

BETCE Examination, 2018 (UG)
 (3rd year, 1st semester
 Supplementary Examination)
 Subject: IC TECHNOLOGY

Full Marks: 100

Time: Three hours

Answer any **five questions** (twenty marks each)
 All the sub-questions should be answered in one place
 The answers should be exact and precise
 The figures in the margin indicate full marks

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| Q1 | (a) Derive Bragg's diffraction condition using an appropriate diagram. | 6 |
| | (b) Draw the {111} plane and $\bar{2}11$ direction in a cubic lattice. | 4 |
| | (c) Classify solid solutions with examples. | 4 |
| | (d) What is Gibb's free energy and how does it modify with temperature? Explain with example. | 6 |
| Q2 | (a) What are the different types of defects in a crystal? Explain with appropriate diagrams. | 2+10 |
| | (b) Draw the Burgers Vector for edge dislocations. | 3 |
| | (c) Calculate the c/a ratio for a hexagonal closed packed structure. | 5 |
| Q3 | (a) Describe the Czochralski method for converting polycrystalline Electronic Grade Silicon into single crystal ingot. | 6 |
| | (b) What is Float Zone technique? Explain how zone refining crystal purification is carried out. | 8 |
| | (c) Explain the generation of characteristic x-ray with schematic diagram of the x-ray tube. | 6 |
| Q4 | (a) Find out the number of atoms per cubic centimetre of Silicon ($a=5.431\text{\AA}$)? | 3 |
| | (b) Write the three basic transport equations for the Deal-Grove Model for the oxidation of Silicon with an appropriate diagram. Define all parameters. | 12 |

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- (c) What are the different types of charges associated with Si/SiO₂ system? Explain with diagram 5
- Q5 (a) State the two Fick's Laws of Diffusion. 4
 (b) Cite examples for (i) solid source (ii) liquid source and (iii) gas source diffusion system 6
 (c) Explain graphically the diffusion from an (i) infinite source and (ii) limited source on surface. Show the two distribution profiles at a constant temperature, for increasing time. 8
 (d) Derive the activation energy for intrinsic diffusion. 2
- Q6 (a) Describe with an appropriate diagram an ion implanter system. 6
 (b) What are the different types of stopping mechanisms? Explain with the energy loss profiles. 2+3
 (c) What are lateral and longitudinal straggles? 4
 (d) How are the damages from ion implantation process mitigated? 5
- Q7 (a) Define CVD technique. What are the different susceptor configurations used in CVD? 6
 (b) Describe the criteria for the deposition of epitaxial Silicon on to a Silicon substrate 4
 (c) Describe the reactant-transport steps of atmospheric CVD for film deposition. 4
 (d) What is sputtering? Classify sputtering processes. What are the advantages of magnetron sputtering over the conventional sputtering processes? 2+2+2
- Q8. (a) What are the causes of non-conformal step coverage for deposition of SiO₂ films? 4
 (b) Explain the role of PECVD in ensuring conformal step coverage of SiO₂ Film. 4
 (c) Enlist the steps of photolithography. 6
 (d) What are the different exposure systems in photolithography? 6