Roll No. | | | | | | | | | | |

Paper Code: MTMC023/MEC906

M TECH
(SEM I) ODD SEMESTER EXAMINATION 2016-17
VLSI TECHNOLOGY

Time: 3 Hours ***Maximum Marks: 70***

Note: ***Attempt all questions. Assume suitable data if not given. Notations have usual meanings.***

Q.1. *Attempt any **TWO** parts of the following.* **7x2=14**

a) Define clean room and explain clean room performance criteria. What do you mean by cost effectiveness?

b) Describe the three tiered approach to control unwanted impurities employed by modern IC factories. Explain the environmental factor which affects the wafer processing phenomena.

c) Discuss the role of wet chemical etching in wafer cleaning processes and also explain the cleaning and processing considerations in silicon technology.

Q.2. *Attempt any **TWO** parts of the following.* **7x2=14**

a) What are the basic requirements of any diffusion system? Describe a typical diffusion apparatus for Boron diffusion if the impurity source is available in liquid form.

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

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

Q.3. *Attempt any **TWO** parts of the following.* **7x2=14**

a) Why is oxidation done? Explain the chemistry of oxidation and kinetics of oxide growth.

b) A silicon wafer is covered with a 100 nm thick layer of silicon dioxide. What is the added time required to double the thickness of the oxide in dry oxygen at $1200\ ^0$ C? 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 $1200\ ^0$C.

c) 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.

Q.4. *Attempt any **TWO** parts of the following.* **7x2=14**

a) Define thin films. What are the desired properties of the metallization for Integrated circuit? Describe vacuum deposition technique for thin film deposition. Explain why the substrate is heated to moderate temperature during film deposition.

b) What are the various film deposition techniques? Describe the LPCVD technique for the deposition of polycrystalline silicon film. What are the variables for deposition? Explain.

c) What is epitaxy? Describe with suitable sketch an epitaxial growth process and its process control. What are the advantages of epitaxy in IC fabrication over diffusion and Cz process?

Q.5. *Attempt any **TWO** parts of the following.* **7x2=14**

a) What are the different methods for CMOS fabrication? Explain any one of them in detail.

b) Explain the different methods to obtain isolation between components in a monolithic I.C. How do you eliminate the parasitic capacitances due to p-n junction isolation?

c) What is sheet resistance? Describe four point probe method for its measurement. Calculate sheet resistance of an one mil thick silicon wafer which has been doped uniformly with phosphorus to a concentration of 1.5×10^{16} per Cm^3 and antimony to a concentration of $2 \times 10^{15\ per}$ cm^3 .