KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2019

Marks scored:

Level: B.E.
Year : II

Course : MEEG 213
Semester: I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No. :

Date : FEB 25 2019

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Tick the most appropriate answer.

1. Ductility of a material can be defined as
   [ ] ability to undergo large permanent deformations in compression
   [ ] ability to recover its original form
   [ ] ability to undergo large permanent deformations in tension
   [ ] none of the above

2. The elastic stress strain behavior of rubber is
   [ ] linear [ ] non-linear [ ] plastic [ ] unpredictable

3. A material is known as allotropic if it
   [ ] has fixed structure under all conditions
   [ ] exists in several crystal forms at different temperatures
   [ ] responds to heat treatment
   [ ] has its atoms distributed in a random pattern

4. The defect that occurs due to displacement of an ion is known as
   [ ] Vacancy defect [ ] Schottky defect [ ] Frankel defect [ ] Interstitial defect

5. In screw dislocation, the Burger's vector lies _____ to the dislocation line
   [ ] perpendicular [ ] parallel [ ] sideways [ ] at a specific angle

6. Which of the following is point defect in crystals
   [ ] edge dislocation [ ] interstitials [ ] grain boundaries [ ] cracks

7. Brinell hardness test uses a hardness steel ball of size
   [ ] 5 mm [ ] 10 mm [ ] 25 mm [ ] 15 mm

8. Toughness of a material is equal to area under _____ part of the stress-strain curve.
   [ ] elastic [ ] plastic [ ] both [ ] none

9. In tensile test necking starts at
   [ ] ultimate tensile stress [ ] lower yield stress
   [ ] upper yield stress [ ] breaking point

10. The property of a material to resist elastic deformation is known as
    [ ] stiffness [ ] hardness [ ] malleability [ ] strength

11. Chilled iron has
[ ] no graphite
[ ] very high percentage of graphite
[ ] low percentage of graphite
[ ] graphite as its basic constituent of composition

12. Hypereutectoid steels have structures of
[ ] pearlite alone
[ ] phases of cementite and pearlite
[ ] phases of ferrite and pearlite
[ ] phases of cementite and ferrite

13. Which of the following constituents of steels is softest and least strong
[ ] austenite [ ] pearlite [ ] ferrite [ ] cementite

14. Annealing of steel is done to impart the following property in steel
[ ] ductility [ ] toughness [ ] hardness [ ] none

15. Mild steel can be converted into high carbon steel by using which of the following process?
[ ] Annealing [ ] Normalizing [ ] Case hardening [ ] Quenching

16. Which one of the following is not correct
[ ] martensite has a BCC structure
[ ] austenite has FCC structure
[ ] martensite is solid solution of carbon in BCC iron
[ ] martensite which is formed during quenching is too brittle

17. A peritectic reaction is defined as
[ ] two solids reacting to form liquids
[ ] two solids reacting not to form a liquid
[ ] a liquid and solid reacting to form another solid
[ ] two solids reacting to form another solid

18. Pick up wrong property of austenite
[ ] softness [ ] ductility [ ] magnetism [ ] malleability

19. White cast iron contains carbon in the form of
[ ] free carbon [ ] graphite [ ] cementite [ ] ferrite

20. Following is the unique property of polymer material
[ ] elasticity [ ] viscoelasticity [ ] plasticity [ ] none

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February/March, 2019

FEB 2 5 2019

Level: B.E.
Year : II
Time: 2 hrs. 30 mins.

Course : MEEG 213
Semester: I
F. M. : 40

SECTION "B"
[40 marks]

Attempt *ALL* questions. Assume suitable data if necessary.

Q.N.1

a. Define composition, structure, synthesis and processing. [2]
b. Explain why single crystal silicon is currently the material of choice for microelectronics applications. [2]

Q.N.2

a. Define the terms lattice, unit cell, basis and crystal structure. [2]
b. Explain the difference between an amorphous and a crystalline material. [2]

Q.N.3

a. The yield strength of mild steel with an average grain size of 0.05 mm is 138 MPa. The yield stress of the same steel with a grain size of 0.007 mm is 276 Mpa. What will be the average grain size of the same steel with a yield stress of 207 MPa? Assume the Hall-Petch equation is valid and that changes in the observed yield stress are due to changes in grain size.
The Hall-Petch equation is $\sigma_y = \sigma_0 + Kd^{-1/2}$ [2]
b. Given two examples of imperfections in atomic arrangements that lead to a desirable property. [1]

