



**FACULTY OF ENGINEERING**

**Electrical Department**

**ENEE 3102**

**Prelab Ex #5**

**The Field-Effect Transistor**

**Student's Name: Dalal bawatneh**

**Student's No: 1170329**

**Prepared For:**

**Instructor: Mr. Mohammad J'beh**

PARAMETERS:

x 0.1

The circuit diagram shows a JFET amplifier configuration. The input is connected to a 15V DC source V1 through a 47k resistor R2. The gate of the JFET (J2N3819) is connected to the wiper of a potentiometer POT, which is also connected to the 15V source. The drain of the JFET is connected to a 534.14fF capacitor and a 0V source V2. The source of the JFET is connected to ground. The circuit is annotated with various voltage and current values, including -15.00V, 263.16uA, 0V, -2.632V, 534.14fA, -1.068pA, -2.368V, and 534.14fA.

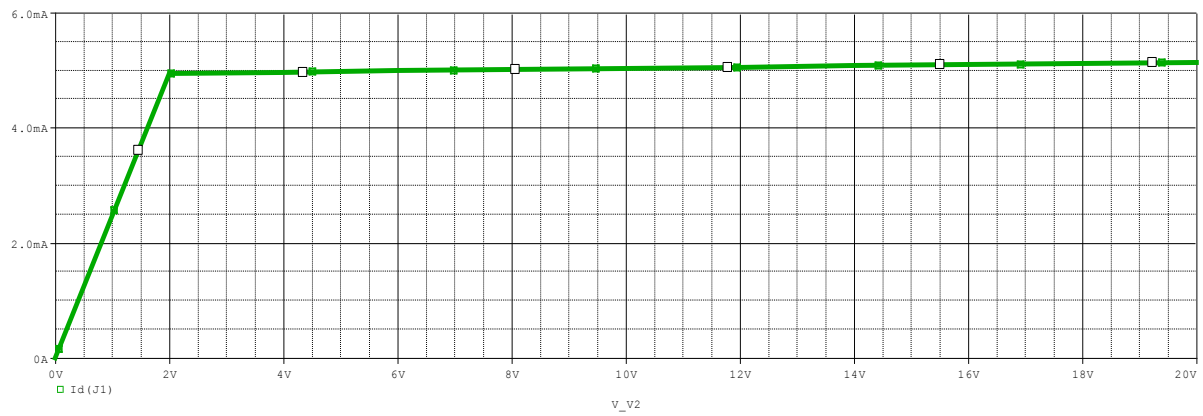
The graph shows the relationship between the voltage  $v_{V2}$  and the current  $I_d(J1)$ . The current starts at 0A for 0V, rises steeply to about 10mA at 2V, and then gradually saturates, reaching approximately 12mA at 20V. The data points are marked with green squares.

| $v_{V2}$ (V) | $I_d(J1)$ (mA) |
|--------------|----------------|
| 0            | 0              |
| 1            | 6              |
| 2            | 10             |
| 3            | 11             |
| 4            | 11.5           |
| 5            | 11.8           |
| 7.5          | 12             |
| 8.5          | 12.1           |
| 10           | 12.2           |
| 12.5         | 12.3           |
| 15           | 12.4           |
| 16           | 12.5           |
| 17.5         | 12.6           |
| 20           | 12.7           |

