ELIZADE UNIVERSITY, ILARA-MOKIN
FACULTY OF BASIC AND APPLIED SCIENCES
DEPARTMENT: PHYSICAL AND CHEMICAL SCIENCES
PROGRAMME: APPLIED GEOPHYSICS EXAM TITLE: DEGREE EXAMINATION
COURSE CODE & TITLE: AGP 416 – GROUNDWATER GEOPHYSICS
TIME ALLOWED: 2Hrs 30 mins SEMESTER/SESSION: SECOND SEMESTER/ 2016/2017
INSTRUCTIONS: Answer question NUMBERS 1 & 4 and any OTHER ONE question of your choice.
*Write your **matriculation number** only on your answer script(s) and NOT your name*

1. (a) Discuss the origin groundwater.
   (b) Describe (with diagram) the vertical distribution of groundwater.
   (c) State the geologic structures that are favourable to groundwater accumulation in a typical basement environment.
   (d) State at least three (3) factors which make groundwater a better alternative to surface water.
   (e) Briefly discuss each of the following: (i) Perched aquifer (ii) Leaky aquifer
   (f) Differentiate between a confined and unconfined aquifer (show diagrams).
   (g) List five factors that affect porosity of rocks.
   (h) Table 1 shows the interpretation results of a Vertical Electrical Sounding for groundwater development in a Basement Complex environment. Sketch the representative VES curve and identify the possible lithology of the layers.

Table 1

Layer	1	2	3	4	5
Resistivity (Ohm-m)	216	70	325	188	1263
Layer Thickness (m)	1.0	0.9	2.4	21.3	-

   (i) As a geophysicist, from Table 1 above, which layer is best for recommendation for groundwater abstraction? Give reason(s) for your choice.
   (j) Compare and contrast groundwater investigation in a basement and sedimentary terrains.

(24 marks)

2. Table 2 shows the field data of a Vertical Electrical Sounding acquired using Schlumberger electrode configuration from a typical Basement Complex environment.

   (a) Plot the data.
   (b) Derive the geoelectric parameters through manual curve interpretation, using appropriate curves among those provided.
   (c) State the geologic structure Identifiable from (b) above. What is your view on the groundwater prospect of the surveyed site?

(15 marks)

3. Table 3 shows data from a seismic refraction survey in a crystalline basement terrain..

   (a) Plot the Time (T) – Distance (X) curve.
   (b) Determine the depth to the bedrock.

(c) Generate a geological section from your interpretation.

(15 marks)

4. (a) List two (2) major operational differences between the Wenner and Schlumberger arrays when engaged in groundwater investigation.

(b) Highlight four (4) factors that are important in the occurrence of groundwater. Briefly state the inter-play between these factors.

(c) (i) State two (2) advantages and limitations of the Very Low Frequency (VLF) EM method in groundwater prospecting.

(ii) VLF EM method in groundwater prospecting often requires a follow-up detailed study, which geophysical method would you recommend and why?

(d) Figure 1 is a cross section of interpreted resistivity data from a typical crystalline basement area of Ondo State for groundwater investigation.

(i) Identify the aquifer layer. Use the scale given to estimate the thickness range of the aquifer identified.
(ii) Identify possible VES location(s) that could be considered for groundwater abstraction, recommend optimum drillable depth.
(iii) Identify the location you consider the aquifer is well protected from surface contaminant, and determine its geoelectric parameters (resistivity and thickness).

(21 marks)

Table 2

ELECTRODE SEPARATION (m)	APPARENT RESISTIVITY (Ohm-m)
(AB/2)	VES 1
1	227
2	210
3	229
4	264
6	330
6	345
8	378
12	250
15	239
15	231
25	249
32	278
40	319
40	312
65	438

Table 3

Geophone	1	2	3	4	5	6	7	8	9	10	11	12
X (m)	50	100	150	200	250	300	350	400	450	500	550	600
T (ms)	10	20	30	40	50	60	65	69	73	77	81	85

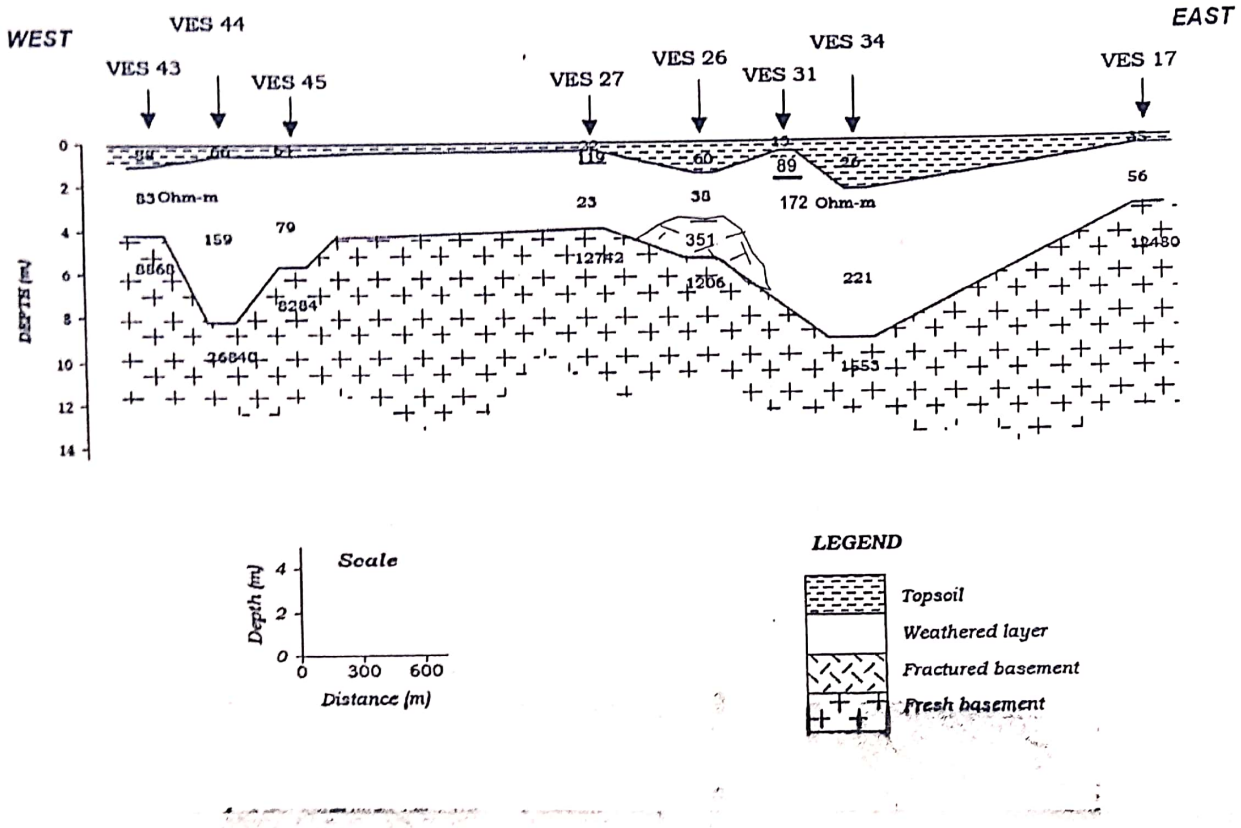

Figure 1: Cross Section of Interpreted Resistivity Data