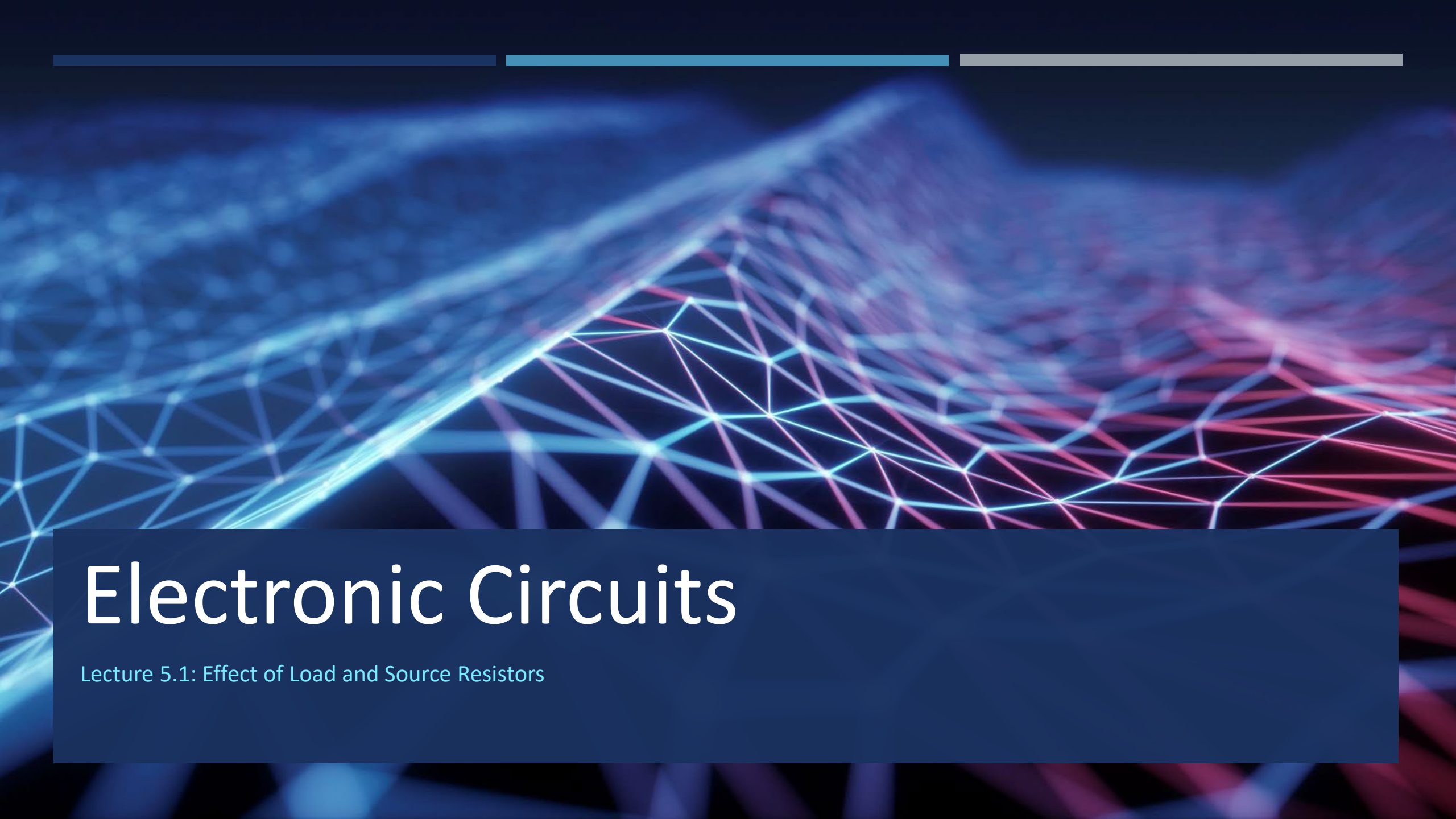
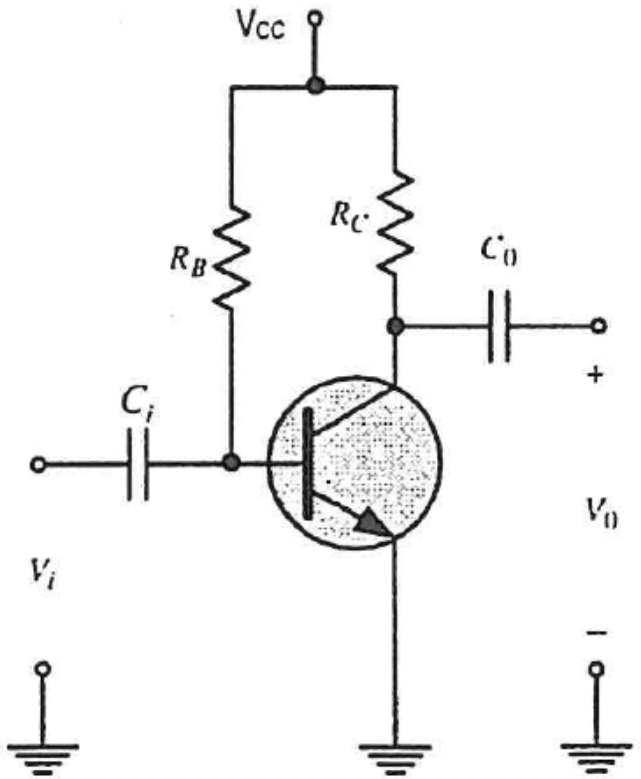


