



**UNIVERSITY OF SWAZILAND  
FINAL EXAMINATION PAPER**

**PROGRAMME: BSC AGRIC. 4 (LWM)**

**COURSE CODE: LUM 407**

**TITLE OF PAPER: FLUID AND SOIL MECHANICS**

**TIME ALLOWED: TWO (2) HOURS**

**SPECIAL MATERIAL REQUIRED: NONE**

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO  
OTHER QUESTIONS.**

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GRANTED BY THE CHIEF INVIGILATOR**

**SECTION I: COMPULSORY QUESTION****QUESTION 1**

- (a) Write short notes on the following:
- (i) The mechanics for the compaction of agricultural soils due to traffic (moving wheels) and implements. (10 Marks)
  - (ii) Fine analysis of soil particle distribution. (10 Marks)
- (b) A masonry dam 6m high has the water level with the top. Assuming that the dam is rectangular in section and 3m wide, determine whether the dam is stable against overturning. Density of masonry is  $1760\text{kg/m}^3$ . (20 Marks)

**SECTION II: ANSWER TWO QUESTIONS FROM THIS SECTION****QUESTION 2**

- (a) Write short notes on tri-axial compression tests. (10 Marks)
- (b) The following data refer to three tri-axial tests performed on representative undisturbed samples of a soil:

Test	Cell pressure ( $\text{kN/m}^2$ )	Axial load dial reading (divisions) at failure
1	50	66
2	150	106
3	250	147

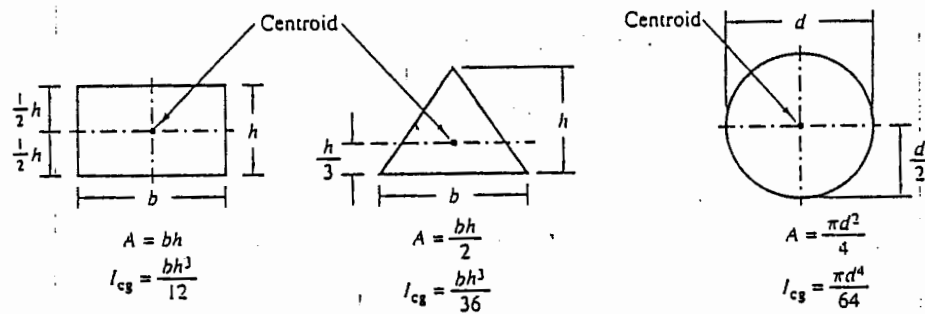
Load dial calibration factor is 1.4N per division. Each sample is 75mm long and 37.5mm diameter. Find, by graphical means, the value of apparent cohesion and the angle of internal friction for this soil. (20 Marks)

**QUESTION 3**

- (a) It is essential for students of land and water management to study Fluid and Soil Mechanics. Justify this statement. (10 Marks)
- (b) Write short notes on friction losses in pipes. (5 Marks)
- (c) Medium lubricating oil, specific gravity 0.860, is pumped through 300m of horizontal 50mm pipe at the rate of  $0.00144\text{m}^3/\text{s}$ . If the drop in pressure is 200kPa, what is the absolute viscosity of the oil?  
[NOTE: lost head =  $(32\mu LV_{av})/d^2$ ] (15 Marks)

**QUESTION 4**

- (a) Write short notes on the following:
- (i) Flow nets;
  - (ii) A soil's "quick" condition;
  - (iii) Tension cracks in a soil.
- (15 Marks)
- (b) In order to measure the *in situ* density of a soil, the following sand replacement test was carried out. 4.56kg of soil was extracted from a hole at the surface of the soil. The hole was then just filled with 3.54kg of loose dry sand.
- (i) If it took 6.57kg of the same sand to fill a container  $0.0042\text{m}^3$  in volume, determine the bulk density of the soil. (5 Marks)
  - (ii) In a water-content determination 24g of the moist soil weighed 20g after drying in an oven at  $105^\circ\text{C}$ . If the specific gravity of the particles was 2.68, determine the water content, the dry density and the degree of saturation of the soil. (10 Marks)

**APPENDIX**

Geometric properties of some figures