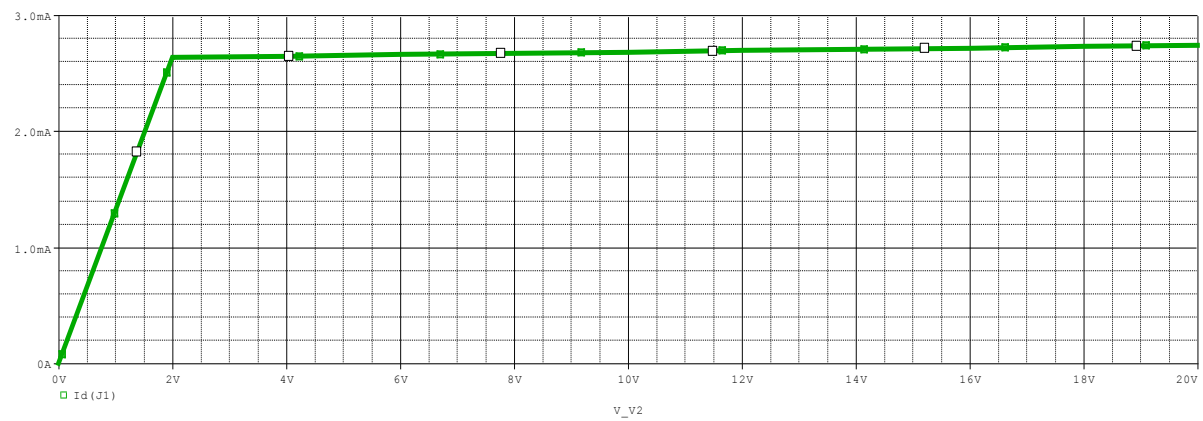
The graph shows the drain current  $I_d(J1)$  as a function of the drain-source voltage  $V2$ . The current starts at 0A for 0V, rises linearly to approximately 8.5mA at 2V, and then enters a saturation region, leveling off at about 9.5mA for voltages above 4V.

| V2 (V) | $I_d(J1)$ (mA) |
|--------|----------------|
| 0      | 0              |
| 1      | 4.5            |
| 2      | 8.5            |
| 4      | 9.2            |
| 6      | 9.3            |
| 8      | 9.4            |
| 10     | 9.4            |
| 12     | 9.4            |
| 14     | 9.5            |
| 16     | 9.5            |
| 18     | 9.5            |
| 20     | 9.5            |

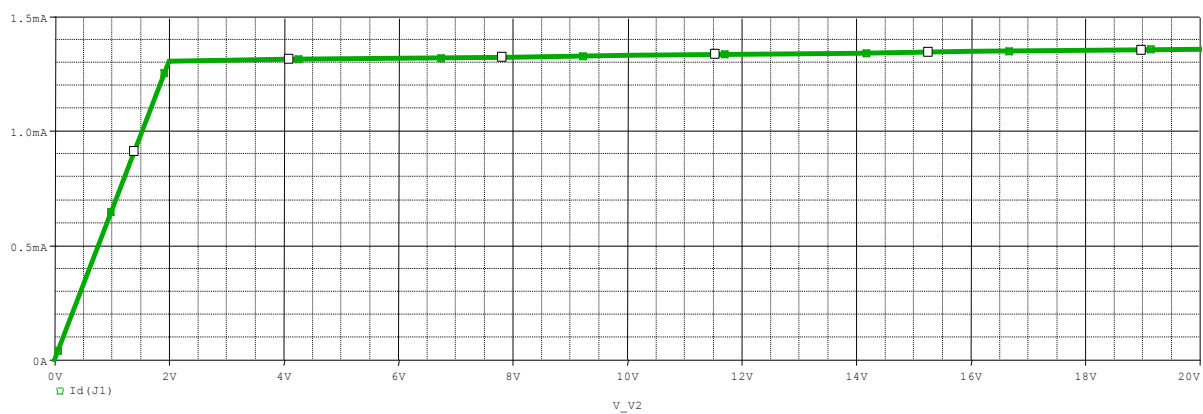
**3** -When  $V_{GS} = -1$  ,  $V_{DS} = 1\text{v}$



