BANGLADESH UNIVERSITY OF PROFESSIONALS
Military Institute of Science and Technology
B.Sc. in Computer Science and Engineering
Student Group : Earned Credit Hour >108, Final Examination (Fall) : Dec 2020

Subject: CSE – 411 VLSI Design

Total: 2.00 hours **Full Marks: 180**
Section A : 1.00 hour **Section A : 90**

INSTRUCTIONS:

a. Use **SEPARATE** answer scripts for each section.
b. **Question – 1 and Question – 4 (Viva Voce)** in **Section A** are compulsory.
c. Answer any **OTHER ONE** question from this section **(From Q - 2 & Q - 3)**.
d. Figures in the margin indicate full **marks**.
e. Assume reasonable data if necessary.
f. **Symbols** used have their usual meanings.

SECTION-A

Question – 1 (Compulsory)

a. Draw the I-V characteristics curve for a PMOS transistor, having $W=L$, $\varepsilon\mu_p / D = 12\ \mu_A/V^2$, $V_{tp} = 1V$. Show the necessary calculations for multiple values of V_{sg}. **12**

b. What are the advantages of using depletion transistor load instead of enhancement transistor in s MOS inverter? Explain with figure. **12**

c. Why should one prefer MOS over BJT? Show the conduction process of PMOS transistor. **12**

Question – 2

a. Consider a CMOS inverter with a NMOS transistor (T_1) whose aspect ratio $W_1/L_1 = 1$, $\varepsilon\mu_n / D = 32\ \mu_A/V^2$ and a PMOS transistor (T_2), having aspect ratio of $W_2/L_2 = 2$ and $\varepsilon\mu_p / D = 16\ \mu_A/V^2$. **16 + 10 = 26**
   (i) Draw I vs V_{out} curves of T_1 and T_2
   (ii) Draw the power curve using the curve in (i)

b. Draw the circuit diagram of non-inverting superbuffer. What are its main purpose? Explain briefly. **10**

Question – 3

a. Find out the inverter ratio of NMOS inverter with deplation transistor load, when $V_p = 5V$, $\varepsilon\mu_{n1} / D = 35\ \mu_A/V^2$ for enhancement NMOS and $\varepsilon\mu_{n2} / D = 25\ \mu_A/V^2$ for depletion NMOS. **16**

b. Show that the rise time of the NMOS inverters with depletion transistor load is given by **20**

$$t_r = \frac{42\ C_{out}}{\left(\frac{W_2}{L_2}\right)}\ ns$$

Why does the actual value rise from the theoretical value mentioned above? Write down the reason with brief explanation.

Question – 4 Viva Voce (Compulsory) **18**