

## VLSI Technology

### Assignment 1

#### Part 1: Multiple choice questions – tick the correct answer(s)

1. What is the crystal structure of silicon?
  - (a) Face Centred Cubic
  - (b) Body Centred Cubic
  - (c) Diamond
  - (d) Hexagonal
  
2. In order to etch a V-groove, the orientation of silicon substrate must be
  - (a) (100)
  - (b) (111)
  - (c) (110)
  - (d) (211)
  
3. Aluminium has been discarded as gate metal in MOSFET because
  - (a) It is difficult to deposit Al
  - (b) Al has a lower conductivity than polysilicon
  - (c) Al gets easily oxidised
  - (d) Al cannot withstand high temperature
  
4. npn bipolar transistors are preferred for VLSI because
  - (a) it is easier to provide ohmic contact to p-Si than n-Si
  - (b) it is easier to provide ohmic contact to n-Si than p-Si
  - (c) it is more difficult to make silicon heavily p-type
  - (d) it is more difficult to make silicon heavily n-type
  
5. The packing density in an FCC lattice is
  - (a) 50%
  - (b) 34%
  - (c) 60%
  - (d) 27%
  
6. The cleavage plane for silicon is
  - (a) (100)
  - (b) (110)
  - (c) (111)
  - (d) (211)

Part 2: Fill in the blanks

1. ---- is the most common inadvertent impurity in Czochralski-grown silicon due to the use of -----
2. Silicon is never grown by gradient freeze (Bridgman) technique as it -----.  
Hence crystals grown by this technique have -----
3. In a horizontal epitaxy process, substrates are kept on an inclined substrate holder in order to -----
4. During VPE of silicon, as the concentration of  $\text{SiCl}_4$  is increased the growth rate first ---- and then -----
5. Excess HCl during VPE of silicon will cause -----
6. The two reasons for autodoping during epitaxy are -----
7. Chlorine oxidation is used to -----
8. At the end of thermal oxidation process, the samples are usually flushed in ----- in order to -----
9. The point defects in a crystal can be classified as -----
10. During thermal oxidation of silicon, the oxide thickness first increases ----- and then ----- with time.