Assignment 11

The due date for submitting this assignment has passed. **Due on 2018-10-17, 23:59 IST.**
As per our records you have not submitted this assignment.

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

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

where, the body-effect coefficient \( \gamma \) 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
- None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

1.03 V

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

- 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 $V_{DS} << V_{GS} - V_{th}$

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

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{\mu C_{ox} W/L (V_{GS} - V_{th})}$

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?

- $R_L$
- $(R_L + r_{ds}) g_m R_L$
- $\infty$
- $\frac{R_L + r_{ds}}{1 + g_m r_{ds}}$

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 $(W/L)_2 = 10/0.5$. $I_{D1} = I_{D2} = 0.5mA$

- -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.

- Linear
- Saturation
- Sub-threshold
- None
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?

No, the answer is incorrect.
Score: 0
Accepted Answers:
Saturation

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

8) Consider the circuit shown in the 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: $\frac{W_1}{W_2}$

- 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. When $V_{IN} = 1 V$, the DC voltage at the output is $V_{OUT} = 1.5 V$. Take $\mu C_{ox} = 0.1 m A/V^2$. Assume that the channel length modulation parameter for the MOSFET is $\lambda = 0.09 V^{-1}$. What is the value of current through the MOSFET device?
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