Q1. A silicon n-channel MOSFET has a length of 100 nm and a width of 250 nm. It has an oxide thickness of 10 nm. Calculate the MOS oxide capacitance and the drain current at a gate-source voltage of 3 volts with a drain-source voltage of 6 volts if the threshold voltage is +2 volts. Take electron mobility in silicon to be 1100 cm2 /v.sec and the permittivity of silicon dioxide to be 3.5x10-11 Farad/meter.

Find

$$C_{ox}$$

$$I_{drain}$$

Given Values

$$\epsilon = 3.5 * 10^{-11}\ F/m$$

$$L = 100 * 10^{-9}\ m$$

$$W = 250 * 10^{-9}\ m$$

$$T_{oxide} = 10 * 10^{-9}\ m$$

$$v_{gs} = 3V$$

$$v_{ds} = 6V$$

$$V_{TN} = 2V$$

$$\mu = 1100 \frac{cm^2}{V * S}$$

Governing Equations

$$C_{ox} = \frac{\epsilon}{T_{oxide}}$$

$$K_n = \mu_n C_{ox}$$

$$i_D = \frac{K_n}{2}\frac{W}{L}(v_{GS} - V_{TN})^2$$

when $v_{ds} \geq v_{GS} - V_{TN}$

Mark Musil
Ohio University

Design of Digital Circuits
Faiz Rahman

Homework 11
March 2022

Code and Solution

C_{ox} = 3.5mF

$I_{drain} =$ 4.8125 A