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BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – B.Tech.(ME)-2021/B.Tech.(ME)-2023
Course Name – Materials Engineering
Course Code - PCC-ME401
(Semester IV)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) The geometry of unit cell is recall as
a) parallelepiped b) Parabola
c) hyperbola d) triangle

(ii) The alloy steel designated as "40Cr18 Ni2" by Bureau of Indian Standards. It records as
a) 4.0% C, 1.8% Cr and 0.2% Ni b) 0.4% C, 18% Cr and 2% Ni
c) 0.4% C, 18% Cr and 0.2% Ni d) 4.0% C, 18% Cr and 0.2% Ni

(iii) A material is said to be allotropic, recall the following statement
a) fixed structure at all temperature b) atoms distributed in random pattern
c) Different crystal structures at different temperature d) atoms distributed in crystalline pattern

(iv) Gibbs phase rule for general system associate with
a) P+F=C-1 b) P+F=C+1
c) P+F=C-2 d) P+F=C+2

(v) Indicate, wt.% of carbon in mild steels
a) <0.008 b) 0.008-0.3
c) 03-0.8 d) 0.8-2.11

(vi) Strain energy define as
a) energy stored in a body when strained within elastic limits b) energy stored in a body when strained upto the breaking of a specimen
c) maximum strain energy which can be stored in a body d) proof resilience per unit volume of a material

(vii) Stress strain curve for cemented tungsten carbide indicate as
a) Hyperbola b) Parabola
c) A curve d) Straight line

(viii) An ultrasonic pulse velocity test is operate as an _____

a) Ex-situ, nondestructive test
b) In-situ, nondestructive test
c) Ex-situ, destructive test
d) In-situ, destructive test

(ix) The line above which the alloy is liquid is indicate as _____

a) Solidus line
b) Tie line
c) Liquidus line
d) Lever line

(x) The phase above eutectoid temperature for carbon steels is indicate as _____

a) Cementite
b) Ferrite
c) Pearlite
d) Austentite

(xi) Select the phenomenon which is/are involved in phase transformation.

a) Nucleation
b) Growth
c) Fission
d) Nucleation and growth

(xii) An eutectoid steel consists of

a) wholly pearlite
b) wholly austenite
c) pearlite and ferrite
d) pearlite and cementite

(xiii) Smelting process generalize as

a) removing the impurities like clay, sand etc. from the iron ore by washing with water
b) expelling moisture, carbon dioxide, sulphur and arsenic from the iron ore by heating in shallow kilns
c) reducing the ore with carbon in the presence of a flux
d) all of this

(xiv) Induction hardening is basically associate

a) carburising process
b) surface hardening process
c) core-hardening process
d) none of these

(xv) A liquid phase produces two solid phases during _____ reaction up on cooling.

a) Eutectic
b) Eutectoid
c) Peritectic
d) Peritectoid

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Illustrate Hume-Rothery rules. (3)
3. Define the terms lattice, unit cell, basis and crystal structure. (3)
4. Write down the difference between Frenkel and Schottky defect. (3)
5. Describe briefly the theory of tempering & its purpose. (3)
6. Explain the effects of alloying chromium and nickel in stainless steel. (3)

OR

Explain the formation of microstructures of pearlite, bainite and martensite in steel. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Define "Hardness" and "Hardenability". Describe the statement "hardenability equal to 1". Explain the effect of grain size on hardenability of a steel. (5)
8. Write a short note on "Martempering". (5)
9. Identify the inspection techniques that would be applied to find the following defects in cast products: (i) internal cavities in a large steel casting. (ii) cracks in grey iron casting. (iii) final cracks in aluminum alloy castings. (iv) internal porosity in aluminum alloy castings. (v) pressure tightness in an automobile cylinder head. (5)
10. For three hypothetical materials A, B and C, the atomic weight, density and atomic radius are listed below. Determine wheather its crystal structure is FCC, BCC or HCP and justify your determination for each. (5)

Material	Atomic Weight (g/mol)	Density (g/cc)	Atomic Radius (nm)
A	24.31	1.74	0.160
B	107.87	10.49	0.144
C	22.99	0.971	0.186

11. Define atomic packing factor (APF). Evaluate APF for (i) BCC (ii) FCC (iii) HCP (5)
12. Briefly write the differences between recovery and recrystallization processes. (5)

OR

Illustrate iron cementite phase with diagram neat and labeled sketch. Also mention the various reactions taking place in iron carbon phase diagram. (5)

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