

# Navlakhi®



Chapter 1

## BJT DC Solutions

[Classwork Supplement]

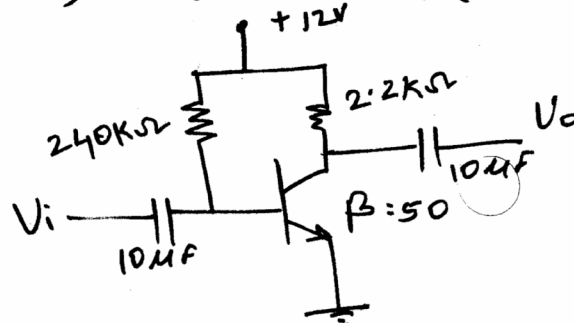
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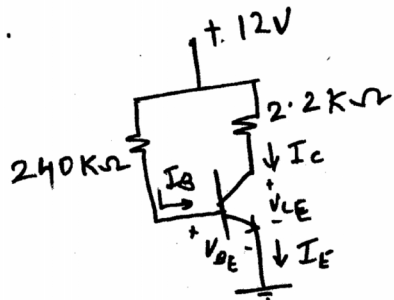
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## BJT DC Analysis SOLUTIONS

Q1. Find (a)  $I_B$  (b)  $I_C$  (c)  $V_{CE}$  (d)  $V_B$  (e)  $V_C$  (f)  $V_{BC}$



Sol.



(a) Applying KVL to BE loop  
 $12 - 240kI_B - 0.7 = 0$   
 $I_B = 47.083 \mu A$

(b)  $I_C = \beta I_B = 2.354 mA$

(c) Applying KVL to CE loop

$$12 - 2.2kI_C - V_{CE} = 0$$

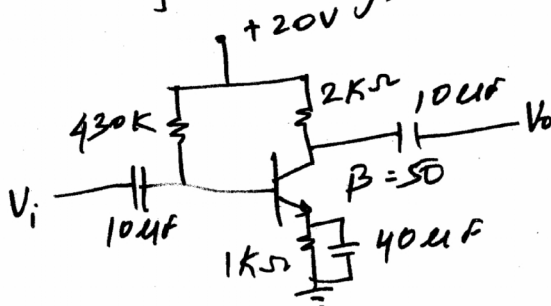
$$V_{CE} = 6.821 V$$

(d)  $V_B = 12 - 240kI_B = 0.7 V$

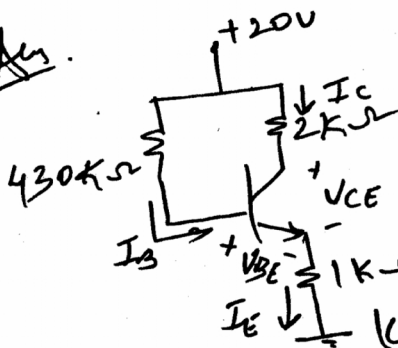
(e)  $V_C = 12 - 2.2kI_C = 6.821 V$

(f)  $V_{BC} = V_B - V_C = -6.121 V$

Q2. Find (a)  $I_B$  (b)  $I_C$  (c)  $V_{CE}$  (d)  $V_C$  (e)  $V_E$   
(f)  $V_B$  (g)  $V_{BC}$



Ans.



(a) Applying KVL to BE loop

$$20 - 430k I_B - 0.7 - 1k I_E = 0$$

$$20 - 430k I_B - 0.7 - 1k \times 5 I_B = 0$$

$$\therefore I_B = 40.125 \mu A$$

(b)  $I_C = \beta I_B = 2.006 \text{ mA}$

(c) Applying KVL to CE loop

$$20 - 2k I_C - V_{CE} - 1k I_E = 0$$

$$20 - 2k (2.006 \text{ mA}) - V_{CE} - 1k \times 5 I_B = 0$$

$$V_{CE} = 13.942 \text{ V}$$

(d)  $V_C = 20 - 2k I_C = 15.988 \text{ V}$

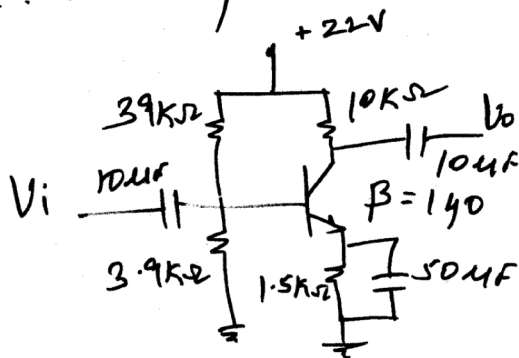
(e)  $V_E = 20 - 2k I_C - V_{CE} = 2.046 \text{ V}$

(f)  $V_B = 20 - 430k I_B = 2.746 \text{ V}$

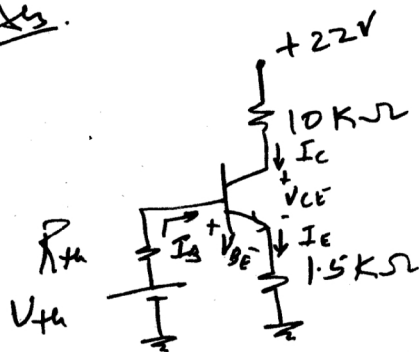
(g)  $V_{BC} = V_B - V_C = -13.242 \text{ V}$

