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



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

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| **Code :** | **16NT2004** | **Duration :** | **3hrs** |
| **Sub. Name :** | **MATERIALS SCIENCE 1** | **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. | Discuss about the number of cells, coordination number and atomic radius in a unit cell of a body centered cubic crystal system. Calculate the packing density of the same. | CO1 | 15 |
| b. | Find the shortest wavelength of X-rays produced by an X-ray tube operated at 10 kV, and hence, calculate the frequency of the X-ray beam emitted. | CO1 | 5 |
| (OR) | | | | |
| 2. | a. | List the various types of bonding in solids. Explain in detail about any two of them. | CO1 | 15 |
| b. | The lattice constants of a cubic lattice is 4.12 Å. Find the lattice spacing between (1 1 1) and (1 2 3) planes. | CO1 | 5 |
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| 3. | a. | Name the 0 (zero) dimensional defects and define the same. Explain ionic 0-D defects with examples. | CO2 | 15 |
|  | b. | Calculate the atomic vacancy concentration of silicon (Si) crystal at 100 °C. The energy for vacancy formation of Si is 2.4 eV per atom. Atomic weight of Si is 28.09 and the density of Si is 2.33 x 103 kg/m3. | CO2 | 5 |
| (OR) | | | | |
| 4. | a. | Name the various types of line defects and explain them in detail. | CO2 | 15 |
|  | b. | Given that the energy of formation of vacancy for aluminum (Al) is 0.75 eV per atom. The concentration of Al is 6.026 x 1028/m3. Calculate the atomic vacancy concentration of Al crystal at 30 °C. | CO2 | 5 |
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| 5. | a. | How does the process of diffusion take place? Explain the mechanisms in detail. | CO3 | 15 |
|  | b. | Carbon is made to diffuse into α-Fe (BCC) lattice at 500 °C. D0= 6.2 x 10-7 m2/s. Qd =0.83 eV/atom. Calculate the diffusion co-efficient at this temperature for carbon. | CO3 | 5 |
| (OR) | | | | |
| 6. | a. | State the factors that influence diffusion. Explain them in detail. | CO3 | 15 |
|  | b. | A diffusion process takes place at a temperature 500 °C with Iron atoms (Fe) in host α-Fe (BCC) crystal lattice. (self diffusion). Given that Do= 2.8 x 10-4 m2/s. The activation energy Qd is given as 2.6 eV/atom. Calculate the diffusion co-efficient D for this process. | CO3 | 5 |
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| 7. | a. | Summarize the various kinds of mechanical behaviour phenomena one has to understand. Explain any two of them briefly | CO4 | 15 |
|  | b. | A wooden rod is subjected to non-uniform bending. The length of the rod between the knife edges is 80 cm. The mass applied is 50 gm. The breadth of the beam is 2.76 cm. The thickness of the beam is 5.86 mm. Calculate the Young’s modulus value if the depression for 50 gram is about 0.1123 cm. | CO4 | 5 |
| (OR) | | | | |
| 8. | a. | Describe the strengthening mechanisms to avoid plastic deformation process. | CO4 | 15 |
|  | b. | A very thin iron rod is subjected to non-uniform bending. The length of the rod between the knife edges is 80 cm. The mass applied is 250 gm. The breadth of the beam is 2.5 cm. The thickness of the beam is 3.56 mm. Calculate the Young’s modulus value if the depression for 250 gram is about 0.1323 cm. | CO4 | 5 |
|  | | **Compulsory:** |  |  |
| 9. | a. | Explain in detail Czochralski method of growing crystals. | CO5 | 15 |
|  | b. | Illustrate with example the process of diffusion process in semi-conductor industry. | CO5 | 5 |

ALL THE BEST