Printed pages: 02 **Sub Code: NEC 603**

Paper Id: 131633 **Roll No:** | | | | | | | | | | |

B TECH
(SEM-VI) THEORY EXAMINATION 2017-18
INTEGRATED CIRCUIT TECHNOLOGY

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x10 = 20

a. What are point defects?
b. List the steps used in the preparation of Si – wafers.
c. What do you mean by SOI?
d. Define the process of oxidation .List two important properties of SiO_2.
e. Explain isotropic & anisotropic etching processes.
f. What is metallization?
g. What is the difference between pseudo homo epitaxy and hetero epitaxy?
h. What is step coverage problem in IC fabrication?
i. What are the advantages of ion implantation technique?
j. Explain basic differences between Bipolar and MOS Integrated Circuits

SECTION B

2. Attempt any *three* of the following: 10 x 3 = 30

a. Describe CZ process in detail with neat diagram. What is the Pull Rate in CZ technique? How the Pull Rate is controlled during the CZ crystal growth process?
b. Why Oxidation is necessary in IC fabrication? Calculate the oxide thickness. Show that $\frac{x}{A/2} = \left[1 + \frac{t+\tau}{A^2/4B}\right]^{1/2} - 1$, reduces to $x = \frac{B}{A}(t+\tau)$ for short time and to $x = \sqrt{B(t+\tau)}$ for long time, where $x =$ oxide thickness.

c. Derive the diffusion equation. How the depth of diffusion is controlled during diffusion process? Give the solution of Fick's Law?
d. Explain the metallization and describe the problems associated with this process. Explain dc sputtering method of metallization.
e. How a NPN transistor can be fabricated? Explain all the steps of fabrication. Also compare it with NMOS fabrication.

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

a. Explain the basic working principle of ion implantation process with all necessary equations. Compare between the diffusion and ion implantation process.

b. A silicon ingot with $0.5x10^{16}$ boron atoms/cm3 is to be grown by CZ method. What should be the concentration of boron in the melt to obtain the required doping concentration? The segregation coefficient of the boron is 0.8.

4. Attempt any *one* part of the following: 10 x 1 = 10

a. What is Epitaxy? Discuss Molecular Beam Epitaxy technique in brief. What are the advantages of MBE over VPE?

b. What do you mean by film deposition? Explain different types of films deposited in IC fabrication.

5. Attempt any *one* part of the following: 10 x 1 = 10

a. Explain the following terms: (i) Self Aligned Bipolar structures (ii) Integrated Injection Logic.

b. Explain proximity printing and projection printing & compare these two.

6. Attempt any *one* part of the following: 10 x 1 = 10

a. (i)Explain the kinetics of wet etching. How gold is etched?
(ii) What are PR materials? What are the properties of different PR?

b. If the measured phosphorus profile is represented by a Gaussian function with a diffusivity D $=2.3x10^{-13}$ atoms/cm^2, the measured surface dose is 10^{18} atoms/cm2 and the measured junction depth is 1 μm at a surface concentration of 10^{15} atoms/cm^3. Calculate the diffusion time.

7. Attempt any *one* part of the following: 10 x 1 = 10

a. Write short note on package types and packaging design VLSI Technology. What is meant by DIP? Explain in brief.

b. Write short Notes on (i) Annealing (ii) Chemical Vapor deposition(CVD)