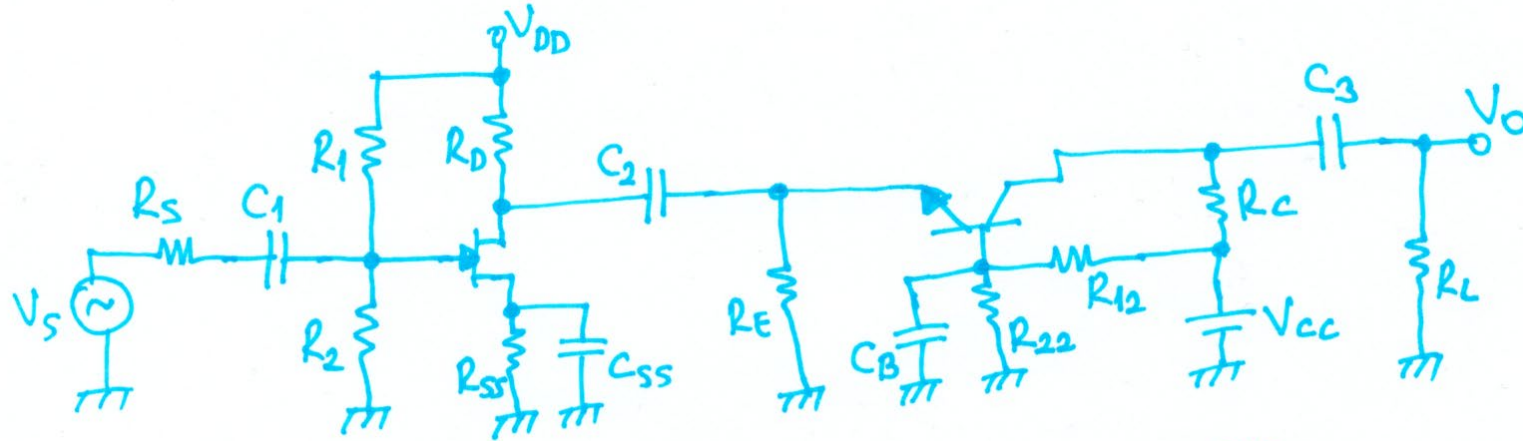




Electronic Circuits

Lecture 7.2: JFET & BJT Amplifier Example

Example: Mix Amplifier Application



$$R_s = 1K$$

$$C_1 = 0.5\mu F$$

$$R_1 = 1.7 M\Omega$$

$$R_2 = 0.3 M\Omega$$

$$R_D = 3K\Omega$$

$$R_{SS} = 1K\Omega$$

$$C_{SS} = 50\mu F$$

$$V_p = -3V$$

$$I_{DSS} = 9mA$$

$$g_m = 4mS$$

$$V_{DD} = 20V$$

$$C_2 = 5\mu F$$

$$R_E = 5K\Omega$$

$$C_B = 7.5\mu F$$

$$R_{22} = 25K\Omega$$

$$R_{12} = 50K\Omega$$

$$R_C = 5K\Omega$$

$$C_3 = 3\mu F$$

$$R_L = 2K\Omega$$

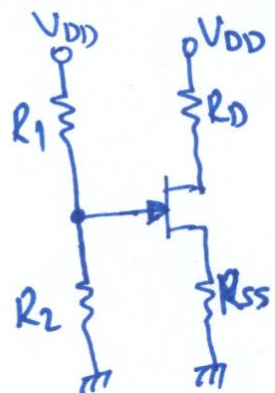
$$\beta = 300$$

$$V_{BE} = 0.7V$$

$$V_{CC} = 15V$$

DC Analysis: Mix Amplifier Application

DC Analysis:

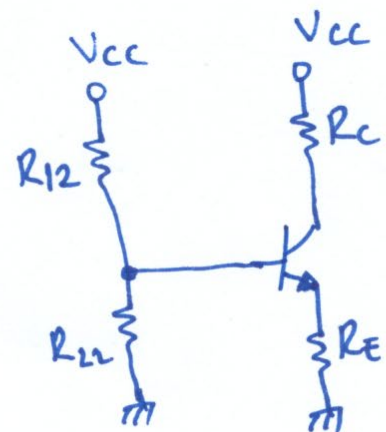


$$V_G = \frac{R_2}{R_1 + R_2} \cdot V_{DD} \quad \left. \vphantom{V_G} \right\} V_{GS} = \frac{R_2}{R_1 + R_2} \cdot V_{DD} - I_D \cdot R_{SS}$$

