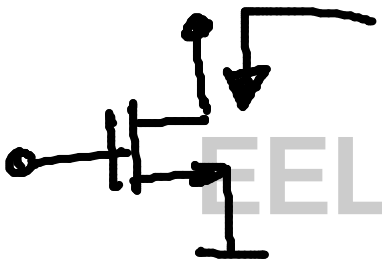
Current sources

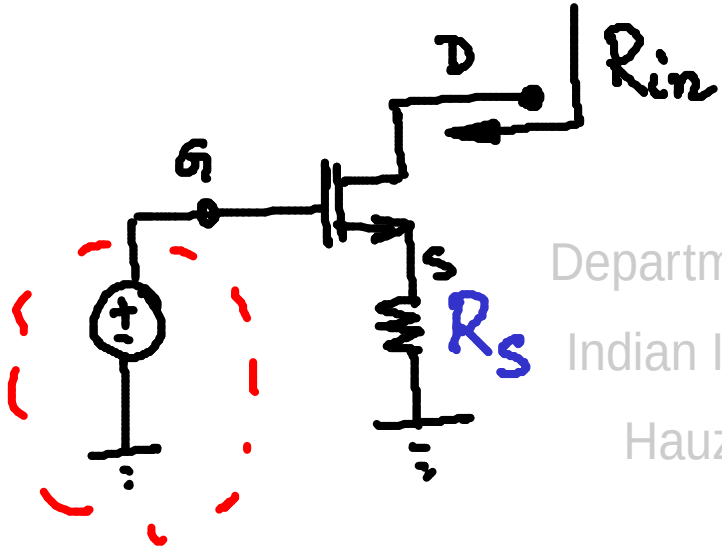


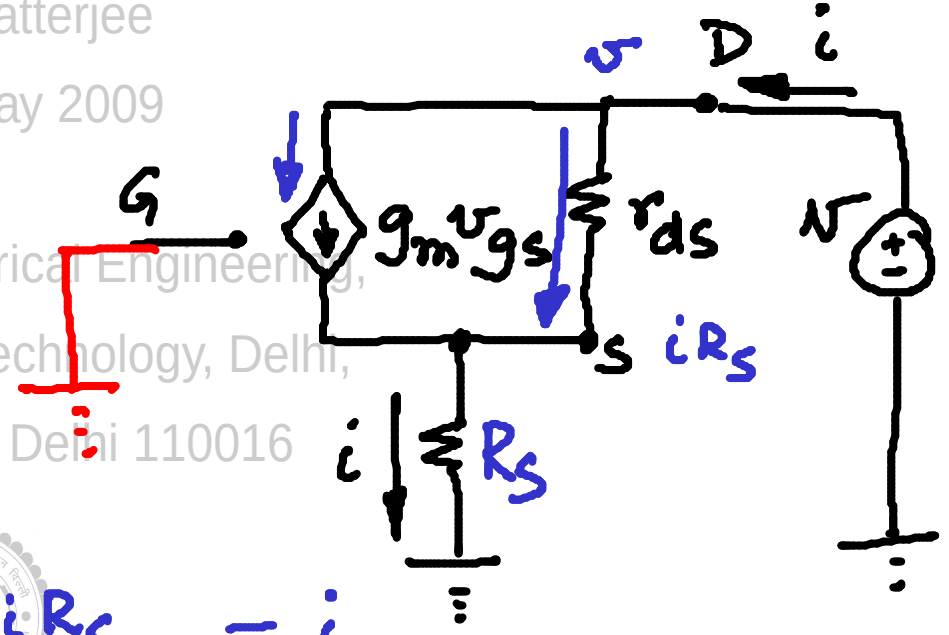
Sat

$$I_D = f(V_{GS}, V_{DS})$$

Lin

$$I_D = f(V_{GS}, V_{DS})$$



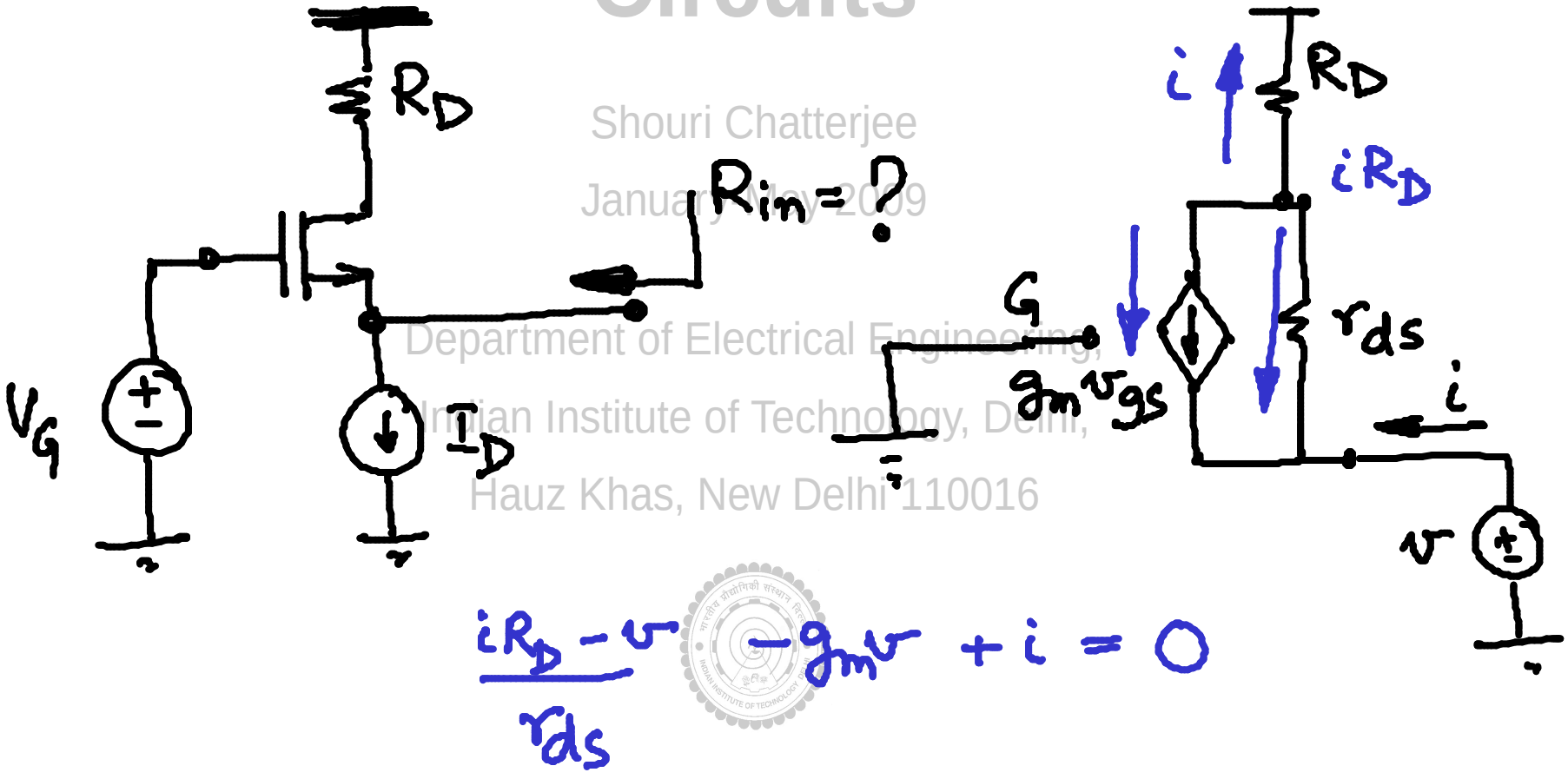


$$\frac{v - iR_S}{r_{ds}}$$

$$-g_m i R_S = i$$

$$\frac{v}{r_{ds}} = i\left(1 + g_m R_S + R_S/r_{ds}\right)$$

