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 $W = 15 \, \text{um}$, $L = 2 \, \text{um}$, and $C_{ox} = 69 \, \text{nF/cmsq}$. Assume that, in the non-saturation regime with $V_{DS} = 0.1 \, \text{V}$, the drain current is $35 \, \mu\text{A}$ for a gate-to-source voltage of $1.5 \, \text{V}$, and $75 \, \mu\text{A}$ for a gate-to-source voltage of $2.5 \, \text{V}$. 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 $= 310 \, \text{cmsq/Vs}$, oxide thickness $= 22 \, \text{nm}$, $W/L = 60$, and threshold voltage is $-0.4 \, \text{V}$. If the transistor is biased in saturation region, find the ratio of drain currents $I_{D1}/I_{D2}$ corresponding to $V_{SG} = 1 \, \text{V}$ and $V_{SG} = 2 \, \text{V}$

- 2.53
- 0.14
- 0.85
- 0.44

No, the answer is incorrect. Score: 0

Accepted Answers:
- 2.53

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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 cm²/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.

- 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 $650 \text{cm}^2/\text{Vs}$ 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.

- 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:

$$
\mu(T) = \mu(300K) \times \left(\frac{300K}{T}\right)^2
$$

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).

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

No, the answer is incorrect.
Score: 0
7) Consider a MOS structure with a p-type semiconductor substrate doped to $N_A = 10^{16} \text{ cm}^{-3}$, with thickness of SiO$_2$ insulator as 50 nm. Let the equivalent oxide surface charge density be 16 nC/cm$^2$. The metal-semiconductor work-function difference is -0.8 V. Calculate the value of flat-band voltage.

- 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:

- 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?

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 characteristics 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:

- 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

Score: 0 points
No, the answer is incorrect.
Score: 0

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