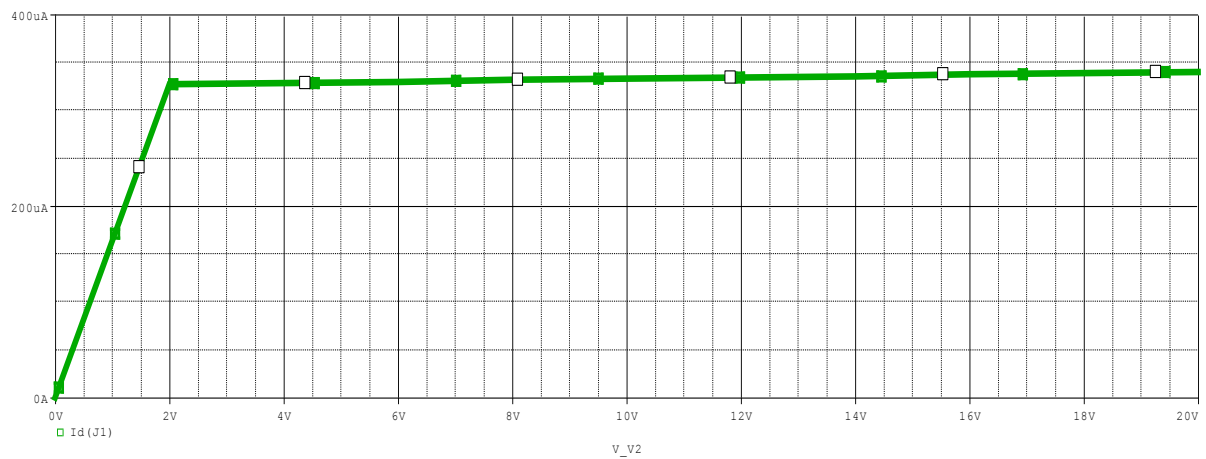
**4** -When  $V_{GS} = -1.5\text{v}$  ,  $V_{DS} = 2\text{v}$



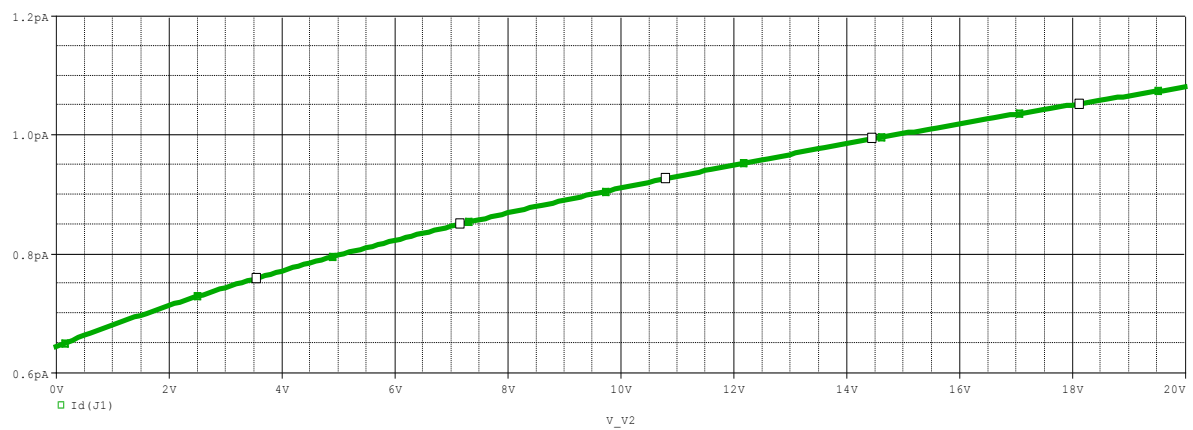
**5** -When  $V_{GS} = -2\text{ v}$  ,  $V_{DS} = 5\text{v}$



