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



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **17NT2004** | **Duration :** | **3hrs** |
| **Sub. Name :** | **MATERIALS SCIENCE – 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. | Identify the crystal system from the following parameters.   1. a=b=c; All angles = 90o 2. a=b≠c; 2 angles = 90o, one angle=120o 3. a≠b≠c; 2 angles = 90o, one angle ≠ 90o 4. a≠b≠c; All angles =90o 5. a=b=c; All angles ≠ 90o | CO1 | 5 |
| b. | Discuss in detail the different types of bonding in solids. | CO1 | 15 |
| **(OR)** | | | | |
| 2. | a. | Differentiate between ceramics and composites based on their constituents and properties. | CO2 | 5 |
| b. | Calculate the number of atoms, coordination number and atomic packing factor for HCP crystal structure. | CO2 | 15 |
|  |  |  |  |  |
| 3. | a. | Mention the steps to determine the Miller indices with an example. | CO2 | 5 |
| b. | Discuss in detail the different types of defects and imperfections in solids. | CO3 | 15 |
| **(OR)** | | | | |
| 4. | a. | Identify the following directions within the BCC unit cell  i) [1 1 1] ii) [1 1 0] iii) [0 1 1] | CO2 | 3 |
| b. | Identify the following crystal planes in a simple cubic unit cell  i) (100) ii) (001) iii) (110) iv) (101) v) (111) | CO2 | 5 |
| c. | Describe the Czochralski’s technique to prepare single crystalline silicon ingot. | CO6 | 12 |
|  |  |  |  |  |
| 5. | a. | Differentiate between the interstitial and vacancy atomic mechanisms for diffusion with suitable sketch. | CO4 | 4 |
| b. | Describe the steady state diffusion and non-steady state diffusion with suitable sketch. | CO4 | 16 |
| **(OR)** | | | | |
| 6. | a. | Describe in detail the applications of diffusion in sintering. | CO4 | 10 |
| b. | An FCC iron-carbon alloy initially containing 0.20 wt% C is carburized at an elevated temperature and in an atmosphere that gives a surface carbon concentration constant at 1.0 wt%. If after 49.5 h the concentration of carbon is 0.35 wt% at a position 4.0 mm below the surface, determine the temperature at which the treatment was carried out.  Given:  ---------------------------  z erf(z)  ---------------------------  0.85 0.7707  0.90 0.7970  0.95 0.8209  1.0 0.8427 | CO4 | 10 |
|  |  |  |  |  |
| 7. | a. | Distinguish yield strength from tensile strength. | CO4 | 4 |
| b. | Define fatigue. Explain in detail the various factors that influences the fatigue life and mention the methods to improve fatigue life. | CO4 | 16 |
| **(OR)** | | | | |
| 8. | a. | Distinguish brittle fracture from ductile fracture. | CO4 | 4 |
| b. | Define creep. Sketch a creep curve and discuss about each stage in the curve. Mention the methods to increase creep resistance. | CO4 | 8 |
| c. | Sketch a typical stress-strain curve and mention the different regions in the curve. | CO4 | 8 |
|  | | **Compulsory**: |  |  |
| 9. | a. | Define solubility limit. | CO5 | 2 |
| b. | Explain the lever rule in the determination of each phase present in the phase diagram. | CO5 | 4 |
| c. | Schematically sketch the isomorphous phase diagram of Cu-Ni system. Label the various phase regions, solidus and liquidus lines. Discuss the different rules in determining the following:   1. Phases present 2. Phase compositions 3. Phase weight fractions | CO5 | 14 |