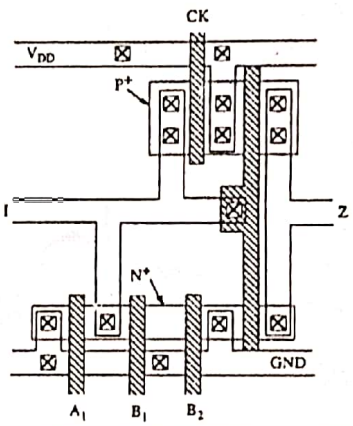
PEC UNIVERSITY OF TECHNOLOGY
Mid-Term Examination, Feb, 2020

Programme: **B.Tech (ECE)**
Course Name: **VLSI Design**
Maximum Marks: **25**

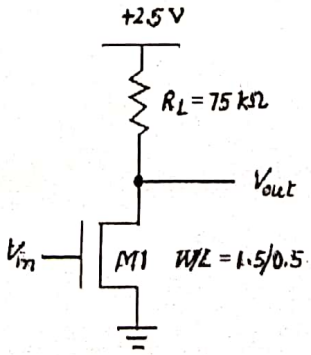
Year/Semester: **Second/2nd**
Course Code: **ECN 208**
Time allowed: **1 hr 30 min**

Notes:

1. All questions are compulsory.
2. Unless stated otherwise, the symbols have their usual meanings in context with subject. Assume suitably and state, additional data required, if any.
3. The candidates, before starting to write the solutions, should please check the question paper for any discrepancy, and also ensure that they have been delivered the question paper of right course code. Use $\varepsilon_{si}=11.7*\varepsilon_0$, $\varepsilon_{ox}=3.97*\varepsilon_0$, $\varepsilon_0=8.85 \times 10^{-14}$F/cm

Q. No		Marks
1 a)	What is the effect of narrow channel on threshold voltage of MOSFET?	2
b)	What is Drain Induced Barrier Lowering? How does it affect the working of MOSFET?	2
c)	Why do we need high Noise margin in an inverter circuit? What is its maximum value possible?	2
d)	A PMOS transistor has Vs = 1.5 V, Vd = 0.9 V, Vg = 0.2 V. What region of operation is it in?	2
2 a)	Why do we use thin oxide under the gate region, while outside the active area thick oxide is used?	2
b)	Draw the circuit diagram corresponding to the given layout. 	3
c)	Consider a diffusion area that has dimension 0.4 um x 0.2 um and the abrupt junction depth is 32 nm. Its n type impurity doping level is $N_D= 2x10^{20}$ cm^{-3} and substrate doping level is $2x10^{20}$ cm^{-3}. Determine the capacitance when diffusion area is biased at 1.2 V. assume there is no channel stop implant.	3
3 a)	A set of IV characteristics for an nMOS transistor is as shown below. Using the data find threshold voltage V_{T0}, Electron mobility μ_n, Body effect coefficient γ. Some of the parameters are given as: W/L=1.0, t_{ox} = 16 A^0, $\lvert 2\varphi_F \rvert$= 1.1 V, λ= 0.05.	3

V_{GS}(V)	V_{DS}(V)	V_{SB}(V)	I_D(μA)
0.6	0.6	0.0	6
0.65	0.6	0.0	12
0.69	1.2	0.3	44
1.2	1.2	0.3	156

b) 

b.1. Show how this circuit behave as an inverter. 6
b.2. Find V_{OH} and V_{OL} for the circuit.
b.3. Compute the power dissipation for (i) V_{in}= 0 V and (ii) V_{in}= 2.5V.