

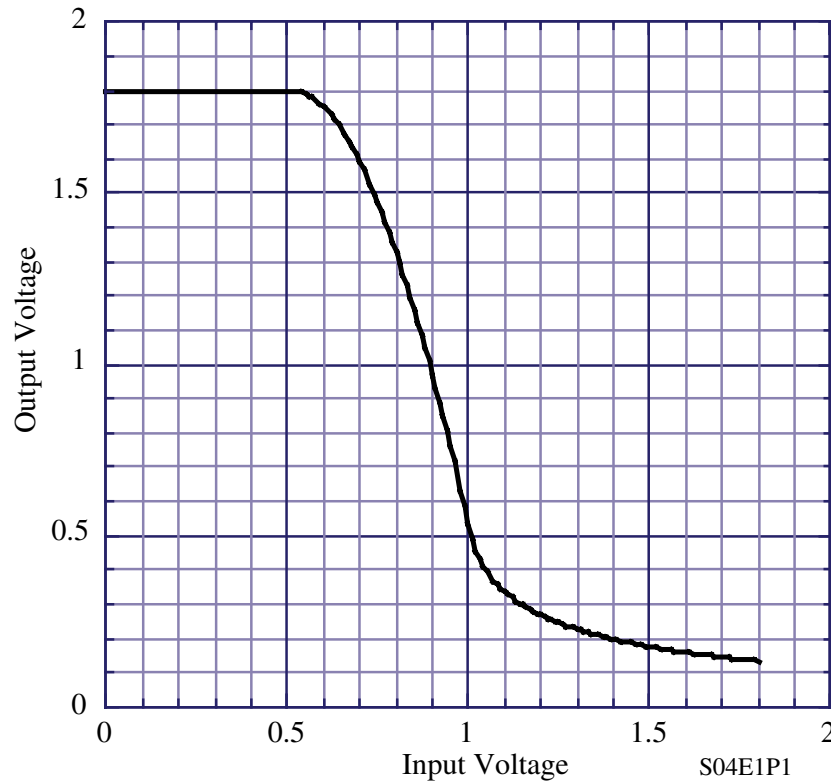
EXAMINATION NO. 1

NAME _____ SCORE _____ /100

INSTRUCTIONS: This exam is open textbook only. The exam consists of 4 questions for a total of 100 points. Please show your work leading to your answers so that maximum partial credit may be given where appropriate. Be sure to turn in your exam with the problems in numerical order, firmly attached together.

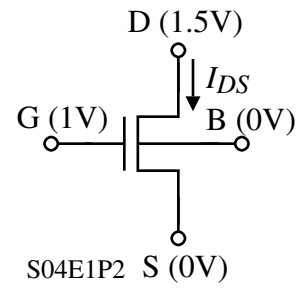
Problem 1 - (25 points)

From the voltage transfer function curve shown, numerically identify, V_{OH} , V_{OL} , V_{IL} , V_{IH} , and V_S . From these values, find the value of NM_H and NM_L .



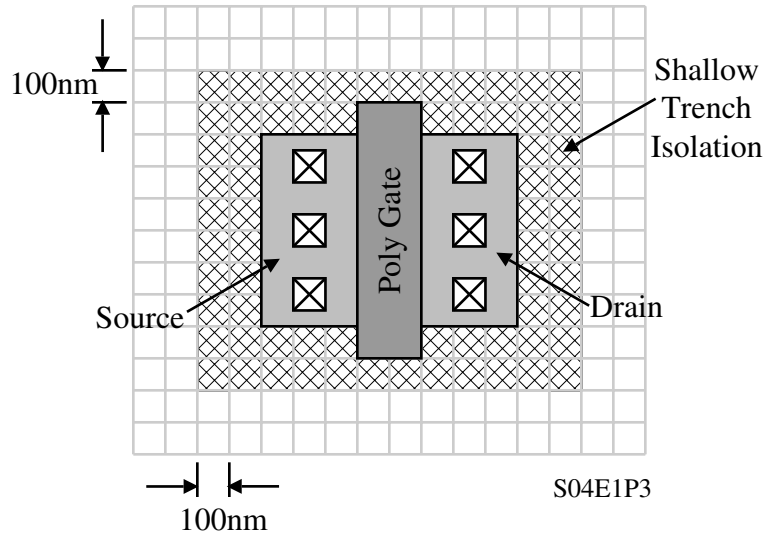
Problem 2 – (25 points)

Solve for the dc value of the drain current, I_{DS} , for the NMOS transistor shown assuming $0.18\mu\text{m}$ CMOS technology. The W and L for this transistor are given in Problem 3.



Problem 3 – (25 points)

Given the layout for the NMOS transistor of Problem 2, find the value of C_{gs} , C_{gd} , C_{gb} , C_{db} , and C_{sb} assuming that the junction depth of the source-drain diffusions is $x_j = 50$ nm, $m = 0.5$ and the lateral diffusion is 10nm.



Problem 4 – (25 points)

A voltage transfer curve of the circuit shown is given for $T = 0^\circ\text{C}$, 27°C , and 54°C . The solid curve corresponds to $T = 27^\circ\text{C}$. Identify which of the two dashed curves corresponds to $T = 0^\circ\text{C}$ and $T = 54^\circ\text{C}$? Justify your reason (for full credit) using the relationships for the temperature dependence of the mobility and threshold voltage given in the text. Assume that the resistor, R_L , has no temperature dependence and that in saturation, the mobility dependence on temperature is greater than the threshold dependence on temperature.

