EXPERIMENT 10: NMOS-E type Common Source amplifier and measurement of its performance parameters i.e Q Point, Voltage gain, input resistance and Output resistance

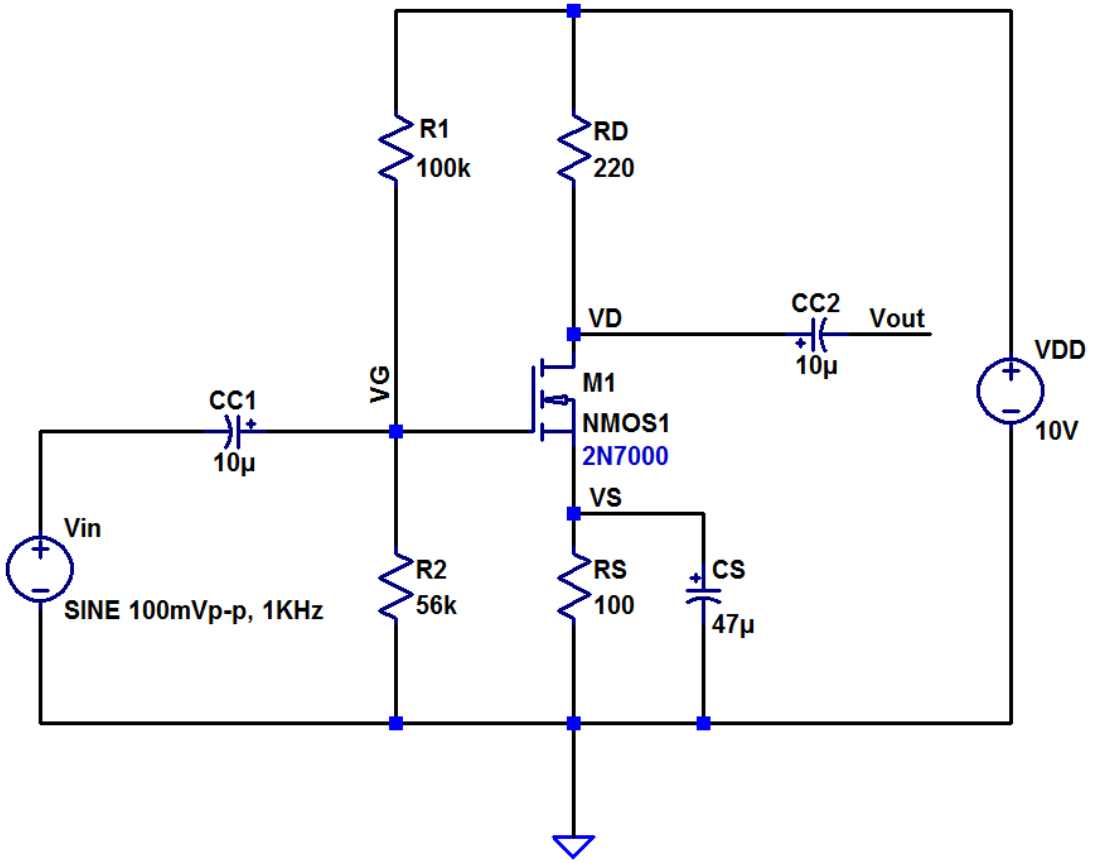
AIM:

1) To perform DC analysis of MOSFET Voltage divider bias circuit and calculation of Q point

2) To perform AC analysis of MOSFET CS amplifier and calculate voltage gain, input resistance and output resistance

APPARATUS: MOSFET (2N7000), Bread board, resistor (220Ω, 56 KΩ, 100Ω, 100KΩ), Capacitors (10 µF – 2 Nos. , 47 µF connecting wires, DC power supply (0-30V), CRO, signal generator and multimeter.

