Week 1

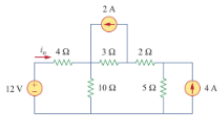
Homework 1.1

Bookmark this page

Homework due Dec 3, 2024 23:59 +06 Completed

HW 1.1.1

2.0/2.0 points (graded)



Which of these statements are true for the above circuit? Assume bottom node as the reference node. There might be more than one correct answer here.

- [ ] There are 5 nonreference node in this circuit.
- [x] $4A$ current source and 5Ω resistor are in parallel.
- [x] There is 0 supernode in this circuit.
- [ ] 3Ω and 2Ω resistors are in series.[x] correct

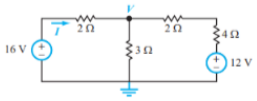
✔

Show answer

Submit You have used 2 of 3 attempts

HW 1.1.2

2.0/2.0 points (graded)



Find the value of I in the above circuit

- ○ 1
- ○ 2
- ◉ 3
- ○ 4

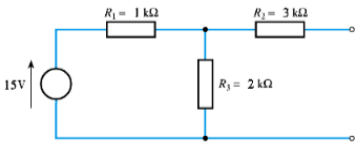
✔

Show answer

Submit You have used 3 of 3 attempts

H.W 1.1.3

2.0/2.0 points (graded)



Determine the open-circuit output voltage of the above circuit.

- ○ $5V$
- ○ $6.82V$
- ○ $8.18V$
- ◉ $10V$

✔

Show answer

Week 1

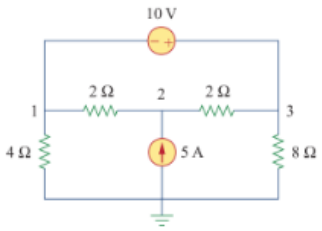
Homework 1.2

Bookmark this page

Homework due Dec 3, 2024 23:59 +06 Completed

HW 1.2.1

5.0/5.0 points (graded)



Use the node equation for the node 2 to **write a formula for v_2 in terms of v_1, v_3 and constant terms.**

Assume voltage of node 1 , 2 and 3 are v_1, v_2 and v_3, write node equation and solve for v_2.(e.g. $v_2 = v_1 - v_3/10 + 98$ then insert $v_1 - v_3/10 + 98$ as your answer). use v_1 for v_1.

v_1/2+v_3/2+5

$\frac{v_1}{2} + \frac{v_3}{2} + 5$

Show answer

Submit You have used 2 of 5 attempts

Week 1

Homework 1.3

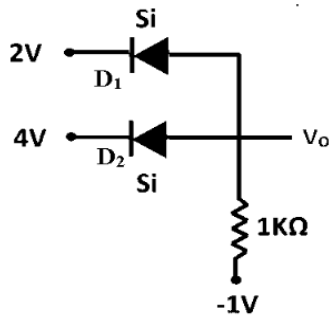
Bookmark this page

Homework due Dec 3, 2024 23:59 +06 Completed

HW 1.3.1

3.0/3.0 points (graded)

Answer all the questions for this following circuit configaration.



If we assume D_1 and D_2 are ON, which of the following statement is contradicting our assumption?

- [ ] If D_1 is ON, it will force D_2 to be ON.
- [ ] All the currents cannot leave the node with voltage V_0.
- [x] There couldn't be two values of voltage for V_0.
- [ ] No contradiction is present here.

✔

Show answer

Submit You have used 1 of 3 attempts

HW 1.3.2

4.0/4.0 points (graded)

If we assume D_1 is ON and D_2 is OFF, which of the following statement is contradicting our assumption?

- [ ] If D_1 is ON, it will force D_2 to be ON.
- [x] All the currents cannot leave the node with voltage V_0.
- [ ] There couldn't be two values of voltage for V_0.
- [ ] No contradiction is present here.

✔

Show answer

Submit You have used 1 of 3 attempts

HW 1.3.3

3.0/3.0 points (graded)

Find the value of V_0.

