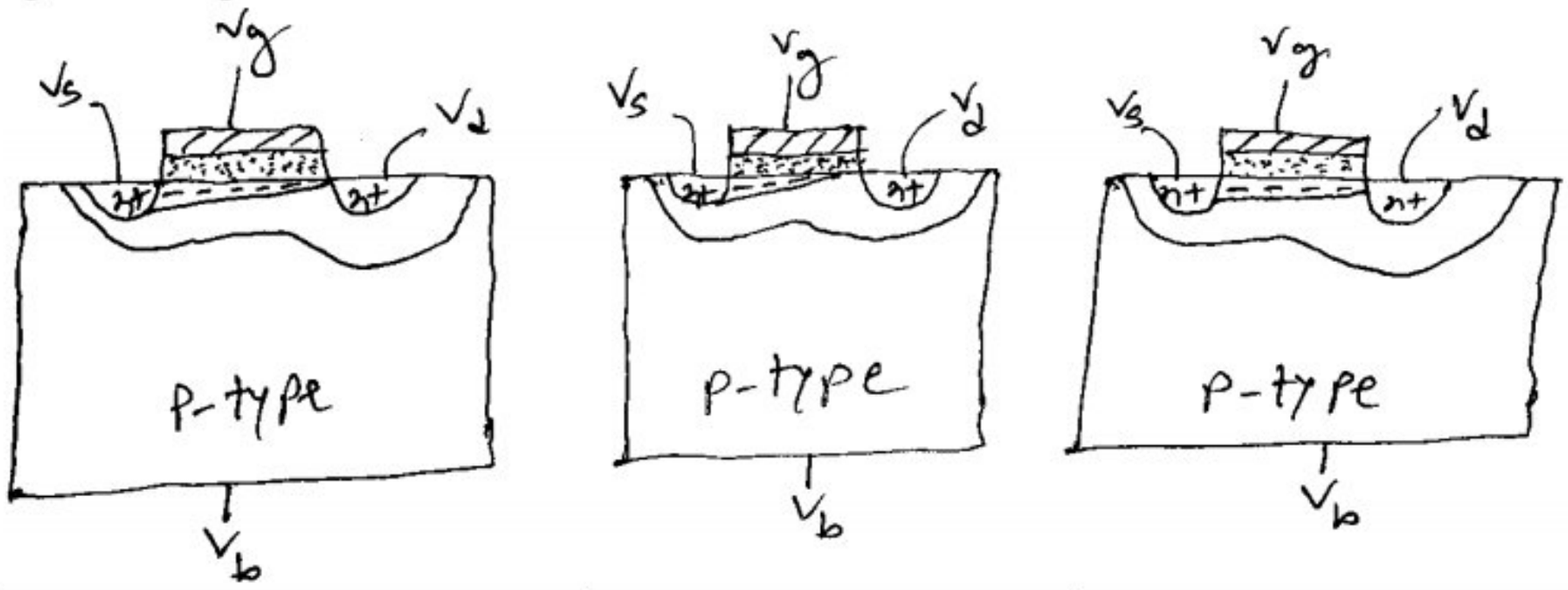
Course No.: CSE 4207 **CT#1** **Time: 20 Minutes** **Marks: 20**

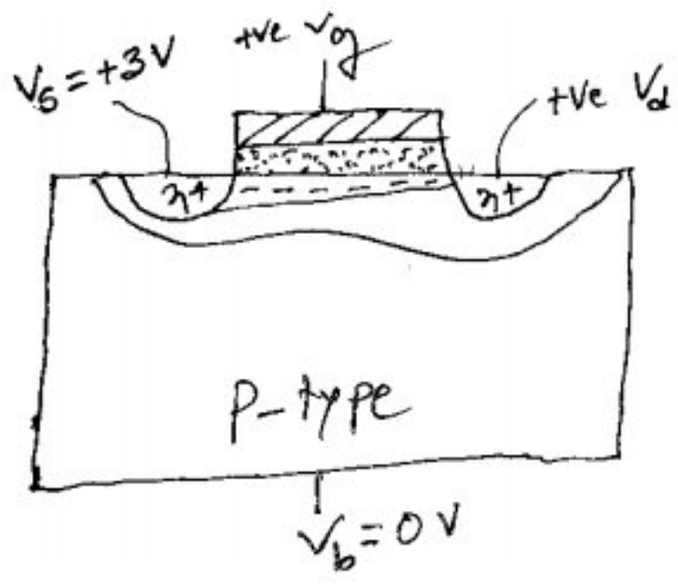
Q1. Mention the working state of each of the MOSFET in the blank box beneath each of the figures. Be specific. 3



Q2. Draw the typical I_{ds} versus V_{ds} characteristics curve of an enhancement mode NMOS for a constant V_{gs}. 4

Q3. Determine the threshold voltage of the following NMOS considering the body-effect where initial threshold is 0.8V. Consider that except the necessary parameters all others are constant. 5

Solution:



Q4. Consider an enhancement mode NMOS where W:L=1:1. The gate input is 2V; source, drain, and body are connected to 1V, 2V, and 0V respectively, and threshold is 1V. Now determine the current through the NMOS. (You can use opposite page if necessary). 8

Course No.: CSE 4207 **CT#2** **Time: 25 Minutes** **Marks: 20**

Q1. Derive the characteristics equation that indicates the behavior of body effect for an inverter having n-channel enhancement mode MOSFET as driver with same as the load. Conclude whether the behavior is linear or non-linear. 10

