

2021

ELECTRONICS— GENERAL

Paper : DSE-A-1

(Semiconductor Devices Fabrication)

Full Marks : 50

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Answer **Question No. 1** and **any four** from the rest.

1. Answer **any ten** :

1×10

- (a) Conductivity of metal _____ with increasing temperature.
(i) increases (ii) decreases
(iii) remains invariant (iv) remains the same
- (b) Schottky defect is a _____ defect.
(i) point (ii) line
(iii) volume (iv) None of these
- (c) For *n* type doping in Si _____ is used.
(i) Al (ii) Ge
(iii) As (iv) In
- (d) Primary pump creates _____ vacuum than secondary pumps.
(i) more (ii) less
(iii) same (iv) None of these
- (e) PLD is a _____ vapour deposition technique.
(i) chemical (ii) physical
(iii) structural (iv) fundamental
- (f) In epitaxial growth, the grown layer is _____.
(i) amorphous (ii) polycrystalline
(iii) single crystalline (iv) None of these
- (g) The inter-solid diffusion can occur by two types of movements _____ and _____.
(i) substitutional, and interstitial (ii) substitutional, and combinational
(iii) combinational, and interstitial (iv) None of these

Please Turn Over

- (h) The terms 'straggle' and 'channeling' are associated with
- (i) CVD (ii) evaporation
(iii) ion implantation (iv) epitaxy
- (i) The I-V equation of the p-n junction diode is known as
- (i) Shockley equation (ii) Einstein relation
(iii) Faraday law (iv) Coulomb's law
- (j) In photolithography, the photoresist is exposed to
- (i) visible light (ii) yellow light
(iii) UV ray (iv) None of these
- (k) The HEPA filter is used in
- (i) rectifier (ii) communication
(iii) cleanroom (iv) None of these
- (l) MOS technology has _____ packing density than bipolar technology.
- (i) lower (ii) same
(iii) higher (iv) invariant
2. (a) Why Si is preferred for IC fabrication?
(b) Compare the properties of metal, semiconductor and insulators.
(c) Explain various defects in crystal briefly with diagram. (2+3+5)
3. (a) What is amorphous material?
(b) What is epitaxial film? Name an epitaxial thin film growth technique.
(c) Sketch Czochralski growth system for single crystalline Si ingot preparation. What are different parameters in Czochralski growth technique? [2+(2+1)+(3+2)]
4. (a) What are primary and secondary vacuum pumps?
(b) Which oil is generally used in oil diffusion pump? What is the role of cold trap in diffusion pump?
(c) What is the function of oil in rotary pump? 2+(1+4)+3
5. (a) Compare PLD and sputtering techniques.
(b) Explain with schematic diagram the working principle of electron beam evaporation system.
(c) How does a Penning gauge work? (2+4+4)
6. (a) What is Schottky contact?
(b) Why enhancement mode MOSFETs are 'naturally OFF' and depletion mode MOSFETs are 'normally ON' devices?
(c) Draw the transfer characteristics of an *n*-channel enhancement mode MOSFET and show the threshold voltage in the characteristic curve. What is meant by threshold voltage? (3+4+3)

7. (a) Schematically explain the fabrication process of PN junction.
(b) Differentiate between bipolar technology and MOS technology.
(c) Why NMOS is preferred to PMOS? (5+3+2)
8. (a) Why material selection is important for MEMS devices?
(b) Differentiate between surface and bulk micromachining.
(c) Briefly discuss (i) sacrificial subtractive process and (ii) additive process. 2+3+(2½+2½)
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