$$R_{in} = v/i = r_{ds} + R_S + g_m R_S r_{ds}$$



$$\frac{iR_D - v}{r_{ds}} - g_m v + i = 0$$

$$i\left(\frac{R_D}{r_{ds}} + 1\right) = v\left(g_m + 1/r_{ds}\right)$$

$$R_{in} = v/i = \frac{R_D + r_{ds}}{1 + g_m r_{ds}}$$

EEL782: Analog Integrated Circuits

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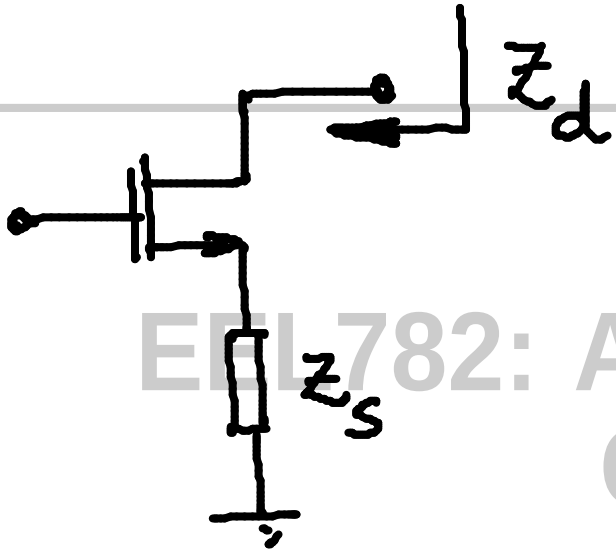
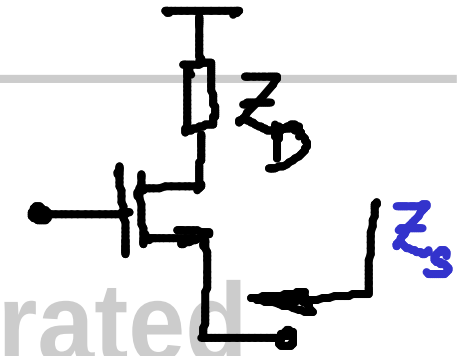


