Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_

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**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **14NT2002** | **Duration :** | **3hrs** |
| **Sub. Name :** | **MATERIALS SCIENCE AND ENGINEERING - I** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Differentiate the materials with long range atomic order and short range atomic order. | CO1 | 3 |
| b. | Calculate the atomic radius of a crystal of (i) BCC system and (ii) FCC system if the lattice parameter for the systems are 4.0 Å. | CO3 | 3 |
| c. | Calculate the number of atoms and atomic packing factor for SC, BCC and FCC structures. | CO3 | 14 |
| (OR) | | | | |
| 2. | a. | Draw (100), (111) and (001) plane in a cubic unit cell. | CO3 | 3 |
| b. | Calculate the coordination number of HCP unit cell, mention its atomic packing factor. | CO3 | 3 |
| c. | With neat sketch, differentiate the seven different crystal systems. Mentions their lattice parameters. | CO3 | 14 |
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| 3. | a. | Differentiate metals, semiconductors and insulators based on their energy band structure. | CO3 | 3 |
| b. | Define polarisation. | CO2 | 3 |
| c. | Explain in detail, ionic and electronic polarisation. | CO2 | 14 |
| (OR) | | | | |
| 4. | a. | Briefly discuss about line dislocations with suitable sketch. | CO3 | 3 |
| b. | Define dielectric constant. Mention some dielectric materials. | CO2 | 3 |
| c. | Derive the expression for Hall coefficient for an-type semiconductor. | CO3 | 14 |
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| 5. | a. | Differentiate Schottky and Frenkel defect. | CO2 | 3 |
| b. | Define dislocation movement. Recall the type of deformation that takes place by the movement of dislocations. | CO1 | 3 |
| c. | With suitable examples, discuss in detail about intrinsic and extrinsic semiconductors. | CO3 | 14 |
| (OR) | | | | |
| 6. | a. | Mention the role of grain boundaries in poly crystalline materials. | CO1 | 3 |
| b. | Write short notes on p-type and n-type semiconductors with suitable examples. | CO3 | 3 |
| c. | Explain in detail, the different types of Lattice defects in a crystalline material. | CO3 | 14 |
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| 7. | a. | Mention Fick’s first law in equation form and describe all the parameters. | CO1 | 3 |
| b. | Distinguish between steady and non-steady state diffusion. | CO1 | 3 |
| c. | A 1cm layer of MgO is deposited as a diffusion barrier between Ni and Ta. At 1400oC , Ni ions are created and diffuse through MgO to Ta. Determine the number of Ni ions that pass through the MgO per second. (Given the diffusion coefficient of Ni ion MgO is 9x10-12 cm2/s and the lattice parameter of Ni at 1400oC is 3.6x10-8 cm, Note- the crystal structure of Ni is FCC). | CO1 | 6 |
| d. | Explain in detail, the various factors that affect diffusion. | CO1 | 8 |
| (OR) | | | | |
| 8. | a. | Differentiate self and inter diffusion. | CO1 | 3 |
| b. | Differentiate vacancy diffusion and interstitial diffusion. | CO1 | 3 |
| c. | Describe the atomic mechanisms of diffusion. Which mechanism is more probable? Why? | CO1 | 14 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | Describe the application of diffusion in sintering. | CO1 | 8 |
| b. | Describe the application of diffusion in doping of semiconductors, with suitable examples. | CO3 | 12 |