

E-3016**B. E. IV Semester (Main & Re-Exam.) July, 2013****MATERIALS AND MECHANICAL METALLOGY**

Branch : MU

(New Course)

Time : Three Hours]**[Maximum Marks : 75/50****[Minimum Marks : 30/20**

Note : Attempt *all* the questions of *Section-A*, *four* questions from *Section-B* and *three* questions from *Section-C*.

SECTION - AWrite down *True or False* : $1 \times 15 = 10(50)$ $1.5 \times 10 = 15(75)$

1. Isotopes having different mass numbers but same atomic numbers.
2. Elasticity is the property of a metal due to which it resists permanent deformation under applied loads.
3. Toughness is the property an account of which a material is able to withstand bending or torsion without fracture.
4. Crystal may be considered as a regular array of units.
5. The distance between atom points is called lattice spacing.
6. A unit cell is the smallest repeating unit in the space lattice.
7. Atomic Packing factor =
$$\frac{\text{volume of atoms per unit cell}}{\text{volume of the unit cell}}$$

P.T.O.

8. Protective coatings on materials are used to prevent the material from corrosion.
9. A composite material is the resultant of two or more materials.
10. Bearing are used for supporting moving shafts and spindles of a machine tool.

SECTION - B

(Short Answer Type)

Attempt any *four* questions.

$4 \times 4 = 16(50)$

$6 \times 4 = 24(75)$

1. What is stress-strain diagram ? Explain various factors affecting stress-strain diagram.
2. Explain Time-Temperature-transformation (TTT) diagram.
3. Discuss the soft and hard magnetic materials and also explain magnetic storage.
4. Discuss various types of plastics and their application in various industries.
5. Discuss various types of corrosion. Explain prevention and control of corosions.
6. Explain the term percentage elongation and proof stress.

SECTION - C

(Long Answer Type)

Attempt any *three* questions out of *five* questions.

$8 \times 3 = 24(50)$

$12 \times 3 = 36(75)$

1. What are the different factors which influence the corrosion ? Differentiate between corrosion and degradation. What is the importance of galvanic series.

(2)

2. What is hardness ? How does the Rockwell hardness test differ from the Brinell hardness test ?
3. Write short notes on any two :
 - (a) Thermoplastics and thermosetting plastics
 - (b) Smart materials and its applications
4. What is heat treatment ? Why are the steels heat treated ? Describe the various heat treatment processes.
5. What is fatigue of a material ? How does a metal fail to fatigue ? Discuss the effects of various factors on fatigue strength of materials.

E-3424

B. E. IV Semester (Main & Re-Exam) Examination, 2014
MATERIAL & MECHANICAL METALLURGY
ME-IV Sem.

Time : Three Hours]**[Max. Marks : 75/50****[Min. Marks : 30/20**

Note : Attempt *all* questions of **Section - A** four from **Section B** and *three* questions from **Section C**.

SECTION - A**(Objective Type Questions)** **$1.5 \times 10 = 15(75)$**

1. The correct order of the co-ordination number in BCC, FCC and HCP unit cell is
 (a) 6, 8, 12 (b) 8, 12, 12 (c) 12, 8, 12 (d) 12, 8, 6
2. Following are three elastic properties Measured as stress from stress-strain diagram
 (a) Yield Point
 (b) Elastic limit
 (c) Proportional limit

The three of these arranged in ascending order are

- | | | | |
|---------|---------|---------|---------|
| (a) abc | (b) cba | (c) bca | (d) acb |
|---------|---------|---------|---------|
3. Which phenomenon is *not* used in the measurement of hardness ?
 (a) Scratch (b) Indentation (c) Wear (d) Fracture
 4. At given stress and temperature creep rate :
 (a) Remains constant
 (b) Decreases continuously
 (c) Increase continuously
 (d) First decrease, remains constant over considerable limit & then increase
 5. In which of the following faces of steel cementite is in Particle form
 (a) Pearlite (b) Martensite
 (c) Ferrite (d) Bainite

P.T.O.

