

Electronic Circuits Laboratory
EE462G
Lab #6

**Small Signal Models: The MOSFET
Common Source Amplifier**

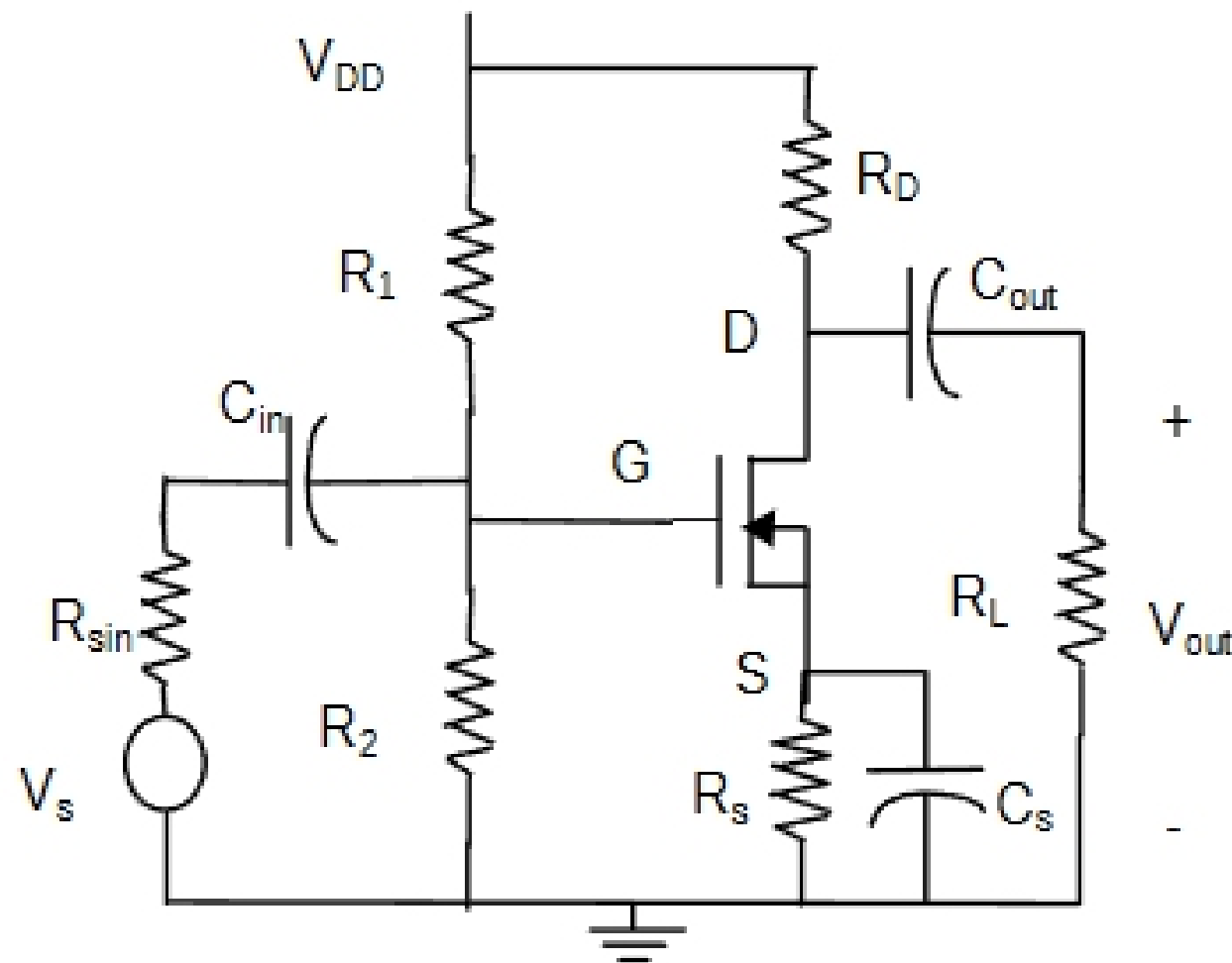
AC and DC Analysis

Amplifier circuits have DC and AC components that can be analyzed separately.

- The purpose of the DC component is to bias currents and voltages to a static operating point in a region where the input and output relationship is reasonably linear for small deviations about the operating point.
- The purpose of the AC component is to provide gain and/or impedance coupling for the information component of a signal, so it can be measured, processed, or used to drive an output device.
- The AC and DC components can be analyzed separately if the AC components are small relative to the DC components, and blocking capacitors are inserted to block DC biasing voltages and currents from the points at which the AC signal couples to the input and output.

Common Source Amplifier

The input and output share a common node at ground through the source of the NMOS transistor. Determine how “good” capacitor values should be chosen to isolate the DC from the AC without significantly affecting the AC operation or DC settings.



For DC blocking, any capacitor value will do:

$$\left| \frac{1}{j\omega C} \right| \rightarrow \infty \text{ as } \omega \rightarrow 0$$

To pass AC components, capacitor impedance should behave as an effective short:

$$\left| \frac{1}{j\omega C_{in}} \right| \lll R_{sin}, \quad \left| \frac{1}{j\omega C_s} \right| \lll R_s,$$

$$\left| \frac{1}{j\omega C_{out}} \right| \lll R_L$$