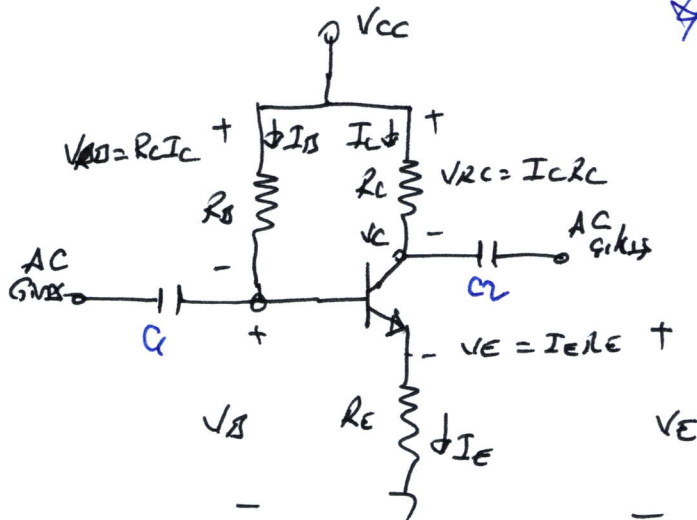


30. Hafta Derst Altu



★ Emetor Derstli DC ayarlan-
lana derest Döşlür.

⇒ Derede C deper verelir.
Kullanıyokuz.

⇒ Kuralları yazalım.

1-) B-E ve C-E den denklemler çıkarılır.

2-) Denklemler birleştirilir. Sayısal deperler en son yerine konur.

C-E Arası Denklemler

B-E Arası

① $V_{CC} = I_C R_C + V_{CE} + I_E R_E$

② $V_{CC} = I_B R_B + V_{BE} + I_E R_E$

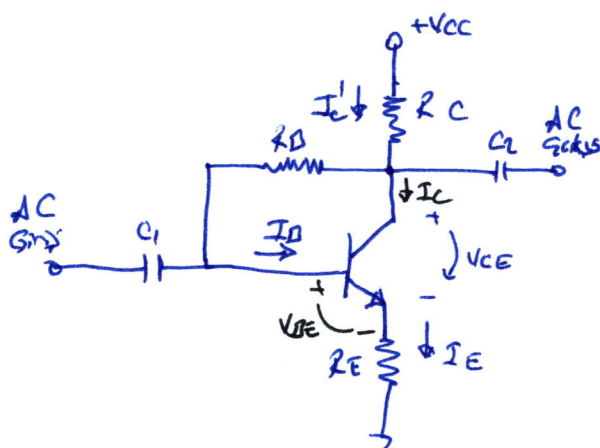
③ $I_C = \beta I_B \rightarrow \text{Aktif}$

④ $I_E = I_C + I_B$

⇒ Aktif bölgede ise 1-4 nolu denklemler kullanılır.

⇒ Diğer bölge ise 5-6 nolu denklemler kullanılır.

Ger? Derstli DC ayarlanılana Deresi?



B-E Arası

① $V_{CC} = I_C' R_C + I_B R_B + V_{BE} + V_{BE} + I_E R_E$

C-E Arası

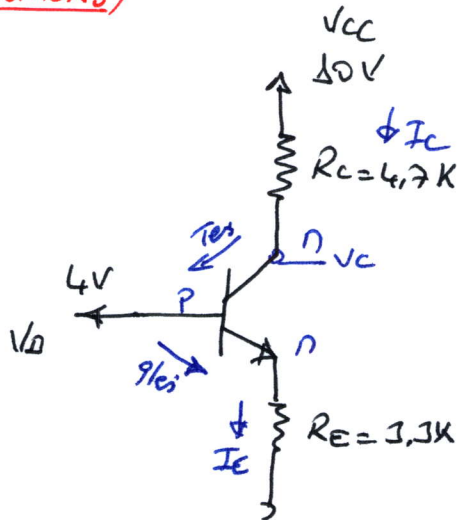
② $V_{CC} = I_E' R_C + V_{CE} + I_E R_E$

④ $I_C = \beta I_B$ ③ $I_C' = I_B + I_C$

07.04.2019

15.48

- 8. sığıkta sanılar ver. Olur sağma.
- Örnekte ver. Kardiye sağma.
- Veret kocam des netlenen sanı sağma.