CIRCUIT DIAGRAM:



Common Source NMOS-E amplifier

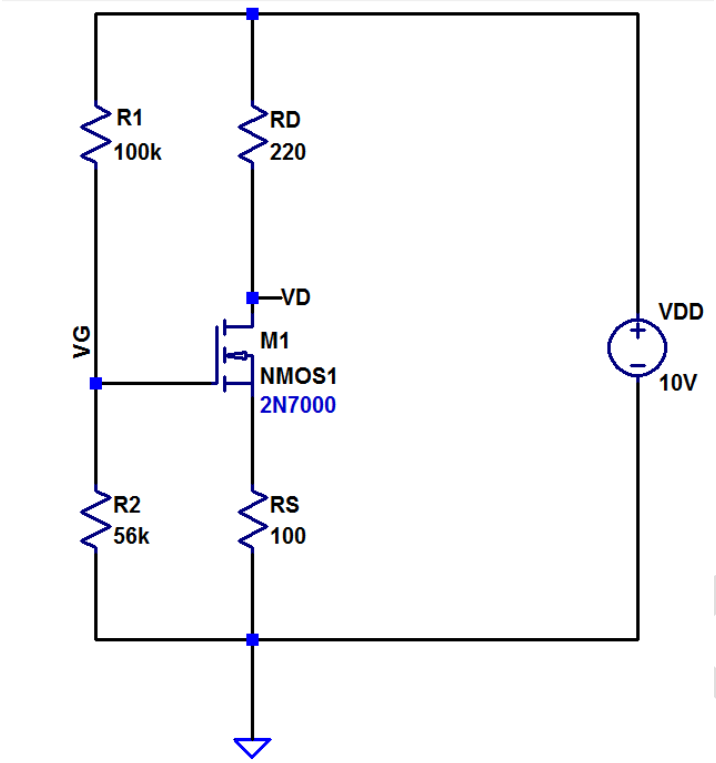


Figure: DC Equivalent Circuit Diagram

THEORY:

A) DC Analysis

1) In DC analysis (f = 0 Hz) , the capacitors are replaced by an open circuit (because the reactance of a capacitor is $Xc = \frac{1}{2\Pi fC}$ = infinite)

2) Also the AC sources are replaced by open circuit

3) From DC analysis, one can find the Q point of a transistor

B) AC Analysis

1) Since we are only interested in the AC response of the circuit, the DC supplies (having a constant DC value with time) can be replace by a short circuit.

2) The coupling capacitors C_{C1} and C_{C2} and the bypass capacitor C_E were chosen to have a very small reactance at the frequency of interest. Therefore, they too, for all practical circuits, can be replaced by a low resistance path or short circuit.

PROCEDURE:

1. Connect the circuit as per given diagram.

Part 1 : DC Analysis
1) Turn on the DC power supply and measure all the terminal DC currents and voltages
2) Locate the Q-point on the DC load Line and plot it on the graph paper.

Part 2 : AC Analysis
1) Apply a sine wave 100mV p-p, 1 KHz from to signal generator to the input section of CS amplifier
2) Keeping DC source on, observe the input and output waveforms and their phase shifts on the CRO.
3) Note down the output voltages and the voltage gain and plot input & output waveforms on the graph paper

Part 3: Determination of Rin and Rout
A) For Rin
1) For finding input impedance Rin, temporarily disconnect the signal generator, and connect a 100K Ω pot in series with signal generator and the circuit input i.e just before C_{C1}
2) Change the resistance of the 100K Ω pot such as the output amplitude is half of the output obtained earlier.
3) Record the resistance of the 100K Ω pot as circuits input impedance.

B) For Rout
1) The procedure will be same as given in A part in part 3, only difference being 500 Ω pot connected across the output of the amplifier.

OBSERVATION TABLE:

DC ANALYSIS TABLE

Parameter	Observed	Calculated
V_G		
V_D		
V_S		
V_{GS}		
I_D		

AC ANALYSIS TABLE

Parameter	Observed	Calculated
A_V		
R_{IN}		
R_{OUT}		

CALCULATION:

Show Calculations for DC ANALYSIS TABLE on blank side

Show Calculations for AC ANALYSIS TABLE on blank side

RESULTS:

Parameter	Observed	Calculated
Q-point		
A_V		
R_{IN}		
R_{OUT}		

NOTE:
Draw Small signal equivalent circuit for MOSFET CS amplifier on blank side
On blank side, attach graph paper showing DC load line and Q point
Also, attach a graph showing input and output waveforms

CONCLUSION:

POST LAB QUESTIONS:

1. What is the role of coupling and bypass capacitors in MOSFET amplifier?
2. What are the possible features of MOSFET amplifier?
3. What is the significance of calculating input impedance and output impedance in amplifiers?