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reviewer3@nptel.iitm.ac.in ▼

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Unit 11 - Week 10: MOSFET: II

Course outline

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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:

1 point

$$I_D = 10^{-15} \exp(V_{GS} / 2.1 * V_t)$$

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 $V_{DD} = 5V$.

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 to the chip at $V_{GS} = 0.7V$

1 point

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

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**Week 9:
MOSFET: I**
**Week 10:
MOSFET: II**
☐ Trapped charge, Body-bias

☐ Scaling of MOSFETs

☐ Scaling of MOSFETs - Continued, Leakage current in MOSFETs

☐ MOSFET Characterization: Parameter Extraction

☐ MOSFET Characterization: Trapped charges, Contact resistance

☐ Quiz : Assignment 10

☐ Assignment 10: Solutions

**Week 11:
Circuits**
Week 12: Thin Film Transistors (TFTs), Tutorial Sessions
☐ 1.94 mW

☐ 49.2 mW

☐ 22.8 mW

☐ 77 mW

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.

1 point

☐

$3.33V^{0.5}$

☐

$0.333V^{0.5}$

☐

$0.03V^{0.5}$

☐

$33.33V^{0.5}$

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 $n_i = 1.5 \times 10^{10} \text{ cm}^{-3}$

1 point

☐

0.16 V

☐

0.33 V

☐

1 V

☐

None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

0.16 V

6) Consider an n-channel MOSFET with channel width 30 μm and channel length 1 μm . The oxide capacitance is 69 nF/sqcm. Assume that the drain current in the non-saturation region for $V_{DS} = 0.07V$ is 25 μA at $V_{GS} = 1.5V$, and 65 μA 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).

1 point

☐

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 ?

1 point

- 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:**1 point**

- ☐ 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 μm , Channel width = 10 μm , 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:

1 point

- ☐ 7 μm , 0.7 μm
- ☐ 7 μm , 7 μm
- ☐ 0.7 μm , 7 μm
- ☐ 0.7 μm , 0.7 μm

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

0.7 μm , 7 μm

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

1 point

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

No, the answer is incorrect.

Score: 0

Accepted Answers:

17.5 nm

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