$$V_S = I_D \cdot R_{SS}$$

$$V_D = V_{DD} - R_D \cdot I_D$$

$$I_D = I_{DSS} \cdot \left(1 - \frac{V_{GS}}{V_P}\right)^2$$



$$V_{TH} = \frac{R_{22}}{R_{12} + R_{22}} \cdot V_{CC}$$

$$R_B = \frac{R_{12} \cdot R_{22}}{R_{12} + R_{22}}$$

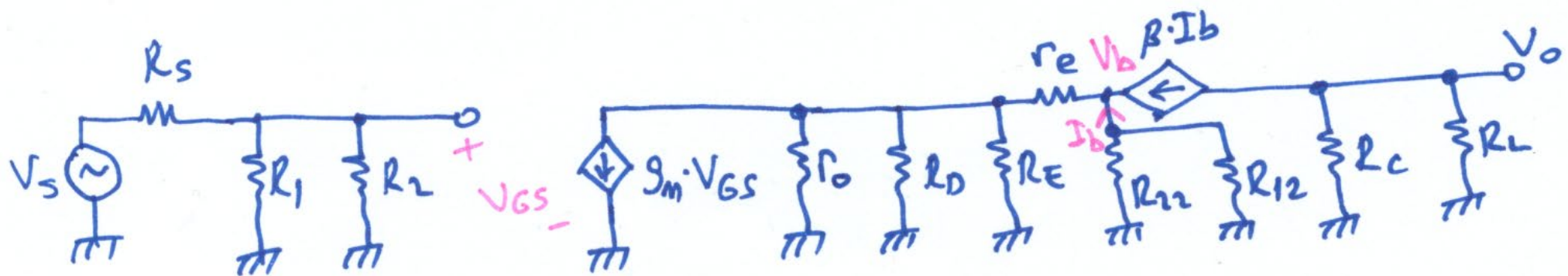
$$-V_{TH} + R_B \cdot I_{BQ} + 0.7 + R_E \cdot I_{EQ} = 0$$

$$I_{EQ} = (\beta + 1) \cdot I_{BQ}$$

$$r_e = \frac{26 \text{ mV}}{I_{EQ}}$$

AC Analysis: Mix Amplifier Application

AC Analysis:



$$V_{GS} = \frac{R_1 // R_2}{R_s + R_1 // R_2} \cdot V_s$$

$$V_o = -\beta \cdot I_b \cdot (R_C // R_L)$$

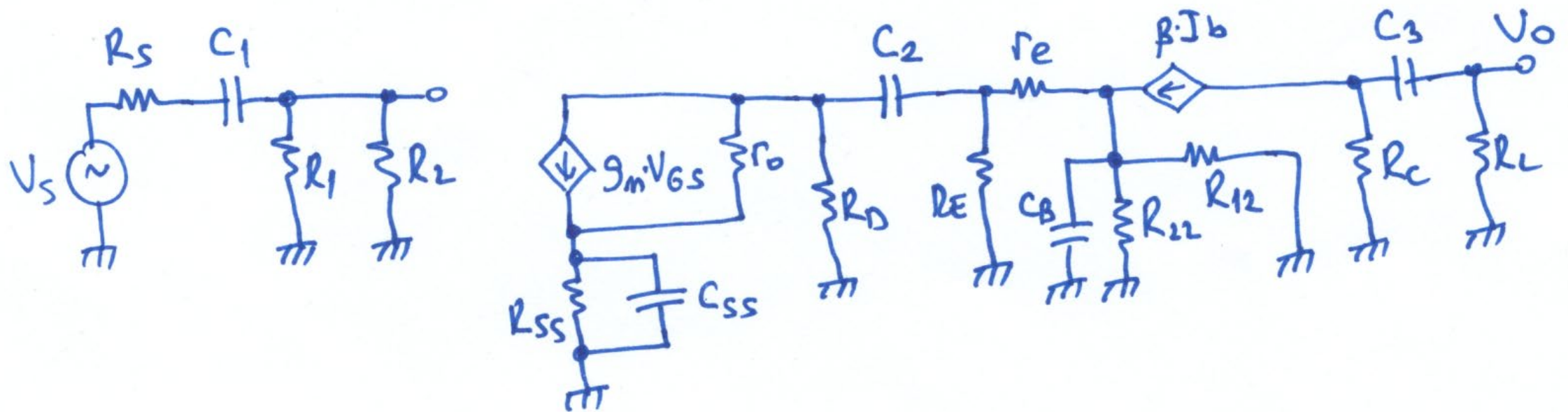
$$V_b = -(R_{12} // R_{22}) \cdot I_b$$

$$V_b = r_e \cdot (\beta + 1) \cdot I_b + (r_o // R_D // R_E) \cdot I_x$$

$$\text{where } I_x = (\beta + 1) \cdot I_b - g_m \cdot V_{GS}$$

Low-Frequency Analysis: Mix Amplifier Application

Low-Frequency Analysis:



Low-Frequency Analysis: Mix Amplifier Application

$$f_1 = \frac{1}{2\pi \cdot C_1 \cdot (R_s + R_1 // R_2)}$$

Since r_o is so high,

$$f_2 = \frac{1}{2\pi \cdot C_{SS} \cdot R_{SS}}$$

$$f_3 = \frac{1}{2\pi \cdot C_3 \cdot (R_c + R_L)}$$

$$f_4 = \frac{1}{2\pi \cdot C_2 \cdot R_{C2}}$$

where $R_{C2} = R_D + R_E // r_e$

$$f_5 = \frac{1}{2\pi \cdot C_B \cdot R_{CB}}$$

where $R_{CB} = R_{12} // R_{22} // (r_e + (\beta + 1) \cdot (R_D // R_E))$



Thanks for
listening 😊

YALÇIN İŞLER

Assoc. Prof.