-1 ✔

-1

Show answer

Submit You have used 1 of 3 attempts

Week 1

Homework 1.4

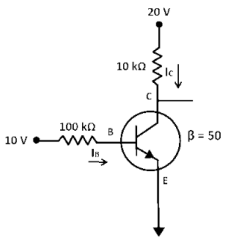
Bookmark this page

Homework due Dec 3, 2024 23:59 +06 Completed

HW 1.4.1

2.0/2.0 points (graded)

Answer all the questions for this following circuit configaration.



In this problem we are going to assume that the transistor is in forward active mode. Therefore, we are going to use the voltage and current relationships for forward active mode. Emitter is connected to ground here. For forward active mode $V_{BE} = 0.7$ and in this particular circuit forward current gain $\beta = 50$.

Find the value of V_B.
Give your answer in voltage.

0.7 ✔

0.7

Show answer

Submit You have used 1 of 3 attempts

HW 1.4.2

6.0/6.0 points (graded)

Find the value of I_B.Use Ohm's law. Give your answer in mA.

0.093 ✔

0.093

Find the value of I_C.Use β. Give your answer in mA.

4.65 ✔

4.65

Find the value of V_C. Use Ohm's law. Give your answer in voltage.

-26.5 ✔

-26.5

Show answer

Submit You have used 1 of 4 attempts

HW 1.4.3

2.0/2.0 points (graded)

Which of the following reason does prove that the BJT is not in forward active mode?

- ○ I_E is now negative.
- ◉ $V_B > V_C$. ✔
- ○ $V_{BE} > 0$.
- ○ $I_C > I_B$.

Show answer

Submit You have used 1 of 2 attempts

HW 1.4.5

6.0/6.0 points (graded)

Now use the assumption that BJT is in saturation mode.

Find the value of I_B in mA.

0.092 ✔

0.092

Find the value of I_C in mA.

1.98 ✔

1.98

Find the value of I_E in mA.

2.072 ✔

2.072

Show answer

Submit You have used 1 of 3 attempts

Week 2

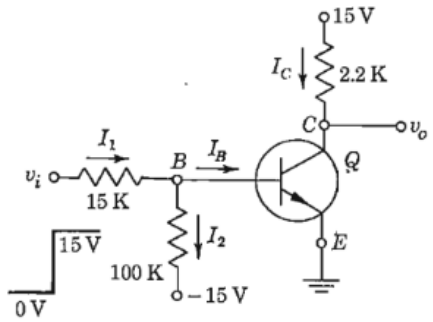
Homework 2.2

Bookmark this page

Homework due Dec 3, 2024 23:59 +06 Completed

HW 2.2.2

10.0/10.0 points (graded)



Now if the inputs voltage is $V_i = 15V$.

Assume for saturation mode $V_{BE} = 0.8V, V_{CE} = 0.2V$.

Find out the output voltage in V.

0.2 ✔

0.2

Find the value of I_C in mA.

6.7273 ✔

6.7273

Find the value of I_1 in mA.

0.9467 ✔

0.9467

Find the value of I_2 in mA.

0.158 ✔

0.158

Find the value of I_B in mA.

0.7887 ✔

0.7887

Show answer

Submit You have used 1 of 4 attempts

Week 2

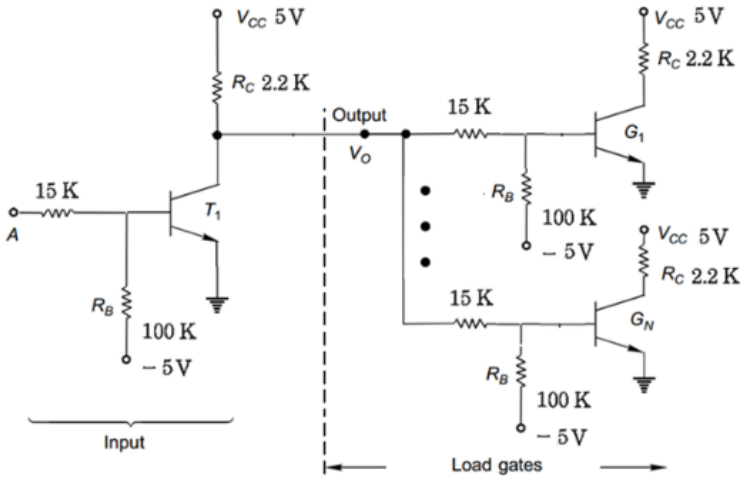
Homework 2.3

Bookmark this page

Homework due Dec 3, 2024 23:59 +06 Completed

HW 2.3

10.0/10.0 points (graded)



For the above RTL inverter circuit assume $V_{OH} = 4V$ and $V_{OL} = 0.2V$.