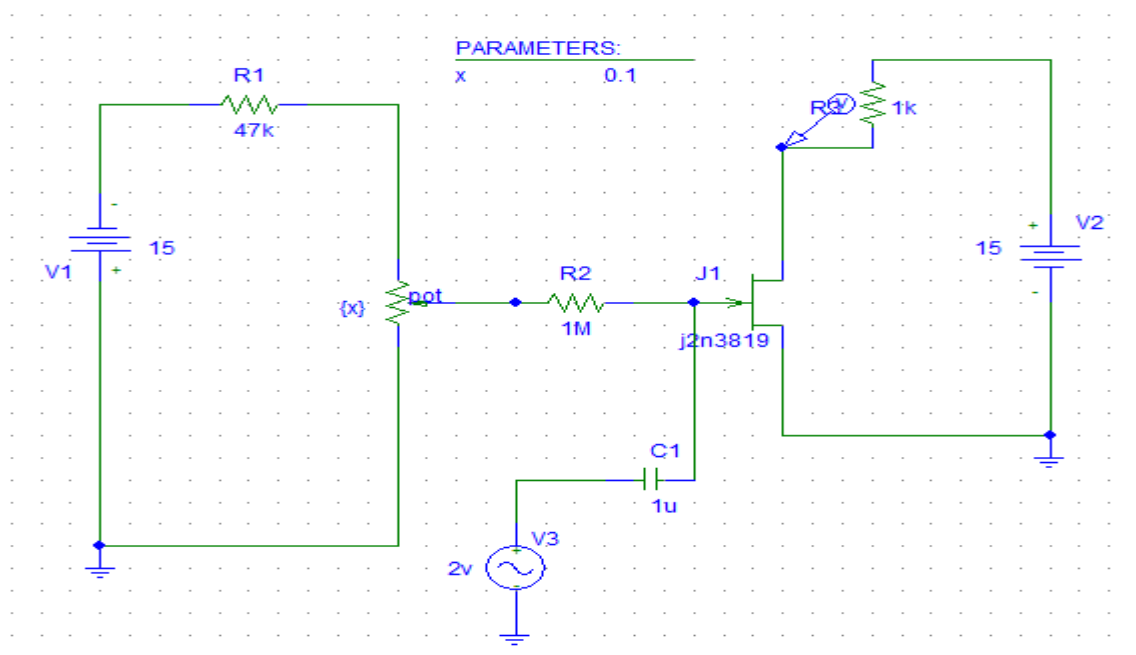
6- When  $V_{GS} = -2.5\text{v}$  ,  $V_{DS} = 15\text{v}$



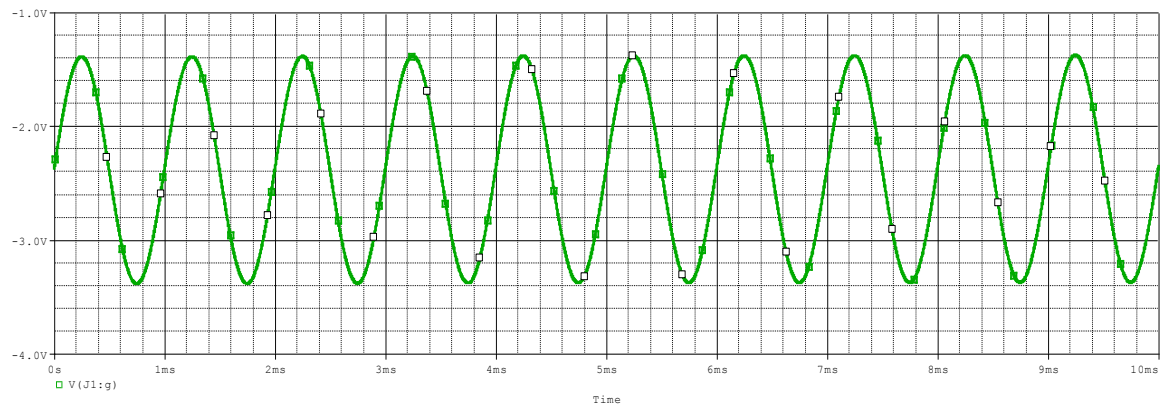
\*\*When  $V_{GS} = 10\text{v}$  ,  $V_{DS} = -1\text{v}$



