



**UTHM**

Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
(ONLINE)  
SEMESTER II  
SESSION 2019/2020**

COURSE NAME : ENGINEERING GEOLOGY  
COURSE CODE : BFC21303  
PROGRAMME CODE : BFF  
EXAMINATION DATE : JULY 2020  
DURATION : 6 HOURS  
INSTRUCTIONS : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

**CONFIDENTIAL**

**TERBUKA**

- Q1** A road cutting is driven through a sequence of granite rock. The rock slope face cutting is shown in **Figure Q1(a)**. The rock slope has been mapped and analysed. The discontinuities contours are presented in **Figure Q1(b)**. **Figure Q1(a)** and **Table Q1(a)** shows the data of slope geometry and rock parameters.
- (a) Determine the dip direction and dip angle of contours joint sets based on **Figure Q1(b)**.  
(3 marks)
  - (b) Determine the rock slope geometry based on **Figure Q1(a)** and analyse the entire rock slope failure modes with its criterion based on **Table Q1(b)**.  
(6 marks)
  - (c) Calculate the factor of safety for the planar failure mode if the tension crack is completely filled with water.  
(3 marks)
  - (d) Calculate the factor of safety for the wedge failure mode when water inside the tension crack on top of the slope is at maximum level.  
(10 marks)
  - (e) Propose the number of anchor bars that are required to stabilize the planar failure of the slope if Jabatan Kerja Raya (JKR) Malaysia stated that the factor of safety of rock slope must be 1.5.  
(3 marks)
- Q2**
- (a) Rotary wash boring is one of foremost method in site investigation around the world which the soil and rock characteristics were recorded into the bore log. List **THREE (3)** information on subsurface conditions that could be obtained from the boring operation and explain **THREE (3)** limitations and advantages of boring test in the site investigation.  
(5 marks)
  - (b) Standard testing and sample preparation procedures (ISRM 1982) are mainly to minimize factors affecting the data obtained from a test. Discuss **FIVE (5)** parameters that possibly affect laboratory testing.  
(5 marks)
  - (c) Explain in detail **FIVE (5)** differences with examples, between index and strength test.  
(5 marks)
  - (d) A scanline survey has been conducted on a rock slope with a length of 20 m at Gua Musang highway for rock slope stabilization purposes. The rock slope was classified as granite with weathering grade II (slightly weathered rock). Two boreholes were drilled at two locations denoted as BH1 and BH2 as shown in **Figure Q2(d)**.

Each borehole sample has a length of 1500 mm.

- (i) Determine the number of joints that intercepts with the scanline. (1 mark)
- (ii) Measure the number of joint sets that forms on the rock slope. (1 mark)
- (iii) Calculate the rock quality designation (RQD) for borehole 1 (BH1). (2 marks)
- (iv) Determine the rock quality designation (RQD) for borehole 2 (BH2). (3 marks)
- (v) Compare your answer in **Q2(d)(iii)** and **Q2(d)(iv)**. Identify the main factor that effect this result and discuss the consequences of this factor to the stability of the rock slope. (3 marks)

- Q3**
- (a) Weathering is a general term that describes all the changes that result from the exposure of rock materials to the atmosphere. Illustrate and explain **THREE (3)** types of physical weathering that probably occur in tropical region like Malaysia. (5 marks)
  - (b) Weathered rock mass is a very complex structure that is difficult to be predicted. For that reason, many specified classification systems were established based on the material decomposition grades for engineering purposes such as slope cut, shallow excavation etc.
    - (i) Construct a weathering classification system for granitic and sedimentary rock and explain **TWO (2)** differences between these two systems. (5 marks)
    - (ii) Discuss **FIVE (5)** applications of weathering rock zone from zone 1 to 5 in civil engineering works. (5 marks)
  - (c) Fault is one of the rock deformations that occur due to movement of continental plate.
    - (i) Illustrate and explain **FIVE (5)** differences of fault and fold that can be found in rock mass deformation. (5 marks)
    - (ii) Demonstrate and explain **THREE (3)** effects on a tall and a short building that might occur if these building are constructed in the fault zone. (5 marks)

