

(3 Hours)

[Total Marks: 80]

N.B.: (1) Question No. 1 is **Compulsory**.(2) Attempt any **three** questions out of **remaining five**.

(3) Each question carries 20 marks and sub-question carry equal marks.

(4) Assume suitable data if required.

1. Solve **any 4** of the following; (20)
 - (a) Draw and explain AND gate using pass transistor logic (5)
 - (b) _____ (5)
Implement $Y = (A+B.C)$ using dynamic CMOS logic.
 - (c) Explain low power design consideration (5)
 - (d) Implement half adder circuit using static CMOS. (5)
 - (e) Draw schematic for 6T SRAM cell and explain its stability criteria (5)
 2. (a) Explain concept of precharge and evolution in dynamic CMOS (10)
 - (b) Define scaling? Explain various types of scaling in detail (10)
 3. (a) Compare Ripple carry adder and carry-look-ahead adder. Explain 4 bit CLA adder implementation. (10)
 - (b) Explain various techniques of clock generation. Discuss 'H' Tree clock distribution (10)
 4. (a) Consider a CMOS inverter circuit with following parameter (10)

$V_{T_{on}} = 0.6\text{ V}$, $V_{T_{op}} = -0.7\text{ V}$,
 $\mu_n C_{ox} = 60\mu\text{A/V}^2$, $(W/L)_n = 8$
 $\mu_p C_{ox} = 25\mu\text{A/V}^2$, $(W/L)_p = 12$

Calculate noise margins and switching threshold of the inverter. The power supply voltage $V_{DD} = 3.3\text{ V}$

 - (b) Implement 4:1 MUX using pass transmission logic. Explain advantages of using transmission gates. (10)
5. (a) Explain Barrel shifter in brief. (10)
- (b) Draw JK flip flop using CMOS and explain its operation. (10)
6. Write short notes on **any two** of the following: (20)
 - (a) ESD protection techniques
 - (b) Interconnect scaling and crosstalk
 - (c) Sense Amplifier
 - (d) NAND based ROM array.