KATHMANDU UNIVERSITY
End Semester Examination [C]
April, 2022

Marks scored:

Level : B.E.
Year : II

Course : MEEG 213
Semester : I

Exam. Roll No. :

Time: 30 mins.

F.M. : 10

Registration No.:

Date :

SECTION "A"

[20 Q × 0.5 = 10 marks]

Choose the most appropriate answer and **mark [X]**.

1. Aluminum foil used for food packing belongs to which category of material.
   [ ] Metals [ ] Polymers [ ] Composites [ ] Ceramics

2. Packing factor of FCC and HCP crystal structure are _____.
   [ ] 0.68 for both [ ] 0.74 for both
   [ ] 0.68 and 0.74 respectively [ ] 0.74 and 0.68 respectively

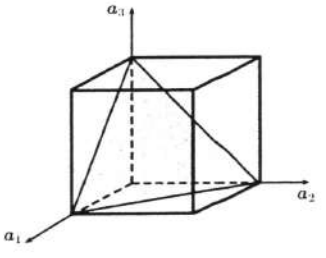
3. The property of a material that resists penetration or indentation by means of abrasion or scratching is known as _____.
   [ ] strength [ ] hardness [ ] toughness [ ] brittleness

4. Molar mass of silver is 107.868 g/mol and Avogadro's number, Na = 6.023×10^{23} /mol. Calculate the number of atoms in 100 g of silver.
   [ ] 6.02×10^{23} atoms [ ] 7.05×10^{23} atoms
   [ ] 5.95×10^{23} atoms [ ] 5.58×10^{23} atoms

5. In Charpy impact test, the specimen is kept as _____.
   [ ] simply supported beam [ ] cantilever beam
   [ ] overhanging beam [ ] fixed ended beam

6. The correct order of coordination numbers for SC, BCC, FCC and HCP unit cells are:
   [ ] 6, 8, 12, 12 [ ] 8, 8, 12,12 [ ] 6, 6, 12, 12 [ ] 8, 12, 12, 12

7. In the given unite cell, plane A is denoted by _____.
   [ ] (000)
   [ ] (111)
   [ ] (101)
   [ ] (110)



8. Which of the following is true for crystal defects?
   [ ] Point defect is a type of defect where a plane of atom is missing.
   [ ] Defects may be created intentionally to produce a desired set of electronic, magnetic, optical, or mechanical properties.
   [ ] Grain boundaries are the only form of surface defect present in materials.
   [ ] Substitutional defect is the one in which positive and negative irons are missing from the crystal arrangement.

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Level : B.E.
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Time : 2 hrs. 30 min.

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Semester: I
F.M. : 40

SECTION "B"

Attempt ALL the questions. Assume suitable data if necessary.

1.

a. Given four different materials: cast iron engine block, heat resistant refractories, polyethylene bag and plywood, state the four general classification of materials with two additional examples for each type of the materials. [3]
b. Tabulate the principle differences between ionic and covalent bonding. [2]
c. Write short notes on Material science and engineering tetrahedron. [1]

2.

a. What do you mean by perfectly aligned crystal structure? Explain the significance of crystal defects on the material properties. [2]
b. Explain the procedure to identify Miller indices of crystallographic direction. Indicate direction [121] in cubic unit cell. [2]
c. Copper has an FCC metal structure with an atom radius of 0.1278 nm. Calculate its theoretical density. (molar mass of Cu = 63.5 g/mol) [2]
d. What do you mean by Burger's vector? Sketch and explain Burger's vector for screw dislocation. [3]

3.

a. Draw a complete stress-strain diagram for ductile metal alloy and label the diagram properly. With respect to the diagram, explain all the material parameters that could be obtained from the diagram. Also, provide formulas to evaluate those parameters. [4]
b. Define material hardness. Explain Rockwell hardness scales. [2]
c. State the differences between ductile and brittle fracture of materials. [2]

4.

a. Define homogeneous and heterogeneous nucleation in solidification process with suitable examples. [2]
b. Explain different casting defects observed in the cast structure. [2]
c. What do you mean by solid solution strengthening? [1]
d. State Lever rule for phase composition. Figure 1 presents Copper – Nickel phase diagram, using Lever rule determine the amount of each phase in the Cu-40% Ni alloy at 1250 °C. [3]

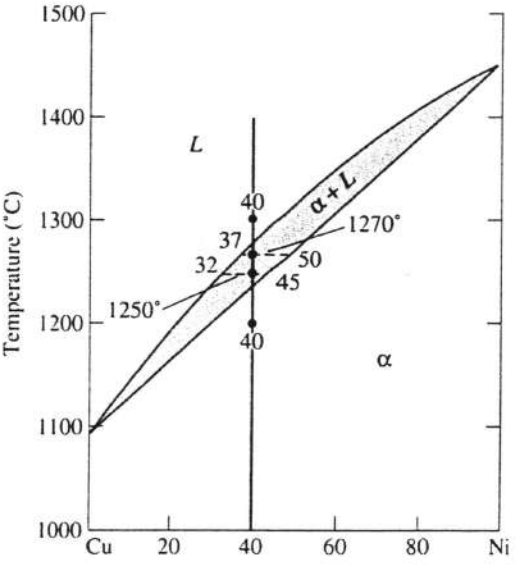

Figure 1: Copper – Nickel phase