PENGUAT SINYAL KECIL
JFET

Tegangan gate ke source mengontrol arus drain source.

gm = Transkonduktansi (siemens)

$$g_m = \frac{\Delta I_D}{\Delta V_{GS}}$$

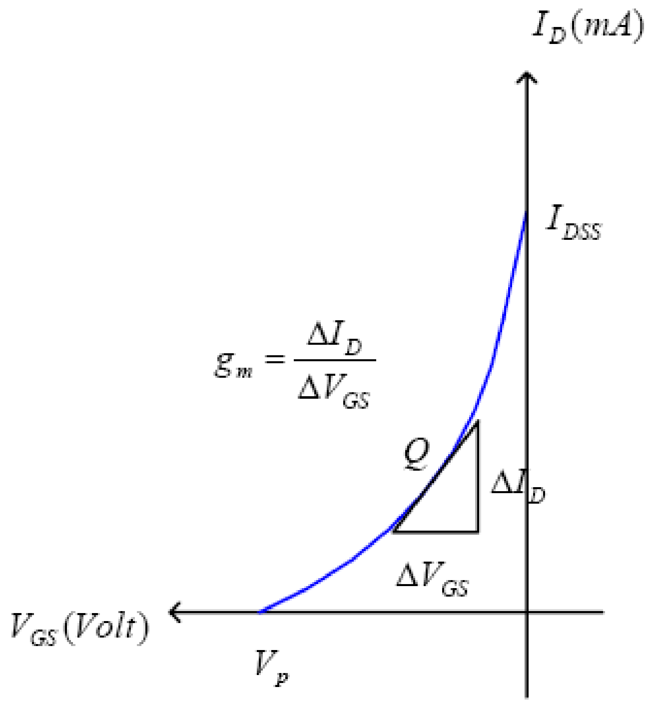
$$g_m = g_{mo}\left(1 - \frac{V_{GS}}{V_p}\right)$$

