ECE 65: Components & Circuits Lab

Amplifier practice problems

Reference notes: sections 6.1, 6.2

Sedra & Smith (7th Ed): section 7.3

Saharnaz Baghdadchi

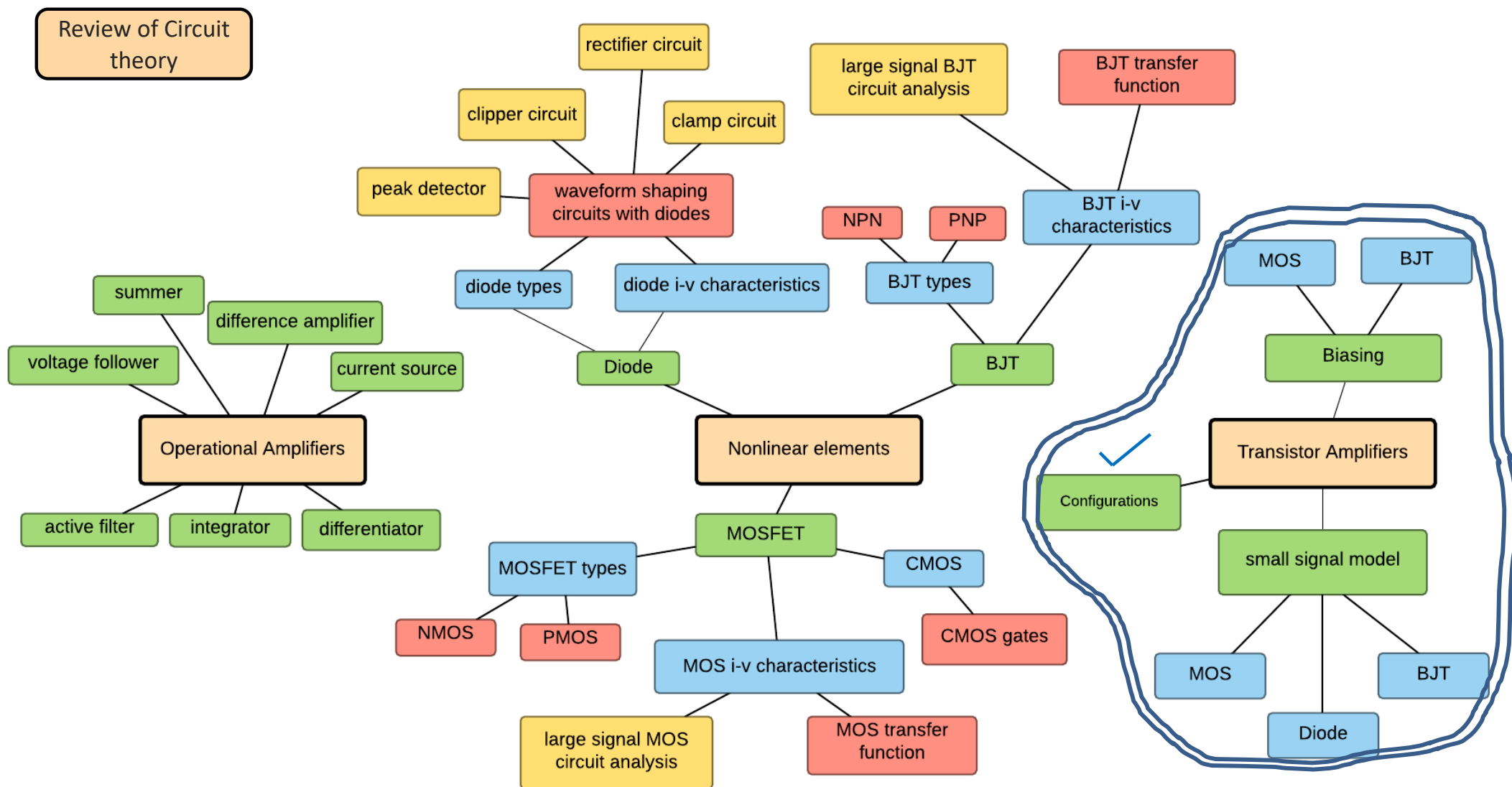# ECE 65: Components & Circuits Lab

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# Course map

7. Transistor Amplifier Configurations

Practice problem 1.

The below BJT amplifier circuit is biased with a constant current source (I). Design the circuit (find I, R_B, and R_C) to meet the following specifications:
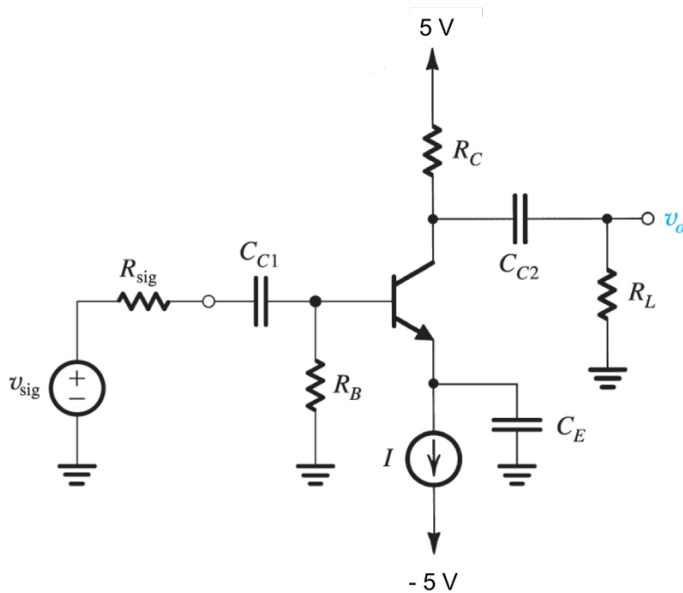
a) $R_i = 10\ k\Omega$.

b) The DC voltage drop across R_B is 0.2 V.

c) The open loop voltage gain of the amplifier (A_{Vo}) is -160 V/V.

