

UNIVERSITI
TEKNOLOGI
PETRONAS

**FINAL EXAMINATION
JANUARY 2023 SEMESTER**

COURSE : QDB1043 - STRUCTURAL GEOLOGY
DATE : 13 APRIL 2023 (THURSDAY)
TIME : 9:00 AM - 12:00 NOON (3 HOURS)

INSTRUCTIONS TO CANDIDATES

1. Answer **ALL** questions in the Answer Booklet.
2. Begin **EACH** answer on a new page in the Answer Booklet.
3. Indicate clearly answers that are cancelled, if any.
4. Where applicable, show clearly steps taken in arriving at the solutions and indicate **ALL** assumptions, if any.
5. **DO NOT** open this Question Booklet until instructed.

Note :

- i. There are **EIGHT (8)** pages in this Question Booklet including the cover page and the Appendix.
- ii. **DOUBLE-SIDED** Question Booklet.

1. a. Define the terms below:

i. Kinematic analysis.

[2 marks]

ii. Growth fault.

[2 marks]

iii. Klippe.

[2 marks]

iv. Stylolites.

[2 marks]

v. Brittle deformation.

[2 marks]

b. Discuss the relation of stress and strain in deformation of the earth.

[4 marks]

c. Compare elastic and pastic deformation.

[6 marks]

2. a. Coulomb Failure Law predicts the formation of brittle structure that led to creation of normal, thrust and strike-slip faults (Anderson's Theory). Based on this statement, analyse the criterion that most rocks on average will fault at angle of 30° to σ_1 .

[8 marks]

- b. Thrust faults are form in the area where compressional tectonic is dominant. Illustrate two geometry of thrust sheets that commonly form in compressive tectonic area. Accompany the illustration with labels.

[8 marks]

- c. List four factors influencing the variation in deformation form in the rocks.

[4 marks]

3. a. Describe the characteristics of structural deformation in the crust and mantle due to changes in the rheology of the Earth.

[6 marks]

- b. Explain the following terms with the aid of a diagram.

i. Pseudotachyllite.

[3 marks]

ii. Boudinage.

[3 marks]

- c. Answer the following questions based on **FIGURE Q3**.

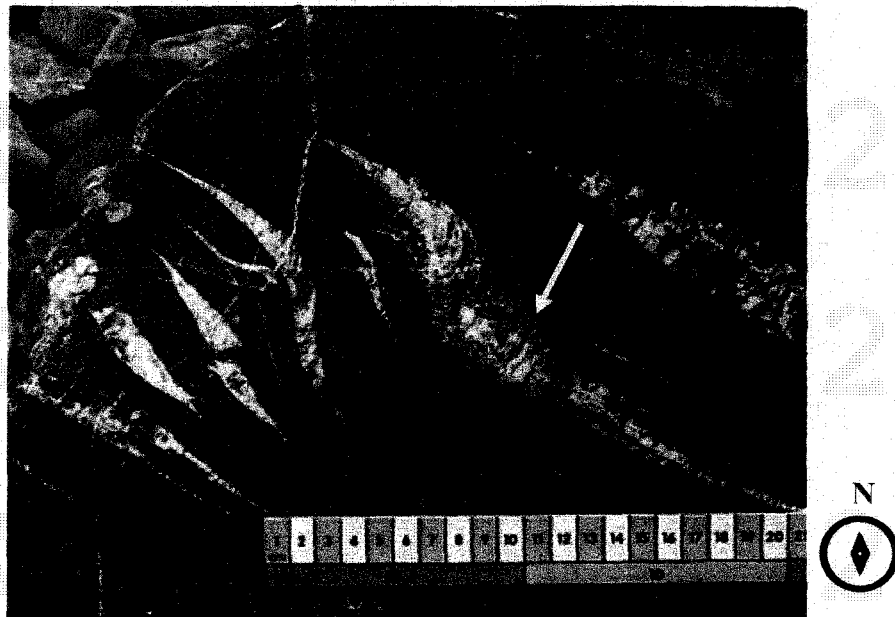


FIGURE Q3: Top view of the structure (pointed by arrow) form in a limestone. N indicate the north direction.

- i. Identify the structure that form in this limestone (pointed by the arrow).

[2 marks]

- ii. Classify the type of fracture mode for the structure identified in **QUESTION 3c(i)**.

