

AE-139

April-2015

M.Sc., Sem.-IV

ELE-507 : Electronics Science (Integrated Circuit Technology)

Time : 3 Hours]

[Max. Marks : 70

- Instructions :**
- (1) All symbols carry usual meanings.
 - (2) Attempt **all** questions.
 - (3) Scientific calculators are allowed.

1. (a) What are the steps required for the silicon wafer shaping ? Give details of the procedure of silicon wafer polishing. 7

OR

- (i) Explain the role of oxygen and carbon impurities in grown silicon crystal. 4
 - (ii) Explain the function of primary and secondary flats on silicon wafer. 3
- (b) What is electronic grade silicon ? Using necessary diagram, explain the preparation of electronic grade silicon. 7

OR

Obtain an expression of maximum pull rate for Si crystal growth. Discuss the Float Zone (FZ) crystal growth technique.

2. (a) State the importance of oxidation in the Si based IC technology. Explain the process of dry oxidation. 7

OR

- (i) What are advantages and limitations of plasma oxidation process ? 5
 - (ii) State advantages of Ion-beam lithography. 2
- (b) What is lithography and why it is needed in the IC technology ? Explain the projection printing method of photo-lithography. 7

OR

With the help of suitable example, explain the working of positive and negative photoresists. Draw exposure characteristics of positive and negative photoresists.

3. (a) Explain the Fick's theory of diffusivity for constant surface concentration and state its significance in VLSI processes. 7

OR

Give schematic of IC packaging types. Discuss the design rules of IC packaging.

- (b) List the different types of metallization techniques in VLSI technology. Explain the process of junction spiking. How it can be reduced in metallization processes with aluminum ?

7

OR

Describe the die bonding process used in VLSI interconnects.

4. (a) Discuss how the integrated circuit capacitor can be formed using Bipolar and MOS technology. How are these capacitors different ?

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OR

With the help of suitable diagrams discuss the basic fabrication process of Bipolar PNP Transistor.

- (b) Explain the electrostatic discharge damage in VLSI circuits. Describe various methods to prevent it.

7

OR

What are the requirements for pure water in IC fabrication ? Discuss any water purifier system.

5. Answer the following : (**one** mark each)

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- (i) State the usefulness of gettering.
- (ii) Draw a schematic diagram of interstitial mechanism of solid diffusion.
- (iii) Why Cu is alloyed with Al in metallization process ?
- (iv) Define segregation coefficient and state its importance.
- (v) Differentiate between diffusion and ion implantation
- (vi) What do you mean by epitaxial growth ?
- (vii) Draw any two VLSI package types.
- (viii) List the requirement of clean room for IC fabrication ?
- (ix) In Electron beam lithography, wafers can not be patterned without mask. (TRUE or FALSE)
- (x) $\langle 100 \rangle$ is the preferred orientation of starting Silicon material for MOS structures. (TRUE or FALSE)
- (xi) What is meant by throughput ?
- (xii) The purpose of buried layer is to minimize the series resistance of the collector. (TRUE or FALSE)
- (xiii) Define anisotropic etching.
- (xiv) What is proximity effect related to electron beam lithography ?