# ELE 3510 Lab 1: Multisim Measurements

### 1 dedicated lab period, 1 lab period to complete

# Objectives

- Review Multisim schematic entry and simulation
- Review timing calculations

	student
Prelab	check off
Setup MultiSim using the MultiSim Setup slides	
In lab Activities – MSOE Library Setup (do not do this on your own)	check off
Setup the MSOE MultiSim Template	
<ul> <li>Setup the MSOE FinFET Library – MSOE_LIB</li> </ul>	

# Assignment

Part 1: RC time constants and simulation measurements

- Using the circuits from the Part 1 Schematic calculate the expected delay times t<sub>pdr</sub>, t<sub>pdf</sub>, and the expected rise and fall times t<sub>r</sub>, t<sub>f</sub> (This requires you to use equations) These measurements are defined in the Common Waveform Measurements slides
- 2) Create the Part 1 Schematic in Multisim (be sure to put it in your personal Multisim project directory)
- 3) Using the circuits from the Part 1 Schematic simulate and measure the delay times t<sub>pdr</sub>, t<sub>pdf</sub>, and the rise and fall times t<sub>r</sub>, t<sub>f</sub>
- 4) Compare your calculations to the simulated results
- 5) Discuss the impact of output impedance (the R) and the load capacitance (the C) on these results

### Part 2: CMOS Inverter Delays

- Create the Part 2 Schematic in MultsSim Carefully note the direction and sizing of the MOSFETs
- 2) Perform the simulation outlined on the schematic with the 15fF capacitor disconnected a. Measure the delay times  $t_{pdr}$ ,  $t_{pdf}$ , and the output rise and fall times  $t_r$ ,  $t_f$
- 3) Perform the simulation outlined on the schematic with the 15fF capacitor connected
  - a. Measure the delay times  $t_{pdr}$ ,  $t_{pdf}$ , and the output rise and fall times  $t_r$ ,  $t_f$

50%

### **Check Off**

# You must demonstrate 1 working simulation from each part prior to submission of your report (all simulations should be in your report)

- Part 1 RC time constant (Simulation) and informal report 50%
- Part 2 Inverter Delays (Simulation) and informal report
- Due at 3:00 pm, 6 days following the lab period in the box