KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Marks Scored:

Level : B.E.
Year : II

Course : MEEG 213
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 11 DEC 2024

SECTION "A"

[20Q. × 0.5 = 10 marks]

Choose and mark [X] in the most appropriate option from each set of choices

1. Metallic glasses are _____.
   [ ] liquid crystals [ ] amorphous metals [ ] single crystals [ ] glass ceramics

2. The highest relative length of stream in spark test is seen in _____.
   [ ] wrought iron [ ] white cast iron [ ] high speed steel [ ] aluminum

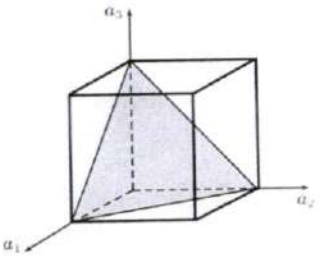
3. Which of this iron form exhibit non-magnetic properties?
   [ ] Pearlite [ ] Ferrite [ ] Austenite [ ] Martensite

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

5. 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.

6. Calculate the number of atoms in 100 g of silver. (molar mass of silver = 107.868 g/mole)
   [ ] 6.023×10^{23} atoms [ ] 6.12×10^{23} atoms
   [ ] 5.58×10^{23} atoms [ ] 5.12×10^{23} atoms

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



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

9. A metal rod is subjected to tensile stress. The metal rod is 100 mm long and the change in length due to the tensile stress is 0.05 mm. Calculate the value of the applied tensile stress. (Given E of the metal rod is 200 GPa.)
   [ ] 25 MPa [ ] 50 MPa [ ] 75 MPa [ ] 100 MPa

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

11. In phase nucleation process, the nucleated solid is _____ if its radius is less than the critical radius.
[ ] a nucleus [ ] an embryo [ ] a tiny particle [ ] a molecule

12. The Miller indices of a plane along Y and Z direction is zero. Which of the following is true?
[ ] The plane is parallel to Y-axis [ ] The plane is parallel to X-axis
[ ] The plane is parallel to Z-axis [ ] The plane is perpendicular to X-axis

13. Formation of micro-voids in the failed material indicates_____.
[ ] ductile fracture [ ] brittle fracture [ ] fatigue fracture [ ] corrosion failure

14. In the solidification process of metal casting, which type of crystals are formed near the mold face?
[ ] Big crystals systematic orientation [ ] Big crystals random orientation
[ ] Small crystals systematic orientation [ ] Small crystals random orientation

15. Which of the following statement is correct?
[ ] At T_m (bulk melting point), Gibb's free energy ΔG is zero
[ ] At T_m (bulk melting point), the solidification does not take place
[ ] At T_m (bulk melting point), critical radius of nuclei r* is zero
[ ] At T_m (bulk melting point), critical radius of nuclei r* is infinity

16. Common cooling heat treatment labels (with increasing cooling rate in steels) are:
[ ] Normalizing < Oil quench < Water quench< Full annealing
[ ] Full anneal < Normalizing < Oil quench < Water quench
[ ] Full annealing < Oil quench < Normalizing < Water quench
[ ] Oil quench < Water quench < Full anneal < Normalizing

17. A Heat treated Cu-40%Zn brass alloy is stronger than pure copper. If the solubility limit of Zn in Cu is 30%, what are the active strengthening mechanisms in brass?
[ ] Solid-Solution strengthening [ ] Dispersion strengthening
[ ] Grain size strengthening [ ] All of the above

18. Which of the following invariant phase transformation process is not observed in iron-carbon phase diagram?
[ ] Peritectic [ ] Monotectic [ ] Eutectic [ ] Eutectoid

19. Which of the following metal has highest specific strength?
[ ] Gray cast iron [ ] Stainless steel [ ] Brass [ ] Aluminum

20. The time dependent extension of steel wire with dead load is known as_____.
[ ] fracture [ ] fatigue [ ] creep [ ] buckling

5.

a. A tensile test is conducted on a copper rod sample having cross-section of 15 mm x 20 mm and length of 1.75 m. At the peak load of 6.5 kN, the length of the rod is 1.91 m and cross-sectional area 255 mm^2.
   i) Calculate engineering stress at the peak load. [1]
   ii) Calculate true stress at the peak load. [1]
   iii) Calculate percentage reduction in area at the peak load. [1]

b. What do you understand by impact load? Explain how impact loading is different from tensile loading in a material. [2]

c. Describe the fatigue failure observed in metallic materials. [2]

d. Explain the similarities and differences between Vickers hardness and Brinell hardness scale used to characterize material hardness. [2]