

B.E. (ETC) Part-II 4th Semester Examination, 2006

**Microelectronics
(ETC-405)**

Time : 2 hours

Full Marks : 50

Use separate **answerscript for each half. One mark is reserved for neatness in each half.**

FIRST HALF

(Answer Q.No.1 and ONE from **the rest.**)

1. What do you understand by (any four) : [4x3]
 - i) Isolation diffusion step in fabricating a Monolithic IC chip, ii) Edge contouring and lapping of silicon wafers, iii) Molecular Impingement rate in MBE systems, iv) Projected Range & Projected Straggle of Ion distribution, v) Electromigration in VLSI chips.

2. a) A silicon ingot, containing 10^{20} boron atoms/cm³ is to be grown by the Czochralski technique. Assuming a segregation co-efficient of 0.8 for boron atoms in silicon crystal, what is the concentration of boron atoms in the melt to offer the right concentration in the ingot? If the initial load of silicon in the crucible is 50 kg, how many gms of boron (atomic weight = 10.8) should be added? (Density of molten silicon is 2.53 gm/c.c).
b) Draw only a neat & labelled sketch of the CZOCHRALSKI APPARATUS for extracting single crystal p-si wafers.
c) What is Segregation Co-efficient? Give typical values. [5+5+2]

3. a) Draw only four to five neat cross-sectional views of a silicon wafer subjected to photolithographic window opening sequence by using negative PR.
b) What are the advantages of using Electron beam lithography over optical lithography?
c) What is the purpose of a Mask aligner? State some of its figures of merit. [6+2+4]

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SECOND HALF

{Answer any TWO questions.}

4. a) Draw a neat and simplified block diagram illustrating the connection of different pumps with a physical vapour deposition (PVD) system. Suggest the type of pumps to be used with PVD systems for attaining vacuum of the order of (i) 10^{-2} Torr, (ii) 10^{-5} to 10^{-6} Torr, (iii) 10^{-8} to 10^{-9} Torr.
- b) Why chilling plants are compulsory unit attached to all vacuum evaporation systems? Which type of thin film materials calls for multiple source evaporation? Why? [(4+3)+(3+2)]
5. a) Identify clearly all the advantages in using GaAs wafers over Silicon wafers in fabricating electronic devices.
- b) Describe very briefly the preparation of single crystal GaAs by the Horizontal Bridgman (HB) technique. Mention the advantages of this technique vis-a-vis the LEG process of preparing GaAs wafers. (6+(4+2)]
6. a) Draw only a neat labelled sketch of the R.F. sputtering systems for depositing thin films. What is meant by 'thin films'?
- b) How can an ohmic electrode be deposited over thin film Gr II-VI semiconductors by using ELECTRODEPOSITION technique? Suggest very briefly how you would proceed to verify the ohmic nature of the contact. [(4+1)+4+3]
7. Write brief technical notes (any two) : [6x2]
- a) Advantages of Ion-Implantation techniques
 - b) Halide and Hydride process of preparing GaAs
 - c) Ion-Implant damages & its remedies.