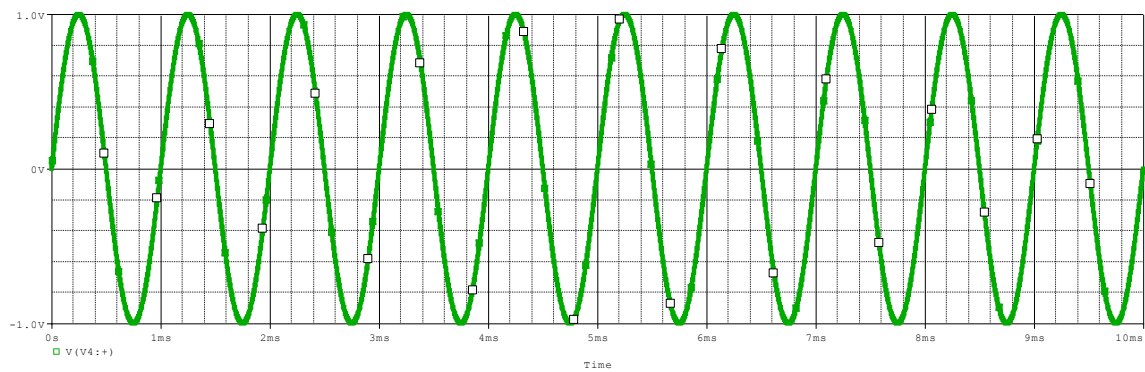
## II. A JFET AMPLIFIER



V Gain:



V input:



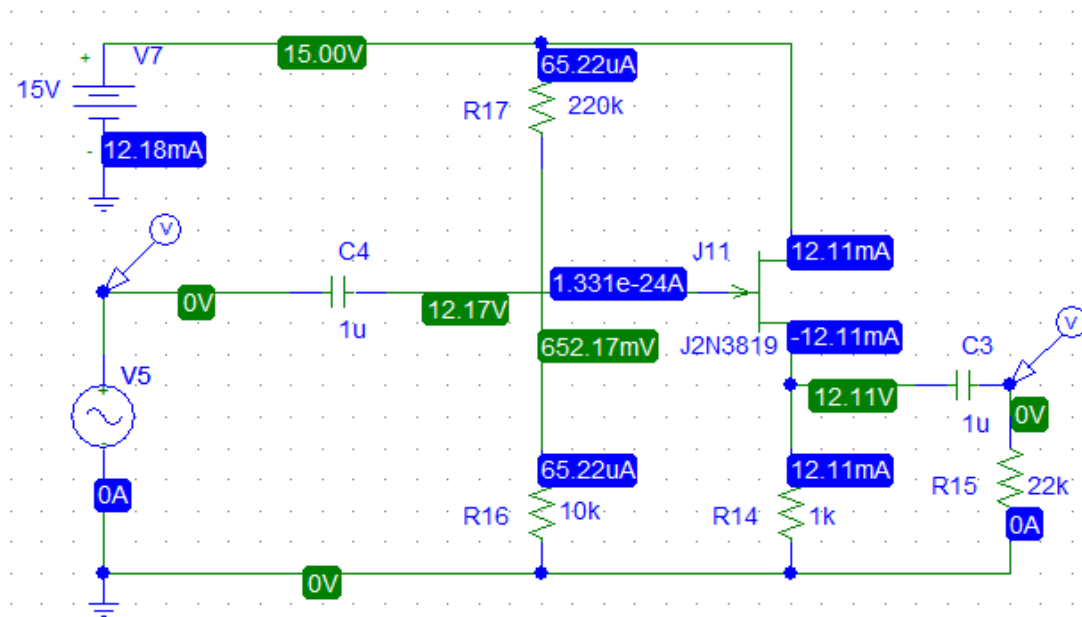
V Output = 10.22 V

V<sub>in</sub>=2.34

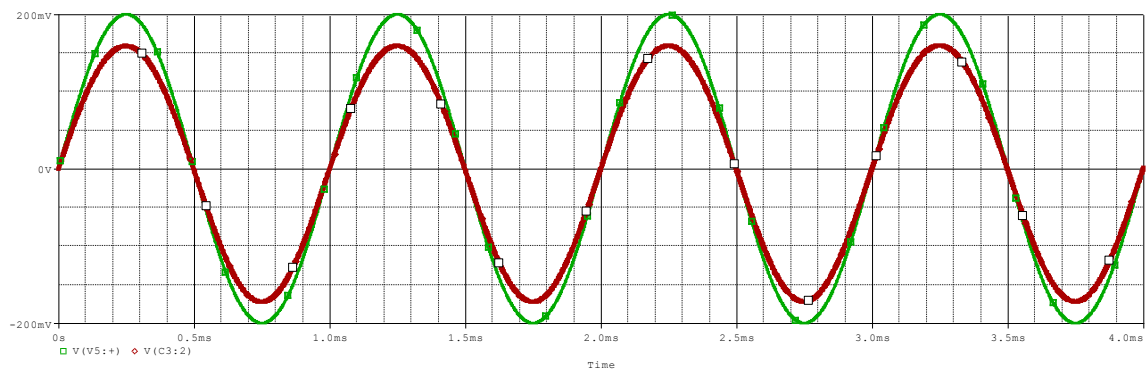
$$A_v = \frac{V_o}{V_i} = \frac{10.22}{2.34} = 4.37$$

