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Courses » **Semiconductor Devices and Circuits**

Announcements **Course** Ask a Question Progress Mentor FAQ

Unit 12 - Week 11: Circuits

Course outline

Assignment 11

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2018-10-17, 23:59 IST.

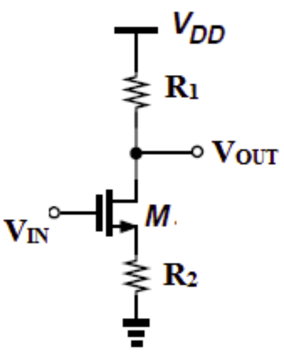
1) Consider the MOSFET circuit shown in the following figure. The threshold voltage of the MOSFET varies as: ***1 point***

$$V_T = 0.5 + \gamma[\sqrt{2\phi_F + V_{SB}} - \sqrt{2\phi_F}]$$

where, the body-effect coefficient γ is $0.2V^{1/2}$

Assume $V_{DD} = 3V, R_1 = 10k\Omega, R_2 = 2k\Omega$ The aspect ratio of the device is 10. The MOSFET device is in saturation. Assume $\mu C_{ox} = 0.8mA/V^2, \phi_F = 0.15V$

The channel length modulation parameter for the device is $\lambda = 0.1V^{-1}$. Calculate the value of V_{IN} such that the DC voltage at the output, V_{OUT}, is 1.5 V.



0.6 V

1.03 V

1.82 V

Week 9: MOSFET: I

Week 10: MOSFET: II

Week 11: Circuits

- MOSFET as a Switch
- MOSFET as a Switch - Continued
- Amplifiers using MOSFET
- Amplifiers using MOSFET - Continued
- Circuits: Frequency Response, Noise
- Quiz : Assignment 11
- Assignment 11: Solutions

Week 12: Thin Film Transistors (TFTs), Tutorial Sessions

2) Calculate the approximate value of output resistance (r_{ds}) of the MOSFET in question-1. ***1 point***

$13.4k\Omega$

$670k\Omega$

$75k\Omega$

None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
$75k\Omega$

3) In a MOSFET used as a switch, which of the following represents the ON-resistance of the MOSFET when $V_{DS} << V_{GS} - Vth$ ***1 point***

$\mu C_{ox} W/L$

$\mu C_{ox} W/L(V_{GS} - Vth)$

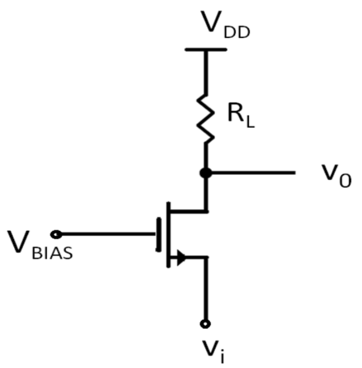
$\frac{1}{\mu C_{ox} W/L(V_{GS} - Vth)}$

∞

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{\mu C_{ox} W/L(V_{GS} - Vth)}$

4) In the voltage amplifier circuit shown in the following figure, V_{BIAS}, V_{DD} are the DC voltages aiding the biasing of the MOSFET. R_L is the load resistance. Let g_m be the transconductance and r_{ds} be the output resistance of the MOSFET device. v_i and v_o are the small signal input and output voltages respectively. Which of the following expressions represents the effective Input Impedance (Z_{in}) seen by the small-signal at the input ? ***1 point***



R_L

$(R_L + r_{ds})g_m R_L$

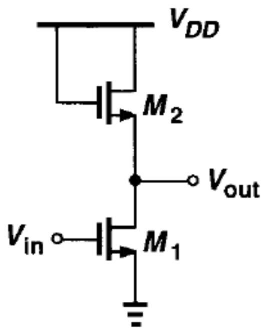
∞

$\frac{R_L+r_{ds}}{1+g_m r_{ds}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{R_L+r_{ds}}{1+g_m r_{ds}}$

5) For the circuit shown in the following figure, calculate the value of small-signal voltage gain, ignoring short-channel effects in the transistors, when $(W/L)_1 = 50/0.5$ and $(W/L)_2 = 10/0.5$. $I_{D1} = I_{D2} = 0.5mA$ ***1 point***



- -2.24
- -7.07
- -1
- -5

No, the answer is incorrect.
Score: 0

Accepted Answers:
-2.24

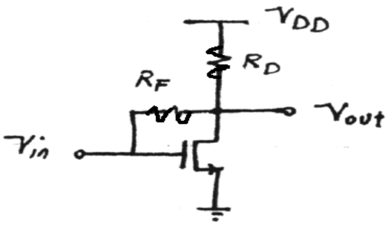
6) When used in an amplifier circuit, a MOSFET is generally biased in ________ mode of operation. ***1 point***

- Linear
- Saturation
- Sub-threshold
- None

No, the answer is incorrect.
Score: 0

Accepted Answers:
Saturation

7) Let g_m be the transconductance and r_{ds} be the output resistance of the MOSFET shown in the following circuit. Which of the following expressions represents the correct small-signal voltage gain of the circuit ? ***1 point***



$\frac{R_D}{R_F}$

$\frac{\frac{1}{R_F}}{\frac{1}{R_F}+\frac{1}{R_D}+\frac{1}{r_{ds}}}$

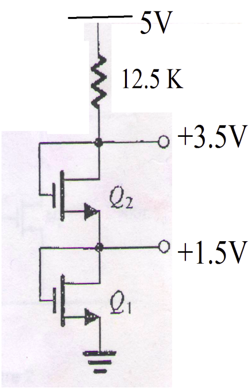
$-\frac{g_m-\frac{1}{R_F}}{\frac{1}{R_F}+\frac{1}{R_D}+\frac{1}{r_{ds}}}$

$-\frac{R_F}{R_D}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$-\frac{g_m-\frac{1}{R_F}}{\frac{1}{R_F}+\frac{1}{R_D}+\frac{1}{r_{ds}}}$

8) Consider the circuit shown in following figure with transistors named Q_1 and Q_2. Channel lengths of the devices are $L_1 = 1\mu m, L_2 = 1\mu m$. The threshold voltage is 1V for both the devices. Take $\mu C_{ox} = 120\mu A/V^2$. Assuming that there is no channel length modulation effect present in the devices, calculate the ratio of the widths of the devices: $\frac{W_1}{W_2}$ ***1 point***



0.25

1

4

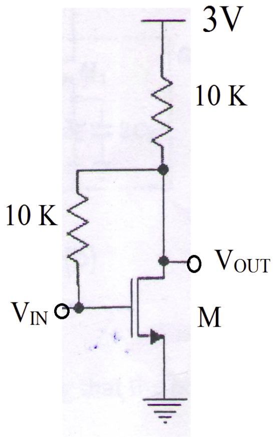
None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:

4

9) In the circuit shown in the following figure, the threshold voltage of the MOSFET M is 0.5 V. ***1 point***
When $V_{IN} = 1V$, the DC voltage at the output is $V_{OUT} = 1.5V$.
Take $\mu C_{ox} = 0.1mA/V^2$. Assume that the channel length modulation parameter for the MOSFET is $\lambda = 0.09V^{-1}$. What is the value of current through the MOSFET device ?



- 0.1 mA
- 0.5 mA
- 0.25 mA
- 0.7 mA

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.1 mA

10)With respect to details given in question-9, find the aspect ratio W/L of the MOSFET device. ***1 point***

- 22
- 1
- 7
- None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
7

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