Also assume common emitter current gan $\beta_F = 30$.

Assume for saturation mode $V_{BE} = 0.8V, V_{CE} = 0.2V$ and cut in voltage for transistor $V_\gamma = 0.5V$.

Find the value of V_{IL} in V.

1.325 ✔

1.325

Find the value of V_{IH} in V

2.7605 ✔

2.7605

Calculate the noise margin in V.

1.125 ✔

1.125

Find the maximum number of FANOUT for this cicuit.

2 ✔

2

Show answer

Submit You have used 1 of 5 attempts

Week 3

Homework 3.1

Bookmark this page

Homework due Dec 3, 2024 23:59 +06 Completed

HW 3.1.1

3.0/3.0 points (graded)

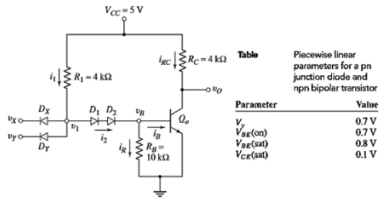


Table Piecewise linear parameters for a pn junction diode and npn bipolar transistor

Parameter	Value
V_γ	0.7 V
$V_{BE(on)}$	0.7 V
$V_{BE(sat)}$	0.8 V
$V_{CE(sat)}$	0.1 V

Consider the DTL circuit in the above figure. Assume the transistor parameters areas given in Table and let $\beta = 25$. In the picture V_γ represents the cutin voltage of diodes.

Assume any of the input is low that means any of the input is $0.1V$.

Find i_1 in mA.

1.05 ✔

1.05

Find i_2 in mA.

0 ✔

0

Find i_R in mA.

0 ✔

0

Find i_B in mA.

0 ✔

0

Find i_{RC} in mA.

0 ✔

0

Show answer

Submit You have used 1 of 3 attempts

HW 3.1.2

7.0/7.0 points (graded)

Now assume that both inputs are high or $v_X = v_Y = 5V$.

Find i_1 in mA.

0.7 ✔

0.7

Find i_2 in mA.

0.7 ✔

Find i_{RC} in mA.

1.225 ✔

1.225

Find i_R in mA.

0.08 ✔

Find i_B in mA.

0.62 ✔

0.62

Show answer

Submit You have used 1 of 5 attempts

Week 3

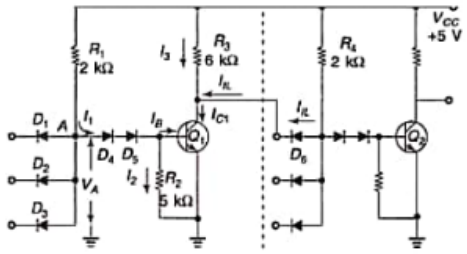
Homework 3.2

Bookmark this page

Homework due Dec 3, 2024 23:59 +06 Completed

HW 3.2.1

5.0/5.0 points (graded)



In this circuit use the following information.

The cutin voltage of diodes $V_\gamma\ (diode) = 0.6V$.

The conducting voltage of diode is = $0.7V$

The cutin voltage of the transistors $V_\gamma\ (transistor) = 0.5V$.

In saturation, transistors have $V_{BE} = 0.8V$ and $V_{CE} = 0.1V$.

The common emitter current gain of the transistors $\beta = 25$.

Here assume the output port is connected to the input of a similar device.

Determine the FANOUT of this DTL NAND gate.

Use floor function for the answer.

14 ✔

14

Show answer

Submit You have used 1 of 5 attempts

Week 3

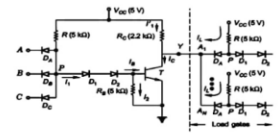
Homework 3.4

Bookmark this page

Homework due Dec 3, 2024 23:59 +06 Completed

HW 3.4.1

3.0/3.0 points (graded)



In the above circuit use this following information.

