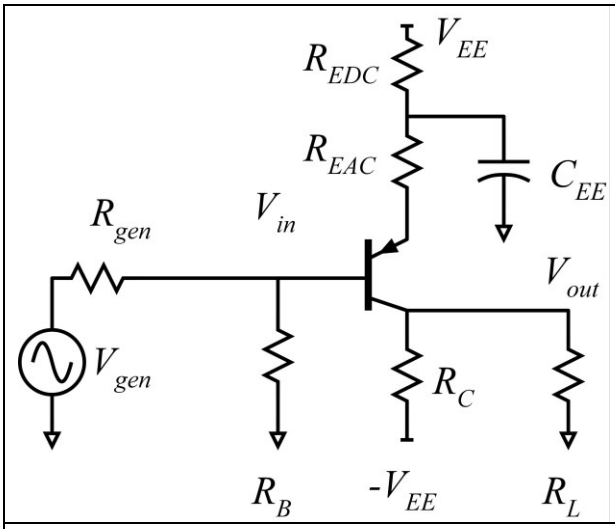
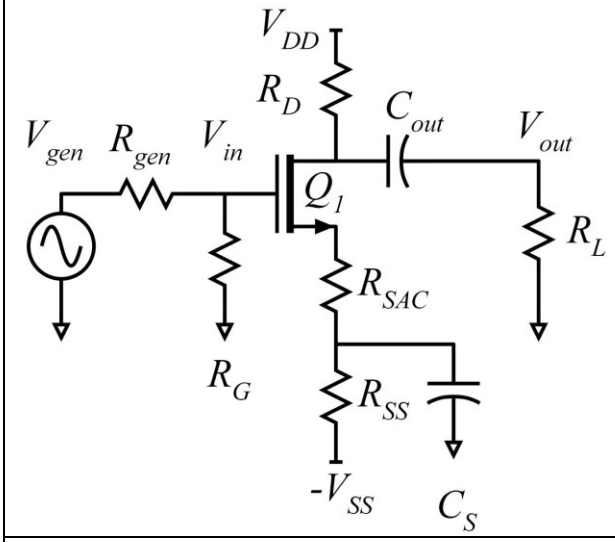
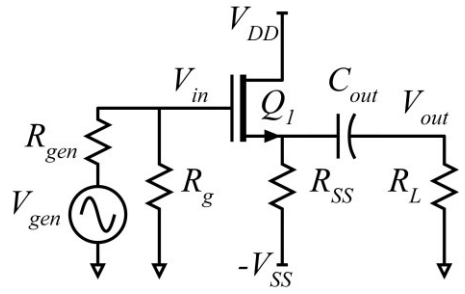
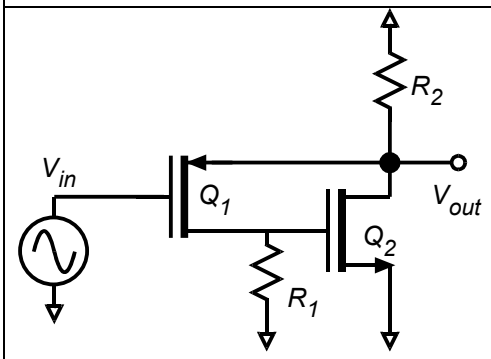
ECE137a Problem set 3

<table>
<tr><td> 
</td><td>1). Common-emitter amplifier with emitter degeneration. Q1: $\beta = 100$, V_A = infinity V
The supplies are +15V and -15 V.
You will bias the transistor with 2mA collector current. The DC collector bias voltage is 0V. R_L is $1000\,\Omega$, R_{gen} is 100 Ω, R_b is 1 kΩ, R_{EAC} is 25 Ω C_{EE} is very large. Assume that it is an AC short-circuit.</td></tr>
<tr><td>a) Give all resistor values
b) Find the small signal Vout/Vin, Vin/Vgen and Vout/Vgen</td><td>c) Find the amplifier input and output impedances
d) Find the maximum positive-going and negative going outputs.</td></tr>
<tr><td> 
</td><td>2) The MOSFET has v_{th} =0.25 Volt,
$K_\mu = 0.55\text{mA/V}^2 \cdot (W_g / 1\mu\text{m})$,
$K_v = 0.69\text{mA/V} \cdot (W_g / 1\mu\text{m})$
$\Delta V = 0.625\text{V}$ and $1/\lambda$ =10 Volts. The supplies are +1V and -1 V. You are to bias the transistor at 2mA drain current, with 0.6V DC drain voltage, and with -0.45 V DC source voltage. R_{SAC}=20 Ω, R_G =1 MΩ, R_{gen}=75 kΩ, R_L=10 kΩ</td></tr>
<tr><td>a) Give all resistor values</td><td>b) Find the small signal Vout/Vin, Vin/Vgen and Vout/Vgen</td></tr>
<tr><td> 

a</td><td>3) Common-drain stage. The transistor has
$K_\mu = \mu c_{gs} W_g / 2L_g = 0.55\text{mA/V}^2 \cdot (W_g / 1\mu\text{m})$
$K_v = c_{gs} v_{inj} W_g = 0.69\text{mA/V} \cdot (W_g / 1\mu\text{m})$
$\Delta V = v_{inj} L_g / \mu = 0.625\text{V}$, $V_{th} = 0.3\text{V}$,
$1/\lambda = 20\text{V}$
The supplies are +2V and -2 V. You are to bias the transistor at 10mA drain current, and with -0.5 V DC source voltage. R_g =1</td></tr>
</table>

	MΩ, R_{gen}=30 kΩ, R_L=500 Ω. C_{out} is very large (AC short-circuit at the signal frequency)
a) find the gate width Wg and Rss. b) Find the small signal voltage gain Vout/Vin and the amplifier small-signal input resistance.	c) find the maximum positive and negative going output signal swings before clipping
	4) . Nodal Analysis exercise. This is a "super-buffer". Ignore DC bias analysis. You don't need it. The two transistors have transconductance gm1 and gm2 respectively. Their drain-source resistances Rds1 and Rds2 are both infinity. a) Compute Vout/Vin by nodal analysis. b) find numerical values of Vout/Vin given gm1=10 mS, gm2=100 mS, R1=10kOhm, R2=1kOhms.