$$g_{mo} = \frac{2I_{DSS}}{|V_p|}$$

$$I_D = I_{DSS}(1 - \frac{V_{GS}}{V_p})^2$$

$$gm = gmo\left(\sqrt{\frac{I_D}{I_{Dss}}}\right)$$

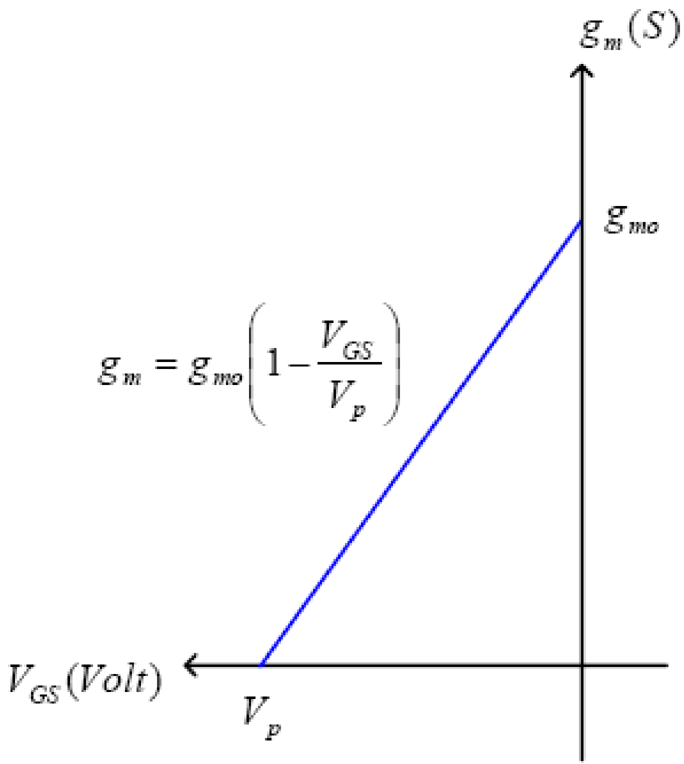
Grafik gm



gm = Transkonduktansi di titik Q

gmo= Transkonduktansi untuk tegangan gate =0

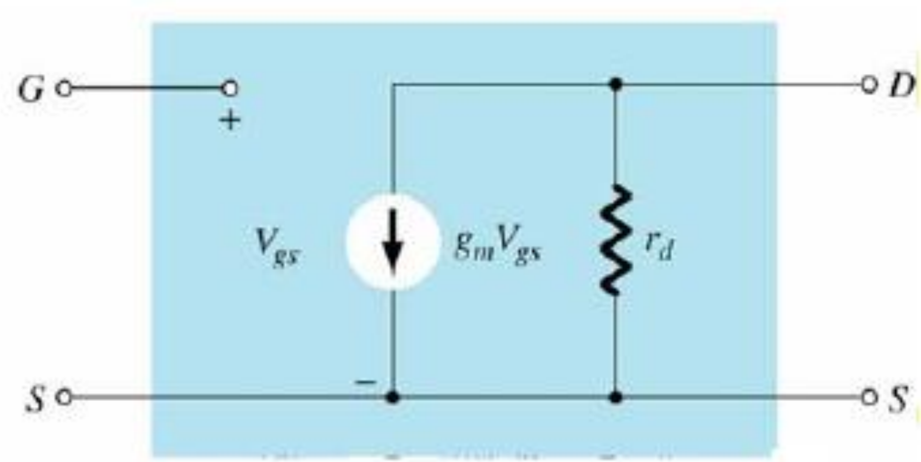
Grafik gm terhadap VGS



MODEL JFET SEDERHANA

Rangkaian Equivalent ac dari JFET

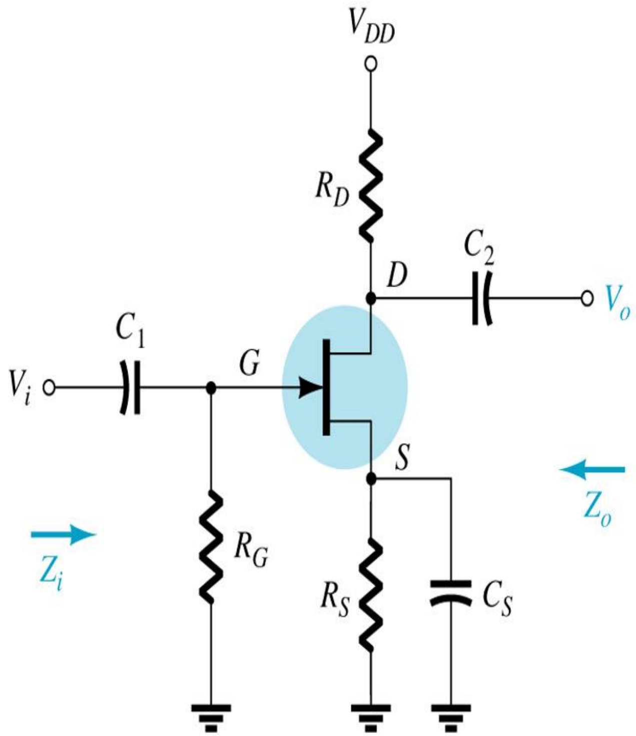
Pengendalian I_D oleh V_{GS} tampak sebagai sebuah sumber arus gmV_{GS} yang Terhubung dari drain ke source. Impedansi input digambarkan sebagai rangkaian Terbuka, dan impedansi output digambarkan sebagai r_d



PENGUAT –PENGUAT JFET (JFET Amplifier)