[2 marks]

- iii. Determine the shear movement of the structure classify in **QUESTION 3c(ii)**.

[2 marks]

- iv. Interpret the maximum principal stress direction (σ_1) that resulted from the shear movement determine in **QUESTION 3c(iii)**.

[2 marks]

4. Answer the following questions based on **FIGURE Q4**.

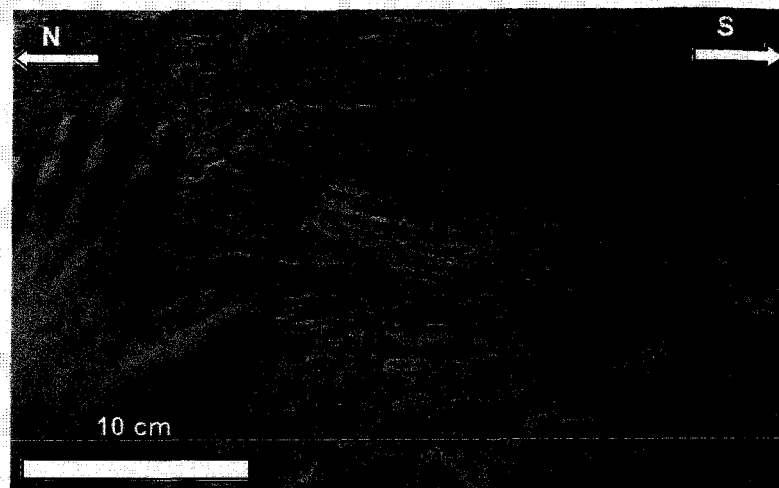


FIGURE Q4: A fault plane in metamorphic rock. N and S are referring to North and South directions.

- i. State the physical appearance of the fault plane. [2 marks]
 - ii. Recognize the subsidiary structures preserve on the fault plane. [2 marks]
 - iii. Relate the structure recognized in **QUESTION 4c(ii)** with the shear movement/direction of the fault. [2 marks]
- b. Illustrate the flexural slip folding and neutral surface folding with the aid of diagram(s). [6 marks]
- c. Evaluate the variation in sedimentary bed thickness and variation in the lithological strength in controlling the spacing of joints and fractures in the rocks. [8 marks]

5. a. Compare horst and ramp-flat geometry in reverse faults.

[6 marks]

- b. Answer the following questions based on **FIGURE Q5** below. **APPENDIX 1** display the enlarge version of **FIGURE Q5**.

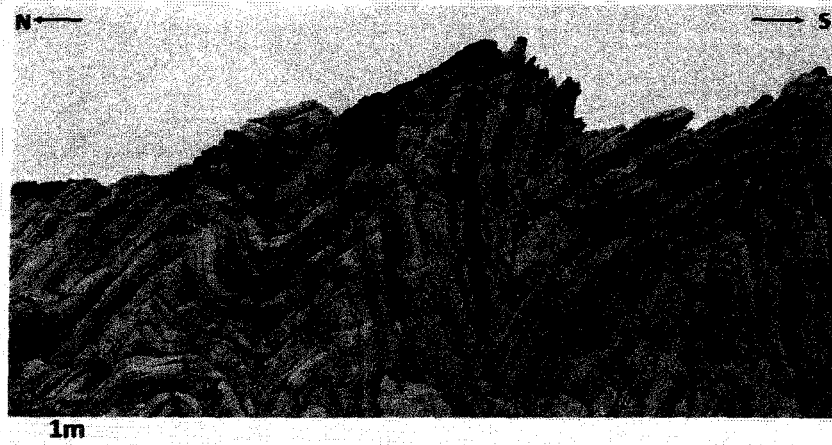


FIGURE Q5: Folded rocks in Greece.

- i. Interpret the structures preserved in this rock. Use the enlarge image of **FIGURE Q5** in **APPENDIX 1** for the interpretation.

[4 marks]

- ii. State if the folds are symmetrical or asymmetrical.

[2 marks]

- iii. Estimate the inter-limb angles on the structures identified in **QUESTION 5B(i)**.

[4 marks]

- iv. Investigate the number fold orders that developed simultaneously in the rock of **FIGURE Q5**.

[4 marks]

- END OF PAPER -

APPENDIX 1: FIGURE Q5

TABLE NO:

EXAM ID:

