



CRAWFORD UNIVERSITY

FAITH CITY, IGBESA, OGUN STATE, NIGERIA.

COLLEGE OF NATURAL AND APPLIED SCIENCES

HARMATTAN SEMESTER EXAMINATIONS, 2020/2021 SESSION

B.Sc. GEOLOGY AND MINERAL RESOURCES EXAMINATIONS

GEM 461 APPLIED GEOPHYSICS UNITS: 3

TIME ALLOWED: 3 HOURS

INSTRUCTION: ANSWER QUESTION ONE AND ANY OTHER THREE QUESTION

- 1(a) Why does gravity vary from place to place?
- (b) A resistivity survey has just been completed in Crawford University at a proposed site for a new four storey boys hostel. A total of fifteen soundings were carried out and you have been instructed to take the raw data to the geophysics workstation for necessary interpretation. However, at the workstation you discovered that one of the sounding has not been completely calculated for plotting and hence cannot be interpreted in its present form. The data for sounding is given below:

$AB/2$	$MN/2$	Δv	I	$G.F$
1.00	0.25	0.7	4.3	5.89
1.30	0.25	6.5	4.0	10.23
1.80	0.25	17.2	3.5	19.97
2.40	0.25	47.3	2.6	35.80
3.20	0.25	54.1	1.3	63.96
4.20	0.25	30.7	1.5	110.46
5.50	1	42.3	2.6	45.95
7.50	1	40.3	1.8	86.79
10.00	1	34.6	1.7	155.53
13.00	1	36.2	1.2	102.27
18.00	2.5	25.7	1.9	199.67
24.00	2.5	19.6	0.9	358.03

Based on this,

- Which array do you think must have been used in the data acquisition process showing a schematic of the survey design

- What needs to be done to the data at this stage in order to effect plotting and list the basic interpretation techniques you would apply?
 - Make the necessary data adjustments/processing to effect plotting.
- (c) List five (5) corrections that could be applied to gravity observations and 5 types of gravity instruments
- 2 (a) With respect to (a) source of energy (b) physical parameter measured (c) relevant physical property (d) and with three applications each, explain the following methods:
- Radiometric method
 - Seismic method
 - Telluric method
 - Electromagnetic method
 - Resistivity method
- (b) State the Biot – savart/Amperes law and differentiate between accuracy and precision
- (c) With the aid of suitable diagrams, explain briefly the following arrays with their various geometric factors and approximate depth of investigation:
- Wenner Array
 - Schlumberger Array
 - Dipole Dipole Array
- 3(a) What are the steps to be taken to reduce electrode resistance during resistivity survey? List two difficulties to be carefully avoided.
- (b) Give 3 applications of ground penetrating radar under the following headings:
- Geological
 - Archeological
 - Engineering
 - Environmental.
- (c) With the aid of appropriate diagrams where necessary, explain the following:
- Coupling
 - Polarization
 - Diamagnetism
- 4(a) Explain briefly the relationship between the Geoid, the Spheroid and Anomalous mass
- (b) With the aid of diagrams only explain:
- Common short gather
 - Ferromagnetism
 - Anti-ferromagnetism
 - Ferrimagnetism

- Common receiver gather

(c) What are the factors that must be considered before designing a gravity survey?

5(a) Gravity survey was done from Crawford university gate to the female hostel, the time at each stations were recorded along with the gravity value at each stations. Correct for drift at each station.

Stations	Time (mins)	$\Delta g(\text{mgal})$	Drift
Crawford gate	8.00	27.0	
Admin	8.20	24.2	
Library	8.40	31.4	
Eco bank	9.00	18.6	
Female hostel	9.20	17.8	
Crawford gate	10.00	24.0	

(b) List four advantages of using log – log graph in VES interpretation and give two ways of interpreting VES data

(c) What are the factors controlling the resistivity of earth material and list five sources of generating seismic waves.

6(a) Give three properties of earth materials and state three ways in which electric current may be propagated in rock and minerals

(b) Elucidate on the term elastic moduli and List five methods of modeling gravity anomalies.

(c) i List and draw the four basic resistivity curve types and List five (5) resistivity survey equipment

ii Identify the following curve types and illustrate them with diagrams

ρ_1 1000 Ωm , ρ_2 -210 Ωm , ρ_3 -308 Ωm , ρ_4 -770 Ωm , ρ_5 -250 Ωm

ρ_1 230 Ωm , ρ_2 255 Ωm , ρ_3 10 Ωm , ρ_4 -170 Ωm , ρ_5 99 Ωm

ρ_1 400 Ωm , ρ_2 650 Ωm , ρ_3 870 Ωm , ρ_4 -700 Ωm , ρ_5 -1200 Ωm

ρ_1 19 Ωm , ρ_2 -88 Ωm , ρ_3 -540 Ωm , ρ_4 -323 Ωm , ρ_5 -800 Ωm

ρ_1 100 Ωm , ρ_2 300 Ωm , ρ_3 175 Ωm , ρ_4 500 Ωm , ρ_5 -330 Ωm