UNIVERSITI SAINS MALAYSIA

2nd. Semester Examination
2001/2002 Academic Session

FEBRUARY / MARCH 2002

EAG 245/3 – Soil Mechanics

Time : 3 hours

Direction to student:-

1. Ensure that this paper contains **EIGHT (8)** printed pages include appendices.

2. This paper contains **SIX** (6) question. Answer **FIVE** (5) question only. Marks will be given to the **FIRST FIVE (5)** question put in order on the answer script and **NOT** the **BEST FIVE (5)**

3. All questions carry the same mark.

4. All questions **MUST BE** answered in Bahasa Malaysia.

5. Write answered question number on the cover sheet of answer script.

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1. Fig. 1 shows the cross section of a gravel dam. The width of the dam, in z direction, is 50.0 m.

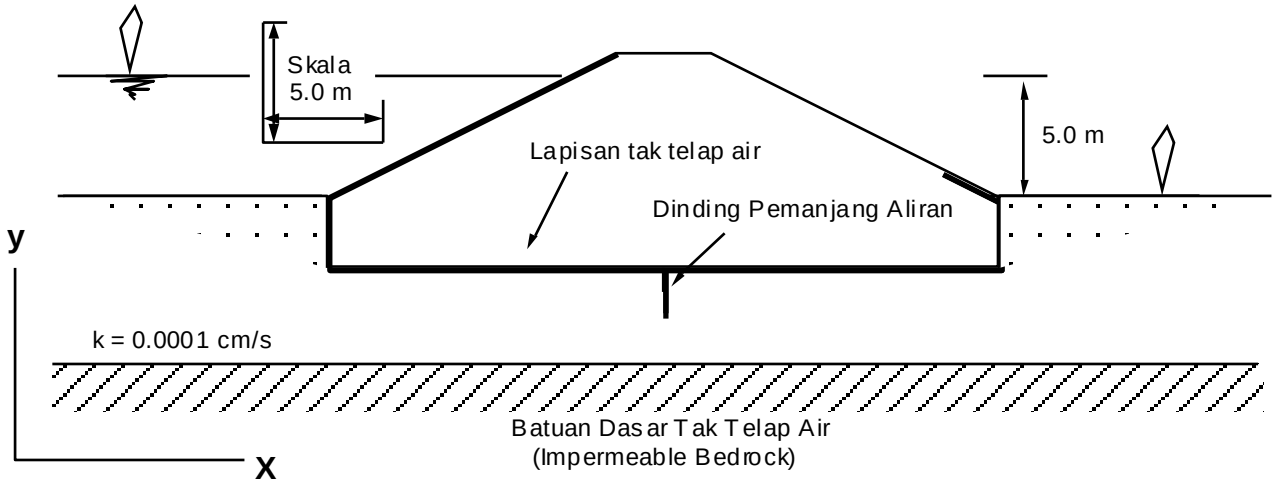


Fig. 1

(a) Draw the flow net for the seepage. Use 3 number of flows ($N_f = 3$). Check for drawing correctness. Mark each correct net unit with a ✓ and each incorrect net unit with a ✗.

(5 marks)

(b) Determine the rate of flow across the dam in m cu. per day.

(5 marks)