Örnekte/

$$V_{CE} = 0.2V$$

$$V_{BE} = 0.7V$$

$$\beta = 100$$

— Transistörün sağma

büyüklüğü ve akımını

bulunuz

Çözüm

Aktif Kolu alıp çalıştırırız

$$V_{CC} = I_C R_C + V_{CE} + I_E R_E$$

$$V_{BE} = V_{BE} + I_E R_E \rightarrow I_E = \frac{V_{BE} - V_{BE}}{R_E} = \frac{4 - 0.7}{3.3} = 1mA \quad (I_E = 1mA)$$

$$I_C = \frac{V_{CC} - V_{CE} - I_E R_E}{R_C} = \frac{10 - 0.2 - 3.3}{4.7} = \frac{6.5}{4.7}$$

$$I_C \approx I_B = I_E \quad (\beta + 1) I_B = I_E$$

$$I_B = \frac{I_E}{\beta + 1} = \frac{1}{101} = 0.0099mA$$

$$I_C = 0.99mA$$

$$\frac{V_{CC} - V_C}{R_C} = I_C$$

$$V_C = -I_C R_C + V_{CC} = 10 - 0.99 \times 4.7 = 5.343V$$

$$V_C = 5.343V$$

$$V_{BE} = 0.7V$$

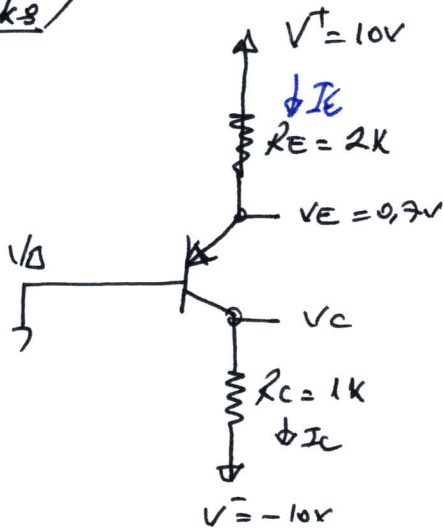
$$V_E = I_E R_E = 3.3V$$

7/2

Örnek

09.04.2019

16.06



$$\beta = 100$$

$$V_{BE} = 0,7V$$

\Rightarrow Transistor akımları ve sabitleri bilginizi kontrol ediniz.

Çözüm

E-B

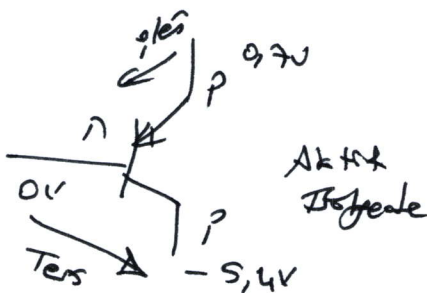
$$V_{EB} = 0,7 \quad V_E - V_B = 0,7 \quad \boxed{V_E = 0,7V}$$

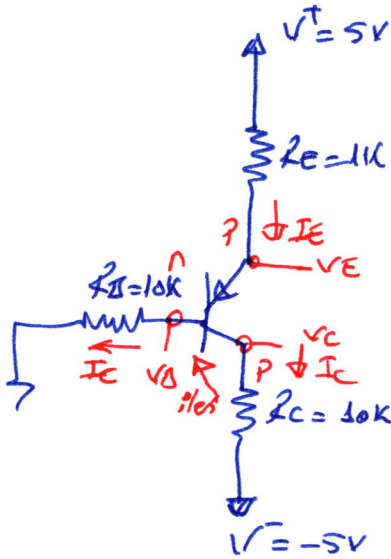
$$\frac{V^+ - V_E}{R_E} = I_E = \frac{10 - 0,7}{2} = \boxed{4,65 \mu A}$$

$$I_B = \frac{I_E}{\beta + 1} = 0,046 \mu A$$

$$I_C = \frac{I_E}{\beta + 1} \cdot \beta = 4,603 \mu A$$

$$V_C = I_C R_C + V^- = \boxed{-5,39604 V}$$





$$\beta = 100$$

$$V_{BE} = 0.7V$$

⇒ Transistor aktif ve çalışma bölgesini bulunuz.

