Bengal Engineering & Science University, Shibpur

Semester Examination, 2011

M. E.(ETC) 1st Semester

Subject: Integrated Circuit Technology(ETC 913)

Time: 3 hrs. F. M.: 70

Answer any five questions; All questions are of equal value

1. a. What are the three most common platforms for fabricating state of the art Integrated Circuits? Is it possible to fabricate IC's on Germanium substrates?
   b. Why Czochralski wafers in a Bipolar technology prefers the <111> surface plane?
   c. Draw one labeled sketch of the CZOCHRALSKI apparatus for yielding p-Si wafers.

   (5+2+7)

2. a. Why clean rooms are at all needed for Fabrication of IC chips? "A particular Fab in Bangalore uses a M3.5 standard clean room". What information is conveyed to you?
   b. Identify the constituents of a positive & negative PR. Outline the principal demerits of negative PR's.

   (7+7)

3. a. Why is Lithography step needed for plantation of circuit components? Draw only the sketches pertaining to the completion of an optical lithography sequence.
   b. Why Non optical lithography is used in State of the art VLSI chips? Describe briefly the principle of either e-beam or X-ray lithography

   (8+6)

4. i. State only the purpose for which the following instruments are used in a microelectronics laboratory: (a) Diamond saw(b) Ellipsometer (c) Mask Aligner & (d) MBE unit
   ii. Given : Molecular weight of Si : 28.9 gm/mol
   Molecular weight of SiO_2: 60.08 gm/mol
   Density of Si: 2.33
   Density of SiO_2: 2.21
   Can you estimate the thickness of silicon consumed for growing a SiO_2 layer 100nm thick?

   (6+8)

5a. Discuss the fabrication procedure of a standard complementary MOS inverter.

b. Where is epitaxial growth required in the fabrication of BJT and why?

(10+4)

6a. Why p-type piezoresistors are fabricated on n-type substrates in a piezoresistive pressure sensor?

b. Draw the flowchart of fabrication of a surface micromachined piezoresistive pressure sensor with the diaphragm size of 300μm by 300μm, piezoresistor dimensions of 10μm by 40μm and distances of piezoresistors from the edges as10μm. Indicate the masks in every step.

(4+10)

7a. Discuss the fabrication process of a cantilever beam by bulk and surface micromachining. Highlight the critical steps in each of the process.

b. How can a capacitive device be fabricated by surface micromachining?

(8+6)

8a. Why a proof mass is required in the design of accelerometers? Develop a flowchart for fabrication of four beamed piezoresistive accelerometers. Indicate the masks in every step.

b. Two membranes of dimensions 500μm by 500μm by 10μm and 200μm by 200μm by 30μm with a gap of 500μm between them are to be fabricated by bulk micromachining. Show the detailed process flow with top view of masks in every step.

(8+6)