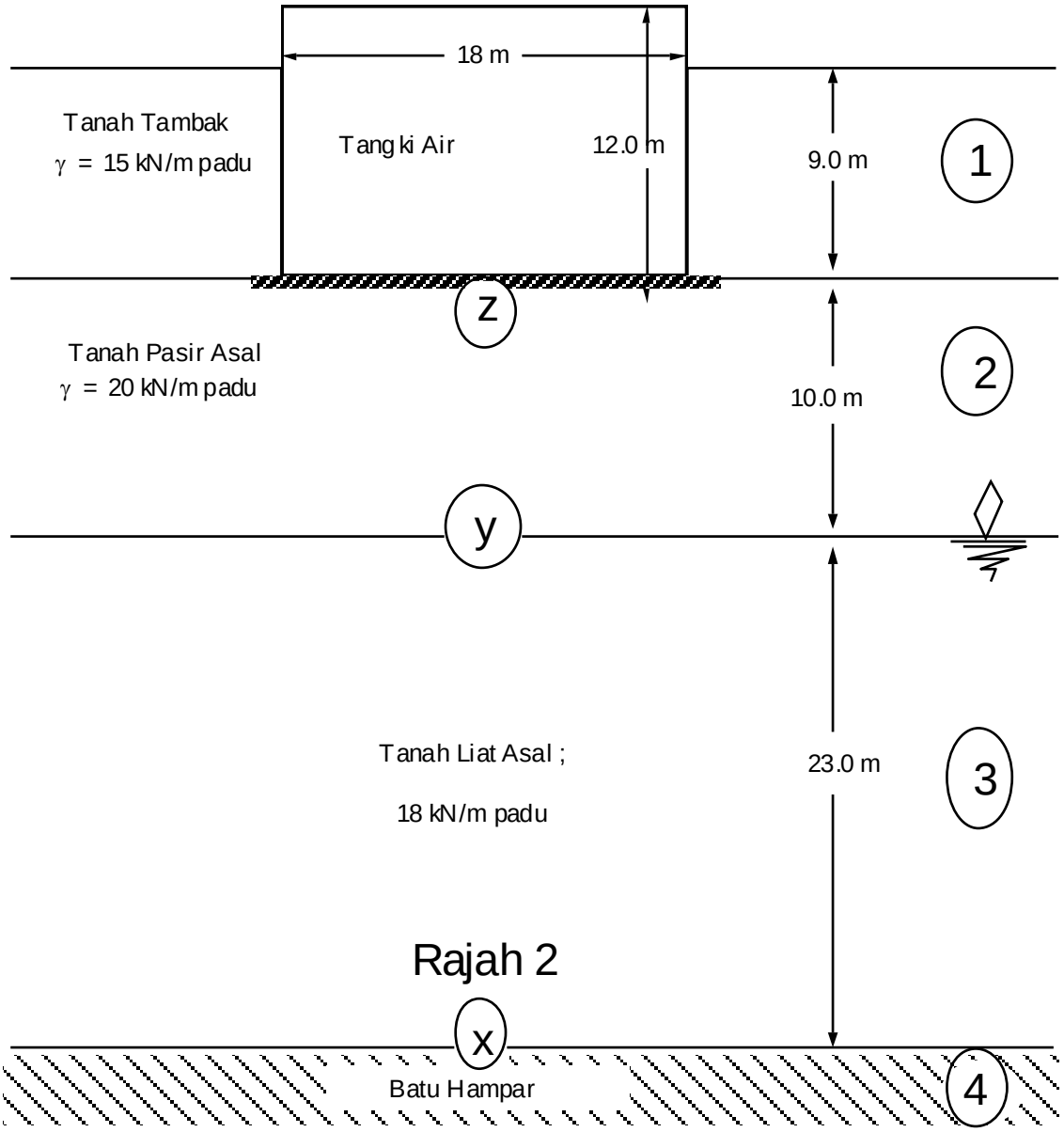
(c) For the most critical net unit in terms of it's quick condition, conduct a stability analysis for that unit. First, determine the total stress at the base of the unit. Second, determine the pore water pressure. Also determine the Factor of Safety against quick condition, $\frac{\sigma}{u}$.

(5 marks)

(d) Determine the uplift and translational forces on the dam for each 1.0 m width.

(5 marks)

2. Fig. 2 illustrates a circular water tank, 18.0 m in diameter, on top of a flexible foundation. Soil layer No. 1 was placed after the construction of the water tank. Soil layers No. 2, 3. and 4 were all originally in-situ.



Rajah 2

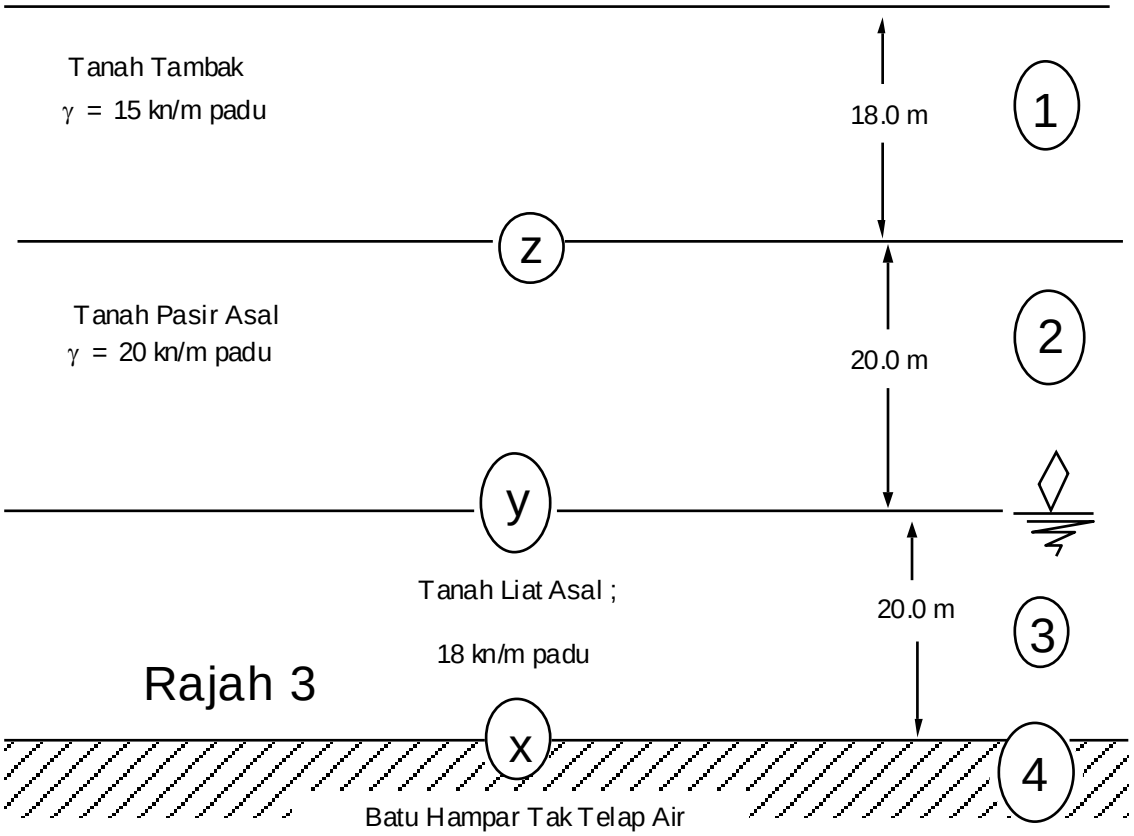
(a) Determine the effective stress at x, y, and z prior to the construction of the tank. (10 marks)

