Assignment 10

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

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

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

\[ I_D = 10^{-15} \exp\left(\frac{V_{GS}}{2.1 \cdot V_t}\right) \]

over the range \(0 < V_{GS} < 1\)V 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 \(V_{DD} = 5\)V.

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 to the chip at \(V_{GS} = 0.7V\)

- 0.388 mA
- 9.83 mA
- 0.678 mA
- 9.83 pA
1) A silicon MOS device has the following parameters: $N_A = 10^{16} \text{cm}^{-3}$, $V_{DD} = 1.94 \text{ mW}$, $V_{SS} = 77 \text{ mW}$.

   - Power is dissipated.
   - No, the answer is incorrect.
   - Score: 0
   - Accepted Answers:
     - $77 \text{ mW}$

2) Scaling of MOSFETs - Continued, Leakage current in MOSFETs

   - No, the answer is incorrect.
   - Score: 0
   - Accepted Answers:
     - $77 \text{ mW}$

3) Trapped charge, Body-bias Scaling of MOSFETs

   - No, the answer is incorrect.
   - Score: 0
   - Accepted Answers:
     - $77 \text{ mW}$

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

   - $3.33V^{0.5}$
   - No, the answer is incorrect.
   - Score: 0
   - Accepted Answers:
     - $3.33V^{0.5}$

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

   - No, the answer is incorrect.
   - Score: 0
   - Accepted Answers:
     - $0.33 \text{ V}$

6) Consider an n-channel MOSFET with channel width $30 \text{ um}$ and channel length $1 \text{ um}$. The oxide capacitance is $69 \text{nF/sqcm}$. Assume that the drain current in the non-saturation region for $V_{DS} = 0.07 \text{ V}$ is $25 \mu\text{A}$ at $V_{GS} = 1.5 \text{ V}$, and $66 \mu\text{A}$ at $V_{GS} = 2.5 \text{ V}$. Extract the mobility (in $\text{cm}^2/\text{V}\cdot\text{s}$) from the given data. (Assume small-$V_{DS}$ approximation for the drain current equation).

   - $552$
   - $138$
   - $276$
   - None of the above

   - 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.

- i only
- ii and iii
- ii only
- i, ii and iv

No, the answer is incorrect.
Score: 0
Accepted Answers:
i, ii and iv

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:
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