



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.*

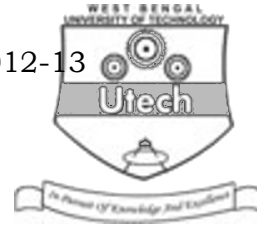
GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

10 × 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) AsH_3 & PH_3
 - d) B_2H_6 & PH_3 .



- v) Deal and Grove model is valid for
 - a) $350^{\circ}\text{C} < T < 1000^{\circ}\text{C}$
 - b) $700^{\circ}\text{C} < T < 1300^{\circ}\text{C}$
 - c) $750^{\circ}\text{C} < T < 1100^{\circ}\text{C}$.
- 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
- $< 0.05 \mu\text{m}$
 - $> 0.05 \mu\text{m}$
 - $> 0.5 \mu\text{m}$.

GROUP – B

(Short Answer Type Questions)

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

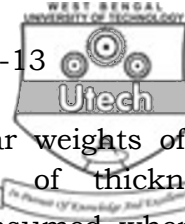
- What do you mean by clean room ? What are the precautions need to be taken to keep the room of fabrication clean ?
 $2 + 3$
- What do you mean 'epitaxy' ? Why epitaxial layer is required ? What are the different methods of epitaxial growth ? $1 + 2 + 2$
- What are the disadvantages of LPE ? What do you mean by autodoping ? $2 + 3$
- What are the effects of crystal damage ? What do you mean by self annealing ? $2 + 3$
- Explain Channeling.

GROUP – C

(Long Answer Type Questions)

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

- Describe the Czochralski method of crystal growth.
 - A boron doped crystal is measured at its seed end with a four-point probe of spacing 1 mm. The V/I reading is 10Ω . At this reading doping density of B is 2×10^{15} . What is the seed end doping and the expected reading at 0.95 fraction solidified ? For boron $K_0 = 0.8$ at $X = 0$.
 $10 + 5$
- Describe the MBE technique ? Explain the advantages and disadvantages of this technique.
- Describe the Thermal oxidation technique using Deal & Grove model and calculate the oxide growth for long and short 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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