FACULTY OF ENGINEERING

END OF SEMESTER EXAMINATIONS - APRIL 2025

PROGRAMME: BACHELOR OF PETROLEUM ENGINEERING

YEAR/SEM: YEAR 1/SEMESTER 2

COURSE CODE: PTE1253

NAME: MINERALOGY

DATE: 2025-04-14

TIME: 2:00-5:00PM

INSTRUCTIONS TO CANDIDATES:

1. Read the instructions very carefully

2. The time allowed for this examination is STRICTLY three hours

3. Read each question carefully before you attempt and allocate your time equally between all the Sections

4. Write clearly and legibly. Illegible handwriting cannot be marked

5. Number the questions you have attempted

6. Use of appropriate workplace examples to illustrate your answers will earn you bonus marks

7. Any examination malpractice detected will lead to automatic disqualification.

DO NOT WRITE ANYTHING ON THE QUESTION PAPER

Section A Attempt any TWO Questions (40 Marks)

Question 1:

a) (i) Define the following terms â??Crystalâ?• and â??Mineraloidâ?• as applied in mineralogy. **(2 marks)**

(ii) Explain why some parts of the earth surface may have higher geothermal gradient than other areas **(3 marks)**

b) Using an example and illustration, explain the following mineral bonding types;

      (i) covalent   **(5 marks)**

      (ii) Ionic   **(5 marks)**

      (iii) Van der waals   **(5 marks)**

Question 2:

a) (i) Briefly state the Millerâ??s Indices rules for crystal planes. **(5 marks)**

(ii) Determine the Millerâ??s Indices for the following planes in figure **1** (**i** and **ii**) below. **(10 marks)**
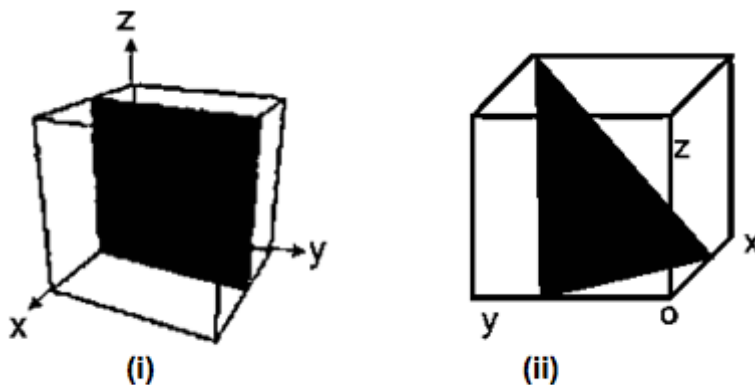

Figure 1

b) (i) Define the following terms â??*refractory*â?• and â?*Industrial mineral* â?•. **(2marks)**

(ii) Briefly explain why industrial minerals are mined either from an existing site or area close to the infrastructure? **(3marks)**

Question 3:

a) Differentiate between;

    (i) fluorescence and Phosphorescence.   **(2 marks)**
    (ii) cleavage and fracture.   **(2 marks)**

b) (i) Briefly explain how counterfeit gems can be identified using luminescence technique.   **(2marks)**

(ii) Any mineral that contains a fairly large amount of certain radionuclides is subject to structural changes, state any two (**2**) ways in which such changes can occur.   **(2 marks)**

c) (i) Light travelling at **3,200m/s** through a medium of refractive index **1.33** is incident onto a mineral surface at **2600m/s.** What is the **mineralâ??s** refractive index**?**   **(2marks)**

(ii) Describe how the optical signs (positive or negative) of a mineral can be determined.   **(10 marks)**

Question 4:

a) (i) Differentiate between a â??rockâ?• and a â??mineralâ?•.   **(1 mark)**
    (ii) State any four (**4**) importance of mineralogy to a Petroleum Engineer?   **(4 marks)**
    b) Explain any three (**3**) processes of minerals formation. **(15 marks)**

Section B Attempt any THREE Questions (60 Marks)

Question 1:

a) (i) How does â??Crystal twinningâ?• occur?   **(1 mark)**

    (ii) State any four (**4**) effects of twinning in mineral crystals. **(4 marks)**

b) Explain the following;

        (i) Growth twins   **(5 marks)**

        (ii) Deformation twins   **(5 marks)**

        (iii) Transformation twins   **(5 marks)**

Question 2:

Describe the following physical properties of minerals;
  (i) Various non-metallic lusters   **(10 marks)**

  (ii) Hardness   **(10 marks)**

Question 3:

Use the following Miller Indices to draw the directions and planes (clearly show all your working).

(i) Directions: $(\bar{1}\ \bar{1}\ \bar{1})$, and $(2, \bar{1}\ \bar{2})$ **(10 marks)**
(ii) Planes: [1 0 2], and [0 3 1]   **(10 marks)**

Question 4:

a) (i) Briefly explain what is meant by the â??crystal symmetryâ?• and an â??inversion centreâ?•   **(5 marks)**

(ii) What does a 4-fold rotational axis mean? State whether crystals **x, y, m, n** in figure **3** is a 1-fold or 2-fold, etc.   **(5 marks)**

(x)   (y)   (m)   (n)
Figure 3
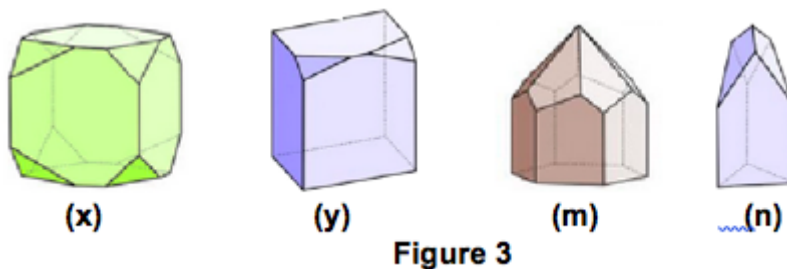
b) (i) Differentiate between isotropic and anisotropic minerals**.**
          (5 marks)
(ii) Explain what you understand by the term â??Solid solutionâ?•.
          (5 marks)