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Unit 10 - Week 9: MOSFET: I

Course outline

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Week 4 : Recombination-Generation, Charge Transport and Continuity Equation

Week 5 : Metal-Semiconductor Junctions

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Assignment 9

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment. **Due on 2018-10-03, 23:59 IST.**

1) Consider a n-channel MOSFET with W = 15 um, L = 2 um, and Cox = 69 nF/cmsq. ***1 point***
Assume that, in the non-saturation regime with $V_{DS} = 0.1V$, the drain current is 35 uA for a gate-to-source voltage of 1.5 V, and 75 uA for a gate-to-source voltage of 2.5 V. Compute the threshold voltage of the MOSFET from the given data. (Use small- V_{DS} approximation in the drain current equation)

- 0.3 V
- 0.1 V
- 0.935 V
- 0.625 V

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.625 V

2) The parameters of a p-channel MOSFET are as follows: Mobility of holes = 310 cmsq/Vs , ***1 point***
oxide thickness = 22 nm, W/L = 60, and threshold voltage is -0.4 V. If the transistor is biased in saturation region, find the ratio of drain currents $\frac{I_{D1}}{I_{D2}}$ corresponding to $V_{SG} = 1V$ and $V_{SG} = 2V$

- 2.53
- 0.14
- 0.85
- 0.44

Week 9: MOSFET: I

- MOSFET: Introduction
- MOSFET: I-V Characteristics
- MOSFET: I-V Characteristics - Contd.
- MOSFET: I-V Characteristics - Contd.
- Subthreshold Swing, Additional Concepts
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threshold voltage is 1V. The device is biased with a gate-to-source voltage of 3V and a drain-to-source voltage of 5V. Assume that the mobility is 300 cmsq/Vs. The MOSFET is biased in which region of operation ?

- Linear
- Sub-threshold
- Saturation
- None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
Saturation

4) For the n-MOSFET given in question (3), calculate the value of transconductance. ***1 point***

- 4.14 mS
- 1.035 mS
- 2.07 mS
- 8.28 mS

No, the answer is incorrect.
Score: 0

Accepted Answers:
1.035 mS

5) Consider an ideal n-channel MOSFET with channel length 1.25 um. The mobility of electrons is $650cm^2/Vs$ and the threshold voltage is 0.65 V. Design the channel width of the MOSFET such that the saturation drain current is 4 mA for an applied gate-to-source voltage of 5 V. Take oxide capacitance to be 69 nF/cmsq. ***1 point***

- 11.8 um
- 65.8 um
- 125 um
- 40 um

No, the answer is incorrect.
Score: 0

Accepted Answers:
11.8 um

6) The threshold voltage for a MOSFET at 300K is 350 mV with a reduction of 1mV/K. Assume that the mobility changes with temperature (in K) as : $\mu(T) = \mu(300K) * (300K/T)^2$ Assuming perfect velocity saturation, the gate voltage, at which the saturation currents at 300K and 400K are equal, is _____. (Make an assumption that the saturation velocity remains independent of temperature). ***0 points***

- 200 mV
- 695 mV
- 478 mV
- 312 mV

No, the answer is incorrect.
Score: 0

Accepted Answers:
478 mV

7) Consider a MOS structure with a p-type semiconductor substrate doped to $N_A = 10^{16} cm^{-3}$, with thickness of SiO2 insulator as 50 nm. Let the equivalent oxide surface charge density be 16 nC/cmsq. The metal-semiconductor work-function difference is - 0.8 V. Calculate the value of flat-band voltage. ***1 point***

- - 1.03 V
- - 1.43 V
- - 0.8 V
- 1.43 V

No, the answer is incorrect.
Score: 0

Accepted Answers:
- 1.03 V

8) For a MOSFET in the sub-threshold region of operation, the log-I_{DS} vs V_{GS} plot is a/an: ***1 point***

- Quadratic curve
- Exponential curve
- Straight line
- None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
Straight line

9) Which of the following statements is/are true with regards to Channel Length Modulation in a MOSFET device ? ***1 point***

i. It is similar to Base width modulation in BJTs
ii. The pinch-off point relocates with respect to applied drain voltage
iii. Drain voltage influences the current-voltage charcteristics of a MOSFET in saturation

- i
- iii
- i and ii
- i, ii and iii

No, the answer is incorrect.
Score: 0

Accepted Answers:
i, ii and iii

10) The subthreshold swing of an enhancement mode MOSFET: ***0 points***

- increases as the depletion capacitance per unit area decreases
- increases as the depletion capacitance per unit area increases
- is typically lesser than 59mV/dec at 300K
- is typically greater than 59mV/dec at 300K

No, the answer is incorrect.
Score: 0

Accepted Answers:
is typically greater than 59mV/dec at 300K

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