The cutin voltage of diode $V_\gamma\,(diode) = 0.6V$.

The conducting voltage of diode is = $0.7V$.

The cutin voltage of the transistors $V_\gamma\,(transistor) = 0.5V$.

In saturation, transistors have $V_{BE} = 0.8V$ and $V_{CE} = 0.1V$.

In forward active mode, transistors have $V_{BE} = 0.7V$.

The common emitter current gain of the transistors $\beta = 30$.

Assume any of the input is low that means any of the input (Suppose, input A) is $0.1V$.

For this part assume inputs of the load devices are not connected to driver device.

Find I_L in mA. Calculate I_L for driver device. (the current through the DA diode of the driver circuit)

0.84 ✔

0.84

Find I_1 in mA.

0 ✔

0

Find I_3 in mA.

0 ✔

0

Find I_B in mA.

0 ✔

0

Find I_C in mA.

0 ✔

0

Show answer

Submit You have used 2 of 3 attempts

HW 3.4.2

7.0/7.0 points (graded)

Assume all the inputs is high that means $V_A = V_B = V_C = 5V$.

For this part assume inputs of the load devices are not connected to driver device.

Find I_L in mA. Calculate I_L for driver device.

0 ✔

0

Find I_1 in mA.

0.56 ✔

0.56

Find I_3 in mA.

0.16 ✔

0.16

Find I_B in mA.

0.4 ✔

0.4

Find I_C in mA.

2.227 ✔

2.227

Show answer

Submit You have used 1 of 5 attempts

HW 3.4.3

3.0/3.0 points (graded)

Find out the FANOUT of the DTL circuit.

Use floor function to find the answer.

11 ✔

11

Show answer

Submit You have used 1 of 5 attempts

Week 3

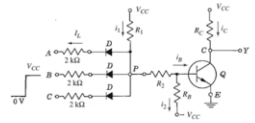
Homework 3.5

Bookmark this page

Homework due Dec 3, 2024 23:59 +06 Completed

HW 3.5.1

10.0/10.0 points (graded)



In the above circuit use the following information.

The cutin or threshold voltage of diode $V_\gamma\,(Diode) = 0.6V$. This voltage is required to just turn on the diode.

The voltage across the diode while conducting is $V_D = 0.7V$.

The cutin or threshold voltage of the transistors $V_\gamma\,(Transistor) = 0.5V$.

In saturation, transistors have $V_{BE}\,(SAT) = 0.8V$ and $V_{CE}\,(SAT) = 0.1V$.

In forward active mode, transistors have $V_{BE}\,(ACTIVE) = 0.7V$.

The common emitter current gain of the transistors $\beta_F = 30$.

In this circuit use $V_{CC} = 12V$. $R_1 = R_2 = 15k\Omega$, $R_C = 2.2k\Omega$, $R_B = 100k\Omega$

Assume $V_A = 0.1V$, $V_B = V_C = 12V$.

For this part assume inputs of the load devices are not connected to driver device.

Find I_L in mA. Calculate I_L for driver device.

0.552 ✔

0.552

Find i_1 in mA.

0.673 ✔

0.673

Find i_2 in mA.

0.125 ✔

0.125

Find I_B in mA.

0 ✔

0

Find I_C in mA.

0 ✔

0

Find power dissipated in this case in mW.

9.516 ✔

9.516

Show answer

Submit You have used 1 of 5 attempts

HW 3.5.2

13.0/13.0 points (graded)

In this circuit use $V_{CC} = 12V$. $R_1 = R_2 = 15k\Omega$, $R_C = 2.2k\Omega$, $R_B = 100k\Omega$

Assume $V_A = V_B = V_C = 12V$.

For this part assume inputs of the load devices are not connected to driver device.

Find I_L in mA. Calculate I_L for driver device.

0 ✔

Find i_1 in mA.

0.373 ✔

0.373

Find i_2 in mA.

0.128 ✔

0.128

Find I_B in mA.

0.245 ✔

0.245

Find I_C in mA.

5.409 ✔

5.409

Find power dissipated in this case in mW.