Assume $\beta = 100$, $V_{D0} = 0.7\ V$, $V_A = \infty$, $V_T = 25\ mV$ and the capacitors are short for the signal circuit.
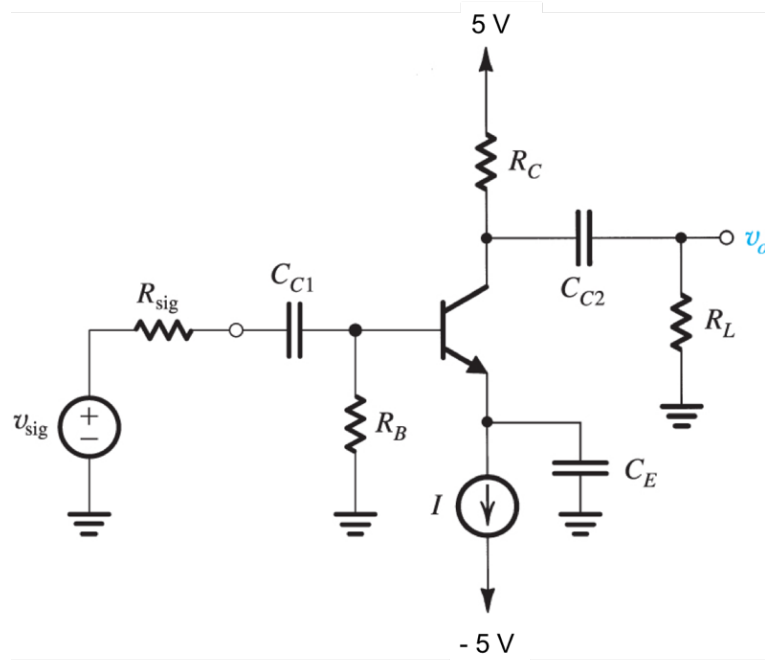
Practice problem 1.

a) $R_i = 10 \ k\Omega$.

b) The DC voltage drop across R_B is 0.2 V.

c) The open loop voltage gain of the amplifier (A_{Vo}) is -160 V/V.

- Identify the amplifier configuration and write the equation of R_i. replace r_{pi} with its corresponding equation in terms of I_B. You should now have an equation relating R_B to I_B.

- Using the given   DC voltage drop across R_B, write another equation relating R_B to I_B. Solve the two equations concurrently to find R_B and I_B.

- Using the equation of A_{vo} and its given value and the equation of g_m, find R_C.

Practice Problem 2.

The PMOS in the below common-source amplifier circuit has $V_{tp} = -0.7\ V$ and $\lambda = 0$.

1. Select a value for R_S to bias the transistor at $I_D = 0.3\ mA$ and $V_{OV} = 0.3\ V$.

2. Select a value for R_D that results in $A_V = -10\ V/V$.
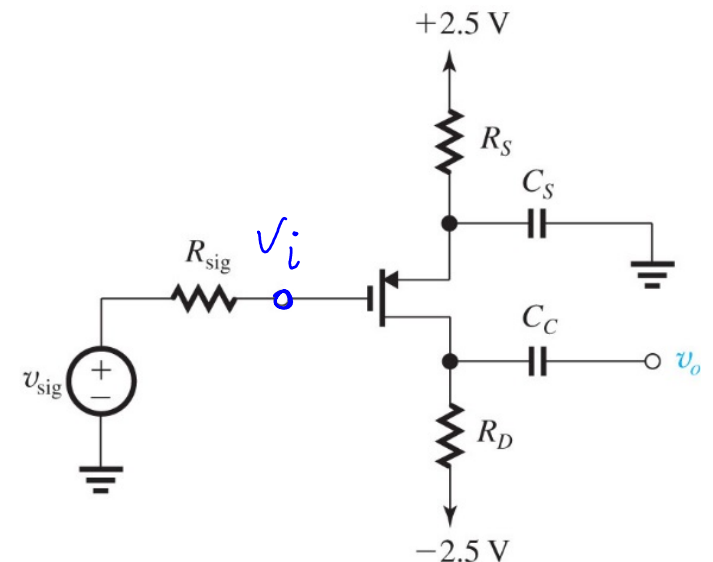
Practice Problem 2.

The PMOS in the below common-source amplifier circuit has $V_{tp} = -0.7\ V$ and $\lambda = 0$.

1. Select a value for R_S to bias the transistor at $I_D = 0.3\ mA$ and $V_{OV} = 0.3\ V$.

2. Select a value for R_D that results in $A_V = -10\ V/V$.

- Using the given values of V_{OV} and I_D, you can find V_{SG}.
From there you can find V_S. Note that I_G =0.

- Using V_S, you can find R_S.

- Using the equations of A_{vo} and g_m, you can find R_D.