

University of Oslo
Faculty of Mathematics and Natural Sciences

Final Exam in: Special Syllabus Lukasz Farian, fall 2013

Date of exam: 18-Dec-2013

Time: 9:00-13:00

This examination paper consists of 2 page(s)

Permitted materials: All printed and written including approved (!) calculator

Make sure that your copy of this examination paper is complete before answering.

Read Carefully:

This is an extra question in addition to the exam in INF3410, fall 2013,
for the special syllabus for Lukasz Farian

Each question is graded indicating the weight when grading.

Chapter 7

The circuit in figure 1 is implemented in the $0.35\mu\text{m}$ technology of table 1 with $L_{1,2}=1\mu\text{m}$.

Task 11 (3p): Find W_1 , W_2 and R so that $V_{eff1,2}=300\text{mV}$ and $I_D=25\mu\text{A}$

Task 12 (3p): How much will I_D change if both V_{tn} and $|V_{tp}|$ increase by 20%?

Table 1.5 MOSFET parameters representative of various CMOS technologies and used for rough hand calculations in this text.

	0.8 μm		0.35 μm		0.18 μm		45 nm	
Technology	NMOS	PMOS	NMOS	PMOS	NMOS	PMOS	NMOS	PMOS
μC_{ox} ($\mu\text{A}/\text{V}^2$)	92	30	190	55	270	70	280	70
V_{t0} (V)	0.80	-0.90	0.57	-0.71	0.45	-0.45	0.45	-0.45
$\lambda \cdot L$ ($\mu\text{m}/\text{V}$)	0.12	0.08	0.16	0.16	0.08	0.08	0.10	0.15
C_{ox} ($\text{fF}/\mu\text{m}^2$)	1.8	1.8	4.5	4.5	8.5	8.5	25	25
t_{ox} (nm)	18	18	8	8	5	5	1.2	1.2
n	1.5	1.5	1.8	1.7	1.6	1.7	1.85	1.85
θ ($1/\text{V}$)	0.06	0.135	1.5	1.0	1.7	1.0	2.3	2.0
m	1.0	1.0	1.8	1.8	1.6	2.4	3.0	3.0
$C_{ov}/W = L_{ov}C_{ox}$ ($\text{fF}/\mu\text{m}$)	0.20	0.20	0.20	0.20	0.35	0.35	0.50	0.50
$C_{db}/W \approx C_{sb}/W$ ($\text{fF}/\mu\text{m}$)	0.50	0.80	0.75	1.10	0.50	0.55	0.45	0.50

Table 1.5
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Table 1: Typical process parameters

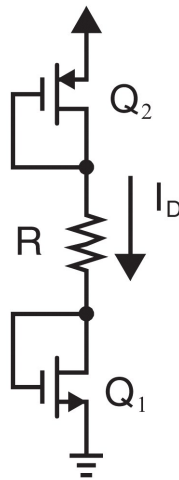


Figure P7.2
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Figure 1: A simple circuit to produce a bias current