- Q4** (a) The composition of earth can be divided into three layers namely crust, mantle and core. Describe the formation of mountain on the earth's crust. (4 marks)
- (b) Deep down into the earth, tremendous heat of the mantle caused the hot magma to flow in convection current. Classify **FIVE (5)** type of rocks that formed from the magma constitution. (6 marks)
- (c) Distinguish the process of compaction and cementation in sedimentary rock formation. (4 marks)
- (d) (i) During excavation works for a housing project, two types of bedrocks were found embedded in the excavation area. The samples from these bedrocks are as shown in **Figure Q4(d)**. Demonstrate **TWO (2)** advantages and disadvantages of these rocks as a foundation structure. (6 marks)
- (ii) Granite aggregate is normally used as one of the road construction materials. Discuss the suitability of granite compared to limestone as pavement materials in Malaysia. (5 marks)

- END OF QUESTIONS -

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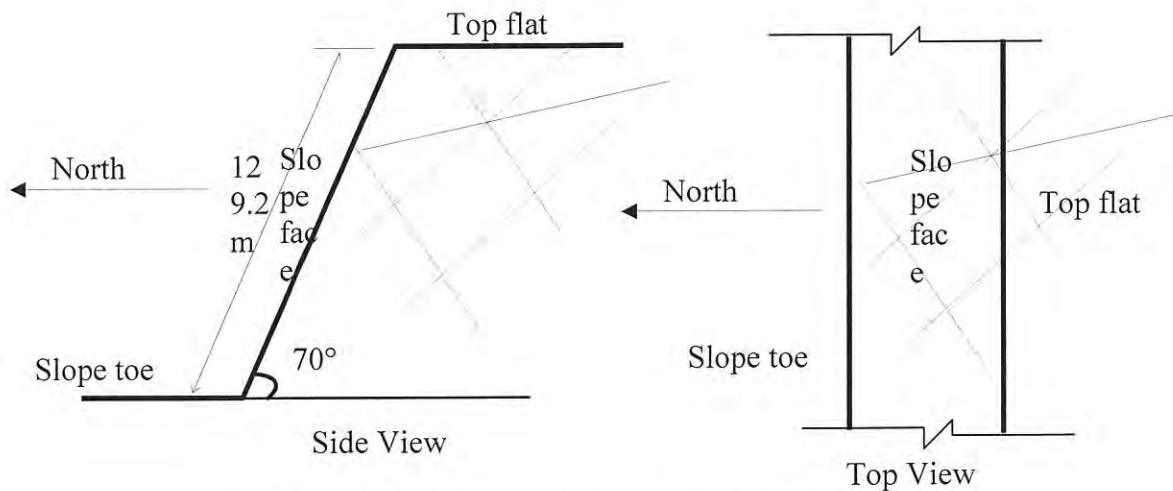


FIGURE Q1(a): Parameter of granite rock slope

TABLE Q1(a): Parameter of granite rock slope

| Parameters                             | Values                 |
|--|------------------------|
| Unit weight of the rock                | 25 kN/m <sup>3</sup>   |
| Depth of tension crack                 | 4 m                    |
| Unit weight of water                   | 9.81 kN/m <sup>3</sup> |
| The cohesion of all discontinuities    | 100 kPa                |
| Friction angle for all discontinuities | 30°                    |