1. Penguat JFET Common Source (CS)
2. Penguat JFET Common Gate (CG)
3. Penguat JFET Common Drain (CD)

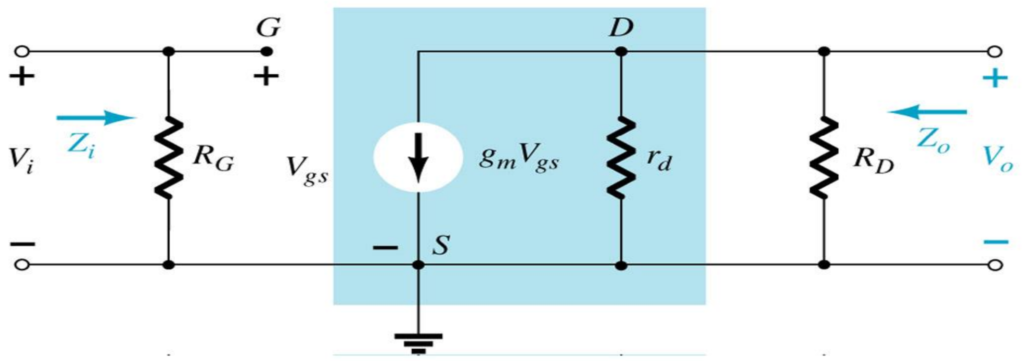
Penguat Common Source (CS) Self bias



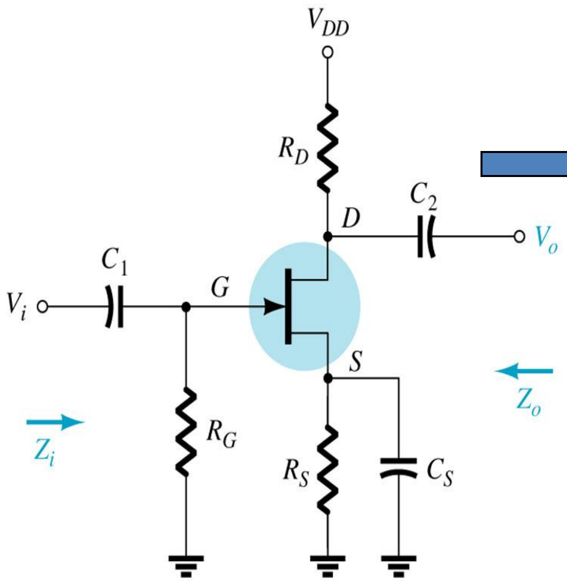
Prosedur analisa rangkaian equivalent ac

1. Asumsikan seluruh kapasitor C1, C2, Cs short untuk sinyal ac
2. DC supply dibuat short circuit
3. Ganti FET menjadi rangkaian model small signal