70.92 ✔

70.92

Find the value of β_{min}.

22.08 ✔

22.08

Show answer

Submit You have used 1 of 5 attempts

HW 3.5.3

2.0/2.0 points (graded)

For this part assume inputs of the load devices are connected to driver device.

Calculate the FANOUT for this circuit.

3 ✔

3

Show answer

Submit You have used 1 of 3 attempts

Week 4

Homework 4.1

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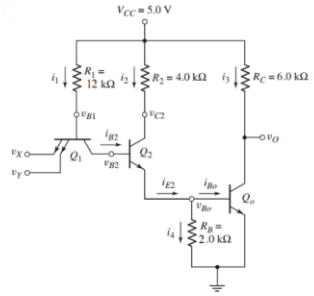
Homework due Dec 3, 2024 23:59 +06 Completed

HW 4.1.1

2.0/2.0 points (graded)



In the above circuit use this following information.

The cutin voltage of diodes $V_\gamma\,(diode) = 0.6V$.

The conducting voltage of diode is = $0.7V$

The cutin voltage of the transistors $V_\gamma\,(transistor) = 0.5V$.

In saturation, transistors have $V_{BE} = 0.8V$ and $V_{CE} = 0.1V$.

In forward active mode, transistors have $V_{BE} = 0.7V$.

The forward common emitter current gain of the transistors $\beta_F = 25$.

The reverse common emitter current gain of the transistors $\beta_R = 0.1$.

Assume any of the input is low that means any of the input is $0.1V$.

For this part assume inputs of the load devices are not connected to driver device.

Find i_1 in mA.

0.342 ✔

0.342

Find i_{B2} in mA.

0 ✔

0

Find i_2 in mA.

0 ✔

0

Find i_{Bo} in mA.

0 ✔

0

Find i_3 in mA.

0 ✔

0

Show answer

Submit You have used 1 of 5 attempts

HW 4.1.2

5.0/5.0 points (graded)

Assume all the inputs is high that means any of the input is $V_x = V_y = 5V$.

For this part assume inputs of the load devices are not connected to driver device.

Find i_1 in mA.

0.225 ✔

0.225

Find i_{B2} in mA.

0.27 ✔

0.27

Find i_2 in mA.

1.025 ✔

1.025

Find i_{Bo} in mA.

0.895 ✔

0.895

Find i_3 in mA.

0.817 ✔

0.817

Show answer

Submit You have used 1 of 5 attempts

Week 5

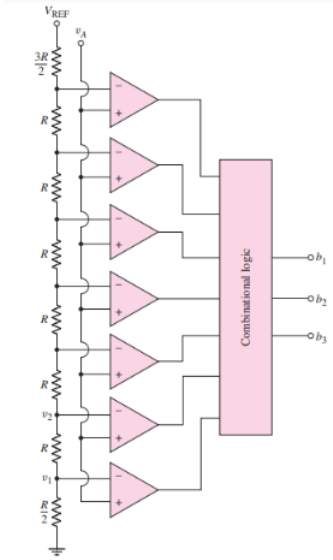
Homework 5.2

Bookmark this page

Homework due Dec 13, 2024 23:59 +06 Completed

HW 5.2.1

6.0/6.0 points (graded)



The 3-bit flash A/D converter in the above figure has a reference voltage of $V_{REF} = 18V$. Here the 3-bit output is 101.

What is the min value of v_A that produces this output?

10.125 ✔

10.125

What is the max value of v_A that produces this output?

12.375 ✔

12.375

Show answer

Submit You have used 3 of 3 attempts

HW 5.2.2

4.0/4.0 points (graded)

A 6-bit flash A/D converter, similar to the one in earlier question, is to be fabricated.

How many resistors are required?

64 ✔

64

How many comparators are needed?