Gözlem

- Aktif kolon

E-D

$$V^+ = I_E R_E + V_{BE} + I_B R_B$$

$$\beta I_B = I_C$$

$$I_B = \frac{I_E}{\beta + 1}$$

$$I_E = (\beta + 1) I_B$$

$$V^+ = (\beta + 1) I_B R_E + V_{BE} + I_B R_B$$

$$V^+ = I_B (R_E (\beta + 1) + R_B) + V_{BE}$$

$$I_B = \frac{V^+ - V_{BE}}{R_E (\beta + 1) + R_B} = \frac{5 - 0.7}{1.101 + 10} = \frac{4.3}{11.1}$$

$$I_B = 0.038 \mu A$$

$$I_E = 3.9126 \mu A$$

$$I_C = 3.8738 \mu A$$

$$V_B = I_B R_B = 0.38 \mu V$$

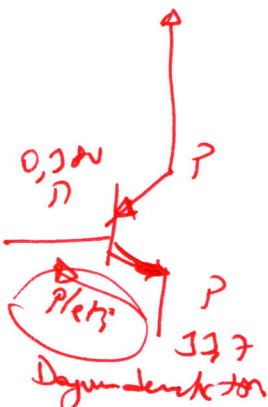
$V_C =$

$$I_C = \frac{V_C - V^-}{R_C}$$

$$V_C = V^- + I_C R_C = -5 + 3.87 = -1.13V$$

⇒ Devre potansiyel
+5 -5 iken $V_C = 33.7V$
gıkamaz.

⇒ Transistor Aktif Bölge
değil. Dayanma kolon et
tekrar göz



Dayanma kolon edip tekrar sistem yapacağız

09.04.2019

18.12

Gözleme alın.

