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Paper Code: EC 603	Roll No.									

B.Tech.
(SEM VI) EVEN SEMESTER EXAMINATION 2015-16
INTEGRATED CIRCUIT TECHNOLOGY

[Time: 3 hrs.] **[Max. Marks: 100]**

Note- Attempt All Questions. All Questions carry equal marks.

Q.1. Attempt any **TWO** parts of the following. **10x2=20**

(a) What is Moore's law? Explain how miniaturization is achieved in Integrated Circuit Technology? Explain the various parameters related to evolution of VLSI circuits.

(b) How are single crystals grown? Describe one of the approaches that allow the crystal to be grown with a contamination free surface.

(c) What do you mean by epitaxy? Explain. Describe the epitaxial growth process control. What are the advantages of epitaxial growth in IC fabrication over diffusion and CZ process? Explain.

Q.2. Attempt any TWO parts of the following. **10x2=20**

(a) Discuss the various types of charges preset in the oxide and oxide –silicon interface. What are the effects of these charges on devices fabricated under such oxides?

(b) (i) Explain wet chemical etching system used for silicon etching.
(ii) What is photoresist? Explain. Describe briefly the photoresist process for IC fabrication.

(c) A deep vertical groove one micrometer wide and two micrometer deep is etched in a silicon substrate .The grooved surface is bare silicon but the plane silicon surface is covered with thin layer of silicon nitride to prevent oxidation of the silicon surface. The wafer is then oxidized in steam at $1100\ ^0$ C to fill the groove with oxide. (i) How long does it take to fill the groove with silicon dioxide? (ii) What is the width of the stripe of silicon dioxide that results when the groove is completely filled? Given that the linear and parabolic rate constants for wet oxidation of silicon at $1100\ ^0$C are 4.64 μm/h and 0.51 μm^2 /h respectively.

Q.3. Attempt any **TWO** parts of the following. **10x2=20**

(a) *(i)* What are the diffusion process variables which affect the diffusion process? Explain.
(ii) What is sheet resistance? Describe four point probe method for its measurement .

(b) What is Fick's law of diffusion? Explain.
Boron impurity is diffused into an n-type single crystal substrate with doping concentration of 10^{15} atoms/ Cm^3 . Assuming diffusion function as Gaussian distribution, if diffusion time is one hour, surface concentration is 1×10^{18} atoms/ Cm^3 and depth of junction is 2 μm, determine the diffusivity.

(c) Write the expression for ion implanted impurity distribution. How a desired impurity distribution is achieved by ion implantation? What are the advantages and disadvantages of ion implantation over diffusion process?

Q.4. Attempt any **TWO** parts of the following. **10x2=20**

(a) Explain the vacuum evaporation system to deposit thin films. Why high vacuum is required in the operation of deposition of films? Describe the method for deposition of Al film. What is the basic theory of vacuum evaporation?

(b) Describe the Low Pressure Chemical Vapour Deposition technique for the deposition of polycrystalline silicon film. Explain, what are the variables for deposition? What are the advantages and disadvantages of this technique over APCVD.

(c) Write a short note on packaging of Integrated circuits.

Q.5. Attempt any **TWO** parts of the following. **10x2=20**

(a) Describe qualitatively a complete epitaxial diffused fabrication process for n-p-n transistor for monolithic Integrated circuit indicating all steps.

(b) What are the various processes of CMOS fabrication? Illustrate the main steps in a typical n-well process with suitable sketches.

(c) Draw the cross section of a discrete transistor and an Integrated circuit transistor and hence compare their performance. How will you optimize the monolithic transistor characteristics?