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Q3. Find Q point



Ans.



$$R_{th} = 39k \parallel 3.9k = 3.545k\Omega$$

$$V_{th} = \frac{3.9k}{3.9k + 39k} \times 22 = 2V$$

Applying KVL to BE loop

$$V_{th} - I_B R_{th} - 0.7 - 1.5k I_E = 0$$

$$2 - I_B (3.545k) - 0.7 - 1.5k \times 141 I_B = 0$$

$$I_B = 6.045 \mu A$$

$$I_C = \beta I_B = 0.846 mA$$

Applying KVL to CE loop

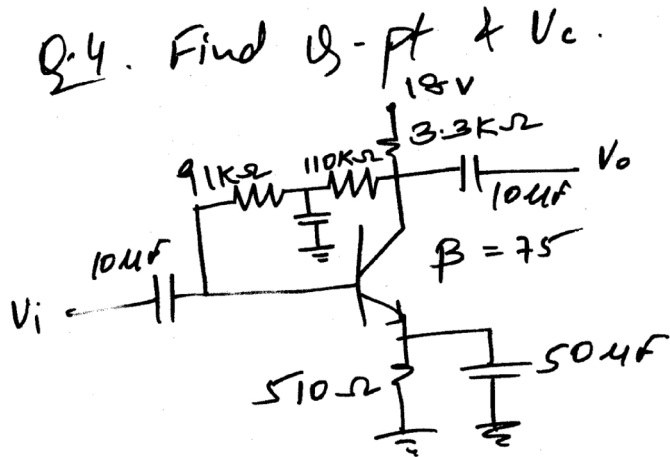
$$22 - 10k I_C - V_{CE} - 1.5k I_E = 0$$

$$22 - 10k (0.846 mA) - V_{CE} - 1.5k \times 141 I_B = 0$$

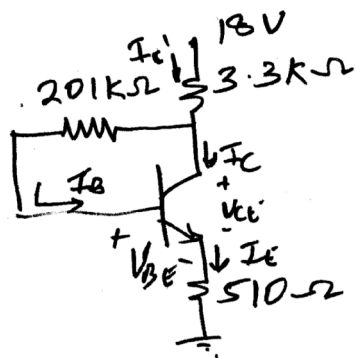
$$V_{CE} = 12.261 V$$

$$Q = (12.261 V, 0.846 mA)$$

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Ans.



Applying KVL to BE loop

$$18 - 3.3k I_{C'} - 201k I_B - 0.7 - 510 I_E = 0$$

$$18 - 3.3k \times 76 I_B - 201k I_B - 0.7 - 510 \times 76 I_B = 0$$

$$I_B = 34.630 \mu A$$

$$I_C = \beta I_B = 2.597 \text{ mA}$$

Applying KVL to CE loop.

$$18 - 3.3k I_{C'} - V_{CE} - 510 I_E = 0$$

$$18 - 3.3k \times 76 I_B - V_{CE} - 510 \times 76 I_B = 0$$

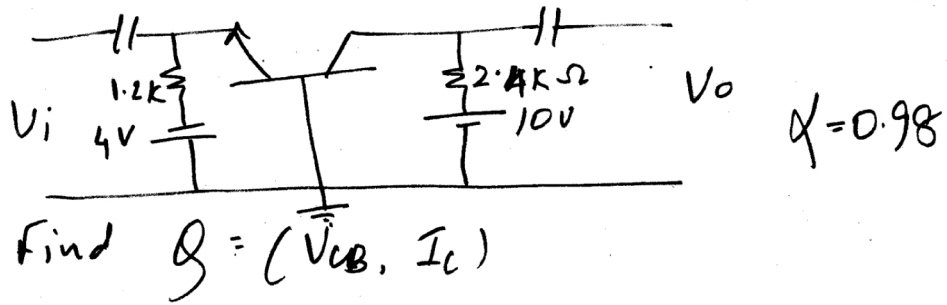
$$V_{CE} = 7.973 \text{ V}$$

$$Q = (7.973 \text{ V}, 2.597 \text{ mA})$$

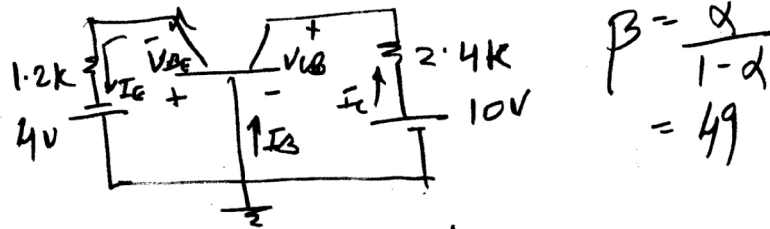
$$V_C = 18 - 3.3k I_{C'}$$

$$= 9.315 \text{ V}$$

Q5.



Ans.



Applying KVL to BE loop

$$4 - 0.7 - 1.2k I_E = 0$$

$$4 - 0.7 - 1.2k \times 50 I_B = 0$$

$$I_B = \frac{55 \mu A}{50}$$

$$I_C = \beta I_B = 2.695 \text{ mA}$$

Applying KVL to CB loop

$$10 - 2.4k I_C - V_{CB} = 0$$

$$V_{CB} = 3.532 \text{ V}$$

$$Q = (3.532 \text{ V}, 2.695 \text{ mA})$$