

Roll No. ....

**8717**

Printed Pages : 3

BT-7 / M 12

**VLSI DESIGN**

Paper-ECE-401-E

Time allowed : 3 hours}

[Maximum marks : 100

Note : Attempt any five questions, selecting at least one from each unit.

**Unit-I**

1. (a) Describe with illustrations, the two-metal n-well CMOS fabrication process to show how a CMOS inverter is fabricated. List all the masks in sequence of usage. 20
- (b) Discuss the voltage transfer characteristics of E/D NMOS inverter. 20
2. (a) Derive the drain current equation for a MOS transistor. What is channel length modulation ? 10
- (b) Draw the stick diagram of a 1-bit full adder in E/D NMOS technology. 10

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**Unit-II**

3. (a) Why do we get propagation delays ? For the CMOS fabrication process with device parameters as :  $\mu_n \cdot C_{ox} = 120 \mu A/V^2$ ,  $\mu_p \cdot C_{ox} = 40 \mu A/V^2$ ,  $L = 0.6 \mu m$ ,  $V_{th,n} = 0.8 V$ ,  $V_{th,p} = -1.0 V$ ,  $V_{DD} = 3 V$ ,  $W_{min} = 1.2 \mu m$ . Design a CMOS inverter by determining the channel widths  $W_n$  and  $W_p$  of the nMOS and pMOS transistors, to meet the propagation delay times  $\tau_{PLH} \leq 0.2 ns$  and  $\tau_{PLL} \leq 0.15 ns$ . Assuming the output load capacitance of 0.2 pF and ideal step input. 10
- (b) What is packaging ? Discuss various packaging technologies. 10
4. Comparing the two scaling theories, constant-E and constant-V, show analytically by using equations how the delay time, power dissipation, power density, power-speed product are affected in terms of the scaling factor S. Which theory is more suitable for smaller geometries ? 20

**Unit-III**

5. What do you understand by routing ? Discuss the various routing algorithms. What is the grid model for global routing ? <http://www.kuonline.in> 20
6. Discuss the various Partitioning Algorithms. Discuss the advantages and disadvantages of each. 20

**Unit-IV**

7. Describe the delay models in Physical Design. How are timing constraints applied ? 20
8. Write short notes on :
- (a) Delay models in physical design. 10
- (b) Timing minimization. 10