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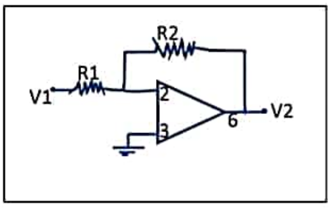
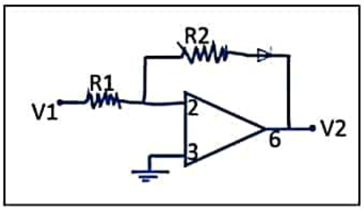
R2=200kΩ.



A) Derive the relation between V2 and V1 (show V2 as a function of V1). Show all your steps.

B) If a diode with Vd=0.7V forward voltage drop is added between R2 and V2, what is the relation between V2 and V1?



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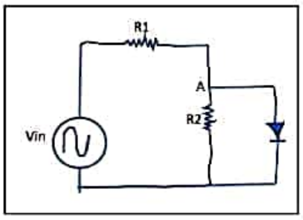
3) In the adjacent diode circuit, R1=20kΩ, R2=10kΩ, Vin(t)=12 cos(t) Volts, and the forward voltage across diode is 0.65 V.

a) Plot $V_n(t)$ and $V_D(t)$ showing multiple cycles



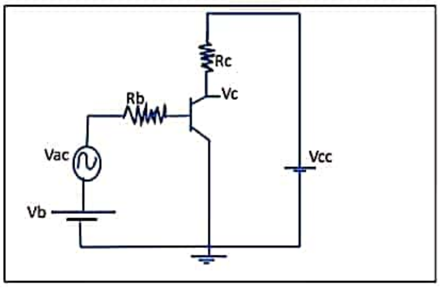
b) Find the current through R2

C) Find the currents through R1 and through the diode

Birzeit University

PHYS336 Final Exam February 2 2021

1- In the adjacent cartoon. Rb=200 kΩ, Rc=10 kΩ, Vb=1 V, Vac=0.3cost Volt, Vcc=20V, β=200, V_{BE}=0.7V. Find



A) The maximum value of current flowing into Rb

B) The current flowing into the emitter of the transistor

C) The highest voltage for V_C

D) The lowest voltage at Vc

Q1)

a) $V_{ac} = 0.3\cos(t)$

Max = 1 → $t = n\pi$

$$I_b = \frac{V_b + V_{ac} - V_{BE}}{R_b} = \frac{1 + 0.3\cos(t) - 0.7}{200\,K}$$

$$I_{b\,max} = \frac{1.3 - 0.7}{200\,K} = \frac{0.6}{200 \times 10^3} = 3 \times 10^{-6}\ Am$$

B) $I_{EE} = (B+1) I_B$

$$= 201 \times 3\times10^{-6} = 6.03 \times 10^{-4}\ Am$$

لازم اقل قيمة

c) $V_c = V_{cc} - I_c R_c$

[illegible]

$I_c = \beta I_B$

$t = \frac{n\pi}{2}$ → -1

$$I_b = \frac{V_b - V_{BE} + V_{ac}}{R_b} = \frac{0.3 + 0.3\cos(t)}{200\,K}$$

$I_b = \text{zero} \Rightarrow I_c = 0$

$V_c = V_{cc} - \text{zero} = 20V$

d) → $\cos(t) = 1$

$$I_b = \frac{0.3 + 0.3}{200k} = 3 \times 10^{-6}\ Am$$

$I_c = I_b \times 200 = 6 \times 10^{-4}\ A$

$V_c = V_{cc} - I_c R_c = 20 - 6 = 14\ V$

$\frac{\pi}{2}$ π $\frac{\pi}{3}$ (t)

B)