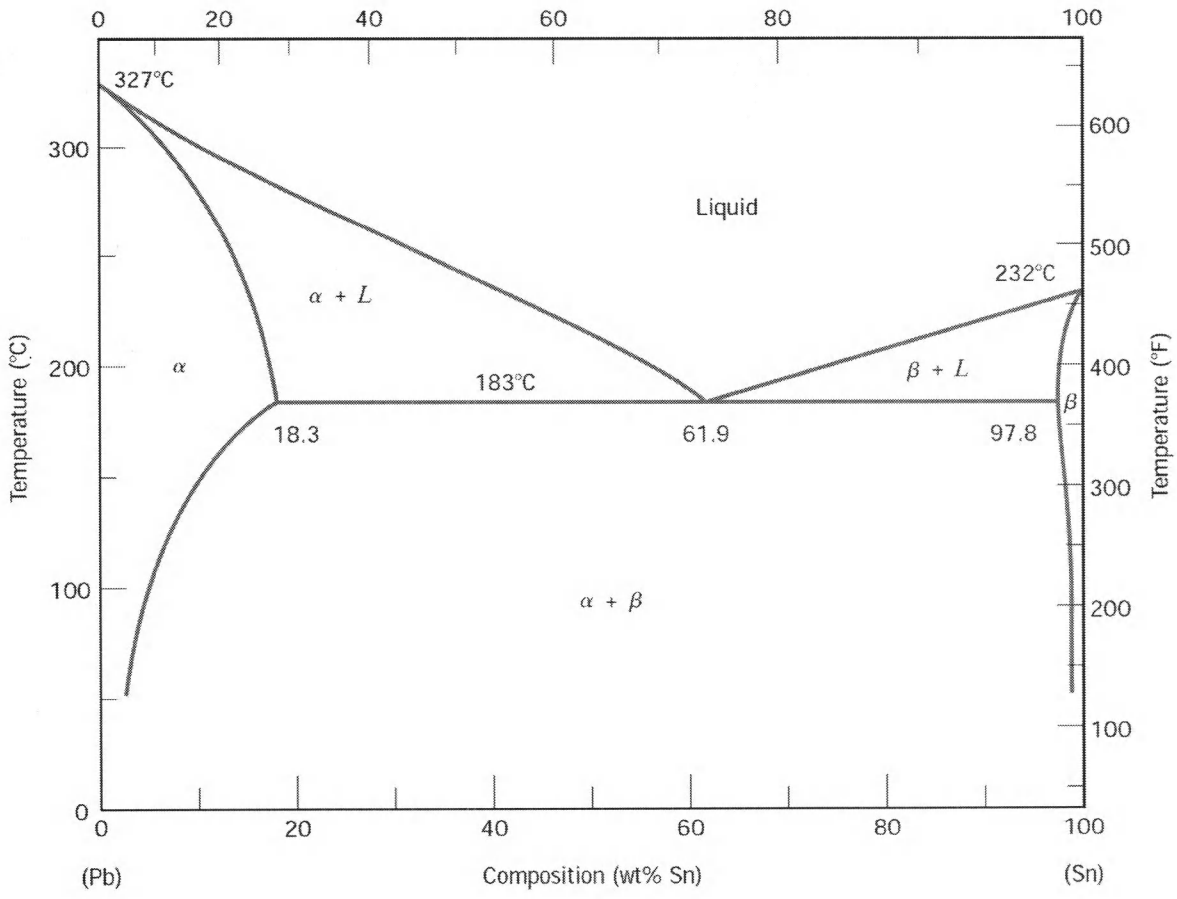
Q.N.4

a. Explain tensile test in detail. Discuss the properties that are obtained from tensile test with the help of stress-strain curve for ductile material. [4]
b. Define impact toughness? Discuss how impact test is useful in determining ductile to brittle transition temperature. [2]
c. Describe rotating cantilever beam test for fatigue failure. Explain the terms fatigue limit, fatigue strength and endurance limit with the help of S-N curve. [2]

Q.N.5

a. Explain the terms superheat, recalescence, thermal arrest, total and local solidification time with the help of cooling curve for pure metal with no inoculation. [4]

b. A 5-cm-cube solidifies in 4.6 min. Assume n = 2. Calculate mold constant in Chvorinov's rule and solidification time for a 12.5 cm x 12.5 cm x 15 cm bar cast under same conditions. [2]
c. Referring to the phase diagram given, identify phases and their composition for 40 wt% Sn-60 wt% Pb alloy at 150 °C. Calculate the relative amount of each phase present in terms of mass fraction. [1+2]



Q.N.6

a. Draw a self-explanatory iron-iron carbide phase diagram showing all the important phases and reactions. [3]

b. Discuss the difference between full annealing and normalizing. [2]

c. Draw and describe TTT diagram for steel of eutectoid composition. Explain the difference between TTT and CCT diagram. [3+1]

Q.N.7

a. Write down two most important properties of ceramics. [1]

b. Differentiate between polyethylene and polyvinyl chloride in terms of structure, properties and applications. [2]