$$Z_{in} = \frac{2.34}{2.664 \times 10^{-3}} = 8.78 \cong 9 \text{ K}\Omega$$

### III. COMMON DRAIN AMPLIFIER.



Output and input voltages

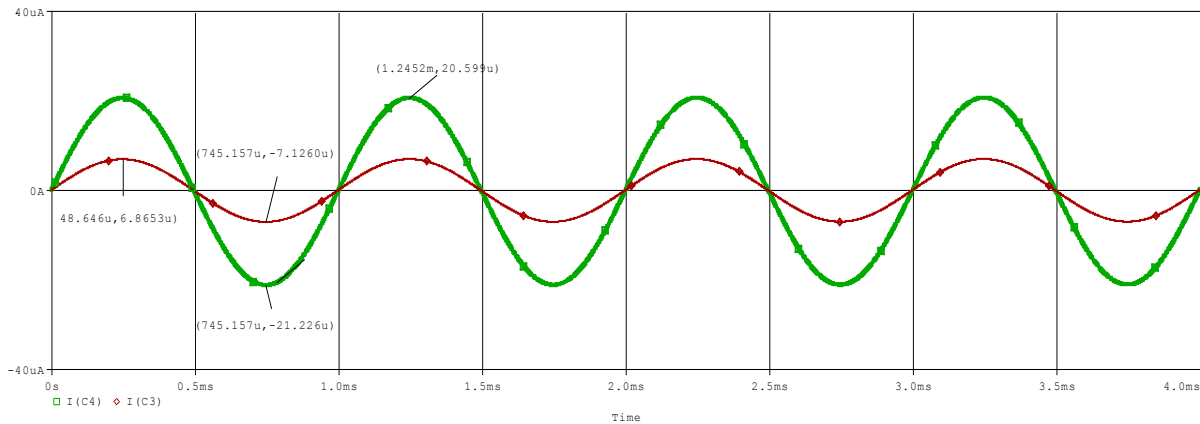


$$V_i(t) = 0.2V, V_o(t) = 0.156V$$

$$A_v = \frac{V_o}{V_i} = \frac{0.156}{0.2} = 0.78, \text{ the input and output in phase}$$

:

## input and output current



$$I_i(t) = 20.599 \text{ u} - -21.226 \text{ u} = 41.825 \text{ uA p-p}$$

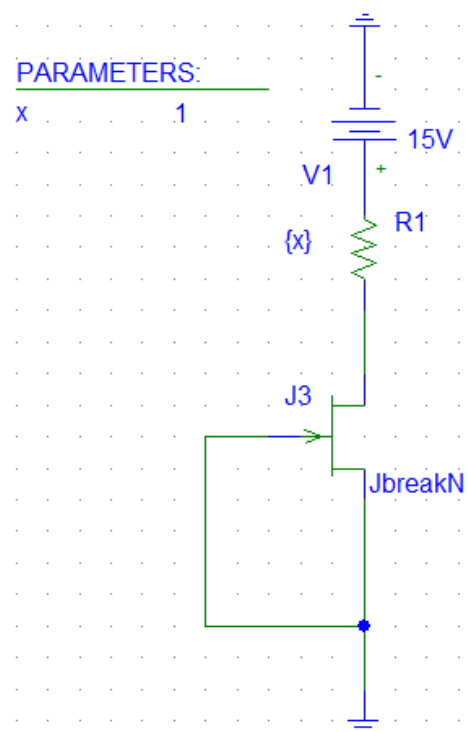
$$I_o(t) = 6.8653 \text{ u} - -7.126 \text{ u} = 13.9913 \text{ uA p-p}$$

The input and output impedance :