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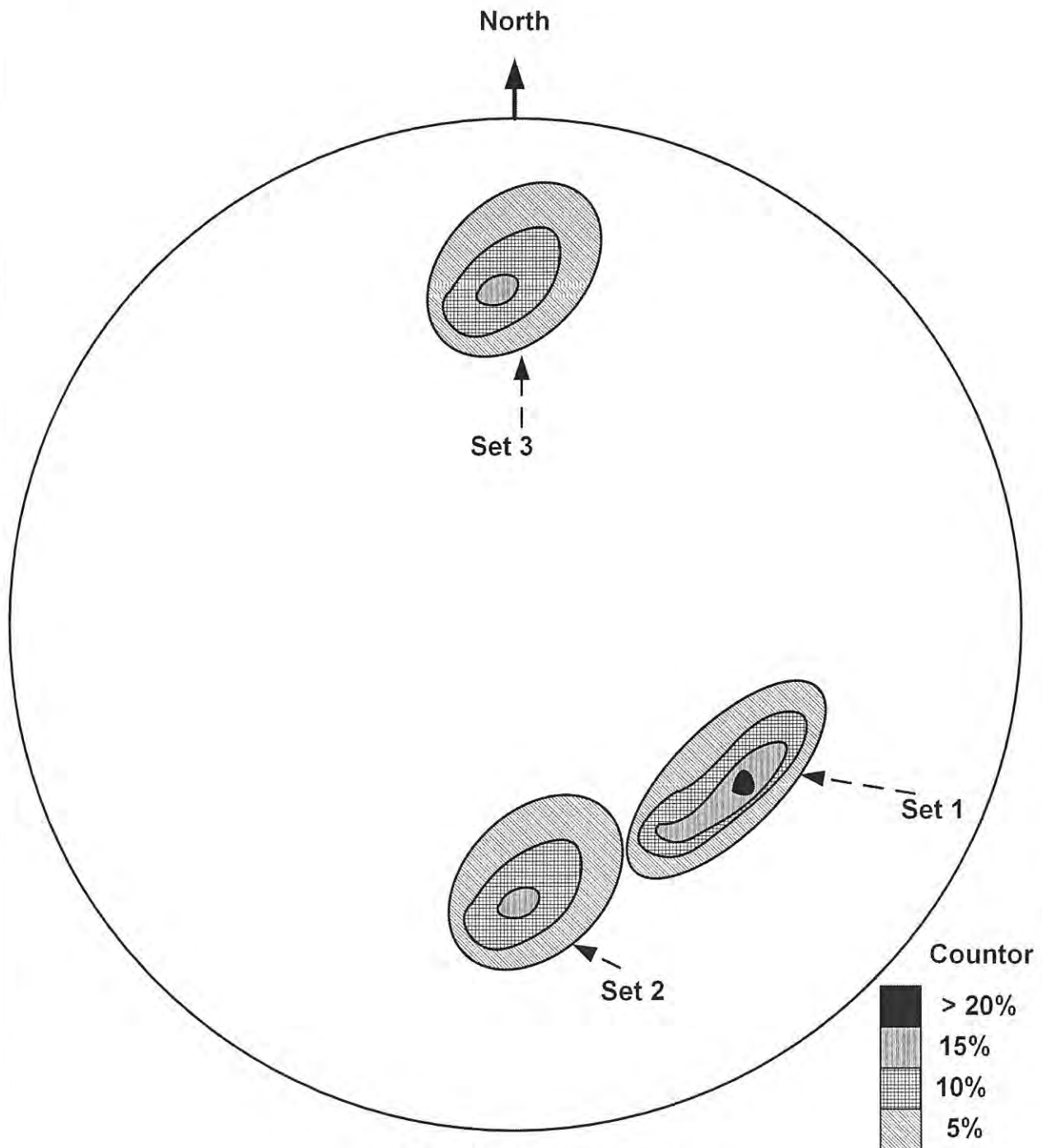


