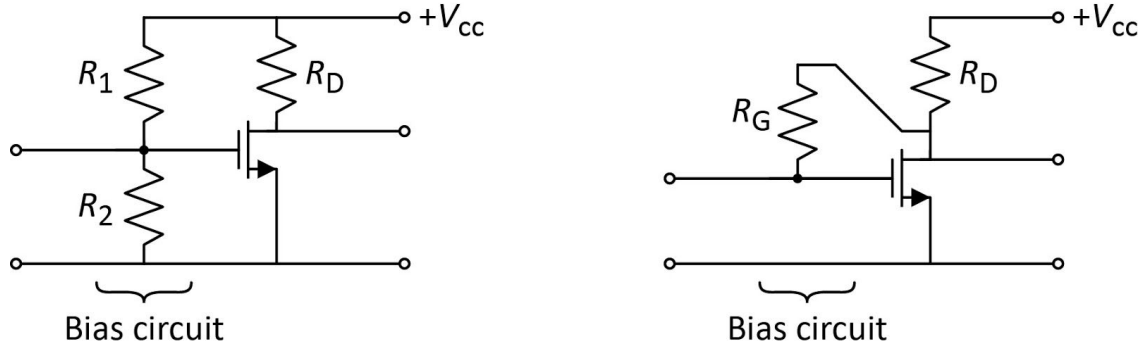
Homework 09

1. ***FET***: This problem concerns properties of FETs.
   (a) Draw the I_D versus V_{DS} family of output curves of an FET (I_D on vertical axis or ordinate and V_{DS} on horizontal axis or abscissa). Indicate three significant regions in the drawing and name these regions.
   (b) Draw the I_D versus V_{GS} curve of an FET. Indicate two significant regions in the drawing and name these regions.
   (c) What is the relationship between source current and drain current of an FET?
   (d) What occurs when the gate voltage reaches the threshold voltage?

2. ***FET***: This problem also concerns properties of FETs.
   (a) What is the value of any DC gate current?
   (b) The input power of a transistor may be defined as input voltage × input current. Given this definition, what is the input power of an FET? When comparing BJTs with FETs, which one of the two consumes a higher input power?
   (c) Why is low input power (or zero input power) an advantage?
   (d) Point out some similarities between BJTs and FETs.
   (e) Point out some differences between BJTs and FETs.

3. ***FET bias circuits***: Consider the bias circuits below. The power supply voltage is V_{CC} = +10 V.



   (a) Draw the LHS (left hand side) circuit diagram. What kind of circuit is it? Assume V_{th} = 2 V, k = 5 mA/V^2, and I_D = 4 mA. Determine the numerical values of R_1 and R_2, assuming that R_1 carries a current of 10 µA.
   (b) Determine the numerical value of R_D so that the Q-point is in approximately the middle of the load line.
   (c) Draw the RHS (right hand side) circuit. What kind of circuit is it? Assume V_{th} = 2 V, k = 5 mA/V^2, and I_D = 4 mA. Determine the numerical values of R_D and R_G.
   (d) Name an advantage of the LHS bias circuit.
   (e) Name an advantage of the RHS bias circuit.

4. ***True / false questions***: Are the following statements true or false? Explain your answer with one or two sentences.
   (a) Because the gate current is zero, the input power of an FET is zero.
   (b) Although an FET device does not consume any input power, an FET circuit (e.g. an FET amplifier circuit) may still consume an input power.
   (c) In a BJT, the emitter current is slightly larger than the collector current. Similarly, in an FET, the source current is slightly larger than the drain current.