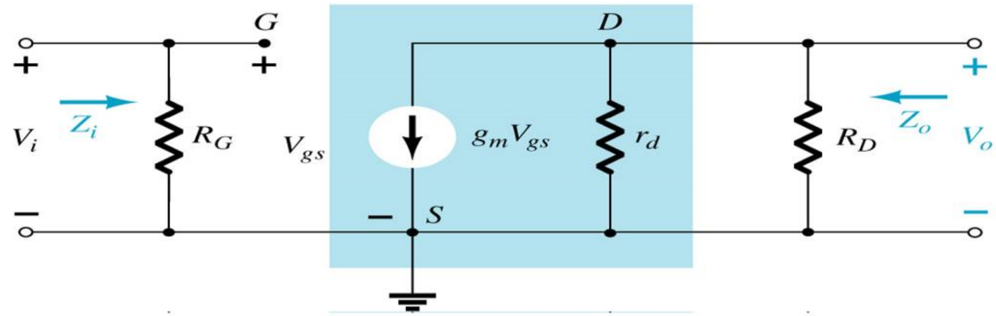
Small Signal model



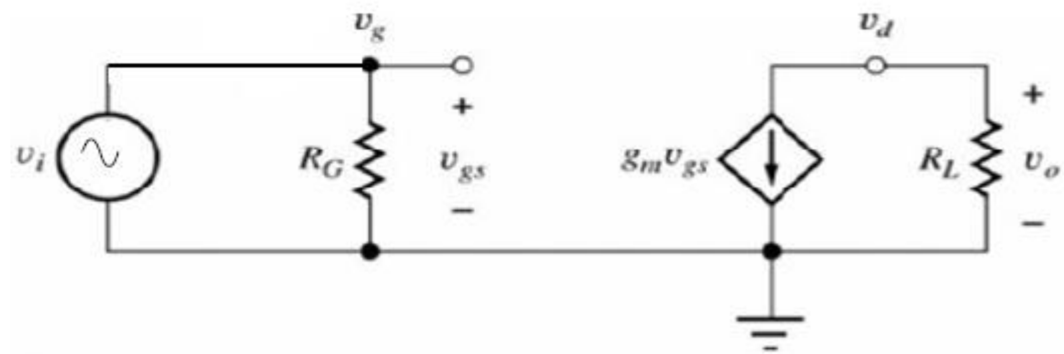
Analisa JFET CS Amplifier



Rangkaian equivalent ac



Penyederhanaan rangkaian equivalent ac



$$\text{Voltage gain, } A_v = \frac{v_o}{v_{in}}$$

$$v_o = i_o R_L = -g_m v_{gs} R_L, \; R_L = R_D // r_d$$

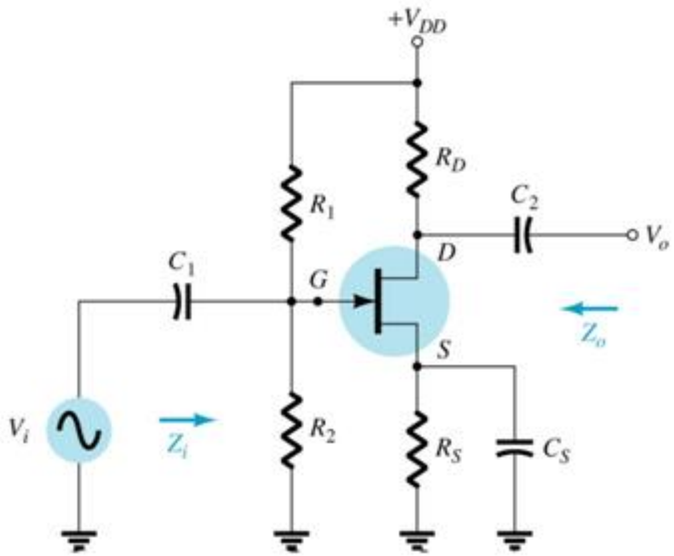
$$v_{in} = v_{gs}$$

$$\text{Out put impedansi. , } Z_o = r_d \| R_D = \frac{r_d R_D}{r_d + R_D}$$

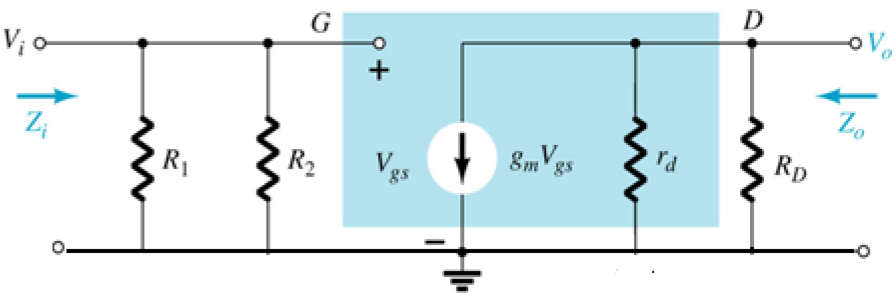
$$\text{Input impedansi. , } Z_{in} = R_G$$

