

**MATERIAL SCIENCE & ENGINEERING
(CHEN 3133)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

**Group – A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Packing efficiency of a crystal depends on
(a) Nature of bonding (b) Coordination number
(c) crystal system (d) Valency.
- (ii) Medium carbon steel contains carbon in the range of
(a) 0.15-0.35% (b) upto 0.15%
(c) 0.35%-0.65% (d) 0.65%- 1.2%.
- (iii) Uncommon impurity in gold ore is
(a) Ag (b) Cu (c) Zn (d) Pb.
- (iv) The hearth and sidewalls of electric arc furnace is lined with refractories of
(a) silica (b) magnesite
(c) 60%alumina (d) silicon carbide.
- (v) Dislocations are called
(a) Point imperfection (b) Line imperfection
(c) Surface imperfection (d) Volume imperfection.
- (vi) Alloy steel is potentially produced in
(a) Open Hearth Furnace (b) Electric arc furnace
(c) LD Converter (d) Bessemer converter.
- (vii) The toughness of a material is tested by
(a) Tensile strength test (c) Creep test
(b) Hardness test (d) Impact test.
- (viii) Fatigue failures of engineering materials occur due to the
(a) Compressive stress (c) Cyclic stress
(b) Tensile stress (d) Shear stress.

B.TECH/CHE/5TH SEM/CHEN 3133(BACKLOG)/2020

- (ix) Which of the following is not present in iron-iron carbide phase diagram?
(a) α -ferrite (b) austenite
(c) cementite (d) martensite.
- (x) Time dependent recoverable deformation is called
(a) elastic deformation (b) plastic deformation
(c) anelastic deformation (c) permanent deformation.

Group – B

2. (a) How X-ray diffraction is performed on a powdered crystalline material? Give schematic presentation of powder diffractometer.
(b) Explain how Bragg's law can be used to determine the crystal structure.
6 + 6 = 12
3. (a) What do you understand by Miller indices of crystal plane? Narrate the systematic procedure for the determination of Miller indices of crystal plane.
(b) What are the two different types of voids present in common crystals and calculate total number of octahedral voids present per unit cell of a FCC crystal
6 + 6 = 12

Group – C

4. (a) Define the terms
(i) Flexural strength
(ii) Toughness
(iii) hardness
(iv) anelastic deformation of engineering materials.
(b) A KCl crystal which has FCC structure has a density of 1.98×10^3 kg/cm². Its molecular weight is 74.55. Find the distance between the adjacent atoms.
8 + 4 = 12
5. (a) How are the hardness and toughness of materials measured? State Gibbs Phase Rule with examples of binary and ternary phase diagrams.
(b) Define plastic deformation and strain hardening. Explain the mechanism of slip.
4 + 4 + 4 = 12

Group – D

6. (a) Summarise the essential activities in a steel melting shop.
(b) What is the purpose of vacuum treatment of molten steel?
6 + 6 = 12

B.TECH/CHE/5TH SEM/CHEN 3133(BACKLOG)/2020

7. (a) What do you understand by creep of a material. Show graphically and explain with reasons for various types of creeps that occur in a material?
- (b) Define plastic deformation and strain hardening. Explain the mechanism of slip.
- 6 + 6 = 12**

Group – E

8. (a) Differentiate between hydrometallurgy and pyrometallurgy. Show the steps in the Electrometallurgical process of extraction of aluminium.
- (b) Describe the industrial process of refining copper?
- (4 + 4) + 4 = 12**
9. (a) Depict the principle for the extraction of gold by cyanidation process followed by gold recovery through cementation process.
- (b) Differentiate between hot and cold working of metals. Draw a neat diagram of a Blast furnace with appropriate temperature profile and feed & product flow & slag outlet for manufacturing iron.
- 6 + 2 + 4 = 12**

Department & Section	Submission Link
CHE	https://classroom.google.com/c/MjgyNTM0MTI1NDU4/a/MjgyNTM0MTI1NDg1/details