Assignment 10

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

1) Assume that the subthreshold current of a MOSFET (in amperes) is given by:

\[ I_D = 10^{-15} \exp(V_{GS} / 2.1 \cdot V_T) \]

over the range 0 < \( V_{GS} \) < 1V and where the factor 2.1 takes into account the effect of interface states.
Assume that the value of thermal voltage \( V_T \) is 25.9 mV. Assume that \( 10^6 \) identical transistors on a chip are all biased at the same \( V_{GS} \) and at VDD = 5V.

Calculate the ratio of subthreshold current in the MOSFET device at \( V_{GS} = 0.7V \) to the subthreshold current at
\( V_{GS} = 0.5V \)

- 100
- 82.5
- 39.5
- 1

No, the answer is incorrect.
Score: 0
Accepted Answers:
39.5

2) With reference to details given in question-1, calculate the total current that must be supplied 1 point to the chip at \( V_{GS} = 0.7V \)

- 0.388 mA
- 9.83 mA
- 0.678 mA
- 9.83 pA

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

3) With reference to details given in question-1, calculate the total power dissipated in the chip 1 point at \( V_{GS} = 0.9V \)

- 1.94 mW
- 49.2 mW
- 22.8 mW
- 77 mW

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.388 mA
No, the answer is incorrect.
Score: 0
Accepted Answers:
77 mW

4) A silicon MOS device has the following parameters: \( N_A = 10^{16} \text{cm}^{-3} \)
Oxide thickness = 20 nm. Calculate the body-effect coefficient for the device.

\[
\begin{align*}
&3.33V^{0.5} \\
&0.333V^{0.5} \\
&0.03V^{0.5} \\
&33.33V^{0.5}
\end{align*}
\]

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.333V^{0.5}

5) For the MOS device given in question-4, calculate the change in threshold voltage for \( V_{SB} = 1V \). Assume thermal voltage is 25.9 mV and \( n_i = 1.5 \times 10^{10} \text{cm}^{-3} \)

\[
\begin{align*}
&0.16 V \\
&0.33 V \\
&1 V \\
&None \ of \ the \ above
\end{align*}
\]

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

6) Consider an n-channel MOSFET with channel width 30 um and channel length 1 um. The oxide capacitance is 69 nF/sqcm. Assume that the drain current in the non-saturation region for \( V_{DS} = 0.07V \) is 25 uA at \( V_{GS} = 1.5V \), and 65 uA at \( V_{GS} = 2.5V \). Extract the mobility (in sqcm/Vs) from the given data (Assume small-\( V_{DS} \) approximation for the drain current equation).

\[
\begin{align*}
&552 \\
&138 \\
&276 \\
&None \ of \ the \ above
\end{align*}
\]

No, the answer is incorrect.
Score: 0
Accepted Answers:
276

7) Which of the following statements are true ?

i. The interface states affect the subthreshold-swing of a MOSFET due to presence of additional capacitances

ii. The C-V characteristics curve of a MOS-system shifts to left/right based on the presence of trap charges in the oxide

iii. Presence of trap-charges has no effect on the C-V characteristics of a MOS-system

iv. Charges present at the oxide-semiconductor interface has strong effects on threshold voltage value.

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

8) Constant voltage scaling is applied to a MOSFET with a scaling factor of $k=5$. As the MOSFET features are scaled down, the current in the MOSFET:

- increases by a factor of 5
- decreases by a factor of 5
- increases by a factor of 25
- decreases by a factor of 25

No, the answer is incorrect.
Score: 0

Accepted Answers:
- increases by a factor of 5

9) An n-MOS transistor has the following parameters: Channel length = 1 um, Channel width = 10 um, Oxide thickness = 25 nm, $N_A = 5 \times 10^{15} \text{ cm}^{-3}$, applied voltages = 3V. If the device is to be scaled using constant-field scaling with a scaling factor of $k = 0.7$, the channel length and channel width for the scaled device would be:

- 7 um, 0.7 um
- 7 um, 7 um
- 0.7 um, 7 um
- 0.7 um, 0.7 um

No, the answer is incorrect.
Score: 0

Accepted Answers:
- 0.7 um, 7 um

10) Find the oxide thickness for the scaled device given in question-9.

- 17.5 nm
- 25 nm
- 35.7 nm
- None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
- 17.5 nm