6. Annealing temperature is :

- (a) Greater than normalizing temperature
- (b) Less than normalizing temperature
- (c) Same as normalizing temperature
- (d) Either less or more than normalizing temperature

7. The correct order of cooling media for decreasing cooling rate :

- (a) Air, water, oil, fused salt
- (b) Water, air, fused salt, oil
- (c) Oil, fused salt air, water
- (d) Water, oil, fused salt, air

8. In the corrosion process by evolution of hydrogen :

- (a) The anodes are larger area than cathodes
- (b) The cathodes are larger area than anodes
- (c) The anode and cathodes are of same area
- (d) None of these

9. The hard magnetic materials used in medical devices is :

- | | |
|------------|-----------------------|
| (a) Alnico | (b) Cunife |
| (c) Cunico | (d) Sm-co type alloys |

10. The measure of ductility is :

- | | |
|-------------------------------|--------------------------|
| (a) Ultimate tensile strength | (b) Yield strength |
| (c) Percentage elongation | (d) Modulus of toughness |

SECTION - B

(Short Answer Type Questions)

$6 \times 4 = 24(75)$

1. Why does the hardness reduce after tempering of a Plane carbon steel ? Explain it.

2. What is Electro chemical corrosion. Explain corrosion mechanism involving hydrogen evolution and oxygen absorption.

3. What is magnetic hysteresis ? Differentiate between hard and soft magnetic material.

4. Differentiate between annealing and Process annealing. What purpose are achieved in these two properties ?
5. What is fatigue of a material ? How does a metal fail to fatigue ? Discuss the effect of various factors on fatigue strength of materials.
6. NaCl has an F.C.C. structure. The density of NaCl is 2.18 g/cm^3 . Calculate the distance between two adjacent atom.

SECTION - C

(Long Answer Type Question)

$12 \times 3 = 36(75)$

1. (a) What is a crystal and what is meant by crystalline solid ? Give the name of substances that are crystalline.
 (b) What is a unit cell ? Describe different unit cell.
 2. (a) What is creep ? Explain characteristic creep curve, stress rupture curve and creep parameters.
 (b) Explain time-temperature transformation diagram.
 3. (a) Draw the following crystallographic planes in cubic unit cell.
 (i) (101)
 (ii) (110)
 (iii) (221)
 (b) Write short notes on :
 Thermoplastics, thermosetting Plastics, Smart materials and its applications.
 4. (a) What is hardness ? How does the Rock-well hardness test differ from the Brinell hardness test.
 (b) Explain corrosion of metal in liquid. What is electromotive force series of metals.
 5. (a) Why it is necessary to temper a quenched steel ? Discuss different ranges of temper temperature.
 (b) Compare the properties of bearing bronzes, Babbitt materials and copper lead alloys for bearing.
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(3)

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E-66

B.E. IV Semester (Main & Re-Exam.) May 2015

Materials & Mechanical Metallurgy

Mech. Engg.

Time : Three Hours /

[Maximum Marks : 75]

[Minimum Marks : 30]

Note : Attempt all the questions of Section-A, four from Section-B and three questions from Section-C.

Section-A

(Objective Type Questions)

Note : This section contain ten objective type questions. They may be fill in the blanks, True/False or Multiple Choice type. $1.5 \times 10 = 15$

1. At given stress and temperature creep rate
 - (a) Remains constant
 - (b) Decrease continuously
 - (c). Increase continuously
 - (d) First decrease, remains constant over considerable limit & then decrease.
2. Cast iron is manufactured in
 - (a) blast
 - (b) cupola
 - (c) open heart
 - (d) Bessemer converter



P.T.O.

3. The type of space lattice found in gamma iron is
- (a) Face centered cubic space lattice
 - (b) body centered cubic space lattice
 - (c) close packed hexagonal space lattice
 - (d) None of these
4. Iron ore is usually found in the form of
- (a) Oxides
 - (b) Carbonates
 - (c) Sulphides
 - (d) All of these
5. Silicon when added to copper improves
- (a) Machinability
 - (b) Hardness
 - (c) Hardness and strength
 - (d) Strength and ductility
6. The charge is fed into the blast furnace through the
- (a) Stack
 - (b) Throat
 - (c) Bash
 - (d) Tuyers
7. The correct order of the co-ordination number in BCC, FCC and HCP unit cell is
- (a) 6,8,12
 - (b) 8,12,12
 - (c) 12,8,12
 - (d) 12,8,6

8. Tungsten when added to steel.....the critical temperature
- (a) does not affect
 - (b) lowers
 - (c) raises
 - (d) may raise or lower
9. The hard magnetic materials used in devices is :
- (a) Alnico
 - (b) Cunife
 - (c) Cunico
 - (d) Sm-co type alloys
10. The lower critical point for all steel is
- (a) 600°C
 - (b) 700°C
 - (c) 723°C
 - (d) 913°C

Section B

(Short Answer Type Questions)

Note : This section will contain six questions. Students will attempt any four questions out of six questions.