$$\therefore A_v = \frac{v_o}{v_{gs}} = -g_m R_L, \; R_L = R_D \| r_d$$

Analisa CS Amplifier dengan voltage Divider Bias



Rangkaian equivalent ac



$$\text{Voltage gain, } A_v = \frac{v_o}{v_{in}}$$

$$v_o = i_o R_L = -g_m v_{gs} R_L, \ R_L = R_D // r_d$$

$$v_{in} = v_{gs}$$

$$\boxed{\therefore A_v = \frac{v_o}{v_{gs}} = -g_m R_L, \ R_L = R_D \| r_d}$$

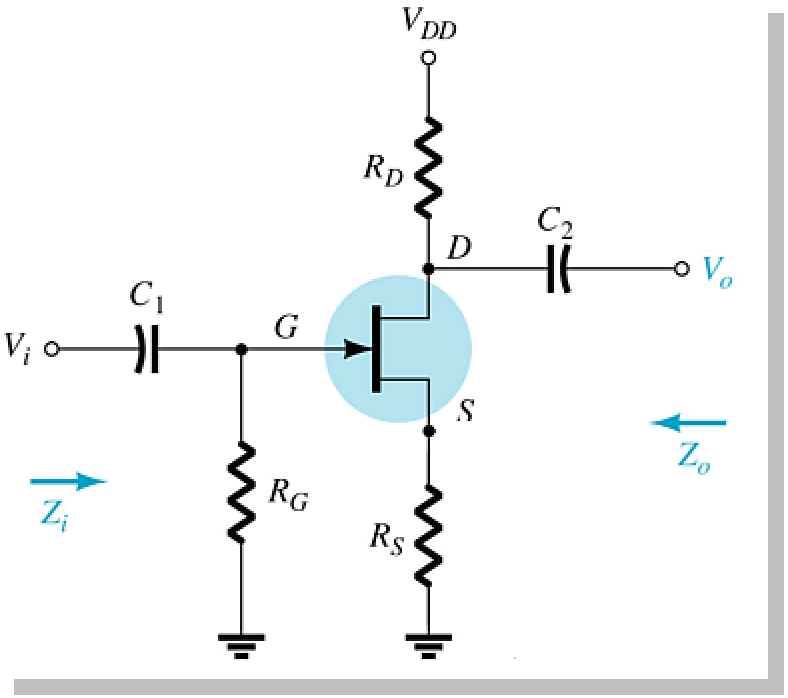
$$\boxed{\text{Input impedansi. , } Z_{in} = R_1 // R_2}$$

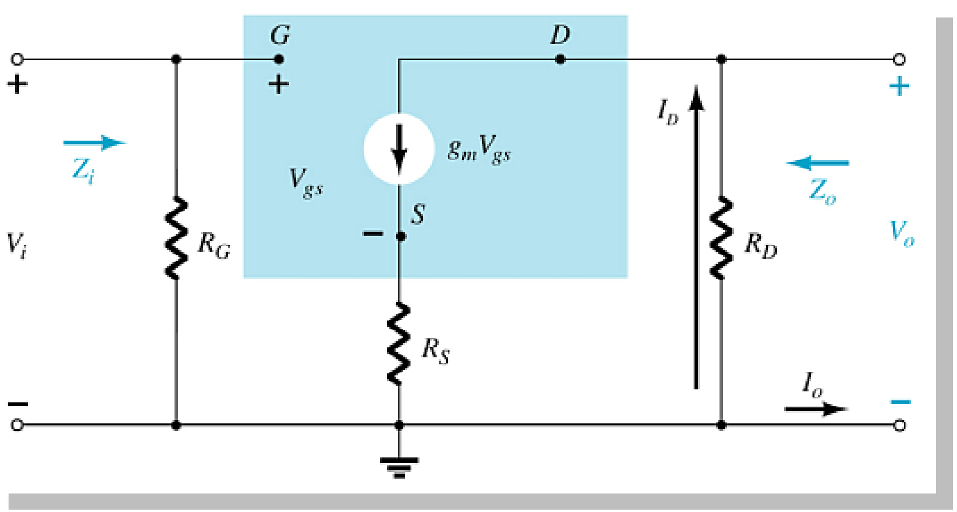
$$\boxed{\text{Output impedansi. , } Z_o = r_d \| R_D = \frac{r_d R_D}{r_d + R_D}}$$

