

**RAJARATA UNIVERSITY OF SRI LANKA  
FACULTY OF APPLIED SCIENCES**

**B.Sc. (Joint Major) Degree in Chemistry and Physics /  
Bachelor of Science Honours in Applied Sciences**

**Fourth Year - Semester II Examination – Jan/Feb 2023**

**PHY 4215 – APPLIED GEOPHYSICS**

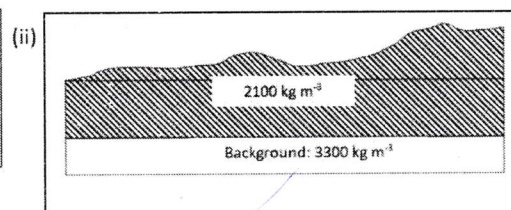
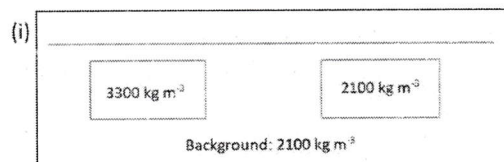
**Time: Two (02) hours**

**Answer all questions in Part I and answer any three (3) questions in Part II.**

Unless otherwise specified, symbols have their usual meaning.  
Use of a calculator is permitted.

**Part I**

1. Discuss the “equivalent models” in geophysics and explain why an integrated (more than one technique) approach is required to identify subsurface targets (mineral deposits etc.) (05 Marks)
2. What is meant by data reduction in geophysics? (05 Marks)
3. Explain with an example why resolution is important for geophysical surveying. (05 Marks)
4. Sketch the Bouguer gravity anomaly and free air gravity anomaly for each of the following structures. (Scales are not required, but comparative levels between free air and Bouguer gravity anomaly are needed to be shown in the sketches). (10 Marks)



## Part II

1. Magnetic surveys have a broad range of applications, from small scale engineering or archaeological surveys to detect buried metallic objects and to large-scale surveys carried out to investigate regional geological structures.

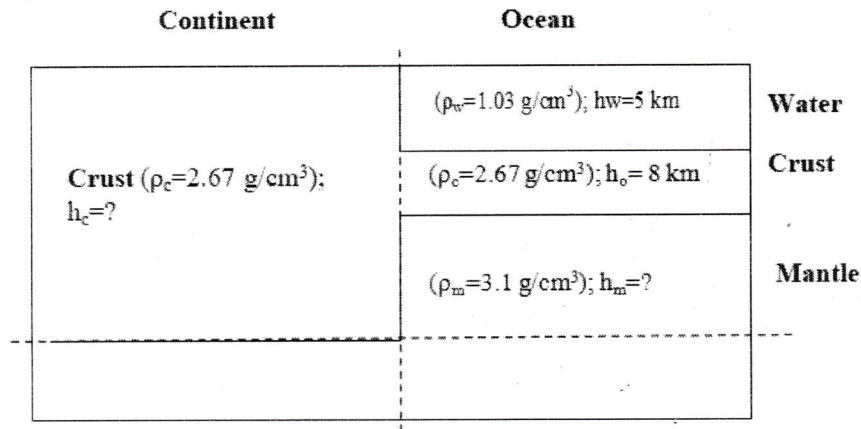
- a. What is the meaning of induced magnetization? (05 Marks)
- b. What are the different induced magnetization behaviour types? Explain one of them by using its magnetization direction and strength? (05 Marks)
- c. Sketch the shape of magnetic anomaly due to following structures. All objects are in the form of induced magnetization and in the present magnetic field.
  - i. A buried sphere of radius of 5 m, whose centre is at a depth of 20 m located at the equator. What would happen if the radius is increased to 10 m? Redraw the magnetic anomaly shape in same figure. (04 Marks)
  - ii. A buried sphere of radius of 5 m, whose centre is at a depth of 20 m located in geographic North Pole. What would happen if the depth is increased to 30 m. Redraw the magnetic anomaly shape in same figure. (04 Marks)
  - iii. A buried sphere of radius of 5 m whose centre is at a depth of 20 m at a location where the latitude is  $+45^\circ$ . (02 Marks)
- d. What is the importance of base correction in a magnetic survey? (05 Marks)

2. Gravity method is one of the commonly used geophysical techniques. However, quality data acquisition depends on well-established survey procedure.

- a. What is the meaning of "Drift" related to the gravimeter? (05 Marks)
- b. Determine the values of gravity at the following series of points belonging to a gravimetric survey, specifying the drift correction for each of them. The gravity at the base is 980.139 82 Gal, and the gravimeter constant is 0.301 81 mGal/ru (ru: reading unit). (10 Marks)

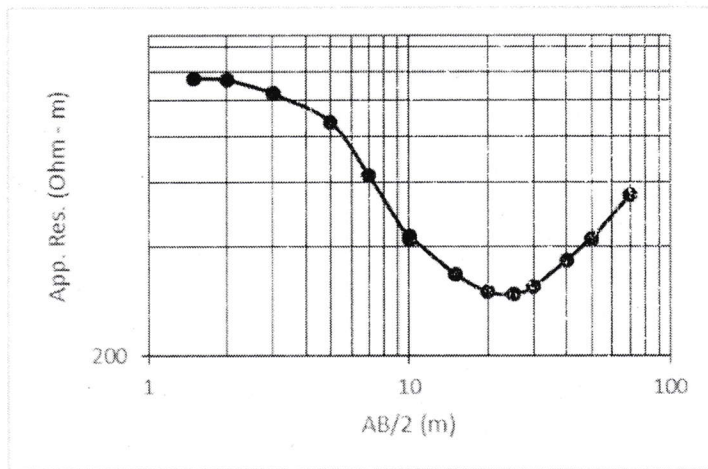
Station	Time	Reading
A (Base station)	08:30	562.5
B	09:21	400.7
C	11:34	437.9
D	13:20	360.1
A	14:20	568.8

- c. Following schematic diagram shows the passive continental margin. Calculate the thickness of continent crust by assuming the system is in Airy isostatic equilibrium. (10 Marks)



3. Resistivity surveys are designed to delineate vertical and lateral changes of resistivity of Earth material.
- What is the meaning of resistivity? (05 Marks)
  - Draw the electrode configuration of Schlumberger array and Wenner array. (05 Marks)
  - The following resistivity survey was conducted to explore a graphite layer within metamorphic bedrock. The graphite layer is less resistive compared to the metamorphic bedrock.

AB/2	MN/2	App.Res
m	m	$\Omega m$
1.5	0.5	1150
2	0.5	1140
3	0.5	1050
3	1	1045
5	1	875
7	1	625
10	1	415
10	2.5	425
15	2.5	335
20	2.5	300
25	2.5	295
30	2.5	310
40	2.5	366
50	2.5	421
50	10	418
70	10	550



- i. How many layers can you observed in this curve? Explain how resistivity of those layers change with depth (No need to use values).  
(05 Marks)
  - ii. Explain why repeat readings were taken at a several AB/2 distances (e.g. at 3m, 10m and 50m).  
(05 Marks)
  - iii. Can we calculate true resistivity values of each layer? Discuss your statement.  
(05 Marks)
4. Write short notes on five (5) of the following.
- a. Bouguer gravity correction
  - b. Diurnal variations
  - c. Remanent magnetization
  - d. Magnetic susceptibility
  - e. Forward and inverse modelling
  - f. Data reduction steps in gravity
  - g. Magnetic anomaly
- (05 x 5 Marks)

-End-