BACHELOR OF COMPUTER SC. ENGG. EXAMINATION, 2012

(3rd Year, 1st Semester)

VLSI DESIGN

Time : Three hours Full Marks : 100

Answer any ***five*** questions with at least ***one*** question from **Group-A**.

GROUP-A

1. a) How do you define LSI and VLSI? What is Moore's law?
   b) Compare Silicon versus Germanium in the use of chip designing.
   c) Explain VLSI design Cycle.
   d) What are the advantages and disadvantages of CMOS over MOSFET?
   e) Explain lithography.

   3+3+6+3+5

2. a) Prove that the ratio of impedances Z_{pu} and Z_{pd} of the pull-up to pull-down transistors of an nMOS inverter is 4 : 1.
   b) What is the significance of finding the ratio Z_{pu}/Z_{pd}?
   c) An nMOS inverter is driven by another nMOS inverter having pull-up to pull-down ratio of 4·75 : 1, through three pass transistors each having threshold voltage of 0·275 VDD . Find the desired ratio of the pullup to pull-down impedance of the driven inverter.

   12+2+6

3. a) Implement the following Boolean function with the help of (i) nMOS (ii) pMOS (iii) CMOS NAND gates (iv) CMOS single complex cell design.

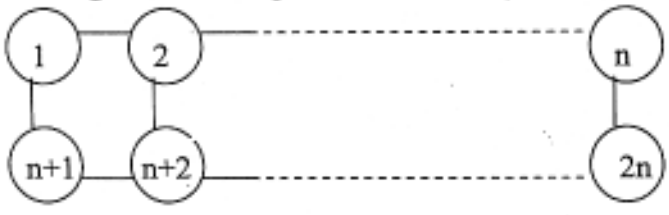
   $$Y = \overline{(A+B+C)\bullet D}$$

   b) Draw the coloured stick and mask diagrams for implementing the Boolean function mentioned in question 3 (a) using (i) NMOS (ii) CMOS.

   10+10

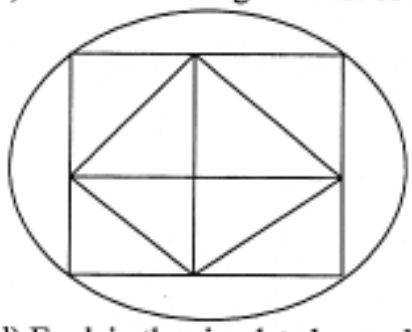
GROUP-B

4. a) Explain physical design cycle.
   b) Why do we need partitioning? What are the different levels of partitioning?
   c) Show how the Kernighan-Lin Heuristic works on the ladder graph with 2n vertices, starting with initial partition of V_1= {1,2,3,……,n}, and V_2={n+1,n+2,n+3,…..,2n}.



6+4+10

5. a) State the floorplan optimization problem.
   b) Define sliceable and non-sliceable floorplan with examples. What are the advantages of sliceable floorplan?
   c) Obtain a rectangular dual of the following adjacency graph.



   d) Explain the simulated annealing approach in Floorplanning problem.

2+5+7+6

6. a) State the consequences and importance of placement in VLSI Design
   b) Explain the Force directed Placement algorithm with its prospects and consequences.
   c) Explain the different procedures for Breuer's Algorithm.

4+8+8

7. a) Explain Global Routing and Detailed Routing.
   b) Explain the different graph models used in Global Routing.
   c) What is the running time of Lee's maze router when there is only one two-terminal net in an n × n grid and the rectilinear distance between the two terminals is d? For what configuration of obstacles is the running time independent of n and depends only on d?
   d) Give an example or counter example as the case may be for the following statement: Soukup's maze router always produces the shortest path.
   e) Explain Hightower line-probe algorithm.

4+4+4+4+4

8. a) Explain grid-based and gridless model in case of detailed routing
   b) Route the following channel using any suitable algorithm.

TOP = {7 2 7 0 0 1 4 6 0 7 4 0}
BOT = {2 5 6 5 6 2 1 0 3 0 3 4}

   c) What are constrained and unconstrained via minimization?
   d) Get the solution for unconstrained via minimization for the following graph.

3+8+3+6