$$\boxed{\mathbf{A_v = -g_m R_D}\Big|_{\mathbf{r_d \geq 10 R_D}}}$$

Common-Source (CS) Self-Bias

Tanpa C_s memberikan efek pada penguatan rangkaian





Perhitungan

Input impedance:

$$Z_i = R_G$$

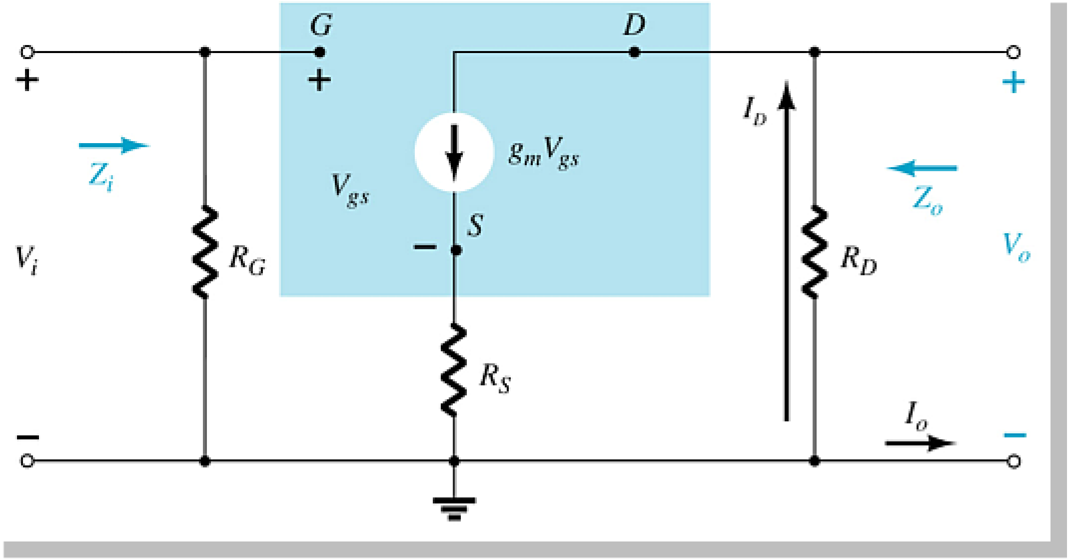
Output impedance:

$$Z_o \cong R_D \Big|_{r_d \geq 10R_D}$$

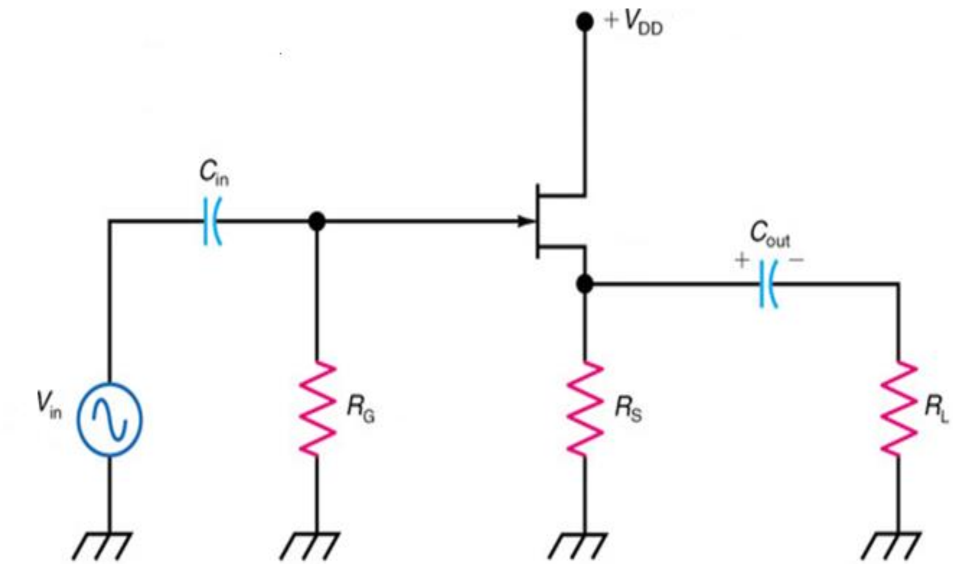
Voltage gain:

