5. Attempt any ***two*** parts of the following :— **(2×10=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 different methods for CMOS fabrication ? Explain any one of them in detail.

(c) What are the advantages of polysilicon gate technology over metal gate ? How is it fabricated ?

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(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2889 **Roll No.**

B. Tech.

(SEM. VIII) THEORY EXAMINATION 2011-12

INTEGRATED CIRCUIT TECHNOLOGY

Time : 3 Hours *Total Marks : 100*

Note :— (1) Attempt ***all*** questions.

(2) All questions carry equal marks.

1. Attempt any ***four*** parts of the following :— **(4×5=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.

(b) Enlist the various steps in order to obtain a prepared silicon wafer. Explain the first and the last steps in detail.

(c) What is epitaxy ? Describe with suitable sketch an epitaxial growth process. What are the advantages of epitaxy in IC fabrication ?

(d) Define integration scale of electronics circuits and explain what are the advantages of integrated circuit over discrete components.

(e) What is the purpose of grinding flats along the length of an ingot ? Explain.

(f) What is the use of sulfur hexafluoride (SF_6) in silicon technology ? Explain.

2. Attempt any ***two*** parts of the following :— **(2×10=20)**

(a) (i) What are the requirement of an oxide used for a diffusion mask ? To obtain good quality of oxide a combination of dry and wet oxidation is used. Should the sequence be

(I) first wet then dry, or

(II) first dry then wet. Explain.

(ii) A silicon wafer is covered with a 200 nm thick layer of silicon dioxide. What is the added time required to grow an additional 100 nm of silicon dioxide in dry oxygen at 1200 ºC ? Given that the linear and parabolic rate constants for dry oxidation of silicon are 1.125 micrometer per hour and 0.045 micrometer square per hour respectively at 1200 ºC.

(b) (i) Explain briefly the photolithography process. What is photomask ? How many masks are required to complete an integrated circuit ? Name them and list the function performed by each mask.

(ii) Plot and explain the isoetch curve for typical HF : HNO_3 : H_2O diluent etching system used for silicon etching.

(c) What are the various film deposition processes ? Describe a Chemical Vapour Deposition (CVD) technique for silicon oxide film deposition.

3. Attempt any ***two*** parts of the following :— **(2×10=20)**

(a) (i) What are the basic requirements of any diffusion system ? Describe a typical diffusion apparatus for Boron diffusion.

(ii) What are the diffusion process variables which affect the diffusion process ? Explain.

(b) (i) Derive an expression for the junction depth resulting from a Gaussian impurity diffusion into an oppositely doped material.

(ii) What is sheet resistance ? Describe four-point probe method for the measurement of sheet resistance.

(c) What is the projected range in an ion-implantation technique ? What are the advantages and disadvantages of ion-implantation ? How will you obtain an uniform impurity doping profile with this technique ? Explain.

4. Attempt any ***two*** parts of the following :— **(2×10=20)**

(a) Explain the various types of vacuum evaporator 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. Explain why the substrate is heated to moderate temperature during film deposition.

(b) Explain, why sputtering is needed for the deposition of refractory materials like tantalum. With neat diagram explain the D.C. sputtering technique.

(c) What are the different types of packages for integrated circuits ? Describe any one in detail.