Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
300 Level 2nd Semester Examination – Sept. / Oct. 2015
MRT 331-3 Applied Geophysics and Engineering Geology

Uva Wellassa University

Instructions to candidates
Duration: 03 hours
Number of questions: 06
Answer all Questions
Mark allocation: 300 marks

1. Give brief explanations to following.
   a. What is a "Geophysical anomaly"
   b. Why do geological layers and geophysical layers not coincide with each other?
   c. Inverse modelling and forward modelling in geophysics?
   d. Why is subsurface mapping a difficult task? How does geophysics allow mapping certain anomalies in the subsurface?
   e. Why is it not possible to apply all geophysical methods in a given terrain? (10×5=50 mark)

2.
   a. Describe the following terms.
      i. Residual soil
      ii. Soil consistency (10×2=20 mark)
   b. Differentiate soil compaction and consolidation. (10 mark)
   c. How can we use engineering/environmental geophysics in aid of geotechnical investigations? (20 mark)

(Total 50 mark)

3.
   a. What is the purpose of having a base station for a magnetic survey? (10 mark)

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b. What will happen if you change the position of the base station during the survey? Is there any method to rectify the effect of above action? (10 mark)

c. Assume that you are in a field of highly dense and highly magnetic scattered ore body. Explain how you would carry out a geophysical field survey to assess the distribution volume ore body. (30 marks)

(Total 50 marks)

4.

a. The mass of a moist soil sample having a volume of 0.0057 m3 is 10.5 kg. The moisture content (w) and the specific gravity of solid soils (G_s) were 13% and 2.68 respectively. Determine

i. Moist density

ii. Dry density

iii. Void ratio.

iv. Porosity

v. Degree of saturation (6×5 = 30 mark)

b. A sandstone core sample with 50 mm diameter and 134 mm length is composed of quartz (60 %), plagioclase (20 %), biotite (10 %) and calcite cement (10 %). On saturation in water, its wet weight is 22.32 N; after oven drying its weight is 20.37 N.

Calculate

i. specific gravity of the rock sample

ii. dry and wet unit weight (n = 0..15)

iii. unconfined compression stress for a rupture at point load test = 598 kPa)

($SG_{quartz} = 2.65$, $SG_{plagioclase} = 2.7$, $SG_{biotite} = 2.95$ and $SG_{calcite} = 2.7$, $\gamma_w = 0.998$ g/cm^3)

(20 mark)

(Total 50 mark)

5. The following is a sample of a Vertical Electrical Sounding (VES) survey that was conducted to identify depth to the bedrock in a construction site.

AB/2 (L)	MN/2 (l)	R(Ω)	AB/2 (L)	MN/2 (l)	R(Ω)
1.5	0.5	26.2500	15	2.5	0.4500
2	0.5	10.6100	20	2.5	0.2400
3	0.5	3.6400	30	2.5	0.1200

3	1	7.9500	40	2.5	0.0800
5	1	2.1700	50	2.5	0.0600
7	1	1.0500	50	10	0.2700
10	1	0.4200	70	10	0.2000
10	2.5	1.1200	100	10	0.1800

a. Plot AB/2 vs apparent resistivity values on the provided double-log sheet. (30 mark)

b. How many layers are there and what are their true resistivity values and thicknesses? (10 mark)

c. Why repeat readings (3m, 10m and 50m intervals) are important in a VES survey. (10 mark)

(Total 50 mark)

6.

a. List and brefly explain the types of corrections applied to gravity data. (20 mark)

b. A gravity survey was conducted (with 2m station interval) to assess a buried horizontal tunnel in the subsurface. After gravity data reduction, calculated Bougure Anomaly (BA) for each station is given in the table below.

Station (m)	BA	Station (m)	BA
0.0	25.0	32.0	20.0
4.0	25.0	36.0	16.0
8.0	25.0	40.0	9.0
12.0	25.0	44.0	9.0
16.0	24.6	48.0	16.0
20.0	24.0	52.0	20.0
24.0	23.2	56.0	23.0
28.0	22.0	60	24

i. Plot the graph of station intervals vs. BA

ii. Calculate the depth to the center of the tunnel from the surface.

iii. Assuming that these gravity stations were in N-S direction, construct the BA that you may expect if a survey was conducted in E-W direction. (30 mark)

(Total 50 mark)

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