

# **AUDIT COURSE ELECTRONIC CIRCUITS 1: SIMULATION BASED STUDY**

## **LAB 16**

Kindly update your name and roll no, once this document is shared with you

Time slot to complete your work is **40 MINUTES**

**Date: 29/9/2020**

Kindly upload your schematic & waveform images here, every 10 minutes, indicating your progress and intention to completion of WORK within time slot allotted

**Time slot allotted to you all for the completion of WEEK 8 DAY 2 is 40 MINUTES**

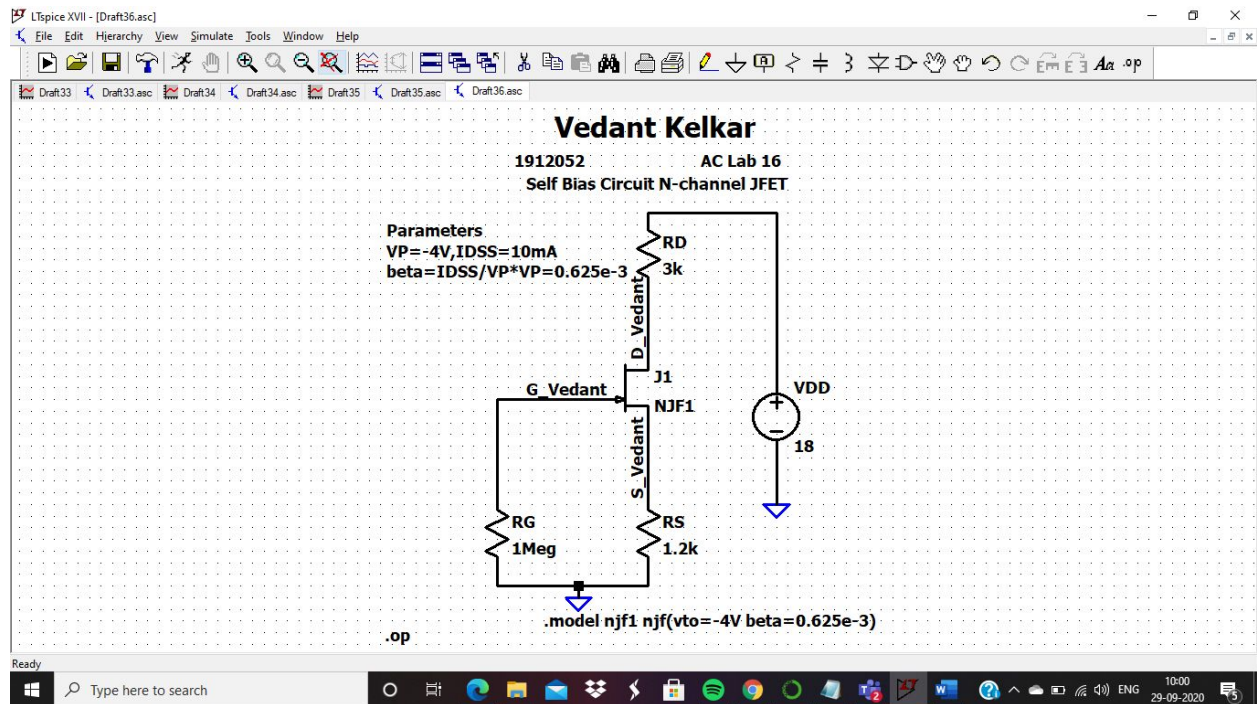
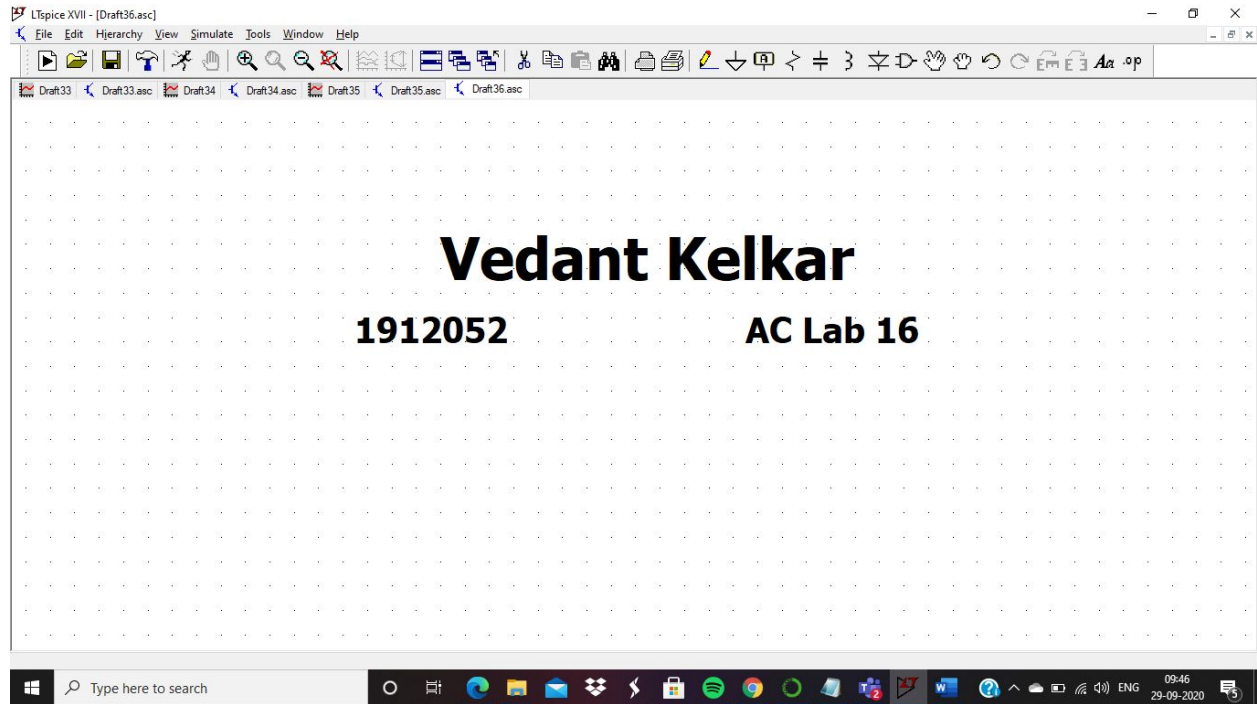
**Kindly upload your work (only circuit schematic & waveform in LTSpice) in the shared google doc between this time slot only.**

