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PRESIDENCY UNIVERSITY

BENGALURU

Mid - Term Examinations – October 2025

Date: 09-10-2025

Time: 09.30am to 11.00am

School: SOE	Program: B.Tech-ECE/B.Tech-VLSI/B.Tech-VLSI design & Technology	
Course Code : ECE3173	Course Name: Introduction to CMOS VLSI Design	
Semester: V	Max Marks: 50	Weightage: 25%

CO - Levels	C01	C02	C03	C04	C05	C06
Marks	28	12	10			

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks.

5Q x 2M=10M

1	Define work function.	2 Marks	L1	C01
2	Differentiate depletion type and enhancement type MOSFET.	2 Marks	L1	C01
3	Draw the MOS spice model using square law I-V characteristics.	2 Marks	L1	C01
4	Mention any four differences between long and short channel devices.	2 Marks	L1	C01
5	Draw the stick diagram for the CMOS inverter.	2 Marks	L2	C02

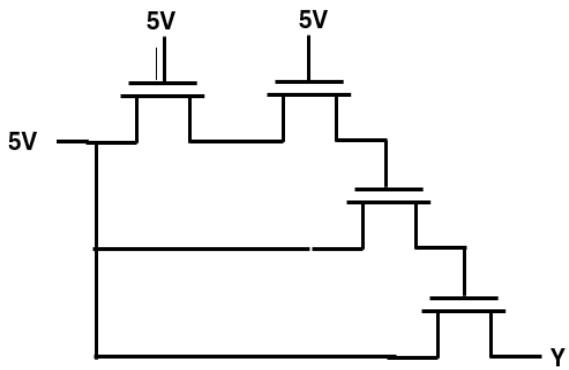
Part B

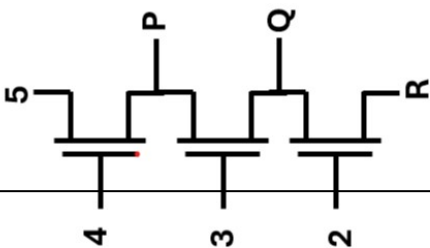
Answer the Questions.

Total Marks 40M

6.	a.	The main working principle of a MOSFET is to control the voltage and the current which is flowing between the source terminal and the drain terminals. Explain all three regions of n-channel MOSFET with neat diagrams.	10 Marks	L2	C01
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	b.	The N-channel MOSFET has a threshold voltage of 0.4V. In the saturation region at one point $I_D=2.25\mu A$ when $V_{GS}=0.5V$. What will be the value of I_D if V_{GS} reaches to 0.7 V while operated in saturation region	10 Marks	L31	CO
Or					
7.	a.	"Channel length" refers to the effective length of the conductive path in a MOSFET (Metal-Oxide-Semiconductor Field-Effect Transistor), which is the distance between the source and drain electrodes. Describe channel modulation with neat diagram and derive the relevant expression for the drain current.	10 Marks	L2	CO1
	b.	A MOSFET is biased at a drain current of 0.5 mA. If $\mu C_{ox} = 100 \mu A/V^2$, $W=L = 10$, and $\lambda = 0.1 V^{-1}$, calculate its small-signal parameters (g_m & r_o).	10 Marks	L2	CO1

8.	a.	(i) For the given circuit, if the threshold voltage of each transistor is 0.3V, then what is the output voltage at node Y.  (ii) An NMOS inverter is a basic digital logic circuit that uses only N-channel MOSFETs (NMOS transistors) to perform a logical inversion. Discuss nmos inverter with passive Load and draw the VTC of nmos inverter.	10 Marks	L3	CO2
	b.	MOSFETs are electronic devices used to switch or amplify voltages in circuits. Discuss MOS as a switch, as a diode and as a resistor.	10 Marks	L2	CO3

Or					
9.	a.	(i) Find the voltage at P, Q, R in the given below circuit. Assume threshold voltage is 1V. 	10 Marks	L3	CO2

		(ii) The main advantage of using MOSFET as load device is that the silicon area occupied by the transistor is smaller than the area occupied by the resistive load. Explain nmos inverter circuit with active loads (Enhancement & Depletion).			
	b.	Current Mirrors are particularly useful in the integrated circuits, for biasing the amplifiers. Discuss mosfet current mirror circuit.	10 Marks	L2	C03