63 ✔

63

Show answer

Submit You have used 2 of 2 attempts

Week 6

Homework 6.1

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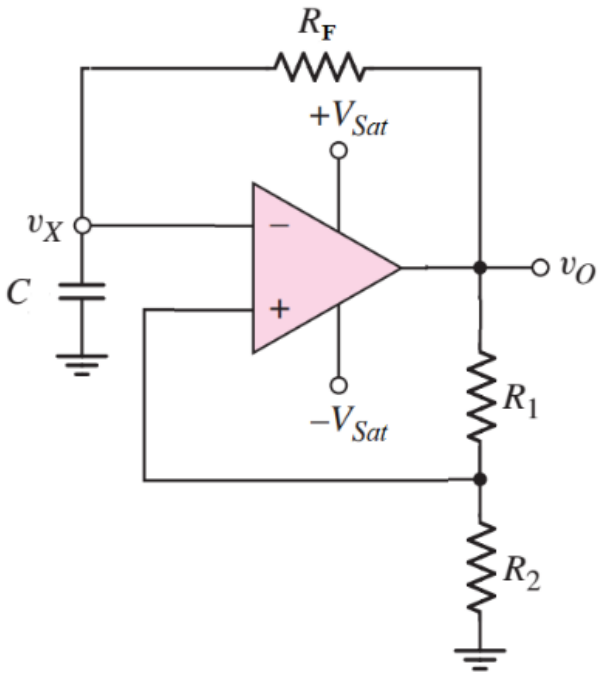
Homework due Dec 27, 2024 23:59 +06 Completed

HW 6.1.1

6.0/6.0 points (graded)



Now in the square wave generator $R_1 = 200k\Omega, R_2 = 172k\Omega$ and $+V_{sat} = 20V$ and $-V_{sat} = -20V$.

Find out the upper threshold voltage.

9.25 ✔

9.25

Find out the lower threshold voltage.

-9.25 ✔

-9.25

Find the total time period T in ms if $R_f C = 10ms$.

20.01 ✔

20.01

Show answer

Submit You have used 1 of 6 attempts

Week 6

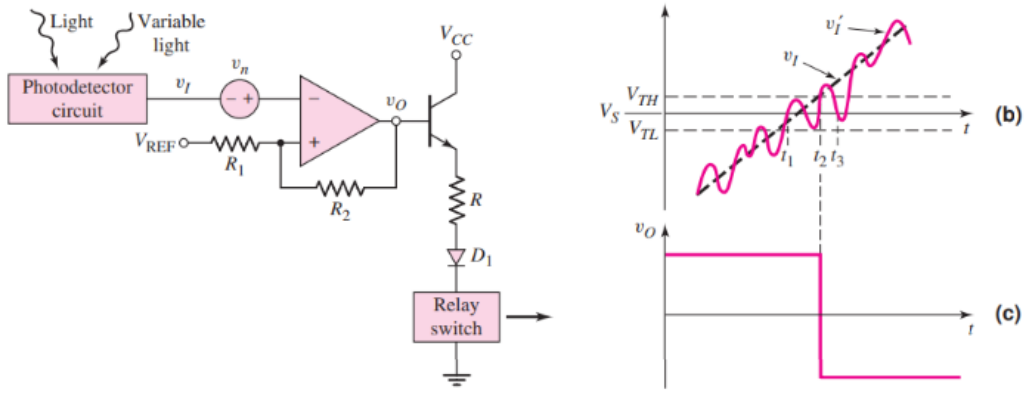
Homework 6.3

Bookmark this page

Homework due Dec 27, 2024 23:59 +06 Completed

HW 6.3.1

10.0/10.0 points (graded)



Here assume conduction voltage of diode is $V_\gamma = 0.7V$ and for the switching transistor $V_{BE}\,(on) = 0.7V$ and β_F is very large.

Design the street light control circuit shown in the above figure such that the switching voltage is $V_S = 1.5V$ and the hysteresis width is $300mV$. Assume $V_H = 10V$ and $V_L = -5V$.

Find the resistances in $k\Omega$. You can assume the value of one resistance.

R_1

1 ✔

R_2

49 ✔

Find the value of V_{REF} in V.

1.53 ✔

1.53

Suppose, the current through resistance R is $300\mu A$ when $v_O = V_H$ and relay switch resistance is 220Ω.

Find the value of R in $k\Omega$.