Diyunla kabalE-D Analizi

$$V^+ = I_E R_E + V_{EB} + I_D R_D$$



$$5 = I_E + 0,7 + I_D 10$$

$$(I_E + 10 I_D = 4,3) \quad (1)$$

$$(I_E - I_D - I_C = 0) \quad (2)$$

$$I_E = I_D + I_C$$

E-C Analizi

$$V^+ = I_E R_E + V_{EC} + I_C R_C + V^-$$



$$5 = I_E + 0,2 + I_C 10 + (-5)$$

$$(I_E + 10 I_C = 9,8) \quad (3)$$

$$I_C = 0,86 \mu A$$

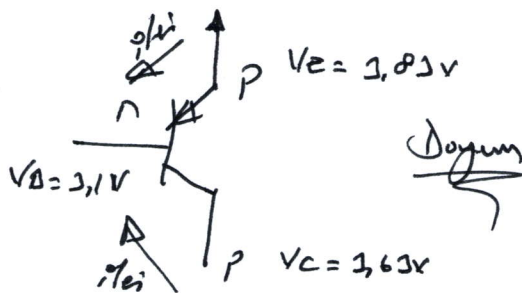
$$I_E = 1,47 \mu A$$

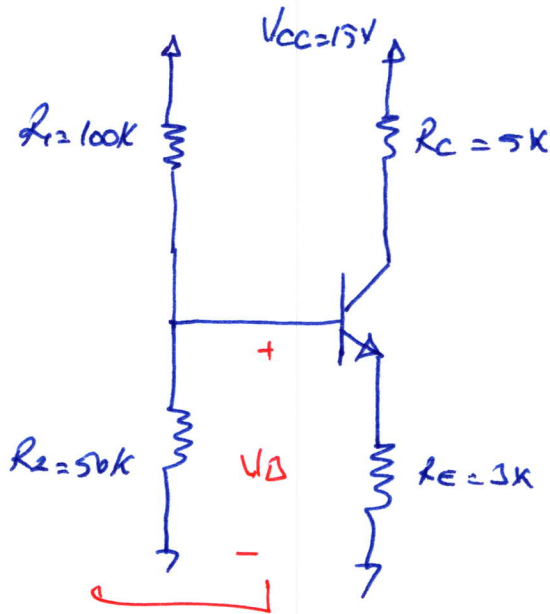
$$I_D = 0,31 \mu A$$

$$V_D = I_D R_D = 3,1 V$$

$$V_C = I_C R_C + V^- = 3,63 V$$

$$V_E = V^+ - I_E R_E = 3,83 V$$





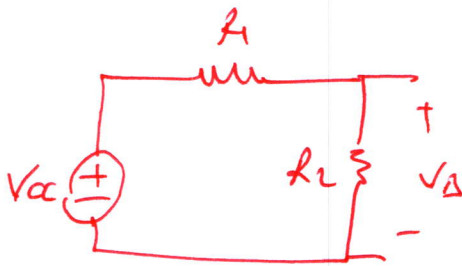
$$V_{BE} = 0,7V$$

$$\beta = 100$$

Devre çalışırken
yapılacak

Gözlem

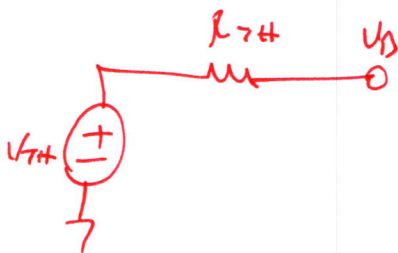
→ Base tarafında bulunan diğer devre sadeleştirilmeli



$$V_{TH} = \frac{V_{CC}}{R_1 + R_2} \times R_2 = \frac{15}{150} \times 50 = 5V$$

$$R_{TH} = R_1 \parallel R_2 \quad (\text{Kaynak kısa devre})$$

$$R_{TH} = 100 \parallel 50 = \frac{100 \cdot 50}{150} = \frac{5000}{150} = 33,3K$$



⇒ Gözetim bu devre üzerinden devam edilmeli.

B-E

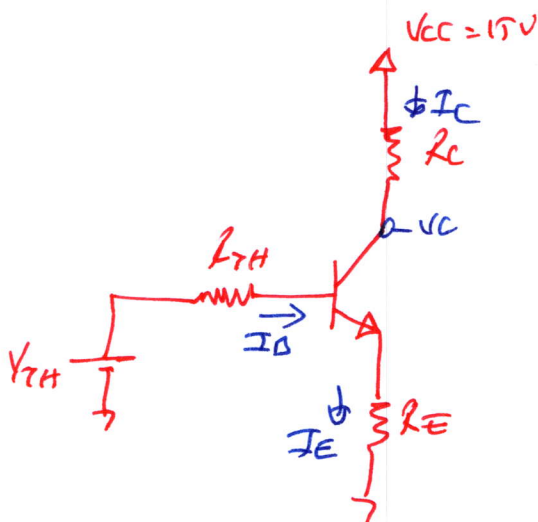
$$V_{TH} = I_B R_{TH} + V_{BE} + I_E R_E \quad I_E = (\beta + 1) I_B$$

$$V_{TH} = I_B R_{TH} + V_{BE} + (\beta + 1) I_B R_E$$

$$V_{TH} = I_B (\beta + 1) R_E + R_{TH} + V_{BE}$$

$$I_B = \frac{V_{TH} - V_{BE}}{(\beta + 1) R_E + R_{TH}} = \frac{5 - 0,7}{101,3 + 33,3} = 0,012 \mu A$$

$$I_E = (\beta + 1) I_B = 1,2 \mu A$$



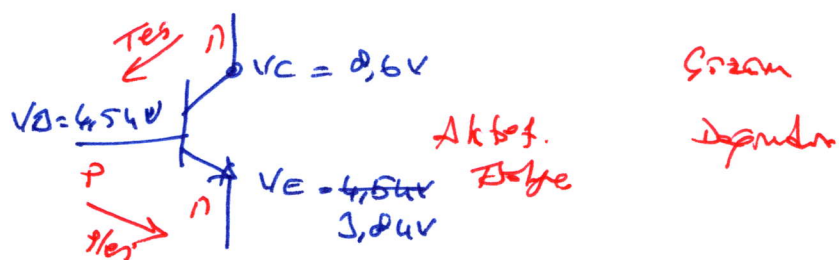
$$I_C = 1,2672 \text{ mA}$$

$$\frac{0,204 \cdot 10}{10,20}$$

$$I_C = \frac{V_{CC} - V_C}{R_C} \quad V_C = V_{CC} - I_C R_C = 15 - 1,2672 \times 5 = \underline{0,6 \text{ V}}$$

$$V_E = I_E R_E = 1,2672 \times 1 \text{ k} = 1,2672 \text{ V}$$

$$V_{BE} = 0,7 = V_B - V_E \quad V_B = V_E + 0,7 = \underline{4,54 \text{ V}}$$



Zauważenie: (7) nowa notka son sisektrary