

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

MAKE UP EXAMINATION- 2016

B.Tech VI Semester

COURSE CODE: 10B11EC612

MAX. MARKS: 25

COURSE NAME: VLSI TECHNOLOGY AND APPLICATIONS

COURSE CREDITS: 04

MAX. TIME: 1 HR 30 MIN

Note: All questions are compulsory.

1. a) Drain terminal and gate terminal of an n- channel MOSFET are connected together. Voltage V_{in} is applied on gate terminal. For this configuration, derive relation between current and voltage. [3]
- b) Design depletion load nMOS inverter : $\mu_n C_{ox} = 30 \mu A/V^2$, $V_{TO} = 0.8V$ (enhancement-type), $V_{TO} = -2.8V$ (depletion type), $\gamma = 0.38V^{1/2}$, $|2\phi_f| = 0.6V$, $V_{DD} = 5.0V$. Determine the (W/L) ratios of both transistors such that: the static power dissipation for $V_{in} = V_{OH}$ is 250mW, assume $V_{OL} = V_{SB} = 0.3V$. [3]
2. a) Consider a MOSFET with $t_{ox} = 20nm$, $\mu_n = 650cm^2/V\cdot s$, $V_{th} = -0.8V$ and $W/L = 10$. Find the drain current when $V_G = 1.4V$, $V_S = 1.7V$ and $V_D = -2.1V$. What is the effect of constant voltage scaling on the same current? [3]
- b) Calculate the threshold voltage V_{t0} for polysilicon gate n-channel MOS transistor parameters are: substrate doping density $N_A = 10^{16}/cm^3$, $N_I = 6.85 \times 10^{11} cm^{-3}$, gate oxide thickness = 500Å, oxide interface fixed charge density = $4 \times 10^{10}/cm^2$ and gate work function = 0.55V. [3]
3. a) Derive the transition point for depletion load n-MOS inverter. [3]
- b) Draw the small signal model and large signal model of a MOSFET. Also write the values of each parameter used in the model. [3]
4. Consider the following parameters for n- channel enhancement type MOSFET having abrupt graded junction profile. Substrate doping = $3 \times 10^{12} cm^{-3}$, Sidewall (P+) doping = $2 \times 10^{22} m^{-3}$, Source/Drain doping = $10^{19} cm^{-3}$, gate oxide thickness = 40 nm, junction depth = 1.2 μm , length of drain = 9 μm , width = 4 μm . If drain voltage changes from 1.5 V to 4 V. Find average drain-substrate capacitance. [7]