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18EC72

**Seventh Semester B.E. Degree Examination, July/August 2022**  
**VLSI Design**

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

**Module-1**

- 1 a. Derive the expression for drain current in linear and saturation region for nmos transistor. (10 Marks)
- b. Implement the following circuits using CMOS logic
- i) Inverter
- ii) Pass transistor. (10 Marks)

OR

- 2 a. Explain the non ideal IV effect of MOSFET with respect to CMOS Channel length modulation and also explain Noise Margin with diagram and equations. (10 Marks)
- b. Implements the following circuits using CMOS logic
- i) 2 input NAND gate
- ii) Transmission gate. (10 Marks)

**Module-2**

- 3 a. Describe with neat sketches the fabrication of P – well CMOS inverter. (08 Marks)
- b. Explain the process of photolithography with a neat diagram in CMOS technologies. (06 Marks)
- c. Draw the stick diagram for the following CMOS logic
- i)  $Y = \overline{A + B + C}$
- ii) 2 input NAND gate. (06 Marks)

OR

- 4 a. Explain the layout Design Rules for MOS process with two metal layers. (06 Marks)
- b. Draw the stick diagram for the CMOS logic  $Y = \overline{(A + B + C)D}$  and estimate the cell area. (06 Marks)
- c. Define scaling. Explain the constant voltage scaling and the effect of scaling on device characteristics. (08 Marks)

**Module-3**

- 5 a. Explain with a waveform the propagation Delay, Rise times and Fall Times of a CMOS inverter. (08 Marks)
- b. Derive the equation of propagation Delay using RC Delay Model for a 1<sup>st</sup> order system. (06 Marks)
- c. Compute the Elmore Delay for  $V_{out}$  in the 2<sup>nd</sup> order RC system. (06 Marks)

OR

- 6 a. Explain Parasitic Delay of common gates in Linear Delay Model. (08 Marks)  
b. Design a circuit to compute  $F = AB + CD$  using NAND and NOR by Bubble pushing. (06 Marks)  
c. Calculate the minimum delay in C to compute  $F = AB + CD$  using the circuits with NAND and NOR gates and with AOI gates. Each input can present a maximum of  $20\lambda$  of transistor width. The output must drive a load equivalent to  $100\lambda$  of transistor width. Choose transistor sizes to achieve this delay. (06 Marks)

Module-4

- 7 a. Explain Resettable Latches and FlipFlops using CMOS transmission Gate. (10 Marks)  
b. Explain the Multistage pass transistor logic driven by two non overlapping clocks. (10 Marks)

OR

- 8 a. Explain conventional CMOS flipflops with neat diagrams. (10 Marks)  
b. Explain Domino CMOS Logic. (10 Marks)

Module-5

- 9 a. Explain the operation of three transistor dynamic RAM cell. (10 Marks)  
b. Explain Full CMOS static RAM cell with schematic diagram. (10 Marks)

OR

- 10 a. Write short notes on :  
i) Built in Self Test (BIST) (10 Marks)  
ii) Scan Design Technology (10 Marks)  
b. Explain briefly logic verification principle with a block diagram. (10 Marks)

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