Roll No.:.....

National Institute of Technology, Delhi

Mid Semester Examination, March 2022

Branch	: ECE	Semester	: VI
Title of the Course	: Basics of VLSI	Course Code	: ECB 351
Time	: 1.5 Hours	Maximum Marks	: 25

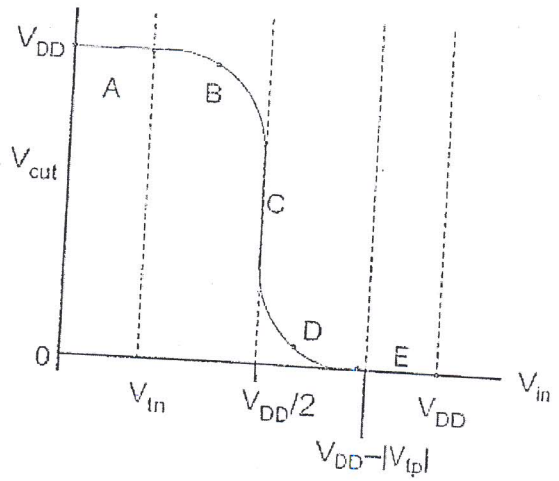
- **All questions are compulsory.**

[1] Draw circuit diagram to implement the following function. Also draw its layout using colour coding.

$$Y = [A.B + C + D]'$$

{3}

[2] In the given voltage transfer characterstics of CMOS inverter write the mode of opration of NMOS and PMOS transistor in region A and region D (Show calculations)



{3}

[3] Define process transconductance parameter for MOSFET. How it affect the voltage transfer characteristics of CMOS inverter.

{3}

[4] Write short note on (i) Short channel effect and (ii) Body Effect

{3}

[5] What is Sclaing of MOS devices. Also explain the need of scaling.

{3}

[6] Consider a process technology for which Lmin = 0.4 μm, tox = 8 nm, μ_n = 450 cm^2/V-s and V_t = 0.7 V.

(a) Calculate oxide capacitance Cox and Kn'

(b) For a MOSFET with W/L = 8 μm / 0.8 μm, calculate the values of V_{GS} and V_{DSmin} needed to operate the in the saturation region with a dc current I_D = 100uA.

(c) For the device in (b), find the values of overdrive voltage V_{OV} and V_{GS} required to cause the device to operate as a 1000-Ωresistor for very small V_{DS}. {5}

[7] A CMOS inverter with minimum sized transistors has βn = 0.2mA/V^2 , βp = 0.1mA/V^2 and Vtn = |Vtp| = 0.6V.Assume V_{DD} = 3.3V.

a) What is the inverter gate switching threshold (midpoint) voltage?

b) What is the resistance for each transistors using general expression for MOSFET resistance in saturation? {5}