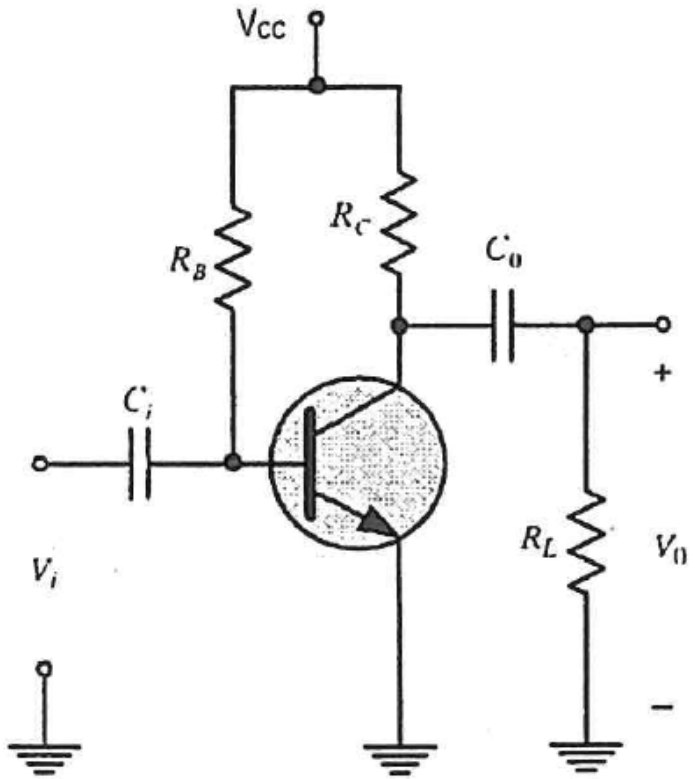
Electronic Circuits

Lecture 5.1: Effect of Load and Source Resistors

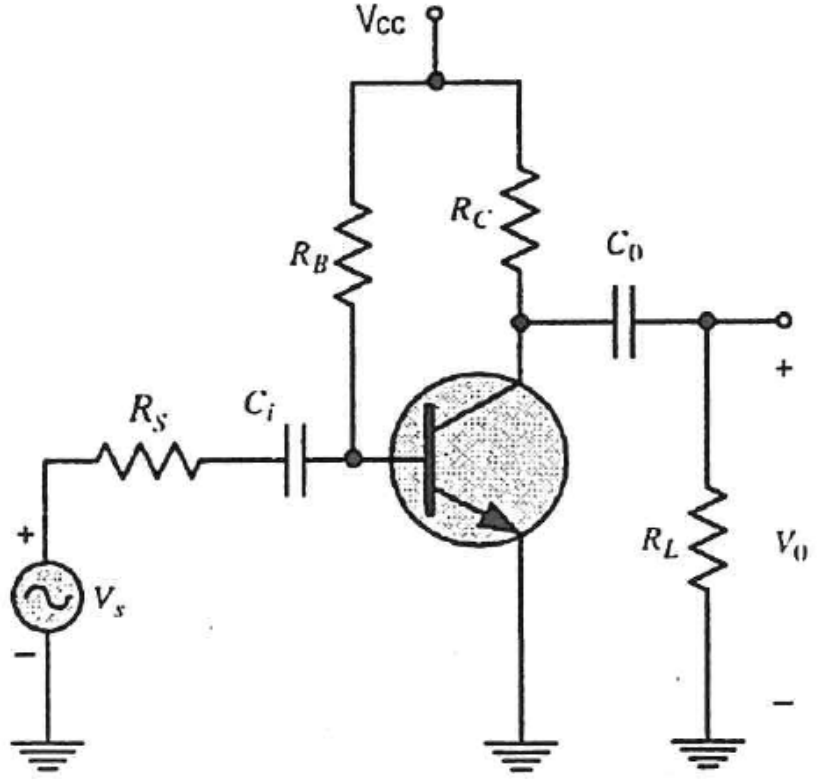
Effect of Load and Source Resistors



$$A_{V,NL} = \frac{V_o}{V_i}$$