28.89 ✔

28.89

Show answer

Submit You have used 2 of 5 attempts

Week 8

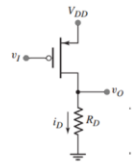
Homework 8.1

Bookmark this page

Homework due Jan 9, 2025 23:59 +06 Completed

HW 8.1.1

5.0/5.0 points (graded)



In the above **PMOS inverter circuit** $V_{DD} = 5V$ and $R_D = 20\text{k}\Omega$.

For p-channel MOSFET conduction parameter $K_p = 0.3mA/V^2$ and threshold voltage $V_{TP} = -0.5V$.

If the input voltage $v_I = 5V$.

Find the ouput voltage v_O in V.

0 ✔

0

Find the drain current i_D in mA.

0 ✔

0

Show answer

Submit You have used 1 of 4 attempts

HW 8.1.2

5.0/5.0 points (graded)

If the input voltage $v_I = 1V$.

Find the ouput voltage v_O in V.

4.82 ✔

4.82

Find the drain current i_D in mA.

.2441 ✔

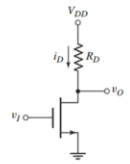
.2441

Show answer

Submit You have used 1 of 5 attempts

HW 8.1.3

5.0/5.0 points (graded)



In the above circuit $V_{DD} = 5V$ and for n-channel MOSFET threshold voltage $V_{TN} = 1V$, conduction parameter $K_n = 10\mu A/V^2$.

If the transition input voltage is $v_I = 2V$, find out the value of R_D in $k\Omega$?

400 ✔

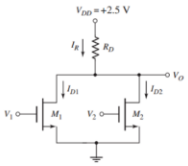
400

Show answer

Submit You have used 1 of 5 attempts

HW 8.1.4

5.0/5.0 points (graded)



In the above NMOS NOR gate circuit $R_D = 1\text{k}\Omega$ and for both n-channel MOSFETs conduction parameter $K_n = 2mA/V^2$, threshold voltage $V_{TN} = 0.5V$.

Remember that voltage swing for both inputs V_1, V_2 are in between $0V$ to $2.5V$.

Find the maximum power dissipation in mW.

5.87 ✔

5.87

In this case, find the output voltage V_O in V.

0.15 ✔

0.15

Show answer

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Week 8

Homework 8.4

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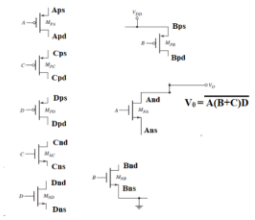
Homework due Jan 9, 2025 23:59 +06 Completed

HW 8.4.1

6.0/6.0 points (graded)



This is the CMOS logic implementation of logic equation $Y = \overline{A\,(B + C)\,D}$. Some of the connections are already given and you need to provide the rest of the correct connection for this circuit.

Select all the terminal(s) that must be connected to the node Bnd.

- [ ] Dnd
- [x] Dns
- [x] Cnd
- [ ] Cns
- [ ] Ans
- [ ] Cpd
- [ ] Cps

✔

Select all the terminal(s) that must be connected to the node Bns.

- [ ] Dnd
- [ ] Dns
- [ ] Cnd
- [x] Cns
- [ ] Ans
- [ ] Cpd
- [ ] Cps

✔

Select all the terminal(s) that must be connected to the node Ans.

- [x] Dnd
- [ ] Dns
- [ ] Cnd
- [ ] Cns
- [ ] Bnd
- [ ] Cpd
- [ ] Cps

✔

Select all the terminal(s) that must be connected to the node And.

- [x] Dpd
- [ ] Dps
- [x] Cpd
- [ ] Cps
- [ ] Bps
- [ ] Bpd
- [x] Apd
- [ ] Aps

✔

Select all the terminal(s) that must be connected to the node Bpd.

- [ ] Dpd
- [ ] Dps
- [ ] Cpd
- [x] Cps
- [ ] Bps
- [ ] Bpd
- [ ] Apd
- [ ] Aps

✔

Select all the terminal(s) that must be connected to the node Bps.

- [ ] Dpd
- [x] Dps
- [ ] Cpd
- [ ] Cps
- [ ] Bps
- [ ] Bpd
- [ ] Apd
- [x] Aps

✔

Show answer

Submit You have used 1 of 8 attempts