

Microelectronics Systems Design ECE 446
Fall 2002 Test 3

1. Draw a diagram illustrating the design of a 4-bit counter using clocked JK-flip-flops. (5 points)
2. Identify the following acronyms (1 point each)
 - (a) ALU
 - (b) JTAG
 - (c) CAM
 - (d) ESD
 - (e) FPGA
3. Explain the function of the sense amplifier in a dynamic memory cell. (5 points).
4. Draw the circuit diagram of a static memory element showing the word line, bit and $\overline{\text{bit}}$ lines, and inverter elements. (5 points)
5. Describe how bonding wires are attached to I/O pads. (5 points).

6. Define (3 points each)

(a) standard cell

(b) self test

(c) floor-planning

(d) tree decoder

(e) voltage pump

7. Explain the terms controllability and observability in the context of testing. (5 points).

8. Draw a Y-chart representation of VLSI design flow and use it to describe the basic design process. (5 points).

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Fall 2002 Course Evaluation

These questions are intended to identify possible improvements in this course for next year. They will not be graded.

1. Rate how the following topics were presented on a scale of 1-5 where 5 means the material was presented very well and 1 means the material was presented poorly. You may give a zero if you believe the topic was never mentioned.
 - (a) ____ Microelectronic Fabrication Processing steps (lithography, etching, diffusion)
 - (b) ____ Layers used in typical semiconductor processes
 - (c) ____ Microelectronic devices (resistors, capacitors, MOS transistors)
 - (d) ____ Device parasitics, (resistance and capacitance)
 - (e) ____ Design of basic digital components (inverter, transmission gate, NAND, NOR, AOI)
 - (f) ____ Design of sequential elements (latches, shift registers, flip-flops)
 - (g) ____ Clocking disciplines and sequential systems
 - (h) ____ Design, layout and analysis of combinational circuits (e.g. 4-bit adder)
 - (i) ____ Design, layout and analysis simple sequential machines (serial adder, multiplier).
 - (j) ____ Design and layout of memory elements.
 - (k) ____ Design and layout of logic arrays
 - (l) ____ Use of chip layout programs (L-Edit)
 - (m) ____ Use of circuit simulation programs (Spice)
2. Which of the above topics were either presented the most clearly or have the most potential use in other courses or in future employment. Give reasons for your choices, if possible
3. Which of the above topics were either presented the least clearly or have the least potential use in other courses or in future employment. Give examples of how the topics could be presented better or whether they should be presented at all

4. Given the choice of a presentation (like we did), a capstone project, or another class assignment as the last class activity, which do you believe offers the most benefit to your learning experience. Assume I realize that they all involve a significant time investment.
5. Did you find the style of testing (closed-book and open-book, types of questions, length of exam) fair and representative of the material covered. If not, make specific suggestions on how testing could be improved.
6. Did you find the division between individual and group assignments useful? If not, how should assignments be organized? Should group membership be assigned by the instructor?
7. How did having the class meet in the computer room affect the way you learned the material. List some of the benefits and disadvantages of meeting routinely in a laboratory environment.