

M.Tech. Degree Examination, Dec.09/Jan.10
CMOS VLSI Design

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

1. a. With neat sketches, explain the behaviour of nMOS device under the influence of different terminal voltages (Enhancement mode). (09 Marks)
 b. Explain small signal model for an MOS transistor. (06 Marks)
 c. Write a note on differential inverter. (05 Marks)
2. a. Explain λ based design rules. (08 Marks)
 b. Obtain the scaling factors for the following:
 i) Gate capacitance C_g
 ii) Saturation current I_{sat}
 iii) Parasitic capacitance. (06 Marks)
 c. Define sheet resistance and also explain the concept applied to MOS transistor and inverters. (06 Marks)
3. a. Explain the second order effects associated with a MOSFET. (10 Marks)
 b. Explain twin tub CMOS process. (10 Marks)
4. a. Explain the effect of long polysilicon wires. Show how to improve the signal propagation. (04 Marks)
 b. Derive the threshold voltage equation (V_t) for 2 inputs CMOS NOR gate ($V_{t,NOR2}$). (10 Marks)
 c. For the given function $f = AB + AC + A(B + D)$, obtain
 i) CMOS TG realization
 ii) CMOS transistor realisation (06 Marks)
5. a. Explain the function of D latch with gate level schematic and CMOS circuit. (06 Marks)
 b. Explain synchronous dynamic circuit implemented using depletion load nMOS. (09 Marks)
 c. Explain the principle of pass transistor circuit. (05 Marks)
6. a. Discuss the general principle of band gap reference and hence obtain expression for V_{BE} . (08 Marks)
 b. Explain cross operational amplifier with necessary expression and characteristics. (08 Marks)
 c. Mention the advantages of CMOS over NMOS. (04 Marks)
7. a. Describe different clock distribution schemes. (06 Marks)
 b. Mention the causes of latch up and guidelines for avoiding latch up. (10 Marks)
 c. Realize the following function $Z = AB + (C + D)(E + F) + GH$ using
 i) Standard CMOS
 ii) Domino CMOS. (04 Marks)
8. Write short notes on:
 a. BiCMOS circuit
 b. Dynamic CMOS logic
 c. Voltage boot strapping
 d. Current mirror. (20 Marks)

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