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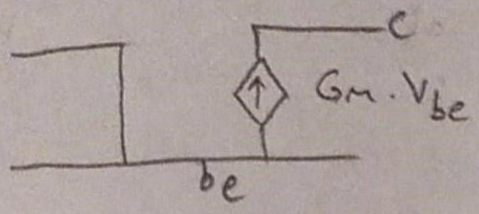
1-) A type of amplifier that its output voltage changes according to input current.

2-) Current amplifier.

3-) 

In MOS, b-e port is open circuit

4-) $V_G = 10V \cdot \frac{300}{1000} = 3V$ $\quad V_D = 10 - 4 = 6V$

$V_{GD} \leq V_T \rightarrow$ Saturation

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

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

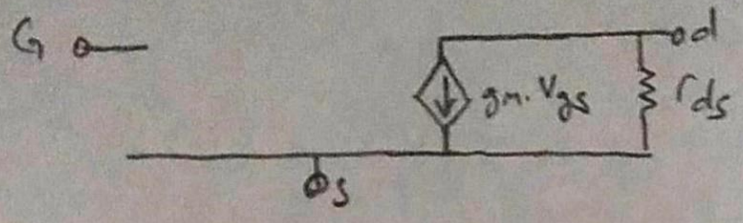
$$1 = \underbrace{(2 - V_S)^2}_{4 + V_S^2 - 4V_S} \cdot \left(\frac{86 - V_S}{80}\right) = \frac{344 - 344V_S + 86V_S^2 - (6V_S + V_S^3 - 4V_S^2)}{80}$$

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

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

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

5) $r_{ds} = \frac{80V}{I_D} = 40\,k\Omega$ $\qquad g_m = \sqrt{2 \cdot \beta \cdot I_D} = 4\,mS$



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

a. $I_{CQ} = \frac{-0,6+2}{0,7} = 2\,mA$

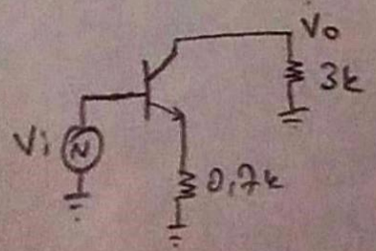
$$I_{CQ} = \frac{V_{CC} - V_{CE\,sat}}{R_{DC} + R_{AC}} = \frac{12V - 0V}{2 \cdot 3,7k} = 1,62\,mA$$

No, it doesn't provide.

b. $\frac{V_o}{V_i} = \frac{V_c}{V_b} \cong -\frac{g_m \cdot r_{co}}{1 + g_m \cdot r_{co}}$

$$g_m = \frac{2\,mA}{26\,mV} = 76,92\,mS$$

$$\frac{V_c}{V_b} \cong -\frac{76,92 \cdot 3}{1 + 76,92 \cdot 0,7} \cong \underline{\underline{-4,20 = A_V}}$$



c. $R_M = \frac{V_o}{i_i} = \frac{V_o}{V_i} \cdot \frac{V_i}{i_i} = Av \cdot r_i$ $\qquad r_i = r_\pi$

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

$$R_M = 2600 \cdot (-4,20) = -\underline{10,920}$$