This question paper contains 3 printed pages.]

Your Roll No. ....

1410 **A**

B.Sc. (Hons.)/III

ELECTRONIC SCIENCE—Paper 3.5 (XIX)

(Material Science and I.C. Technology)

Time : 3 *Hours* *Maximum Marks* : 38

(Write your Roll No. on the top immediately

on receipt of this question paper.)

Attempt five questions in all, including

Question No. 1 which is compulsory.

Non-programmble scientific calculator is allowed.

1. (a) Outline the steps involved in obtaining Electronic grade from Metallurgical grade Silicon.

   (b) What is the preferred technique for crystal purification?

   (c) Explain the process of P-glass flow and outline its significance.

   (d) What is emitter push effect?

   (e) Mention the range of resistance values that can be obtained while fabricating monolithic ICs. Also discuss the feasibility of fabricating inducters on these ICs. 2×5

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2. (a) Explain the CZ technique for growing single crystal of Silicon. 3

(b) Show that in case of growth from mett, the ratio is $\frac{C_s}{C_o}$ is given by $K_0\left[1-\frac{M}{M_0}\right]^{K_0-1}$ where K_0 is equilibrium segregation coefficient and $\frac{M}{M_0}$ is the fraction solidified. 4

3. (a) What do you mean by epitaxy? Explain the Kinetics of growth of VPE. Derive necessary formula for vapour phase mass transfer coefficient (hg). 5

(b) Calculate the value of gas phase mass transfer coefficient for a Silicon epitaxial process at 1200°C. The diffusivity of the gas is 25 cm^2/sec, $\rho_d = 1.5 \times 10^{-5}\ g/cm^3$, $\mu = 2 \times 10^{-4}$ poise, V = 10 cm/sec, L = 50 cm. 2

4. (a) Outline the importance of SiO_2 in device fabrication. If a SiO_2 layer of thickness x is grown from thermal oxidation, what is thickness of Silicon being consumed? 4

Mol. wt. of Si = 28.09 gm/mole

Mol. wt. of SiO_2 = 60.08 gm/mole

Density of Si = 2.33 gm/cm^3

Density of SiO_2 = 2.21 gm/cm^3.

Why is the basic model for thermal oxidation of Silicon not valid for dry Oxidation of Silicon when Oxide thickness $\leq$ 200Å.

(b) Explain the technique of scanning Electron Microscopy. 3

5. (a) What is the difference between intrinsic and extrinsic diffusion? 3

(b) Explain the ion implantation and ion stopping process. Draw a graph to show the variation of energy loss with energy for light and heavy ions. 4

6 (a) Distinguish between a positive and a negative photoresist. Draw the exposure response curves and cross-section of the resist image after the development process. 4

(b) Explain the basic steps of a dry etching process. 3

7. (a) Explain various steps involved in the fabrication of MOSFET. 4

(b) Explain the different methods of isolation used for IC fabrication. 3