Lecture 5 Quiz Solution

May 2020

Q1:

Question 1

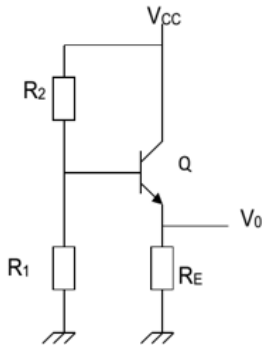
The Figure shows a transistor circuit with V_{CC} = 10 V, R_1 = 5KΩ, R_2 = 5KΩ, R_E = 4.3KΩ, and β = 100.

Compute

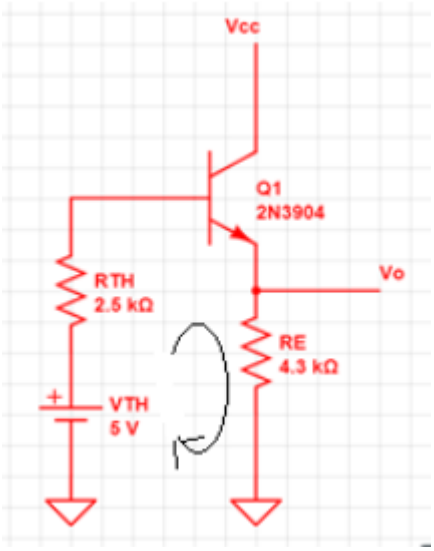
a. I_{CQ}

b. V_{CEQ}

c. I_{R2}.



Ans



$$V_{th} = V_{CC}\frac{R_1}{R_1 + R_2} = 5\ V$$

$$R_{th} = R_1||R_2 = 2500\ \Omega$$

$$I_{EQ} = \frac{V_{th} - V_{BE}}{R_E + \frac{R_{th}}{\beta + 1}} = 0.9943\ mA$$

a) $I_{CQ} = \alpha I_{EQ} = \frac{100}{101} * 0.9943 = 0.9845\ mA$

b) $V_{CEQ} = V_{CQ} - V_{EQ} = V_{CC} - I_E R_E = 10 - 0.9943 * 4.3 = 5.725\ V$

c) $V_B = V_{EQ} + 0.7 = I_{EQ}R_E + 0.7 = 4.97V$

$$I_R = \frac{V_{CC} - V_B}{R_2} = 1mA$$

Q2

Question 2

The transistor circuit shows resistance values and voltages in the Figure.

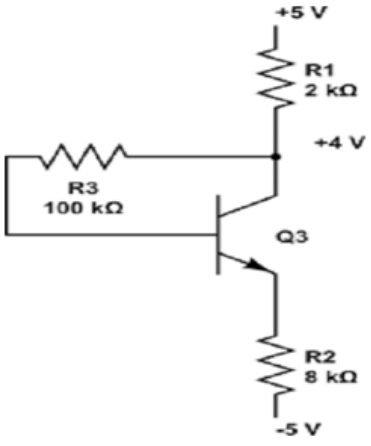
Compute

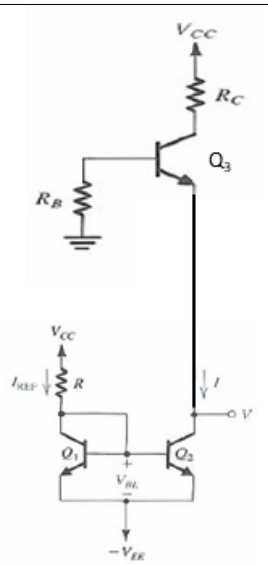
a. I_{R1}

b. V_{EQ}

c. V_{CEQ}

d. I_{R3}



ans.	a. $I_{R1} = \frac{5-4}{R1} = 0.5mA$ b. $V_{EQ} = -5 + I_{R1}R_2 = -1V$ c. $V_{CEQ} = V_{CQ} - V_{EQ} = 4 - (-1) = 5V$ d. $I_{R3} = \frac{V_C - V_B}{R_3} = \frac{4-(0.7+V_{EQ})}{R_3} = 43\mu A$
Q3	Question 3 The circuit shown in the Figure consists of components and voltages as follows: V_{CC} = 10V, V_{EE} = 5V, R_C = 5K, R_B = 10K and I = 1mA. Given that all transistors are identical with β = 100 and V_{BE} = 0.7V. a. What is the name of the circuit consisting of Q1 and Q2. b. Compute R. c. Compute V_{E3}. d. Compute V_{CE3}. 
ans	a. Current source b. $R = \frac{V_{CC}+V_{EE}-0.7}{I_{ref}} = \frac{14.3}{1mA} = 14.3k\Omega$ c. $I_{B3} = \frac{I}{\beta+1} = 9.9\mu A \rightarrow V_{B3} = -I_{B3}R_B \approx -0.1V \rightarrow V_{E3} = V_{B3} - 0.7 \approx -0.8V$ d. $I_{C3} = \frac{\beta}{\beta+1}I \rightarrow V_{C3} = V_{CC} - I_{C3}R_C = 5.05V \rightarrow V_{CE3} = V_{C3} - V_{E3} = 5.85V$