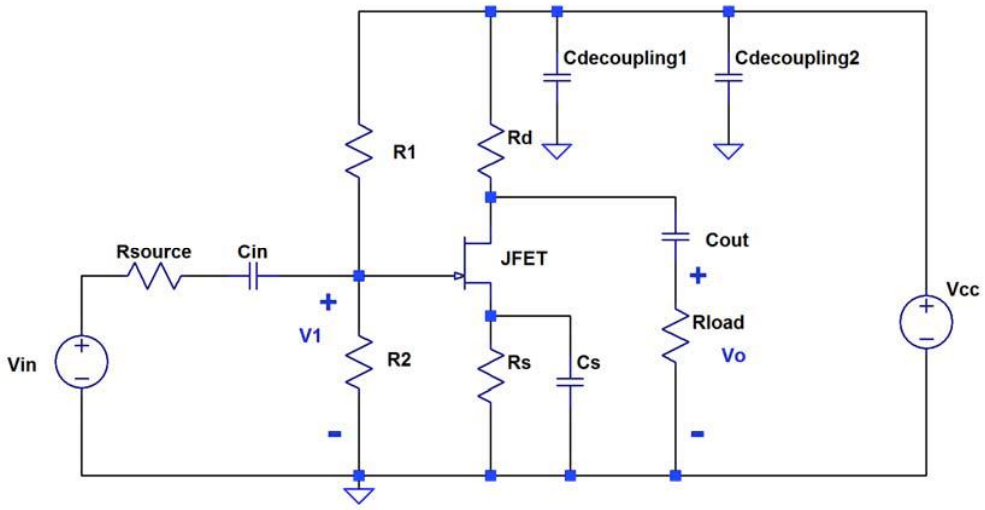
JFET Common Source Amplifier Simulation

The aim of this experiment is to design and simulate a single-stage JFET common source amplifier using the circuit topology shown in the figure. In this lab you will be using SPICE to analyze your design. Thus this is a simulation lab, and you do not actually construct the circuit.



Parameters are given as:
V_{CC}=20V, R_{source}=50Ω, R_{load}=1000Ω, C_{in}=10μF, C_{out}=10μF, C_s=100μF
$C_{decoupling1}$=100nF, $C_{decoupling2}$=10μF,

1. The transistor that you will use is BF245C. This transistor has the following parameters: I_{DSS} =16 mA, $|V_P|$=5 V (Note: The parameters may not be the same in reality. Nevertheless you use the parameters I_{DSS} =16 mA, $|V_P|$=5 V in this preliminary work)

You are asked to design a Common-Source amplifier and specify the values of R_1, R_2, R_s and R_d.
Approximate design requirements are as follows:
Output Resistance (Rout): 1000 Ω
Voltage Gain ($A_v = V_o/V_1$): 2
Power Gain ($A_p = P_o/P_{in}$) with 1000 Ω load: 20dB
Input Resistance (Rin): 200kΩ
Peak-to-Peak undistorted output voltage swing ≥ 3.0 V
Design the amplifier and determine the values of R_1, R_2, R_s and R_d.
Show all your work clearly. Use only standard resistor values.

2. Find Spice model of BF245C and comment on its parameters. Note that the parameter names in the model you find (e.g. from internet) may not be the same as we use above

a) Enter the circuit to LTSPICE using schematic entry. Use the resistor values you found above.

b) Find the voltage gain of the circuit and the unclipped output voltage swing. Optimize your circuit to get maximum output swing and maximum gain.
c) Use the FFT utility of LTSPICE to find the max input ac peak level for which the highest harmonic has less than 1% amplitude compared to the fundamental. Use 1 KHz sine wave input.
d) Also find the harmonic level for 2 and 5 times more input compared to what you found above.

In writing your report explain what you have done (circuits, parameters, procedures, etc.), what you have obtained (values, graphs, tables, screenshots, etc.), and your comments. You are expected to upload your report to Moodle after you show your results and simulation set-up and results to your assistant and get his/her check.