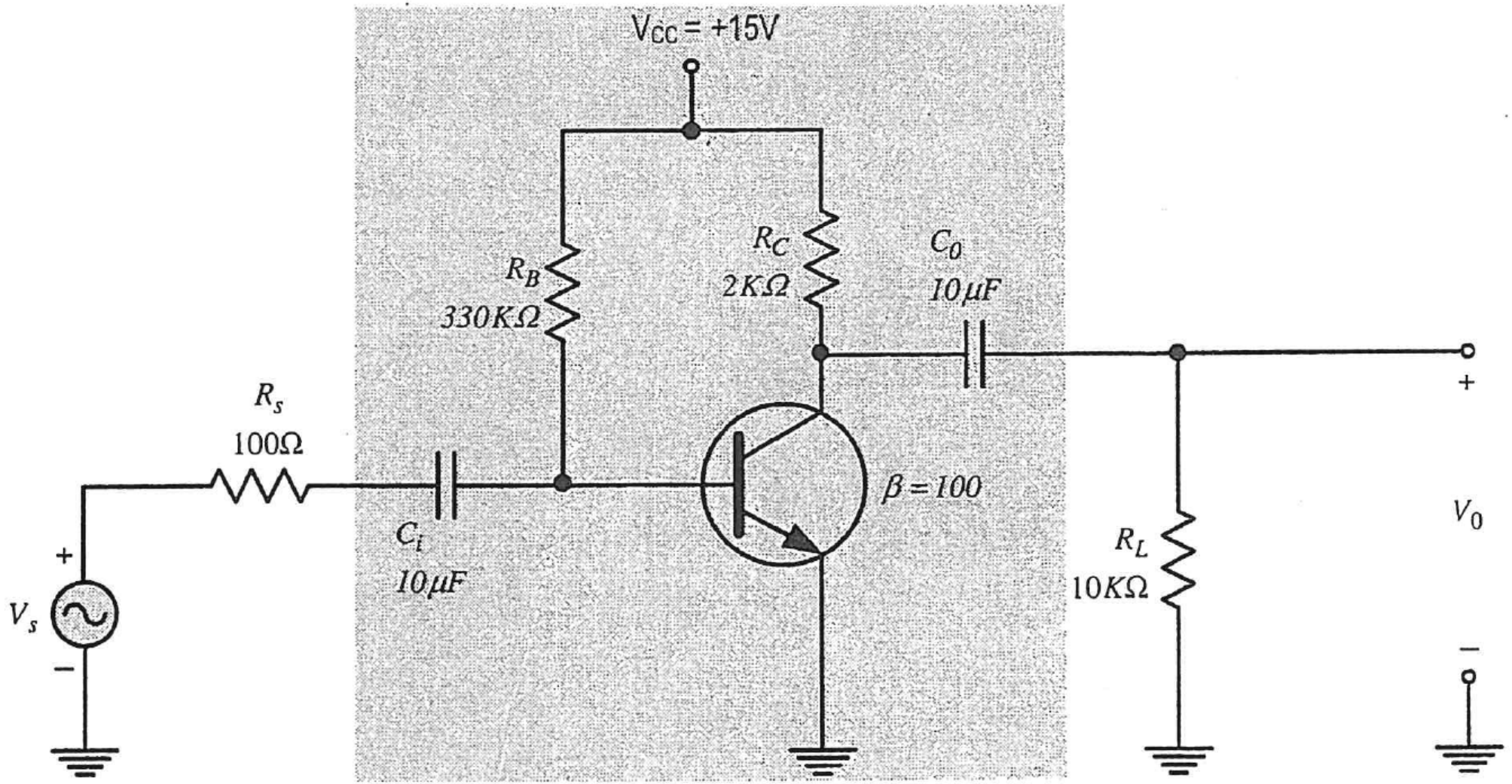


$$A_V = \frac{V_o}{V_i}$$



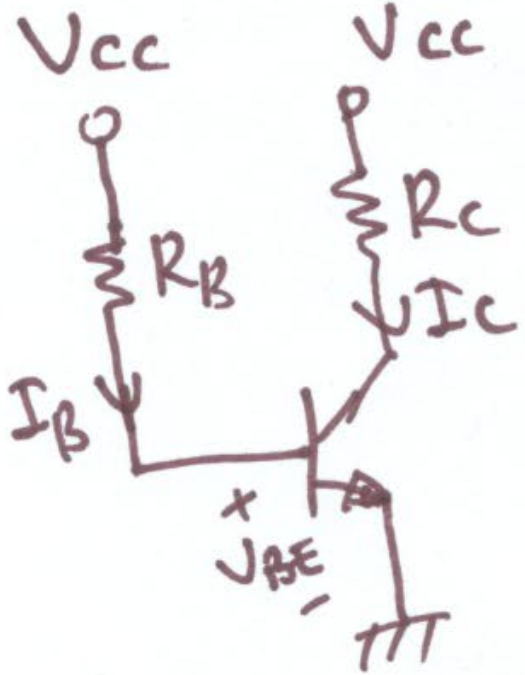
$$A_{V,S} = \frac{V_o}{V_s}$$

Effect of Load and Source Resistors Example (1)



Effect of Load and Source Resistors Example (2)

#1: DC Analysis:

