

Thapar Institute of Engg. & Tech
[Deemed University], Patiala

End semester Exam, Dec 2006

Microelectronics & I.C.s [EC-029]

Subject Instructor: Urmi Agnihotri

Max. Marks: 45

Max. Time : 3 hours

- Note: 1.] Attempt any 9 questions. Each question carries 5marks. Don't over attempt.
2.] Use diffusivity of boron as $4 \times 10^{-3} \text{cm}^2/\text{sec}$.
3.] See your answer sheets on 13th at 5.10pm in my room.

- Q1. i.] Explain with help of diagram and chemical equations, Czochralski crystal growing technique.
ii.] List the various steps in the final manufacture of a wafer from the raw silicon.
- Q2. i.] Write a short note on dry, HCl Dry, Wet, High-pressure and plasma oxidation.
ii.] Discuss any two oxide properties.
- Q3. i.] Discuss plasma surface interactions.
ii.] What are plasma etchers and barrel reactors?
iii.] Discuss side wall mechanism
- Q4. Write detailed note on the usage of silicon on insulators.
- Q5. Write short notes on :
i.] Ion beam lithography ii.] Electron beam lithography iii.] Optical lithography
- Q6. i.] What is range theory? Explain in detail.
ii.] Draw only the complete schematic of typical ion-implantation machine.
- Q7. Explain in detail the causes imperfect yield.
- Q8. Explain i.] Package types ii.] Thermal design considerations
iii.] Mechanical design considerations iv.] Electrical design considerations
- Q9. Find the diffusivity from a known impurity profile. Assume that boron is diffused into n type Si crystal substrate with doping concentration of $10^{15} \text{atoms/cm}^3$, and also that the diffusion profile can be described by gaussian function. Using a diffusion time of 60 min, one obtains measured junction depth of 2 microns and a surface concentration of 10^{18}cm^{-3} .
- Q10. Equilibrium concentrations of boron at solid and liquid interface are 10^{-3} and $10^{-4} \text{atoms/cm}^3$ respectively. If the boundary layer thickness is 0.0025mm, find the value of equilibrium segregation coefficient and effective segregation coefficient for a pull rate of 2.7mm/min.
- Q11. i.] Find the linear rate constant if the parabolic rate constant for wet oxidation is $0.287 \mu\text{m/h}$ and the value of A is $0.226 \mu\text{m}$.
ii.] Calculate the mean free path (in cm) of the dopant if the pressure in the MBE chamber is 10^{-8}Torr .
- Q12. i.] What is rents rule? Estimate the number of gates that can be included on a logic array chip, which is to be assembled in a 100 I/O package. Assume $\alpha = 2.5$ and $\beta = 0.45$.
ii.] Draw the sequence only for packaging starting from wafer preparation till test showing material and piece part.