$6 \times 4 = 24$

- 1. What is atomic packing factor? Give examples.
- 2. What is magnetic hysteresis? Differentiate between hard and soft magnetic material.
- 3. Differentiate between annealing and process annealing. What purpose are achieved in these two properties?

4. What are the effects of different alloying elements in steel?
5. Define the parameters used for select cutting tool materials.
6. What is fatigue of a material? How does a metal fail to fatigue? Discuss the effect of various factors on fatigue strength of materials.

Section C

(Long Answer Type Questions)

Note : This section will contain five questions. Students will ask to attempt any three questions out of five questions.

$$12 \times 3 = 36$$

1. Discuss the Importance of dislocations. Differentiate between edge and screw dislocations.
2. (a) What are smart materials? Give examples.
(b) Briefly define ceramic and refractory materials. Give example of each.
3. (a) Explain heat treatment process.
(b) Explain the application of phase rule with suitable examples.
4. (a) Discuss the process used to manufacture plastic with neat figures.
(b) Define and differentiate crystalline solids, liquids & glass.
5. (a) Why it is necessary to temper a quenched steel? Discuss different ranges of temper temperature.
(b) Explain time-temperature transformation diagram.

E-438

**B.E. IV Semester (Main & Re-Exam)
Examination, May-2017**

M.M.M.**Time : Three Hours]****[Max. Marks : 75****[Min. Marks : 30**

Note : Attempt all questions of Section-A, Four from Section-B and three questions from Section-C.

Section - A**(Objective Type Question)**

Note : This section will contain ten objective type questions. They may be fill in the blanks. True/False or Multiple Choice Type. $1.5 \times 10 = 15$

1. Which one of the following is not basic component of Materials Science?

(a) Cost	(b) Properties
(c) Structure	(d) Performance
2. Figure out the odd statement about ceramics in the following:

(a) Good Insulators of heat and electricity	(b) Usually less dense than metals
(c) Ductile in nature	(d) Contains both metallic and nonmetallic elements
3. Pick the composite from the list

(a) Wood	(b) Steel
(c) Nylon	(d) Mica
4. Detrimental property of a material for shock load applications

(a) High density	(b) Low toughness
(c) High strength	(d) Low hardness

P.T.O.

5. What is the effect of temperature on stiffness of a metal?
 - (a) Temperature has no effect on stiffness of a metal
 - (b) As temperature increases stiffness of metal decreases
 - (c) As temperature increases stiffness of metal increases
 - (d) None of the above
6. When are the slip lines observed?
 - (a) after plastic deformation
 - (b) before plastic deformation
 - (c) after mechanical working
 - (d) after annealing
7. Which among the following is a paramagnetic material?
 - (a) Iron
 - (b) Cobalt
 - (c) Nickel
 - (d) Aluminum
8. The angle between [111] and [112] directions in a cubic crystal is (in degrees)
 - (a) 0
 - (b) 45
 - (c) 90
 - (d) 180
9. Schottky defect is
 - (a) a vacancy interstitial combination
 - (b) a pair of oppositely charged ion vacancies
 - (c) Purely an interstitial defect
10. The temperature and carbon content at which eutectoid reaction occurs in Fe C equilibrium diagram are
 - (a) 723°C and 0.02% C
 - (b) 723°C and 0.08% C

Section-B

(Short Answer Type Questions)

Note : This section will contain **six** questions. Students will ask to attempt any **four** questions out of **six** questions.

$$6 \times 4 = 24$$

1. Differentiate between edge and screw dislocations.

2. Explain the process of Recovery, Recrystallization and Grain Growth in detail.
3. Name any two commonly used thermosetting polymers and their applications.
4. How is hardenability test is carried out.
5. Explain the term percentage elongation and proof stress.
6. Discuss heat transfer characteristics during quenching and its effect on mechanical properties.

