Printed Pages : 4

EEC-703

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 131703

Roll No.

B. Tech.

(SEM. VII) (ODD SEM.) THEORY EXAMINATION, 2014-15

VLSI DESIGN

Time : 3 Hours] [Total Marks : 100

Note : (1) Attempt all questions.
(2) All questions carry equal marks.

1 Attempt any four parts of the following : 5×4

(a) Define VLSI design methodology (Y Chart) and MOS Scaling.

(b) Explain the CAD Tools for VLSI Design.

(c) Discuss the classification of CMOS digital logic families.

(d) Draw a 4×1 Multiplexer using Transmission Gate (TG).

(e) For an n channel MOS transistor with $\mu_n = 60\,\text{cm}^2\,\mu A/V^{-s}$, $C_{ox} = 7 \cdot 10^{-8}\,F/\text{cm}^2$, $W = 20\,\mu m$, $L = 2\,\mu m$ and $V_{TO} = 1.0V$. Examine the relationship between the drain current and the terminal voltages.

(f) Explain the CMOS inverter switching characteristic and explain the definitions of delays and transition times.

2 Attempt any **two** parts of the following : **10×2**

(a) Enlist the Layout design process and design rules of CMOS circuit. Draw a stick diagram of CMOS NOR gate.

(b) Consider a CMOS inverter circuits with the following parameters V_{DD} = 3.3V, V_{Ton} = 0.6V, V_{Top} = –0.7V, $k_n = 200\,\mu A/V^2$, $k_p = 80\,\mu A/V^2$, k_R = 2.5 Calculate the noise margin of the circuits.

(c) Consider a CMOS inverter, with the following device parameters, $V_{DD} = 5V$, $V_{Ton} = 0.6V$, $V_{Top} = -0.7V$, $\mu_n C_{ox} = 60\,\mu A/V^2$, $\mu_p C_{ox} = 20\,\mu A/V^2$, $\lambda = 0$. Determine the $\left(\frac{W}{L}\right)$ ratios of the nMOS and the pMOS transistors such that the switching threshold is V_{th} = 2.5V.

3 Attempt any four parts of the following : **5×4**

(a) Discuss the Elmore Delay.

(b) Discuss the classification of Dynamic CMOS logic families.

(c) Discuss the operation of pass transistor in dynamic logic circuit.

(d) In a logic Design logic function is $Z = \overline{(A+B+C+D)\,(E+F+G)\,(H+I)}$ implemented with domino CMOS circuits diagram with implements Z.

(e) Discuss the overview of Power Consumption in CMOS logic circuits.

(f) Design 2 input EXOR Logic Gate using CMOS Transmission Gate.

4 Attempt any two parts of the following : **10×2**

(a) In a CMOS inverter power supply $V_{DD} = 5V$, determine the fall time, which is define as the time elapsed between the time point at which $V_{out} = V_{90\%} = 4.5V$ and the time point at which $V_{out} = V_{10\%} = 0.5$. The output load capacitance is 1pF. The nMOS transistor parameters are as follows : $V_{Tn} = 1.0V$, $\mu_n C_{ox} = 20\mu\, A/V^2, \left(\frac{W}{L}\right)_n = 10$.

(b) Design the circuit described by the Boolean function $Y = \overline{A \cdot (B + C)(D + E)}$ using CMOS logic. Calculate the equivalent CMOS inverter circuit for simultaneous switching of all inputs assuming that $\left(\frac{W}{L}\right) = 10$ for pMOS transistor and $\left(\frac{W}{L}\right) = 5$ for all nMOS transistor.

(c) Discuss the operation of single stage shift register circuits. Design a SR flip-flop using CMOS circuits.

5 Attempt any four parts of the following : 5×4

(a) Define the terms Controllability and Observability.

(b) Explain the implementation of Built-In Self Test (BIST) design techniques for VLSI circuit testing.

(c) Design a D flip-flop using CMOS Transmission Gate circuits.

(d) Discuss the operation of CMOS SRAM cell circuit.

(e) Write short notes on Adiabatic CMOS logic. Design an adiabatic 2 input AND/NAND.

(f) Discuss the low power MTCMOS VLSI designs techniques.
