UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: DTD 2112
COURSE	: METALLURGY
SEMESTER/SESSION	: 1 - 2024/2025
DURATION	: 2 HOURS

Instructions:

1. This booklet contains 4 questions. Answer all questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 4 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) List three (3) characteristics of metals and two (2) examples of metals. (5 marks)

b) Describe

i. ferrous and two (2) of their classifications (4 marks)

ii. non-ferrous metals; and two (2) of their classifications. (4 marks)

c) Illustrate:

i. Metallic bonding (3 marks)

ii. Body-centred cubic (BCC) crystal structure (3 marks)

iii. Face-centred cubic (FCC) crystal structure (3 marks)

iv. Hexagonal close-packed (HCP) crystal structure (3 marks)

QUESTION 2

a) Define

i. low alloy steels (3 marks)

ii. high alloy steels (3 marks)

b) Low alloy steels can be divided into three (3) classes. Describe those three (3) classes of low alloy steels and their range of carbon contents. (9 marks)

c) High alloy steels have outstanding mechanical properties and divided into structural/tool steels and stainless steels. Demonstrate five (5) categories of stainless steels. (10 marks)

QUESTION 3

a) Define the terminology in phase diagram below:

i. Components (2 marks)

ii. Solvents and solutes (3 marks)

b) Using the Gibbs phase rule to identify the degree of freedom for point labelled in the Pb-Sn phase diagram in Figure 1 below.

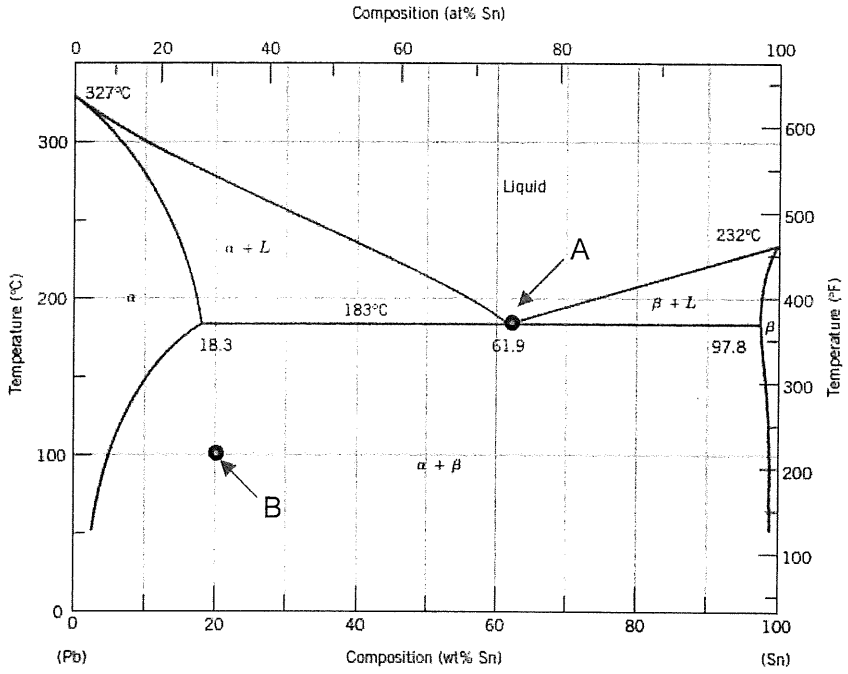

Figure 1: Pb-Sn phase diagram

i. Point A (4 marks)

ii. Point B (4 marks)

c) A lead-tin of alloy in Figure 1 of composition 50 wt%Pb–50 wt%Sn slowly heated to temperature of 300°C. Solve

i. Composition of α (2 marks)

ii. Composition of β (2 Marks)

iii. Weight fraction of α (4 Marks)

iv. Weight fraction of β (4 Marks)

QUESTION 4

a) Define what is surface hardening and give two (2) purposes of surface hardening. (5 marks)

b) Describe type of surface hardening below:

i. Cyniding (2 marks)

ii. Nitriding (2 marks)

iii. Flame hardening (2 marks)

iv. Induction hardening (2 marks)

c) Illustrate the three (3) methods of carburising

i. Liquid carburising (4 marks)

ii. Pack carburising (4 marks)

iii. Gas carburising (4 marks)

----------End of question----------