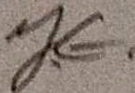
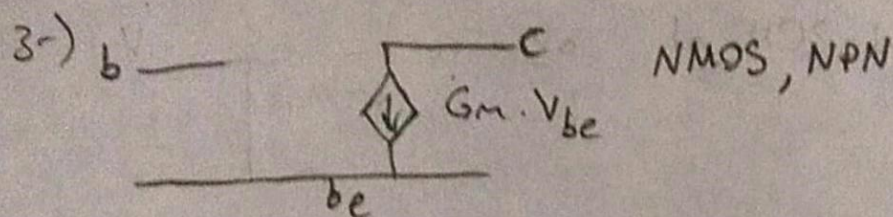


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1-) A type of amplifier that its output voltage changes according to input current.

2-) Current amplifier:



4-) $V_G = 10V \cdot \frac{300}{1000} = 3V$ $V_D = 10 - 4 = 6V$
 $V_{GD} \leq V_T \rightarrow \text{Saturation}$

$$I_D = \frac{\mu}{2} (V_{GS} - V_{th})^2 \cdot \left(1 + \frac{V_{DS}}{V_A}\right)$$

$$2 \cdot 10^{-3} = \frac{4 \cdot 10^{-3}}{2} \cdot (3 - V_S - 1)^2 \cdot \left(1 + \frac{6 - V_S}{80}\right)$$

$$1 = \frac{(2 - V_S)^2}{4 + V_S^2 - 4V_S} \cdot \left(\frac{86 - V_S}{80}\right) = \frac{(344 - 344V_S + 86V_S^2) - (4V_S + V_S^3 - 4V_S^2)}{80}$$

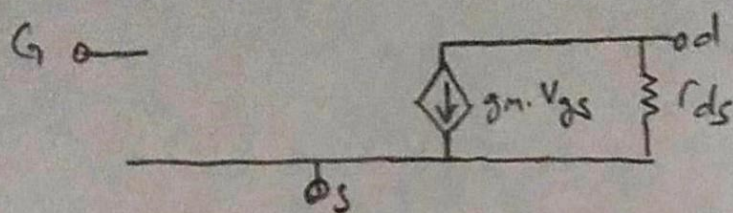
$$0 = V_S^3 + 90V_S^2 - 348V_S + 264$$

$$V_{S1} = 3,25 \quad V_{S2} = -94,11 \quad \boxed{V_{S3} = 0,86V}$$

$$\boxed{V_S = 0,86V}$$

$$5) \quad r_{ds} = \frac{80V}{I_D} = 40 \text{ k}\Omega$$

$$g_m = \sqrt{2 \cdot \beta \cdot I_D} = 4 \text{ mS}$$



6-) In DC case $V_i = 0$, short circuit. $V_B = 0$, $V_E = 0.6V$

$$a. \quad I_{CQ} = \frac{-0.6 + 2}{0.7} = 2 \text{ mA}$$

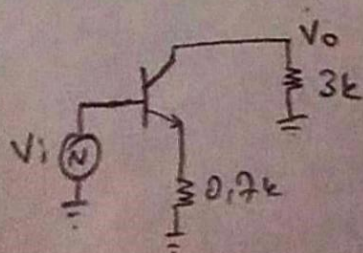
$$I_{CQ} = \frac{V_{CC} - V_{CEsat}}{R_{DC} + R_{AC}} = \frac{12V - 0V}{2 + 3.7k} = 1.62 \text{ mA}$$

No, it doesn't provide.

$$b. \quad \frac{V_o}{V_i} = \frac{V_C}{V_B} \approx - \frac{g_m \cdot r_{CO}}{1 + g_m \cdot r_{CO}}$$

$$g_m = \frac{2 \text{ mA}}{26 \text{ mV}} = 76.92 \text{ mS}$$

$$\frac{V_C}{V_B} \approx - \frac{76.92 \cdot 3}{1 + 76.92 \cdot 0.7} \approx -4.20 = A_V$$



$$c. \quad R_M = \frac{V_o}{i_i} = \frac{V_o}{v_i} \cdot \frac{v_i}{i_i} = A_v \cdot r_i \quad r_i = r_\pi$$

$$r_\pi = \frac{200}{76,92 \text{ m}} \approx 2600 \Omega$$

$$R_M = 2600 \cdot (-4,20) = - \underline{\underline{10920}}$$