ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2024

INDUSTRIAL ENGINEERING
II Semester
PH 3205 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	Write the Arrhenius expression for the temperature dependence of diffusion coefficient.	2	2	L1
4	Mention any two applications of diffusion.	2	2	L2
5	Draw the tensile load – elongation curve.	2	3	L1
6	Mention any two mechanisms of strengthening in metals.	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 TTT diagram for eutectoid steel.	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.	13	2	L4
	OR			
12 (b)	Describe homogenous and heterogeneous nucleation.	13	2	L4
13 (a)	Explain mechanisms of creep and creep resistant materials.	13	3	L3
	OR			

Q. No.	Questions			
13 (b)	Explain Griffith criterion for the propagation of a crack and Fatigue fracture.	13	3	L3
14 (a)	Describe Fe-Fe3C phase diagram system in detail.	13	4	L4
OR				
14 (b)	Describe copper and aluminum alloys.	13	4	L4
15 (a)	Explain the type, physical, chemical and mechanical properties of nanomaterials.	13	5	L4
OR				
15 (b)	Explain physical vapour deposition (PVD) and chemical vapour deposition (CVD) characterization techniques.	13	5	L4

PART- C (1x 15=15Marks)
(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	You are given a hard material. Enumerate methods to evaluate its hardness by Rockwell, Brinell, Knoop and Vickers testing methods.	15	3	L5