Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M. Tech (ECE-VLSI)/SEM-1/MVLSI-104/2011-12

2011
MICRO-ELECTRONIC TECHNOLOGY AND IC FABRICATION

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Question No. 1 is compulsory and answer any *four* from the rest

1. Answer the following questions : $7 \times 2 = 14$

a) What material is used to create *n*-type doping ?

b) What material is used to create *p*-type doping ?

c) What material is used to create Gate of NMOS and PMOS transistor ?

d) What material is used to create interconnect (or wire) ?

e) What is the difference between Wafer and Die ?

f) What is the name of technique to grow Silicon ingot ?

g) What does CVD stand for ?

Answer any *four* questions from the rest. 4 × 14 = 56

2. a) Describe Integrated Circuit Process flow chart.

   b) Explain photolithography with example of *n* + diffusion creation in *p*-substrate. 8 + 6

3. a) Draw physical cross-section of CMOS inverter after fabrication.

   b) Show all physical layers in the cross-section.

   c) Identity Source, Drain, Gate and Channel Length of NMOS and PMOS in the cross-section.

   d) Draw schematic diagram of the CMOS inverter with IN, OUT, VDD and GND nodes and show corresponding nodes in CMOS cross-section. 5 + 3 + 3 + 3

4. a) Draw layout of CMOS inverter using Standard Cell Topology and show all the layers.

   b) If channel length (L) is 0·5 μm, PMOS Width (W_p) is 4·0 μm and NMOS Width (W_n) is 2·0 μm, show those dimensions in layout picture.

   c) Explain key features of standard cell layout design.

   d) Why do Layout Design rules exist ? 5 + 3 + 4 + 2

5. Describe *n*-well CMOS fabrication steps with Mask definitions.

6. a) Explain Euler Path with the example of a CMOS gate which represents function $f = (A + B + CD)$!

   b) Draw Stick Diagram and layout of the same CMOS gate based on Euler Path solution. 7 + 7

7. Provide brief description on the following fabrication steps : 5 + 5 + 4

   a) Oxidation and CVD

   b) Diffusion and Ion Implantation

   c) Metallization.