Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2025

INDUSTRIAL ENGINEERING
II Semester
PH 23C03: MATERIALS SCIENCE
(Regulation 2023)

Time:3 hrs Max. Marks: 100

CO1	To make the students understand the basics of phase diagram and their applications
CO2	To impart knowledge about diffusion and Phase transformations
CO3	To introduce various mechanical properties and their measurement.
CO4	To learn about iron-carbon systems, and about various ferrous and non-ferrous alloys
CO5	To introduce the preparation, properties and applications of ceramics, composites and nanomaterials

BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A (10x2=20Marks)
(Answer all Questions)

Q. No.	Questions	Marks	CO	BL
1	What is a phase? Write the formula for Gibbs phase rule.	2	1	L1
2	In Cu – Ni alloy phase diagram, the composition of alpha phase is 43 wt% Ni – 57 wt% Cu and the composition of liquid phase is 32 wt% Ni – 68 wt% Cu. For alloy of composition 35 wt% Ni – 65 wt% Cu at 1250 degrees centigrade calculate the relative amount of each phase present interms of mass fraction.	2	1	L5
3	What are the factors influencing diffusion?	2	2	L1
4	Calculate the value of diffusivity by D in m^2 /s for the diffusion of carbon in γ-iron (FCC) at 727°C. Given $D_0 = 2.0 \times 10^{-5} m^2$ /s, Q = 142 kJ/mol and R= 8.314 J/(mol.K).	2	2	L2
5	Draw the tensile load – elongation curve.	2	3	L1
6	Write the Griffith criterion for crack propogation.	2	3	L2
7	A sample of glass has a crack of length 2 μm. The Young's modulus of the glass is 50 GN m^{-2} and the specific surface energy is 1J m^{-2}. Estimate its fracture strength.	2	4	L5
8	Draw the S-N curve	2	4	L1
9	Give two examples in each (a) ceramics (b) composite materials.	2	5	L1
10	What is the use of X-ray powder diffraction technique?.	2	5	L4

PART- B (5x 13=65Marks)
(Restrict to a maximum of 2 subdivisions)

Q. No.	Questions	Marks	CO	BL
11 (a)	Explain the unary Phase diagram of Iron.	13	1	L1
	OR			
11 (b)	Explain Cu-Ni and Pb-Sn phase diagrams.	13	1	L1
12 (a)	Describe Fick's laws of Diffusion and the diffusion mechanisms.	13	2	L4
	OR			
12 (b)	Explain applications of Phase transformation	13	2	L4
13 (a)	Explain mechanisms of creep and creep resistant materials.	13	3	L3
	OR			

13 (b)	Enumerate methods to evaluate its hardness by Rockwell, Brinell, Knoop and Vickers testing methods.	13	3	L3
14 (a)	Describe Fe-Fe3C phase diagram system in detail.	13	4	L4
	OR			
14 (b)	Describe isothermal transformation diagram for eutectoid iron-carbon alloy.	13	4	L4
15 (a)	Explain physical vapour deposition (PVD) and chemical vapour deposition (CVD) characterization techniques.	13	5	L4
	OR			
15 (b)	Explain Transmission electron microscopy and Atomic force microscopy characterization techniques	13	5	L4

PART- C (1x 15=15Marks)

(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	Describe homogenous and heterogeneous nucleation	15	2	L5