$$I_b = \frac{V_B - V_{BE} + V_{ac}}{R_b} = \frac{1 - 0.7 + 0.3\cos t}{200k}$$

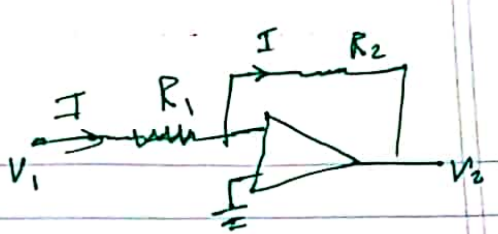
$$I_b = \frac{0.3 + 0.3\cos t}{200k}$$

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

$$= 201 \times \left(\frac{0.3 + 0.3\cos t}{200k} \right)$$

Q2) (a) $R_1 = 5\,k\Omega$

$R_2 = 200\,k\Omega$



$$I = \frac{V_1}{R_1}$$

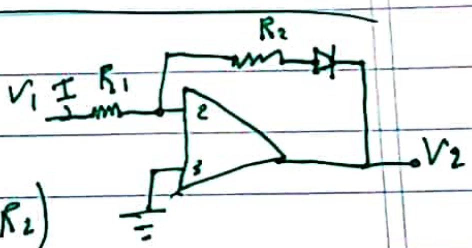
$$V_2 + I R_2 = 0$$

$$V_2 = -I R_2$$

$$V_2 = \frac{-V_1 R_2}{R_1} = \frac{-R_2}{R_1} V_1$$

$$V_2 = \frac{-200}{5} V_1 = -40 V_1$$

B) $I = \frac{V_1}{R_1}$, $\quad V_2 + V_d + I R_2 = 0$



$$V_d = -(V_2 + I R_2)$$

$I_D = I$

$$I_D = I_0 \left(e^{\frac{eV_d}{k_B T}} - 1\right)$$

$$\frac{V_1}{R_1} = I_0 \left(e^{\frac{e\cdot -(V_2 + I R_2)}{k_B T}} - 1\right)$$

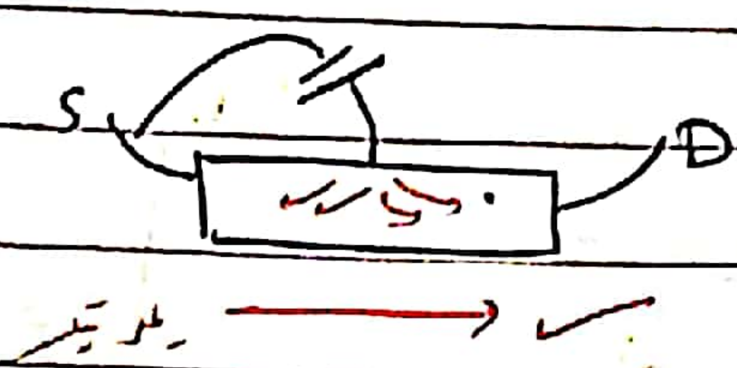
$$\left(e^{\frac{e\cdot -(V_2 + I R_2)}{k_B T}}\right) = \frac{V_1}{R_1 I_0} + 1$$

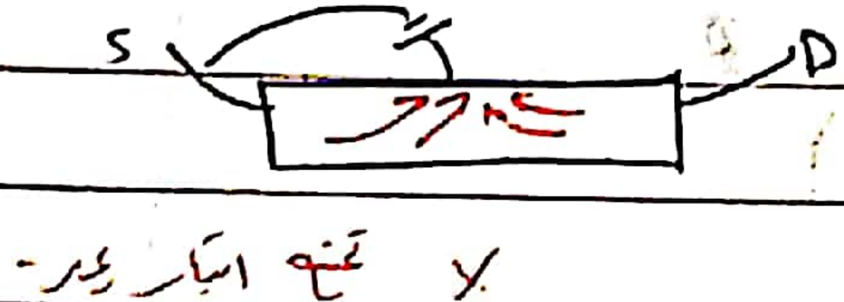
$$\frac{-e(V_2 + I R_2)}{k_B T} = \ln\left[\frac{V_1}{R_1 I_0} + 1\right]$$

