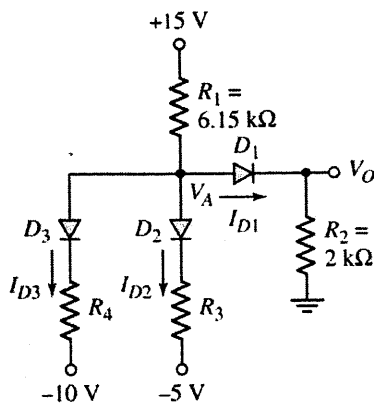


Figure 1

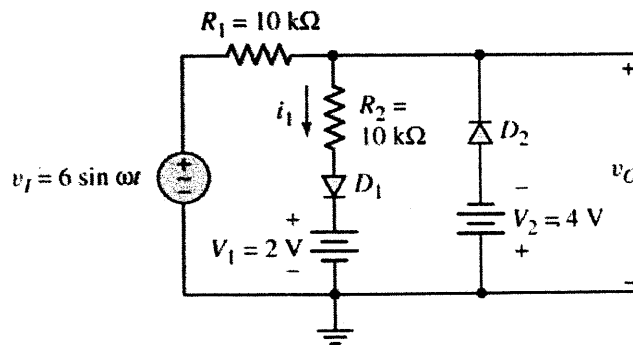


Figure 2

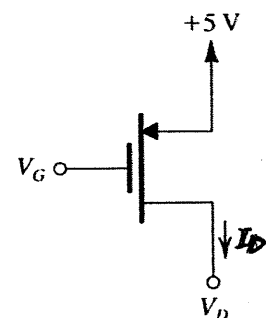


Figure 3

4、For the op-amp circuit shown in Figure 4, determine the gain $A_v = v_o/v_i$. (15%)

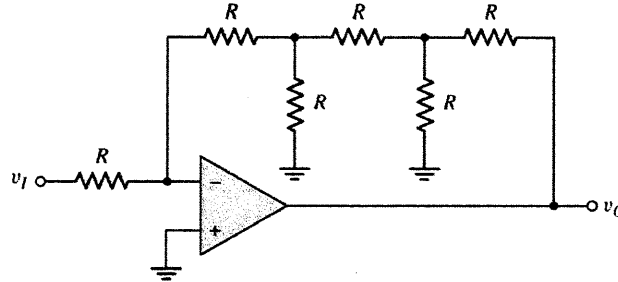


Figure 4

5、The amplifier of Figure 5 consists of two identical common-emitter amplifiers connected in cascade. Observe that the input resistance of the second stage, R_{in2} , constitutes the load resistance of the first stage. (25%)

(a) For $V_{CC} = 15V$, $R_1 = 100k\Omega$, $R_2 = 47k\Omega$, $R_E = 3.9k\Omega$, $R_C = 6.8k\Omega$, and $\beta = 100$, (5%)

determine the dc collector current and dc collector voltage of each transistor.

(b) Draw the small-signal equivalent circuit of the entire amplifier and give the values of all its components. (4%)

(c) Find R_{in1} and v_{b1}/v_{sig} for $R_{sig} = 5k\Omega$. (4%)

(d) Find R_{in2} and v_{b2}/v_{b1} . (4%)

(e) For $R_L = 2k\Omega$, find v_o/v_{b2} . (4%)

(f) Find the overall voltage gain v_o/v_{sig} . (4%)

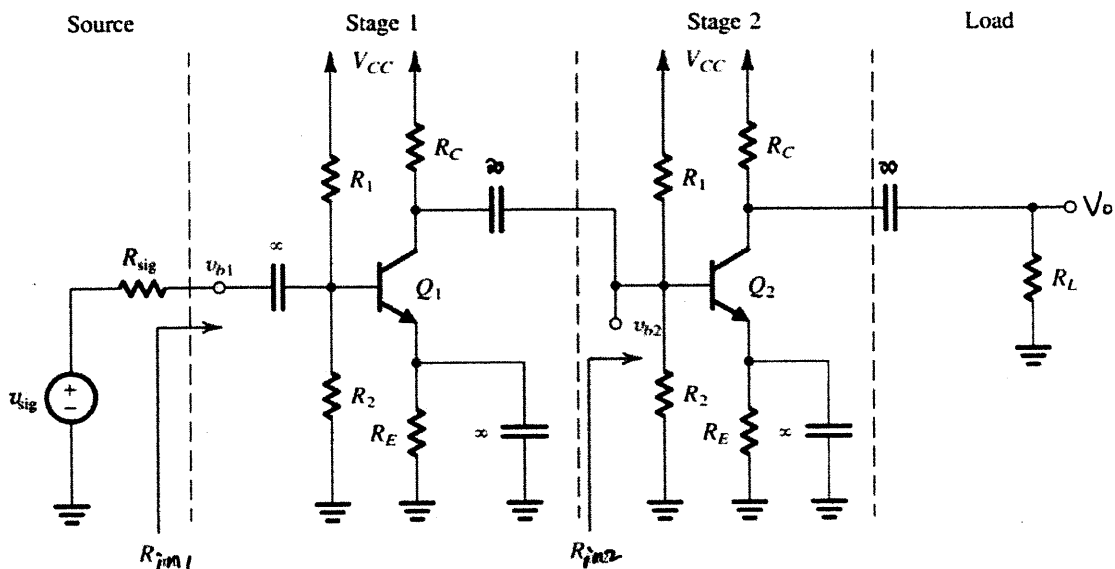


Figure 5