BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – B.Tech.(CE)]-2021
Course Name – Engineering Materials
Course Code - PCC-CE701
(Semester VII)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A
(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Describe a characteristic of a face-centered cubic (FCC) unit cell
   a) Atoms at the corners only
   b) Atoms at the corners and the center
   c) Atoms at the corners and the centers of the faces
   d) Atoms at the edges only

(ii) Describe the arrangement of atoms in a hexagonal close-packed (HCP) structure.
   a) A cubic lattice
   b) A triangular lattice
   c) A hexagonal lattice
   d) A rectangular lattice

(iii) Examine which type of point defect is present in solids
   a) Dislocations
   b) Grain boundaries
   c) Vacancies
   d) Precipitates

(iv) Describe the main effect of dislocation strengthening mechanisms.
   a) Decrease the number of atoms in a crystal
   b) Increase the hardness and strength of materials
   c) Eliminate all types of defects
   d) Increase the grain size

(v) Define what "slip" refers to in dislocation theory.
   a) The sliding of atoms along planes in a crystal lattice
   b) The movement of atoms across a phase boundary
   c) The diffusion of atoms through a material
   d) The breaking of atomic bonds

(vi) Identify which of the following defects is considered an interfacial defect
   a) Edge dislocation
   b) Screw dislocation
   c) Grain boundary
   d) Vacancy

(vii) Recognize the type of dislocation is associated with a helical or spiral atomic arrangement

a) Edge dislocation
b) Screw dislocation
c) Mixed dislocation
d) Thread dislocation

(viii) Illustrate how the concept of critically resolved shear stress (CRSS) is used in material science

a) To determine the thermal expansion coefficient
b) To evaluate the amount of stress needed for plastic deformation
c) To measure the electrical resistance of a material
d) To assess the density of a material

(ix) Describe the test that involves applying a twisting force to measure material properties.

a) Torsion test
b) Tensile test
c) Compression test
d) Hardness test

(x) List the methods for measuring hardness.

a) Vickers
b) Brinell
c) Young's modulus
d) Rockwell

(xi) Describe what ductility refers to in terms of mechanical properties.

a) The ability of a material to absorb energy before fracturing.
b) The ability of a material to deform plastically under tensile stress.
c) The resistance to indentation or penetration.
d) The ability of a material to resist shear stress.

(xii) List the property that describes the maximum stress a material can withstand without permanent deformation.

a) Yield strength
b) Ultimate tensile strength
c) Hardness
d) Elastic modulus

(xiii) List the property that measures the amount of energy a material can absorb before failing.

a) Toughness
b) Ductility
c) Hardness
d) Young's modulus

(xiv) Compare the phases present in cast iron with those in steel.

a) Cast iron contains more cementite; steel contains more ferrite
b) Cast iron contains more ferrite; steel contains more cementite
c) Cast iron has a higher carbon content; steel has a lower carbon content
d) Cast iron is more ductile; steel is more brittle

(xv) Differentiate between the solidification processes of cast iron and steel.

a) Cast iron solidifies with a higher carbon content and forms different phases compared to steel
b) Cast iron and steel solidify in the same manner and form the same phases
c) Cast iron solidifies at a lower temperature; steel solidifies at a higher temperature
d) Cast iron and steel have identical solidification processes

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Explain yield strength. (3)
3. Define resilience in the context of material properties. (3)
4. Explain the main phases in the iron-carbon phase diagram. (3)
5. Describe the difference between substitutional and interstitial solid solutions. (3)
6. Explain the four types of cast iron and their key properties. (3)

OR

Explain the primary alloying elements in brass. (3)

Group-C
(Long Answer Type Questions) 5 x 6=30

7. Define the concept of a unit cell in crystallography. Describe its role in determining the crystal structure of a material. (5)
8. Compare and contrast the roles of interstitial and substitutional point defects in altering the properties of ceramics. (5)
9. Analyze the development of microstructure in cast iron and its dependence on carbon content and cooling rate. (5)
10. Explain how the interpretation of a phase diagram can influence alloy composition and processing decisions. (5)
11. Analyze the impact of alloying elements on the phase diagram of a metal system. Provide examples of how alloying affects phase stability and microstructure. (5)
12. Write the different types of metallic crystal structures. Compare and contrast FCC, BCC, and HCP structures with examples. (5)

OR

Express the types of defects found in crystalline solids. How do these defects affect the material properties. (5)

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