$$V_2 = \frac{k_B T}{-e} \ln\left[\frac{V_1}{R_1 I_1} + 1\right] - I R_2$$

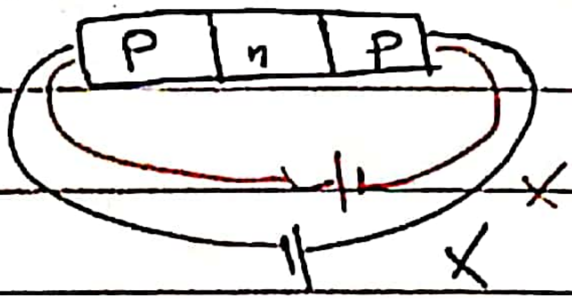
+ Field Effect Transistor :-

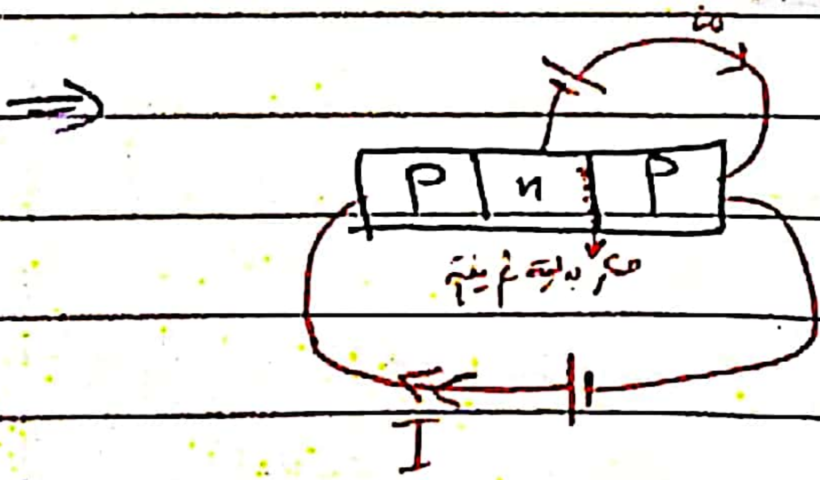
$I \propto (n)$





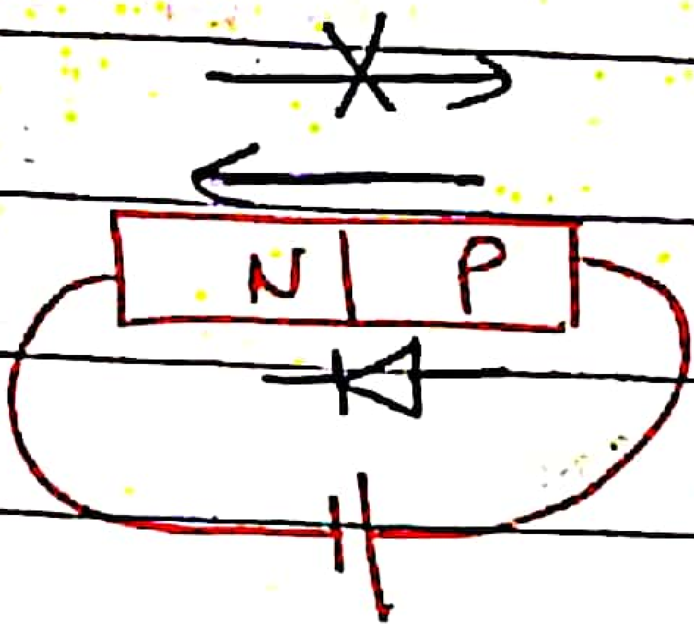
Bipolar Junction Transistor :-

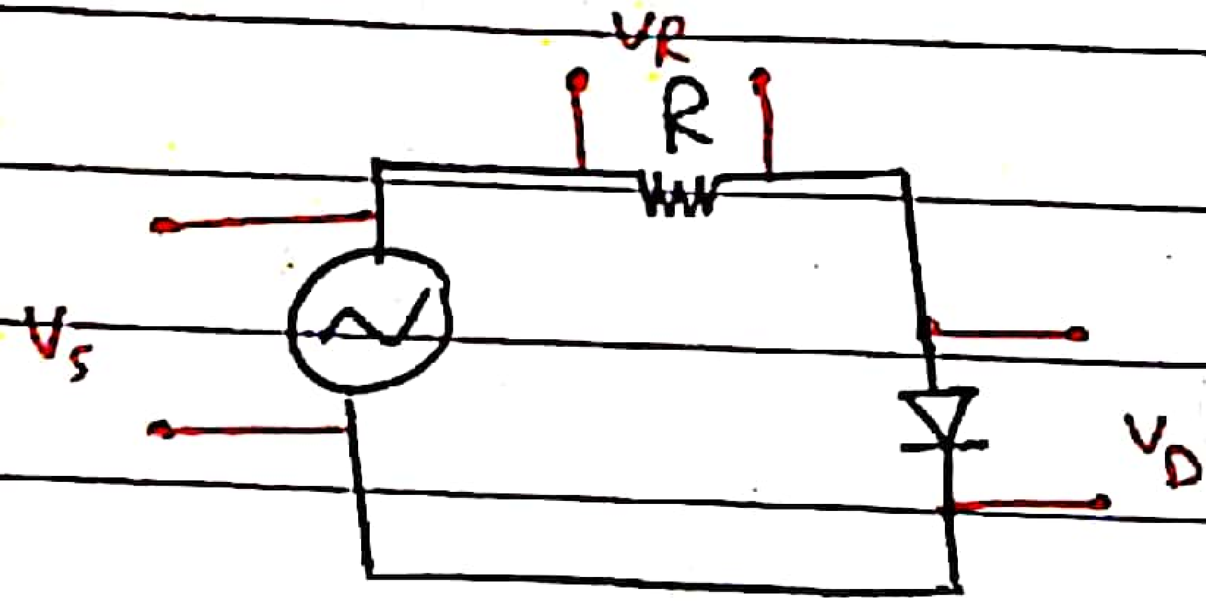




or

* Diode:-





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