FIGURE Q1(b): Contour plot

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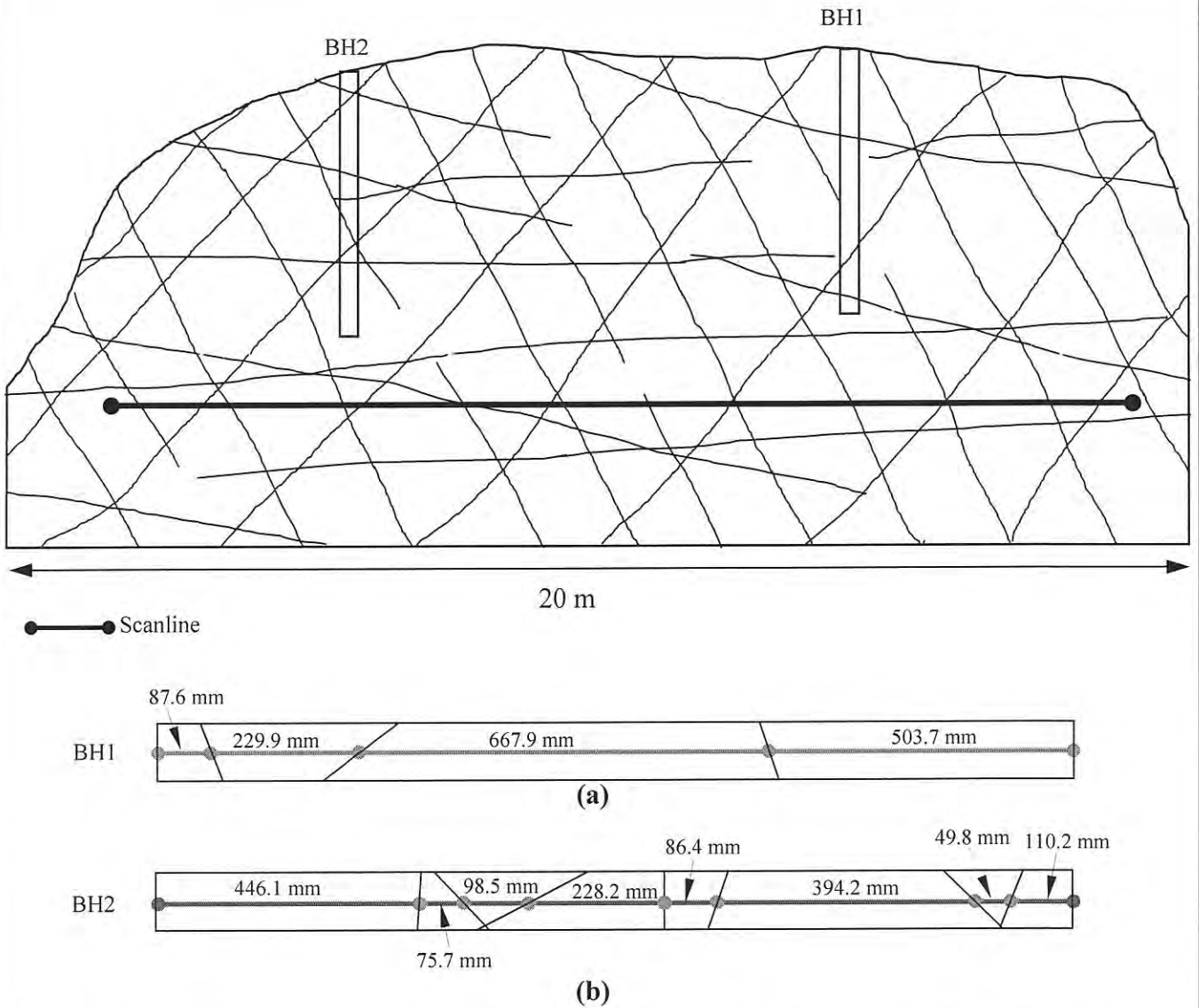
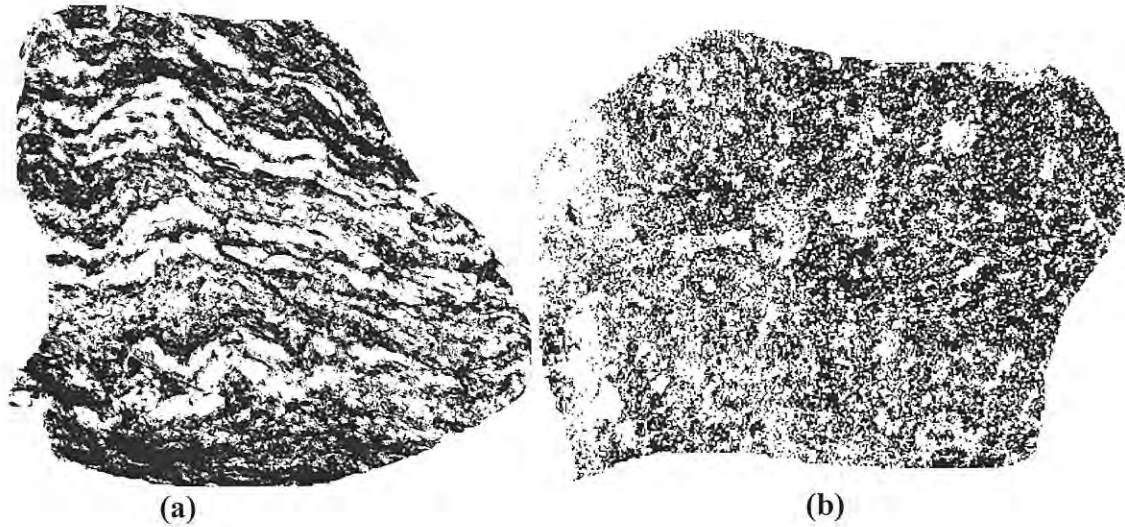


FIGURE Q2(d): Rock slope stability analysis at GuaMusang, a) scanline survey and borehole locations, and b) borehole samples denoted as BH1 and BH2.

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**FIGURE Q4(d):**Rock materials from two bedrocks, a) Gneiss, and (b) Quartzite