Reg. No.					



MANIPAL INSTITUTE OF TECHNOLOGY Manipal University FIRST SEMESTER M.TECH (ME) DEGREE END SEMESTER EXAMINATION - NOV/DEC 2016 SUBJECT: VLSI PT (ECE - 5124)

TIME:	3	HOURS	

MAX. MARKS: 50

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.
- 1A. Explain the process of wafer fabrication using float zone process.
- 1B. Explain different type of light source used in photolithography.
- 1C. In cubic cell, find the angle normal to the planes (111) and (121).

(5+3+2)

2A. In wet oxidation of silicon at 950°C, the following data are obtained

t (hour)	0.11	0.30	0.40	0.50	0.60
d _o (oxide thickness in μm)	0.041	0.100	0.128	0.153	0.177

Show how to graphically determine the linear and parabolic rate constants from these experimental data. Assume that $\tau = 0$ for wet oxidation. Use linear graph sheet.

2B. A CZ grown crystal is doped with boron.

(i) Why is the boron concentration larger at the tail end of the crystal than at the seed end?

(ii) In a CZ growth, oxygen diffuses into the molten silicon from the silica crucible used to contain it; will the concentration of oxygen in the crystal be larger at the tail end or the seed end? Explain

2C. Explain two Resolution enhancement technique in photolithography.

(5+3+2)

- 3A. Intel is designing an implant step which will implant phosphorus ions through 50 nm of SiO2 into an underlying silicon substrate such that the peak concentration in the substrate is 1×10^{17} cm⁻³ and the concentration at the SiO2 /Si interface is 1×10^{16} cm⁻³. What energy and dose would you use to achieve these conditions? Assume that the stopping power of SiO2 is the same as that of silicon. Neglect channeling effects.
- 3B. Explain damage distribution of wafer due to ion implantation of light ion and heavy ion. How rapid thermal annealing rectify the damages?
- 3C. Explain thermocompression bondings of wafer.

(5+3+2)

4A. A boron pre-deposition step is performed into an n-type Si substrate with a background concentration C_B of 1×10^{16} /cm³. The pre-deposition thermal cycle is 975 °C for 15 minutes. Given: Boron solid solubility at 975 °C = 3.5×10^{20} /cm³ Boron diffusion constant at 975 °C = 1.5×10^{-14} cm²/sec. (a) Calculate the junction depth xj.

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- (b) Calculate the incorporated boron dose Q.
- 4B. Explain Molecular Beam Epitaxy process with neat diagram.
- 4C. Explain the fabrication of diffused resistor.

(5+3+2)

- 5A. Explain the principle of plasma-based etching with chemical reactions involved in it.
- 5B. Explain the sputtering process.
- 5C. Explain electromigration process with neat diagram.

(5+3+2)