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



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – Nov/Dec– 2017**

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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. | Distinguish between crystalline and amorphous materials. | 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 3.5 Å. | CO3 | 3 |
| c. | Define packing factor. Calculate the number of atoms and packing factor for SC, BCC and FCC structures. | CO3 | 14 |
| (OR) | | | | |
| 2. | a. | Draw (001), (111) and (010) plane in a cubic unit cell. | CO3 | 3 |
| b. | Calculate the number of atoms and 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 |
|  |  |  |  |  |
| 3. | a. | Differentiate semiconductors and insulators, based on their energy band gap. | CO3 | 3 |
|  | b. | What is Burger circuit? Explain. | CO3 | 3 |
|  | c. | List the different types of polarisation. Explain in detail, any two types of polarisation. | CO2 | 14 |
| (OR) | | | | |
| 4. | a. | Differentiate screw and edge dislocation. | CO3 | 3 |
|  | b. | Define dielectric constant. What are dielectric materials? | CO2 | 3 |
|  | c. | Define Hall effect. Derive the expression for Hall coefficient for a p-type semiconductor and list the applications of Hall Effect. | CO3 | 14 |
|  |  |  |  |  |
| 5. | a. | Differentiate Schottky and Frenkel defect. | CO2 | 3 |
|  | b. | Define dislocation movement. What type of deformation 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 difference between grain and grain boundary. | CO1 | 3 |
|  | b. | Write short notes on doping of semiconductors. | CO3 | 3 |
|  | c. | Explain in detail, the different types of Lattice defects in a crystalline material. | CO3 | 14 |
|  |  |  |  |  |
| 7. | a. | Write Fick’s second 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. | Briefly explain the necessary conditions for diffusion to occur. | 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 |
|  | |  |  |  |
|  | | **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 |

ALL THE BEST