Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

FIFTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION - NOV/DEC 2016
SUBJECT: VLSI PT (ECE - 323)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.

1A. (i) Explain the process of fabrication of electronically graded silicon with chemical equation.
(ii) Explain the Gettering process.

1B. Explain the importance of constant source diffusion process in silicon diffusion. What salient features can be observed with solution of error function profile?

(6+4)

2A. Explain Deal-grove model.

2B. Explain basic physics and chemical reactions involve in plasma etching.

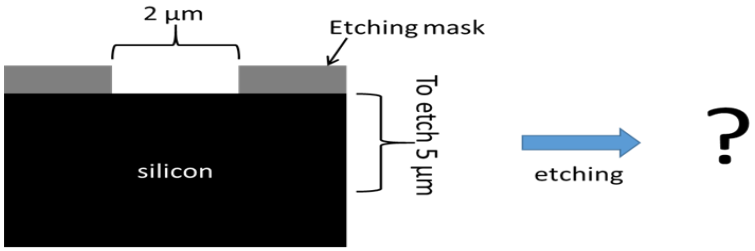
(6+4)

3A. Explain the contact printing and Proximity printing technique.

3B. A boule of silicon is pulled from a melt that contains 0.015% (weight percentage) phosphorus (P).
(i)What concentration (number/cm^3) of P would you expect at the top of the boule ($f=V_s/V_0=0$)?
(ii)If the boule is 1m long, at what position (or f value) would you expect the concentration of P to be twice as large as it is at the top?

(6+4)

4A. (i) Explain the wet etching of silicon.
(ii) Draw the etched profile for silicon after etching 5 µm deep using
(a) Ar^+ ion milling
(b) HF:HNO3:H2O wet etching
(c) KOH wet etching (the wafer is (100) wafer).



4B. Explain the fabrication of NMOS transistor structure.

(6+4)

5A. In a two-step process, phosphorus was diffused into a p-type silicon wafer ($N_B = 10^{16}$ cm^{-3}). In the deposition step, the temperature was 900°C and the diffusion time was 45 minutes. In the drive step, the temperature was 1100°C and the time was 60 minutes. Determine the surface concentration and junction depth. Given, D_0=4.7 cm2/sec, Ea=3.68 eV, solid-solubility of phosphorus in silicon at 900°C=7x10^{20} cm^{-3}.

5B. Why electron beam evaporation is more popular than thermal evaporator? What is the most important reason that evaporation is not used for semiconductor IC manufacturing?

(6+4)

6A. A silicon wafer with n-type background doping of 10^{16} cm^{-3} is subjected to a boron implant. The implant energy is 100 keV and the dose is 10^{16} cm^{-2}. Then the wafer is annealed for 30 minutes at 1000°C. Find the peak concentration and junction depth(s) immediately after implantation and then after annealing. Given, $R_P \approx 0.3$ μm and $\Delta R_P \approx 0.07$ μm.

6B. (i) What is a "Knudsen-cell" used in evaporation and molecular beam epitaxy (MBE) and how does it work? Can it be used for electron beam evaporation?

(ii) Explain Electromigration process.

(6+4)