

Con. 3255-09.

VR-4719

(3 Hours)

[Total Marks : 100

N.B. : (1) Question No. 1 is **compulsory**.(2) Attempt any **four** questions out of remaining questions.

1. (a) Implement the following function using CMOS gate $F = (AB + \bar{C}D) E$ 6
- (b) An NMOS transistor with $K = 20 \mu\text{A}/\text{V}^2$ and $V_{\text{TH}} = 1.5 \text{ V}$ is operated at $V_{\text{GS}} = 5 \text{ V}$ and $I_{\text{D}} = 100 \mu\text{A}$. 5
- (c) Explain Ion Implantation and compare it with diffusion, clearly stating the advantages and disadvantages. 9
2. (a) Draw the stick diagram and layout using λ -based design rule for the depletion load NMOS NOR Gate. 13
- (b) What are the various factors affecting the threshold voltage ? Explain analytically. 7
3. (a) Explain the concept of pass transistor. Compare PMOS/NMOS and CMOS pass transistor for their merits and demerits. 10
- (b) Compare constant voltage and constant field scaling with their merits and demerits. 10
4. (a) Explain the operation of CMOS inverter with clearly mentioning all five cases. 10
- (b) Explain the latch up in CMOS. What are the remedies to avoid the same ? 10
5. (a) Design 4 : 1 MUX using pass transistor logic. Draw the stick diagram of same. 10
- (b) Compare Resistive, Depletion and Enhancement load inverters stating their merits and demerits. 10
6. (a) Describe the hot electron and short channel effects in MOS devices. Also explain their effect on MOS characteristics. 10
- (b) Find the depletion layer width, red, the depletion region charge, the threshold voltage with no substrate bias and the body factor of a device with the following physical parameters. 10

$$t_{\text{ox}} = 400 \text{ \AA}, N_{\text{a}} = 1.5 \times 10^{16}/\text{cm}^3, N_{\text{d}} = 10^{18}/\text{cm}^3.$$

$$N_{\text{ss}} = 5 \times 10^{10}/\text{cm}^3, \epsilon_{\text{si}} = 1.035 \times 10^{-12} \text{ F/cm}$$

$$\epsilon_{\text{ox}} = 0.345 \times 10^{-12} \text{ F/cm}.$$
7. Write short note on any **three** :- 20
 - (a) VHDL in Design of IC
 - (b) Butting and Burried contacts in VLSI
 - (c) The design verification methods
 - (d) Custom and semicustom design methods.