(b) Determine the effective stress at x, y, and z once the construction completed, i.e., when the surrounding soil has been placed, and the tank is filled up with water. Assume negligible weight of tank when compared to the weight of the water. (10 marks)

help: for a position underneath the middle of a circular load

$$\Delta\sigma = q\left\{1 - \frac{1}{\left[(R/z)^2 + 1\right]^{3/2}}\right\}$$

3. Fig. 3 illlustrates a layer of fill (Layer 1) which was placed on the original deposit. Soil layers No. 2, 3. and 4 were all originally in-situ. This question deals with the consolidation of clay of Layer 3.



Rajah 3

(a) Before filling of Layer 1, a sample of the clay layer was tested using a double drainage oedometer and the following results were obtained.

Stress, σ', kN/m^2	Thickness at the end of consolidation, mm
25	17.65
50	17.41
100	16.93
200	16.21
400	15.08
800	12.68
1600	10.11

Determine the pre-consolidation stress and whether the soil is normally, over, or under consolidated.

(5 marks)

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(b) Determine the total settlement due to the filling of Layer 1.

(5 marks)

(c) During loading increment from 800 kN/m^2 to 1600 kN/m^2, the following data were collected.

Time, minutes	Thickness, mm
0	12.68
0.1	12.59
0.25	12.53
0.5	12.47
1	12.39
2	12.27
4	12.09
8	11.87
15	11.54
30	11.16
60	10.83
120	10.59
240	10.41
480	10.26
1382	10.11

Determine c_v. Determine the time required for the clay layer in the field to consolidate 95%. Determine the settlement 20 years after filling. Use Table 1.

(10 marks)

Table 1

U_{avg}	T
0.10	0.008
0.20	0.031
0.30	0.071
0.40	0.126
0.50	0.197
0.60	0.287
0.70	0.403
0.80	0.567
0.90	0.848
0.95	1.163
1.00	α

4. (a) Define weight-volume parameters based on dimensions shown in the phase diagram and what are the dimensions.

(5 marks)

(b) A sample of soil is compacted into 9.5 x 10^{-4} m^3 laboratory mould. The mass of the compacted soil is 19.5 kg and its moisture content is 14.5%. Using a specific gravity of solids of 2.66, compute the degree of saturation, density and unit weight of this compacted soil.

(15 marks)

5. (a) What are the three most common clay minerals? Which one usually causes the most problem for geotechnical engineers? And why?

(5 marks)

(b) A sand with Gs = 2.65 and e = 0.60 is completely dry. It then becomes wetted by rising groundwater table. Compute, the unit weight in kN/m^3 of sand under the following condition;
(i) when the sand is completely dry.
(ii) when the sand is 40% saturated.
(iii) when the sand is completely saturated.

(15 marks)

6. (a) How would you determine if a soil was a silty sand or sandy silt if;

(i) Laboratory test equipment was available?
(ii) Laboratory test equipment was not available?

(5 marks)

(b) The following information and the grain size distribution data in Fig.1.0, are to be used. All these soils are inorganic.

Soil Sample Identification	Liquid Limit	Plastic Limit
D	55	32
E	45	31
F	35	25
G	Non - plastic	

Determine:

(i) USDA classification for soil D through G.
(ii) AASHTO group classification and group index for D through G.
(iii) USCS group symbol and group name for soil D through G.

(15 marks)

Figure 4

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