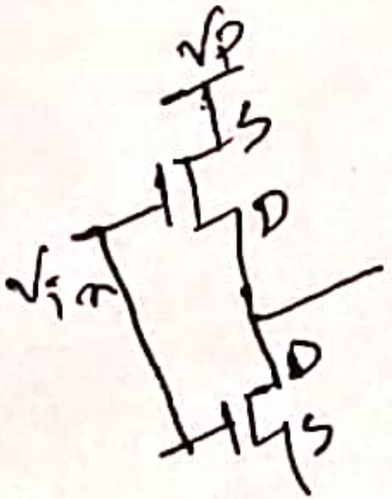
Q2. Given V_{gs} = 0V, V_{td} = - 4V, W_2/L_2 = 1:1; Now derive the approximation of R (resistance) to calculate the rising time for an NMOS inverter with depletion load and enhancement driver. Finally determine the value of R in MΩ from your derived approximation using the given values. 10

Course No.: CSE 4207 **CT#3** **Time: 25 Minutes** **Marks: 20**

Q1. For a CMOS inverter $W_1:L_1=1:1$, $W_2:L_2=2:1$, $V_{tc} = V_{tcp} = 1V$, $\frac{\epsilon\mu_n}{D} = 3x10^{-8}\frac{mA}{mV^2}$, $\frac{\epsilon\mu_p}{2D} = 0.75x10^{-11}\frac{A}{mV^2}$. Now if $V_{sg} = V_{gs} = 3.3V$ then find out the followings (a-d) for both load and driver transistors: (You must specify the necessary equations clearly). 14

a. Pinch-off voltages
b. Input voltages
c. Output voltages
d. Saturation currents
e. Finally find out the current flow throughout the CMOS inverter.

Q2. Briefly explain the operating principle of CMOS transmission gate with necessary diagram. 6



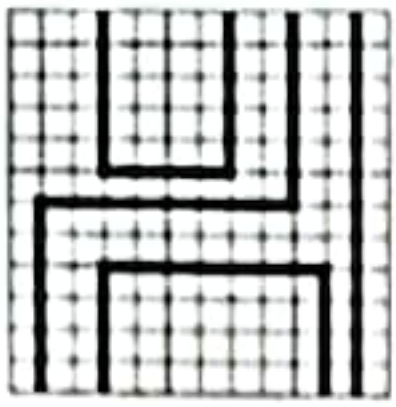
$V_{pg} = V_s - V_g = V_p - V_{gin}$

$\Rightarrow V_{gsn} = V_p - V_{out}$

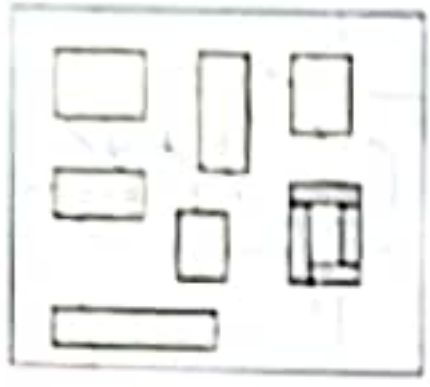
$V_{out} = V_p - V_{out}$

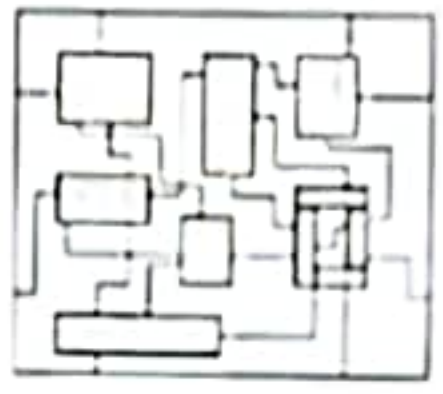
Course No.: CSE 4207 **CT#4** **Time: 10 Minutes** **Marks: 20**

Q1 Mention the name of each of the routing models beneath the individual figures. 4

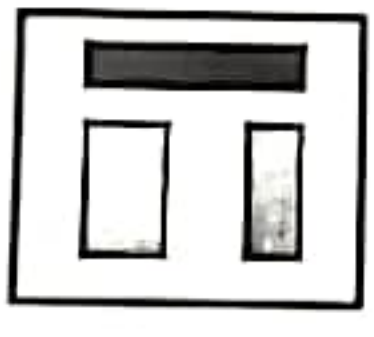


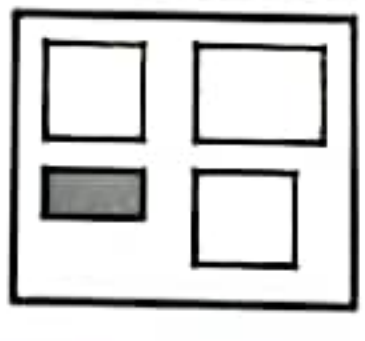
Q2 Mention the name of each of the routing technique used beneath the individual figures. 4

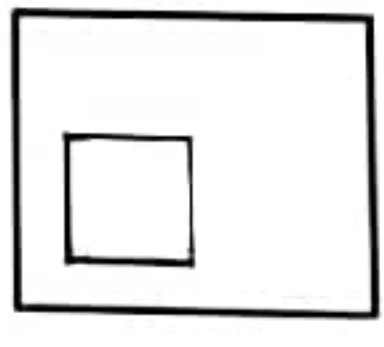




Q3 Mention the name of each of the channel junction created beneath the individual figures 6







Q4 Mention the name of each of the routing regions created beneath the individual figures 6