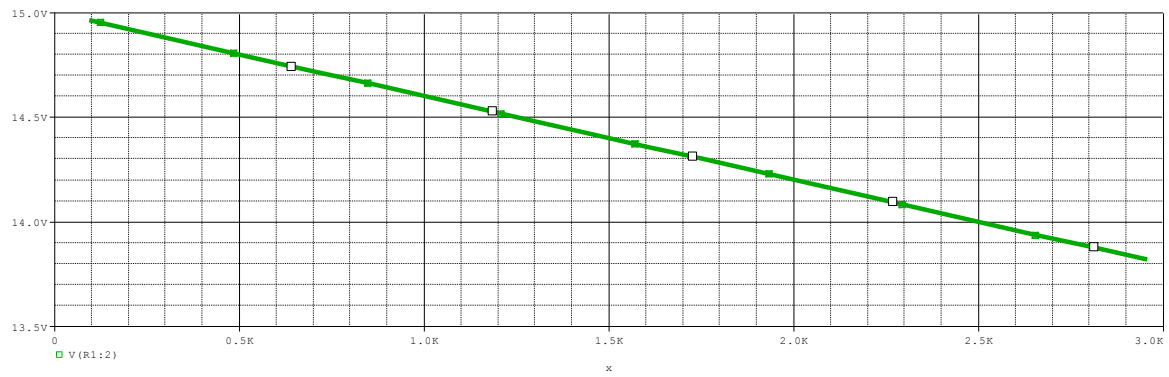
$$Z_i = \frac{V_i}{I_i} = \frac{0.4}{41.825} = 9.56 \Omega$$

$$Z_o = \frac{V_o}{I_o} = \frac{0.2}{13.9913} = 14.29 \text{ k} \Omega$$

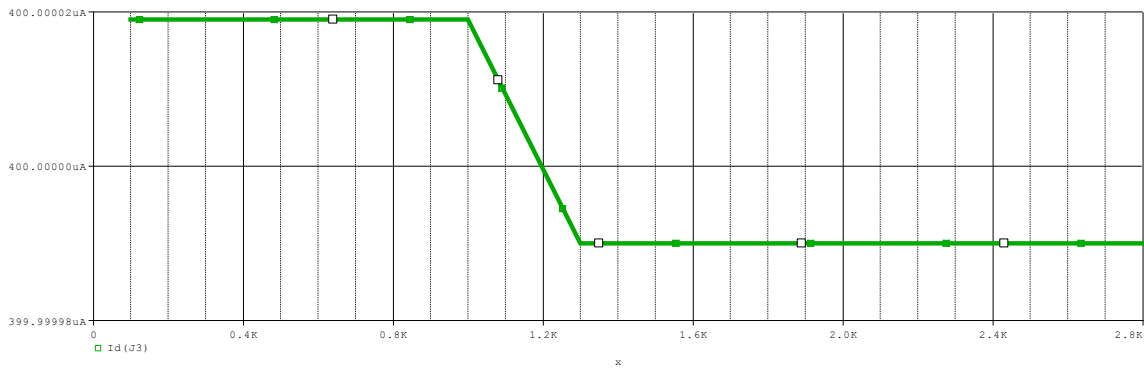
### III. CONSTANT CURRENT SOURCE.



$V_L$  :



$I_D$  :



| $R_L(K\Omega)$ | $I_D(mA)$   | $V_L(V)$     |
|----------------|-------------|--------------|
| <b>0.1</b>     | <b>0.04</b> | <b>14.96</b> |
| <b>0.22</b>    | <b>0.06</b> | <b>14.91</b> |
| <b>0.33</b>    | <b>0.1</b>  | <b>14.87</b> |
| <b>0.47</b>    | <b>0.2</b>  | <b>14.81</b> |
| <b>0.56</b>    | <b>0.21</b> | <b>14.78</b> |
| <b>1</b>       | <b>0.4</b>  | <b>14.60</b> |
| <b>1.5</b>     | <b>0.5</b>  | <b>14.40</b> |
| <b>2</b>       | <b>0.9</b>  | <b>14.20</b> |
| <b>3</b>       | <b>1.4</b>  | <b>13.81</b> |