Reg. No. : | | | | | | | | | | |

Question Paper Code: 41272

M.E. DEGREE EXAMINATION, DECEMBER 2014.

First Semester

VLSI Design

14PVL101 – VLSI TECHNOLOGY

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (5 x 1 = 5 Marks)

1. The Dielectric material for MOS devices can be
   (a) Thin thermal oxide (b) Silicon Nitride
   (c) Composite structure of thermal oxide (d) All the above

2. Electron Lithography offers higher resolution than optical lithography because of its small wavelength of
   (a) 20-40 keV (b) 100-200 keV (c) 10-50 keV (d) 0-100 keV

3. Rutherford backscattering technique has been used for measuring distributions of heavy elements in
   (a) Gold (b) Platinum (c) Arsenic (d) Silicon

4. The charge stored on a capacitor of area A, dielectric thickness d, and dielectric permittivity ε, with a voltage across the capacitor V_s is.
   (a) $Q_s= \varepsilon Ad/ V_s$ (b) $Q_s= \varepsilon A V_s /d$ (c) $Q_s=d/ \varepsilon AV_s$ (d) $Q_s= \varepsilon d/A V_s$

5. Estimate the number of gates that can be included on a logic gate array chip which is to be assembled in a 100 input-output package. Assume α=4.5 and β=0.5
   (a) 490 gates (b) 100 gates (c) 103 gates (d) 493 gates

PART - B (5 x 3 = 15 Marks)

6. List the steps to evaluate epitaxial slices, layer doping and thickness.

7. Illustrate the lithographic process used to fabricate circuit chips.

8. What is the significance for determining diffusivities in diffusion study?

9. What is electron beam lithography? Calculate the energy deposition functions to electron scattering in solids.

10. Elucidate the fundamental principles of Chromatography.

PART - C (5 x 16 = 80 Marks)

11. (a) Illustrate the silicon crystals prepared by the Czochralski technique for the IC fabrication. (16)

Or

(b) (i) Examine the oxidation model and its fit to experimental data. Also describe the effects of orientation, dopant concentration and surface damage on the kinetics of oxidation. (10)

(ii) Describe the oxidation of polysilicon in fabricating CMOS VLSI technology. (6)

12. (a) (i) Explain the optical lithography for the formation of images. (10)

(ii) List the various materials, sources and masks used in X-ray lithography. (6)

Or

(b) (i) Describe the various mechanism for anisotropic etching. (10)

(ii) Discuss the effect of plasma parameters. (6)

13. (a) (i) Why polysilicon is used as the gate electrode in MOS devices. Analyze the polysilicon utilized in the CMOS fabrication. (6)

(ii) Discuss the theory on fick's one-dimensional diffusion equation. (10)

Or

(b) (i) Analyze the practical aspects of ion implantation. (6)

(ii) What is annealing? Explain the process involved in annealing. (10)

14. (a) (i) Elucidate the methods used to simulate ion implantation phenomena in solids. (10)

(ii) Describe a model that simulates epitaxial doping profiles in a variety of growth conditions. (6)

Or

(b) (i) Explain the steps in fabricating CMOS inverter. (10)

(ii) List and discuss the special considerations for Bipolar Integrated circuits. (6)

15\. (a) (i) Discuss the interactions of various analytical beams with materials. (10)

(ii) Explain the fourier transform Infrared Spectrophotometer. (6)

Or

(b) Describe the today's basic assembly operations for VLSI devices. (16)