$$A_v = \frac{V_o}{V_i} = -\frac{g_m R_D}{1 + g_m R_S + \dfrac{R_D + R_S}{r_d}}$$

$$A_v = \frac{V_o}{V_i} = -\frac{g_m R_D}{1 + g_m R_S}\Big|_{r_d \geq 10(R_D + R_S)}$$



Analisa CD Amplifier (SOURCE FOLOWER)

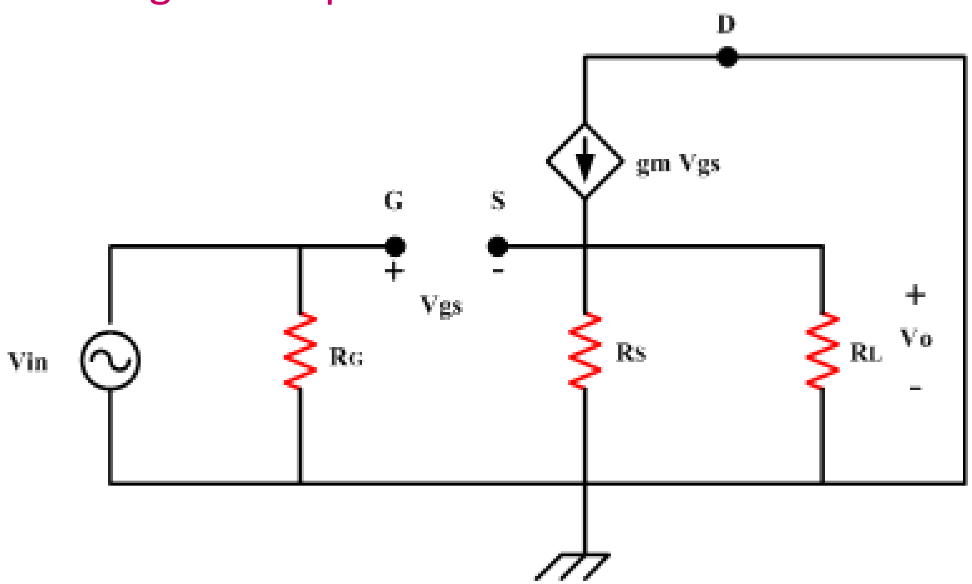


Asumsi rd=0

$$\boxed{\text{Input impedansi. , } Z_{in} = R_G}$$

$$\boxed{\text{Output impedansi.,} Z_o = R_S \| R_L}$$

Rangkaian equivalent ac



$$\text{Voltage gain, } A_v = \frac{v_o}{v_{in}}$$

$$v_o = i_o r_s = g_m v_{gs} r_s, \; r_s = R_S // R_L$$

$$v_{in} = v_{gs} + v_o \rightarrow v_{gs} = v_{in} - v_o$$

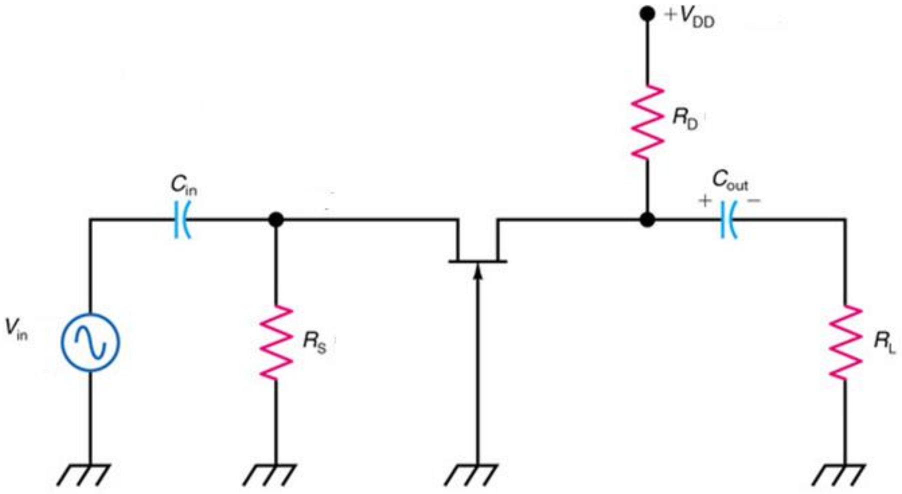
$$v_o = g_m (v_{in} - v_o) r_s$$

