USAF Academy
Department of Electrical and Computer Engineering
ECE 321 – Electronics 1

Fall 2016

The Digital Lab – Prelab

(Each part due at beginning of class IAW syllabus. Make a copy for yourself.)

Part A Prelab: Inverter

(25 pts) Theory

1. Describe the basis for propagation delay in a CMOS inverter.

2. Derive the propagation delays, t_{PHL} and t_{PLH}, for the CMOS inverter using the method of average currents.

(**25 pts) Design** (Use the $V_{tn,p}$ and $k_{n,p}$ you found from the Amplifier lab)

1. Through hand calculations estimate propagation delays, t_{PHL} and t_{PLH}, using the method of average currents. Use V_{DD}=6 V and C=1 nF. Comment on the ability to measure this small unit of time.

2. Through hand calculations estimate V_{IL}, V_{IH}, NM_H, and NM_L.

(25 pts) Simulation

Attach your simulation (circuit schematic and graph) of the circuit shown in Figure 1 of the Lab and include figures similar to the DC Sweep and Transient Analysis (Figures 2 and 3 of lab). Compare your hand calculations and simulated values in the table below. Comment on differences.

Parameter	Calcs	Sim	% Diff
V_{IL} (V)			
V_{IH} (V)			
NM_L (V)			
NM_H (V)			
t_{PHL} (ns)			
t_{PLH} (ns)			

(25 pts) Procedure/Test Plan

Describe how will you measure, collect and analyze data. Describe the test equipment you will use. Include a schematic showing how your test equipment is connected to your circuit.