$$Z_d = r_{ds} + Z_s + g_m r_{ds} Z_s$$

if $|Z_s| > r_{ds}$, $Z_d \approx g_m r_{ds} Z_s$

Look in from drain

→ Large impedance



$$Z_s = \frac{r_{ds} + Z_D}{1 + g_m r_{ds}}$$

Look in from source

→ Small impedance

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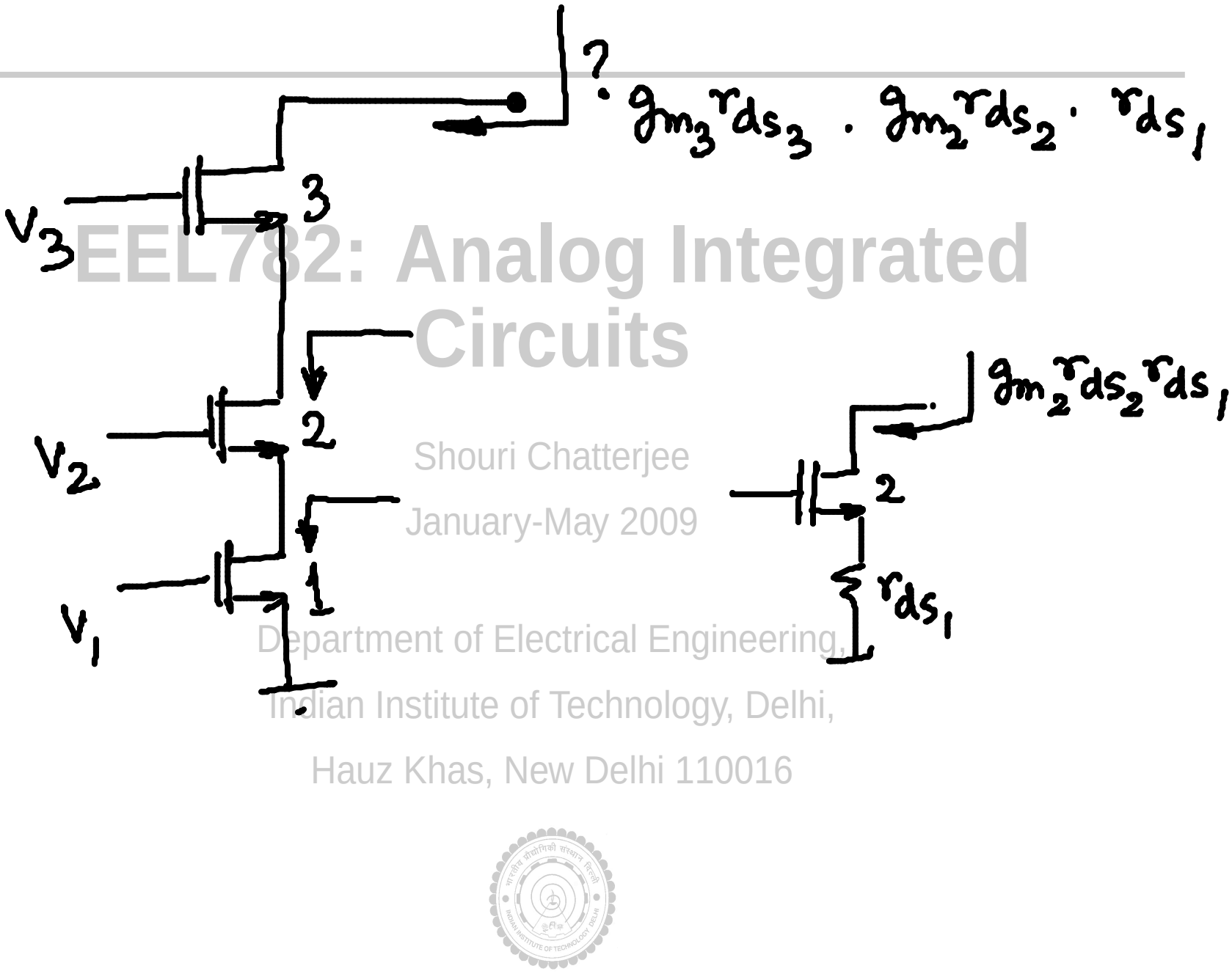

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