2072
B.E. (Mechanical Engineering)
Sixth Semester
MEC-605: Materials and Heat Treatment

Time allowed: 3 Hours   Max. Marks: 50

NOTE: *Attempt* <u>*five*</u> *questions in all, including Question No. I which is compulsory and selecting two questions from each Section.*

x-x-x

1. (a) What is the effect of alloying molybdenum and Tungsten in steels?

   (b) Crystalline solid are anisotropic in nature. What does this statement means?

   (c) Define the term 'stacking fault'.

   (d) Draw in unit cube the crystal plane that has the following Miller indices $(1, \bar{2}, 1)$.

   (e) What are the main limitations of solid solution strengthening?

                                                                    (5x2)

Section A

2. (a) Differentiate between Edge dislocation and Screw dislocation with neat sketches.   5

   (b) Discuss various types of Non-Stoichiometric defects.   5

3. (a) Iodine has an orthorhombic unit cell for which the a, b, and c lattice parameters are 0.481, 0.720, and 0.981 nm, respectively. If the atomic packing factor and atomic radius are 0.547 and 0.177 nm, respectively, determine the number of atoms in each unit cell.   5

   (b) Derive planar density expressions for BCC (110) plane in terms of the atomic radius R.   5

4. (a) Differentiate between Homogeneous and Heterogeneous nucleation? In which case nucleation rate will be high and why?   5

   (b) Derive the expression for critical nucleus size and critical free energy change for homogeneous nucleation.   5

Section B

5. Draw the TTT curve of eutectoid steel showing the beginning and ending of phase transformations, various phases and superimpose it with CCT curve. Also, specify 'critical cooling rate'.   10

6. (a) With the aid of suitable diagram, explain the process of Martempering. How does it differ from austempering? What do the microstructures of martempered and austempered steel consist of?   5

   (b) State the purpose of annealing steel. Discuss diffusion annealing and recrystallization annealing.   5

7. (a) Explain any two techniques of diffusion hardening.   5

   (b) Describe the 'mechanical methods' used for measurement of case depth.   5

x-x-x