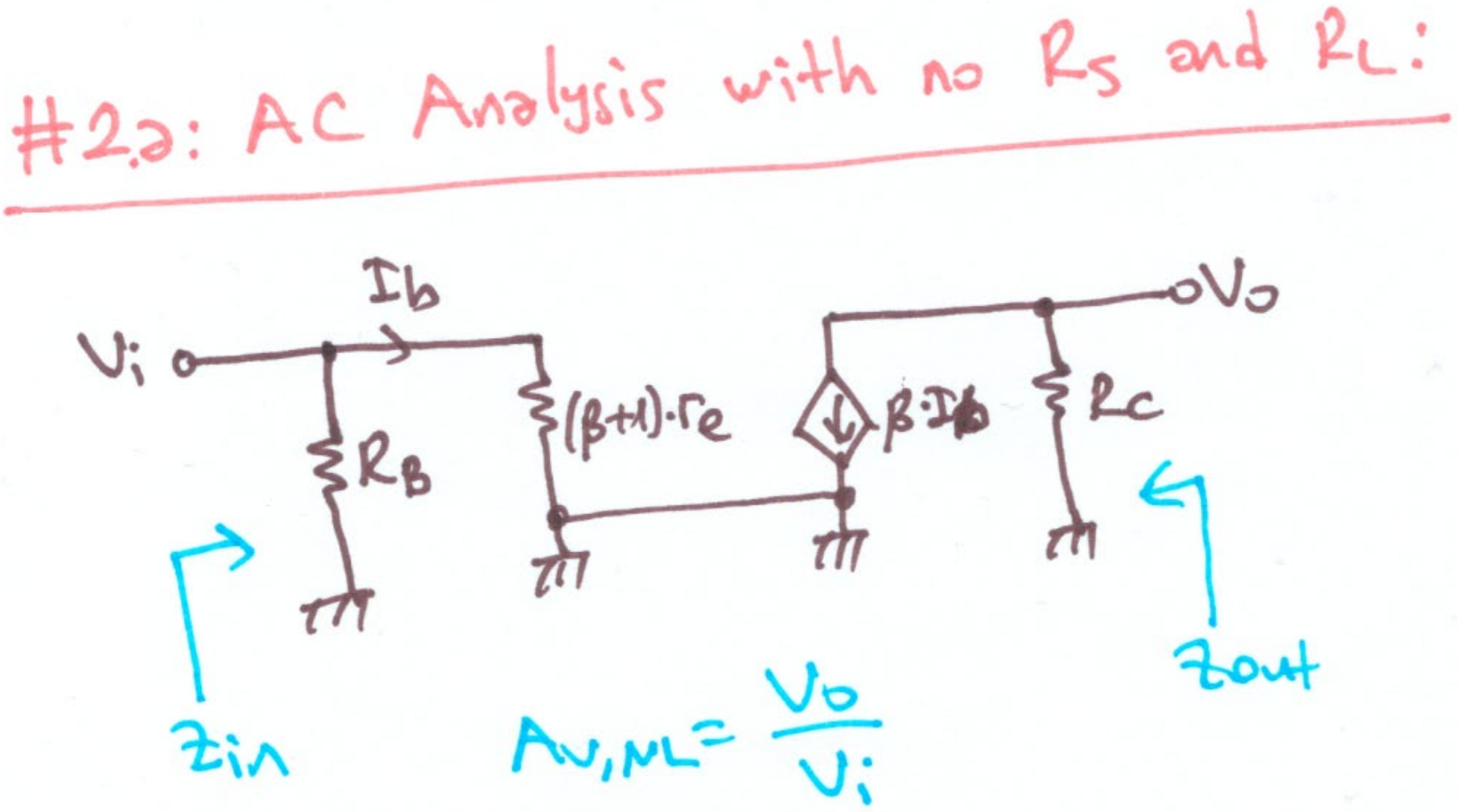


$$I_{BQ} = \frac{V_{CC} - V_{BE}}{R_B} = \frac{15 - 0{,}7}{330K} = 43\,\mu A$$

$$I_{EQ} = (\beta + 1) \cdot I_{BQ} = 101 \cdot 43\,\mu A = 4{,}37\,mA$$

$$r_e = \frac{26\,mV}{I_{EQ}} = \frac{26\,mV}{4{,}37\,mA} = 5{,}95\,\Omega$$

Effect of Load and Source Resistors Example (2)



Effect of Load and Source Resistors Example (3)

$$Z_{in} = R_B \,//\, ((\beta+1)\cdot r_e) = \frac{R_B \cdot (\beta+1)\cdot r_e}{R_B + (\beta+1)\cdot r_e} \simeq (\beta+1)\cdot r_e = 601\,\Omega \quad (R_B \gg (\beta+1)\cdot r_e)$$

