Name : .....

Roll No. : .....

Invigilator's Signature : .....

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

2011
MICRO ELECTRONIC TECHNOLOGY & 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.

Answer Question no. 1 and any *four* from the rest.

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

   a) Write down the names of different steps involved with IC fabrication

   b) What is BiCMOS ?

   c) What are the different steps involved in a CVD process ?

   d) What do you mean by scale of integration ?

   e) State the applications of CVD and PVD.

   f) State the differences between evaporation and sputtering.

   g) Depending on the doping concentration of the semiconductor, what are the two types of contacts used in metallization ?

2. What is diffusion mechanism ?

   What are the different types of diffusion profiles ?

   Determine the diffusivity from a known imprutiy profile. Assume that a boron is diffused into a n-type Si single-crystal substrate with a doping concentration of 10^15/cm^3 is obtained. 2 + 6 + 6

3 What are the main differences between ion implantation & diffusion.

   Expalin the method of photolithography. 4 + 10

4. What do you mean by twin tub process ?

   Expalin p-well processing steps. 4 + 10

5. Give a clear idea on clean-room concepts.

   Expalin the process of sputtering technology. 5 + 9

6. a) What are the various applications of SiO_2 in VLSI technology. Distinguish between thermally grown dry and steam oxidation. "During thermal oxidation of silicon, Si – SiO_2 interface moves downward as oxide thickness increases" – Justify.

   b) If a silicon oxide layer of thickness x is grown by thermal oxidation, what is the thickness of silicon being consumed ? The molecular weight of Si is 28.9g/mol and 2.21g/cm^3.

   c) Why is oxidation growth faster in case of heavily doped silicon ? How do the crystal orientation, dopants doping level damages in silicon substrate affect the oxide growth rate ? 6 + 5 + 3

7. a) Discuss about the process of silicon crystal growth from the melt.

   b) Explain the Czochralski Technique for silicon crystal growth process.

   c) A silicon ingot, which should contain 10^{16} boron atoms/cm^3, is to be grown by the Czochralski Technique. What concentration of boron atoms should be in the melt to give the required concentration in the ingot ? If the initial load of silicon in the crucible is 60 kg, how many grams of boron (atomic weight 10.8) should be added ? The density of molten silicon is 2.53 g/cm^3. Assume $k_0 = 0.8$. 3 + 6 + 5

8. a) What is epitaxy ? Bring out the differences in the techniques of solid phase, liquid phase and vapour phase epitaxy.

   b) Mention four different categories of reaction process of epitaxy.

   c) State the characteristics features of plasma enhanced CVD (PE CVD).

   d) Compare the advantages and disadvantages of AP CVD, LP CVD and PE CVD. 5 + 4 + 2 + 3