EE 391 (All Sections)

Midterm Examination

Tuesday, October 31, 2006

Time Allowed: 2 Hours

Materials allowed: Laboratory Notebooks, Calculators

Instructions:

- **Answer all questions in the space provided (use page backs for rough work if necessary)**
- **State your assumptions; show all relevant work. Box, circle or otherwise highlight your answers where appropriate. For multiple choice, circle the correct answer.**
- ***Put your <u>name</u> and <u>student number</u> on each page; (we may separate them for marking purposes)***
- **Refer to the last page for relevant product data when required**
- **Weighting for each question is indicated in the left margin (Total marks: 120)**

(Marker's use only.)

S. L.	Noise	Op A	Fourier	2nd Ord	FET	Total
15 /20	/21	/19	/20	/20	/20	85 /~~120~~

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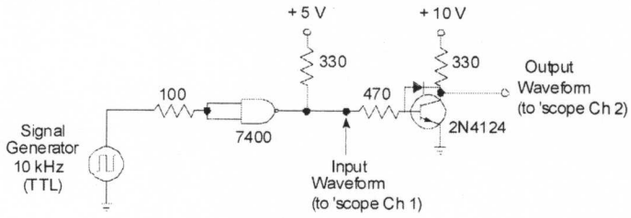
Timing in Sequential Logic

Q1.1) In general, a ring of N inverters with an average propagation delay of t_p, will oscillate with a frequency of $\frac{1}{2Nt_p}$ and a period of $2Nt_p$. N must be (odd) / even (circle one) number of inverters.
[3]

Q1.2) Consider the basic inverter circuit shown below driven by a 10kHz TTL square wave from the signal generator.



The oscilloscope trace of the input and output waveforms are shown at right. Determine the values of the following parameters *if shown*, and label them on the 'scope figure.

[6]

i) t_r 30ns

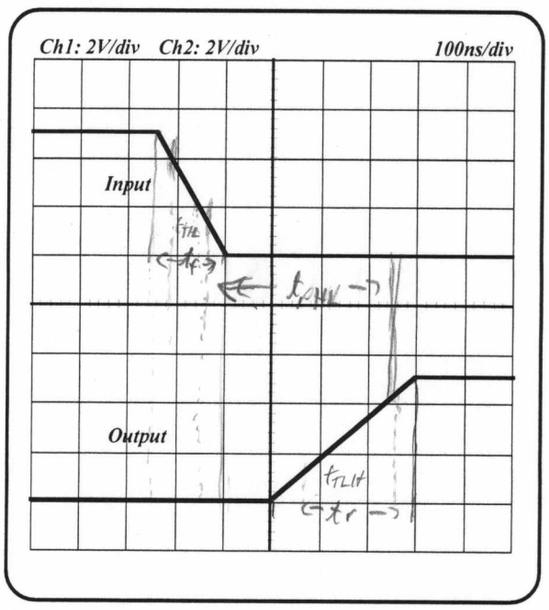
ii) t_f 150ns

iii) t_{PLH} 40ns

iv) t_{PHL} Not shown

v) t_{THL} 50ns

vi) t_{TLH} 20ns



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