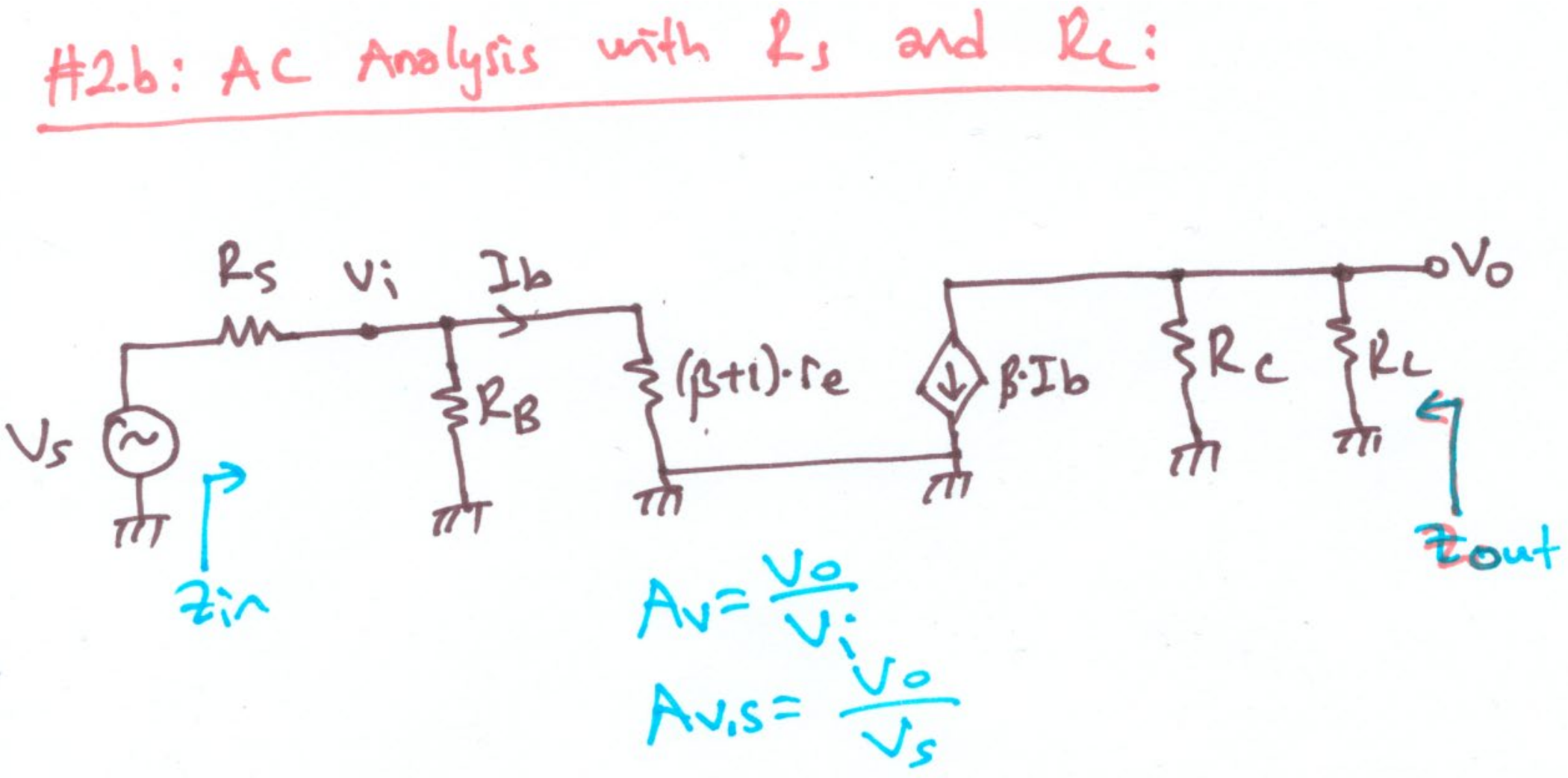
$$(= 539{,}86\,\Omega)$$

$$Z_{out} = R_C = 2\,K\Omega$$

$$V_i = I_b \cdot (\beta+1)\cdot r_e \quad \text{and} \quad V_o = -\beta \cdot I_b \cdot R_C \Rightarrow V_o = -\frac{\beta \cdot R_C \cdot V_i}{(\beta+1)\cdot r_e}$$

$$A_{V,NL} = \frac{V_o}{V_i} \simeq -\frac{R_C}{r_e} = -336$$

Effect of Load and Source Resistors Example (4)



Effect of Load and Source Resistors Example (5)

$$z_{in} = R_B \,//\, ((\beta+1)\cdot r_e) = 534\,\Omega$$

$$z_{out} = R_c \,//\, R_L = \frac{2K \cdot 10K}{2K+10K} = 1{,}67\,K\Omega$$

$$I_b = \frac{V_i}{(\beta+1)\cdot r_e} \quad \text{and} \quad V_o = -z_{out}\cdot\beta\cdot I_b$$

$$= -z_{out}\cdot\beta\cdot\frac{V_i}{(\beta+1)\cdot r_e}$$

$$A_v = \frac{V_o}{V_i} = -\frac{\beta}{\beta+1}\cdot\frac{z_{out}}{r_e} \cong -280$$

Effect of Load and Source Resistors Example (6)

$$V_i = V_s \cdot \frac{R_B // ((\beta+1)\cdot r_e)}{R_s + R_B // ((\beta+1)\cdot r_e)} = V_s \cdot \frac{z_{in}}{R_s + z_{in}}$$

$$A_{v_s} = \frac{V_o}{V_s} = \frac{V_o}{V_i} \cdot \frac{V_i}{V_s} = A_v \cdot \frac{z_{in}}{R_s + z_{in}} \cong -240$$

$$|A_{v,NL}| > |A_v| > |A_{v_s}|$$

Thanks for listening ☺

YALÇIN İŞLER

Assoc. Prof.