



CRAWFORD UNIVERSITY

FAITH CITY, IGBESA, OGUN STATE, NIGERIA.

COLLEGE OF NATURAL AND APPLIED SCIENCES

HARMATTAN SEMESTER EXAMINATIONS, 2024/2025 SESSION

B.Sc. GEOLOGY AND MINERAL RESOURCES EXAMINATIONS

GEM 461 APPLIED GEOPHYSICS UNITS: 3

TIME ALLOWED: 2 HRS 30 MINS

INSTRUCTION: ANSWER QUESTION ONE AND ANY OTHER THREE QUESTION

- 1(a) Why does gravity vary from place to place? And state the factors that affect the resistivity of rocks
- (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
1.00	0.25	0.7	4.3
1.30	0.25	6.5	4.0
1.80	0.25	17.2	3.5
2.40	0.25	47.3	2.6
3.20	0.25	54.1	1.3
4.20	0.25	30.7	1.5
5.50	1	42.3	2.6
7.50	1	40.3	1.8
10.00	1	34.6	1.7
13.00	1	36.2	1.2
18.00	2.5	25.7	1.9
24.00	2.5	19.6	0.9

Based on this,

- Which array do you think must have been used in the data acquisition process, and show 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.
- 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:

- i. Ground penetrating Radar method
- ii. Seismic method
- iii. Gravity method
- iv. Magnetic method
- v. Resistivity method

(b) State the Biot – savart/Amperes law and List five (5) resistivity survey equipment

3(a) With clear annotated diagrams, Discuss the following arrays with their various geometric factors and approximate depth of investigation: (Wenner, Schlumberger, Dipole Dipole)

(b) Give 3 applications of ground penetrating radar under the following headings: (Geological, Archaeological, Engineering, Environmental)

4(a) Discuss the relationship between the Geoid, the Spheroid and Anomalous mass.

(b) With the aid of appropriate diagrams where necessary, explain the following: (Ferrimagnetism, Coupling, Polarization, Diamagnetism, Ferromagnetism)

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

6(a) what are the four typical shapes of an apparent resistivity curve of a layered structure consisting of three horizontal layers

(b) 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