Section-C

(Long Answer Type Questions)

Note : This section will contain **five** questions. Students will ask to attempt any **three** questions out of **five** questions. $12 \times 3 = 36$

1. With a neat sketch explain T-T-T diagram. Indicate its use to a mechanical engineer in practice. Also state its applications. $(6+3+3)$
2. What are composite materials? Explain how they are involved in improving the quality. $(4+8)$
3. Describe Jominy End quench test for the determination of hardenability of steels.
4. (a) Why hardening followed by tempering process.
(b) Explain briefly the process of tempering.
(c) Also enumerate its limitations.
5. Derive an expression for number of atoms per unit cell and Atomic Packing Factor in case of Simple cubic, BCC, and FCC.

(3)

E-712**B. E. IV Semester (Main & Re-Exam) Examination, May 2018****M. M. M.****Branch : ME****Time : Three Hours]****[Maximum Marks : 75****Minimum Marks : 30**

Note : Attempt *all* questions from *Section - A*, *four* questions from *Section - B* and *three* questions from *Section - C*.

SECTION - A**[Marks : $1.5 \times 10 = 15$**

Note : Objective type questions :

1. There are basic crystal systems.

(a) Two

(b) Four

(c) Six

(d) Seven

2. The coordination number of FCC structure its :

(a) Two

(b) Four

(c) Six

(d) Eight

3. The atomic packing factor of a simple cube is approximately equal to :

(a) 0.4

(b) 0.42

(c) 0.52

(d) 0.8

P. T. O.

4. The distance 'd' between adjacent planes of a set of parallel planes of the indices (h, k, l) is given by where 'a' is the edge of the cube.

(a) $d = \frac{a}{\sqrt{h^2 + K^2 + l^2}}$

(b) $d = \frac{a^2}{\sqrt{h^2 + K^2 + l^2}}$

(c) $\cancel{d = \frac{a}{\sqrt{h^2 + K^2 + l^2}}}$

(d) $d = \frac{a^3}{\sqrt{h^2 + K^2 + l^2}}$

5. The ability of a metal to withstand elongation is known as :

(a) Ductility

(b) Stiffness

(c) $\cancel{\text{Brittleness}}$

(d) Malleability

6. The maximum stress at which stress remains directly proportional to strain is called :

(a) \cancel{A} Elastic limit

(b) Yield point stress

(c) Proportional limit

(d) Rupture stress

7. The Brinell Hardness Number (B. H. N.) is found out by the following equation.

(a) $\frac{2P}{\pi D^2(D - \sqrt{D^2 - d^2})}$

(b) $\frac{3P}{\pi D^2(D - \sqrt{D^2 - d^2})}$

(c) $\cancel{\frac{3P}{\pi D(D - \sqrt{D^3 - d^2})}}$

(d) $\frac{2P}{\pi D(D - \sqrt{D^2 - a^2})}$

8. is a eutectoid of steel.

(a) Pearlite

(b) Austentite

(c) Cementite

(d) $\cancel{\text{Martensite}}$

9. is a process decomposes the martensite into a ferrite-cementite mixture.

(a) $\cancel{\text{Tempering}}$

(b) Induction

(c) Quenching

(d) Nitriding

10. Vanadium steel is often used for :

- (a) Bearing
- (b) Electromagnets
- (c) Machine beds
- (d) Axles and springs

SECTION - B

[Marks : $8 \times 4 = 32$]

1. FCC unit cell has a lattice constant $a = 4 \times 10^{-10} \text{ m}$. Calculate the number of atoms per unit area on (110) and (111) planes and density of atoms per unit area.

2. Define the following terms :

- (a) Unit cell
- (b) Space lattice
- (c) Lattice Parameter
- (d) Co-ordination number

3. Define 'Burger's vector' and illustrate it on the sketch of an edge dislocation.

4. What is creep ? Draw a typical creep curve and explain the different stages of creep.

5. Distinguish between full annealing and tempering.

6. Define the term refractories and state their properties.

SECTION - C

[Marks : $12 \times 3 = 36$]

1. Draw the 'iron carbon equilibrium diagram' and explain it.

2. Write short notes on :

- (a) TTT curves
- (b) Normalizing

3. Draw B-H curve for hard and soft steel and name the factors on which the shape of B-H curve for different types of soft and hard magnetic materials depend.

4. Define the terms corrosion of metals. Explain corrosion by oxidation and discuss different methods of preventing corrosion of metals.
5. Define the term miller indices and find spacing of (i) (200) planes (ii) (220) planes (iii) (III) planes of lead which is the FCC with an atomic radius $r = 1.747 \text{ \AA}^\circ$.