*Name* : .....

*Roll No.* : .....

*Invigilator's Signature* : .....

**CS/M.TECH(ECE-VLSI)/SEM-1/MVLSI-104/2012-13**

**2012**

# MICROELECTRONICS TECHNOLOGY & I.C. 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.*

## GROUP – A
## ( Multiple Choice Type Questions )

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) In class 100 environment maximum particle size is

a) 0·5 μm b) 0·05 μm

c) 0·15 μm d) 0·01 μm.

ii) Segregation coefficient $K_s$ is

a) $C_s / C_1$ b) $C_s - C_1$

c) $C_s \times C_1$ d) $C_s + C_1$.

iii) $CH_3COOH$ is used in the etching process as

a) lubricant b) heat controller

c) rate controller d) none of these.

iv) For growing *n* type epitaxial layers suitable dopants are

a) $B_2H_6$ b) $PH_3$

c) $A_SH_3$ & $PH_3$ d) $B_2H_6$ & $PH_3$.

v) Deal and Grove model is valid for
   a) 350°C < $T$ < 1000°C
   b) 700°C < $T$ < 1300°C
   c) 750°C < $T$ < 1100°C.

vi) The technique of changing the resistivity of Si or Ge is
   a) etching b) LPE
   c) oxidation d) diffusion.

vii) Channeling is occurred in
   a) crystal growth technique
   b) edge contouring technique
   c) ion implementation.

viii) Desired property of metallization for IC is
   a) high resistivity
   b) low resistivity
   c) very high resistivity.

ix) Ion dose means total number of ions
   a) entering the target
   b) reflected by the target
   c) absorbed by target.

x) Faraday cage is used in ion implantation equipment
   a) to collect the all ions
   b) to collect the secondary electron
   c) to oppose the electrons.

xi) If Si concentration becomes too high in case of epitaxial growth, the growth rate
   a) reduces
   b) increases
   c) remain constant.

xii) In MBE process the deposited film thickness may be

a) < 0·05 μm

b) > 0·05 μm

c) > 0·5 μm.

## GROUP – B

### ( Short Answer Type Questions )

Answer any *three* of the following $3 \times 5 = 15$

2. What do you mean by clean room ? What are the precautions need to be taken to keep the room of fabrication clean ? 2 + 3

3. What do you mean 'epitaxy' ? Why epitaxial layeris required ? What are the different methods of epitaxial growth ? 1 + 2 + 2

4. What are the disadvantages of LPE ? What do you mean by autodoping ? 2 + 3

5. What are the effects of crystal damage ? What do you mean by self annealing ? 2 + 3

6. Explain Channeling.

## GROUP – C

### ( Long Answer Type Questions )

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Describe the Czochralski method of crystal growth.

   b) A boron doped crystal is measured at its seed end with a four-point probe of spacing 1 mm. The V/I reading is 10 Ω. At this reading doping density of $B$ is $2 \times 10^{15}$. What is the seed end doping and the expected reading at 0·95 fraction solidified ? For boron $K_0 = 0{\cdot}8$ at $X = 0$. 10 + 5

8. Describe the MBE technique ? Explain the advantages and disadvantages of this technique.

9. a) Describe the Thermal oxidation technique using Deal & Grove model and calculate the oxide growth for long and sort oxidation.

b) Show from the densities and molecular weights of Si and $SiO_2$ that a layer of silicon of thickness approximately equal to 0·44 $d_0$ is consumed when a $SiO_2$ layer of thickness $d_0$ is formed. Use density of 2·27 gm/cm$^3$ for $SiO_2$ and 2·33 gm/cm$^3$ for Si. 10 + 5

10. What do you mean by lithography ? What are the different classes of lithography ? Describe the photolithography process. 2 + 3 + 10

11. Describe the steps to form a MOS capacitor.

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