**Follow these instruction strictly:**

- 1, Start sharp ON TIME, by posting your name and roll no and **screenshot of your LT spice work screen ( time and date MUST BE VISIBLE)**
2. Upload your work every 10 minutes, i.e LT spice work screen
3. This means you will upload LT spice work screen 4 times during this time slot.
4. Point 3 indicates your readiness and presences for completion of WEEK 8 DAY 2

**You are entitled for 1 CREDIT per Lab only if you follow above instruction to the details**

**STUDENTS WORK AREA STARTS HERE**



**Vedant Kelkar**  
1912052 AC Lab 16  
Self Bias Circuit N-channel JFET

**Parameters**  
 $VP = -4V, IDSS = 10mA$   
 $\beta = IDSS / VP * VP = 0.625e-3$

**Operating Point**

V(g_vedant):	1.46255e-005	voltage
V(d_vedant):	12.3426	voltage
V(s_vedant):	2.26298	voltage
V(n001):	18	voltage
Id(J1):	0.00188581	device_current
Ig(J1):	-1.46255e-011	device_current
Is(J1):	-0.00188581	device_current
I(Rs):	0.00188581	device_current
I(Rd):	0.00188581	device_current
I(Rg):	1.46255e-011	device_current
I(Vdd):	-0.00188581	device_current

**.model njf1 njf(vto=-4V beta=0.625e-3)**

**.op**

**V(g\_vedant): 1.46255e-005 voltage**  
**V(d\_vedant): 12.3426 voltage**  
**V(s\_vedant): 2.26298 voltage**  
**V(n001): 18 voltage**  
**Id(J1): 0.00188581 device\_current**  
**Ig(J1): -1.46255e-011 device\_current**  
**Is(J1): -0.00188581 device\_current**  
**I(Rs): 0.00188581 device\_current**  
**I(Rd): 0.00188581 device\_current**  
**I(Rg): 1.46255e-011 device\_current**  
**I(Vdd): -0.00188581 device\_current**

## JFET Biasing.

Vedant Kelkar.  
1912052. B2

$$V_G = I_G R_G$$

$$V_G = 0 \quad \because I_G = 0$$

due to Reverse bias.

$$V_S = I_D \cdot R_S \quad (I_D \approx I_S)$$

$$V_S = I_D (1200)$$

$$V_{GS} = V_G - V_S$$

$$= -I_D (1200) \quad (1)$$

Drain current  $I_D$

$$I_D = I_{DSS} \left[ 1 - \frac{V_{GS}}{V_P} \right]^2 = 10 \times 10^{-3} \times \left[ 1 - \frac{V_{GS}}{4} \right]^2 \quad (2)$$

from (1) & (2)

$$V_{GS} = -1200 \times 10 \times 10^{-3} \left[ 1 + \frac{V_{GS}}{2} + \frac{V_{GS}^2}{16} \right]$$

$$V_{GS} = -12 \left[ 1 + 0.5 V_{GS} + 0.0625 V_{GS}^2 \right]$$

$$V_{GS} = -12 - 6 V_{GS} - 0.75 V_{GS}^2$$

$$\underline{0.75 V_{GS}^2 + 7 V_{GS} + 12 = 0} \quad (3)$$

Solving ③

1912052  
B2.

$$\underline{V_{GS} = -2.2629 \text{ V}} \quad \text{or} \quad V_{GS} = -7.07 \text{ V}$$

✓ ✗

Find  $I_D$ .

$$I_D = I_{DSS} \left[ 1 - \frac{V_{GS}}{V_P} \right]^2 = 10 \times 10^{-3} \left[ 1 - \frac{(-2.2629)}{-4} \right]^2$$

$$\underline{I_D = 1.8859 \text{ mA}}$$

$$\text{Qpoint} : [V_{GS} I_{DQ}]$$

$$= [-2.2629, 1.8859]$$

$$V_{DS} = V_{DD} - I_{DQ}(R_D + R_S) = 18 - 1.8859 \times 10^{-3} \times (3k + 1.2k)$$

$$\underline{V_{DS} = 10.0792 \text{ V}}$$

IDQ calc	IDQ sim	VGSQ calc	VGSQ sim	VDSQ calc	VDSQ sim
0.0018859A	0.00188581A	-2.2629V	-2.26298V	10.0792V	10.0797V

AC LAB 16 is approved: Inderjit Singh Dhanjal