$$v_o = g_m v_{in} r_s - g_m v_o r_s$$

$$v_o (1 + g_m r_s) = g_m v_{in} r_s$$

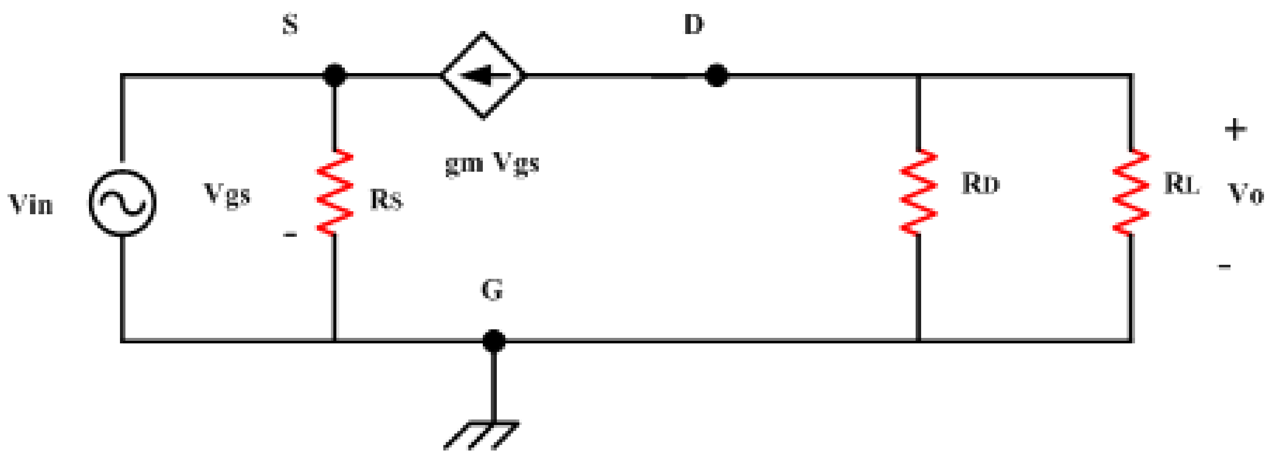
$$\boxed{A_v = \frac{v_o}{v_{in}} = \frac{g_m r_s}{(1 + g_m r_s)}}$$

Analisa CG Amplifier



$$\text{Output impedansi.}, Z_o = R_D \| R_L$$

Rangkaian equivalent ac



Voltage gain, $A_v = \dfrac{v_o}{v_{in}}$

$$v_o = i_o r_s = g_m v_{gs} r_s,\ r_s = R_D // R_L$$

$$v_{in} = v_{gs}$$

$$A_v = \frac{v_o}{v_{in}} = \frac{g_m v_{gs} r_s}{v_{gs}} = g_m\, r_s$$

Input impedansi., $Z_{in} = \dfrac{V_{in}}{I_{in}}$, $I_{in} = g_m V_{gs} + I_{Rs}$

$$Z_{in} = \frac{1}{g_m} // Rs$$

Output impedansi., $Z_o = R_D \| R_L$