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## 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?

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## CS/M.TECH (ECE-VLSI)/SEM-1/MVLSI-104/200

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  $10^15/\text{cm}^3$  is obtained. 2 + 6 + 6

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

Expalin the method of photolithography.

4. What do you mean by twin tub process?

Expalin p-well processing steps. 4 + 10

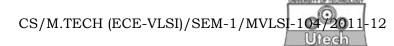
4 + 10

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<sub>2</sub> in VLSI technology. Distinguish between thermally grown dry and steam oxidation. "During thermal oxidation of silicon, Si SiO<sub>2</sub> 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<sup>3</sup>.
  - 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

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- 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<sup>3</sup>, 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<sup>3</sup>. 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

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