FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF PHYSICAL SCIENCES
DEPARTMENT OF GEOLOGY

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BTech GEOLOGY
2017/2018 SESSION

COURSE CODE: GEL 324 **UNIT:** 2

COURSE TITLE: PRINCIPLES OF GEOPHYSICS

INSTRUCTIONS: ANSWER QUESTION ONE AND ONE QUESTION EACH FROM SECTIONS A AND B

TIME ALLOWED: 2 HOURS **DATE:** 13TH APRIL, 2018

PRACTICAL

1. The data below was generated from a geological formation during one of the GEL 324 practical fieldwork.

Fill in the table and answer the following questions.

S/No	Electrode spacing AB/2	Locations ρ_a	ρ_b
1	1.00	81	178
2	2.00	132	126
3	3.00	125	118
4	5.00	103	84
5	6.00	90	79
6	6.00	89	51
7	8.00	74	75
8	10.00	67	82
9	10.00	60	83
10	15.00	52	80
11	20.00	45	81
12	30.00	65	130
13	40.00	105	188
14	40.00	20	222
15	50.00	120	269
16	60.00	189	349
17	70.00	191	422
18	80.00	230	476
19	80.00	210	582
20	90.00	280	598
21	100.00	301	650

i. Using the data presented above, answer the following questions:
ii. Plot the appropriate graphs
iii. What is the approximate depth of the overburden in each location?
iv. How many layers are there in each case?
v. Identify the terrains with reasons?
vi. Write the geological names of the layer(s) you may find.
vii. Arrange locations A and B in other of productivity if the two are to be drilled.
viii. If the subsurface is to be exploited, at what depth will you encounter fresh rock?
ix. If the subsurface is drilled, will the data give productive borehole?
x. What are the major problems encountered during the practical fieldwork exercise?

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SECTION A

2. (a) Name a geophysical surveying method and how you will use it to solve water problem in F.U.T. Minna, Bosso Campus?

(b) Outline:
i. the differences between Schlumberger and Werner array methods.
ii. the principles and limitations of self-potential surveying method.
iii. the applications of electric resistivity surveying method.

3. (a) State the resistivity equation for Werner configuration and proof the resistivity equation: $\rho = \frac{\pi r^2}{I} \cdot \frac{\Delta V}{\Delta r}$

(b) Draw the:
i. four electrode array.
ii Werner configuration and Schlumberger configuration.

(c) i. Explain the term apparent resistivity.
ii. What are the limitations of Induced Polarization surveying method?

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1) a. State the Law of Universal Gravitation.
b. State Newton's Second Law.
c. Using the Law of Universal Gravitation and Newton's Second Law, derive an expression for the acceleration of gravity.
d. A spherical cavity of radius 8 m has its centre 15 m below the surface. If the cavity is full of water and is in rocks of density 2400 kg/m^3, what is the maximum size of its anomaly?

2) a. Calculate the acceleration due to gravity, g, on Mars to the nearest 0.01 m/s^2. Assume: mass of Mars is 6.42x10^{23} kg, Mars radius is 3397 km, and the universal gravitational constant is 6.67x10-11 m^3·kg^{-1}·s^{-2}.

b. What are the advantages and disadvantages of aeromagnetic surveys in comparison to ground level ones?
c. Sketch the anomaly of a buried sphere with induced magnetisation at the south magnetic pole.
d. What is the advantage of a magnetic anomaly being 'reduced to the pole'?

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PRINCIPLES OF GEOPHYSICS TEST 2017/2018
GEL 324 C.A 20%

1. What is the most important tool in any method of geophysical survey_____
2. Name the electrodes used in the electric resistively method_____
3. State the resistively equation for schlumberger array system_____
4. In an electrode array, what is the equivalence of $C_1C_2/2$ in the schlumberger array system?_____
5. State the (in formular) Hook's law and resistivity.
6. Which of the following rocks has the lowest electrical resistivity.. shales, limestones, sandstones and granite.
7. State the two mechanisms through which currents are carried in S.P method
8. In SP method, state the list of materials associate with it
9. The interpretation of SP anomalies is similar to_____interpretation
10. Hematite, ilmenite and pyrhotite, which one of them has the lowest resistivity?
11. One of limitations of resistivity surveying method in respect to structures is _____
12. The best application of S.P is _____
13. One of the disadvantages of S.P method is _____
14. _____ method makes use of natural currents flowing in the ground.
15. In a schlumberger array system, a depth of 100 metres is to be sounded with $P_1 P_2$ = 15m, what will be the distance C_1C_2? _____
16. In a Wenner array system a/2 = 20 metres, what is the depth of investigation_____
17. In a S.P survey, deep, shallow, intermediate or very deep depth is investigated.
18. In a three layered system. How many bends / point of inflection does the anomaly has _____
19. Which of the following rocks is most resistive? gabbros , quartzite, shist, clay, alluvium

Which of the rocks in number 19 is least resistive?_____

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SCHOOL OF PHYSICAL SCIENCES
DEPARTMENT OF GEOLOGY

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BTech GEOLOGY
2017/2018 SESSION

COURSE CODE: GEL 324 **UNIT:** 2

COURSE TITLE: PRINCIPLES OF GEOPHYSICS

INSTRUCTIONS: ANSWER QUESTION ONE AND ONE QUESTION EACH FROM SECTIONS A AND B

TIME ALLOWED: 2 HOURS **DATE:** 13TH APRIL, 2018

PRACTICAL

1. The data below was generated from a geological formation during one of the GEL 324 practical fieldwork.

Fill in the table and answer the following questions.

S/No	Electrode spacing AB/2	Locations	
		Path	
1	1.00	93	178
2	2.00	132	126
3	3.00	125	118
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5	6.00	90	79
6	6.00	89	91
7	8.00	74	75
8	10.00	67	82
9	10.00	69	85
10	15.00	82	80
11	20.00	85	81
12	30.00	65	130
13	40.00	105	198
14	40.00	20	222
15	50.00	120	269
16	60.00	189	349
17	70.00	191	422
18	80.00	230	476
19	80.00	210	582
20	90.00	280	598
21	100.00	301	659

i. Using the data presented above, answer the following questions:
ii. Plot the appropriate graphs
iii. What is the approximate depth of the overburden in each location?
iv. How many layers are there in each case?
v. Identify the terrains with reasons?
vi. Write the geological names of the layer(s) you may find.
vii. Arrange locations A and B in other of productivity if the two are to be drilled.
viii. If the subsurface is to be exploited, at what depth will you encounter fresh rock?
ix. If the subsurface is drilled, will the data give productive borehole?
x. What are the major problems encountered during the practical fieldwork exercise?

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SECTION A

2. (a) Name a geophysical surveying method and how you will use it to solve water problem in F.U.T. Minna, Bosso Campus?

(b) Outline:
i. the differences between Schlumberger and Werner array methods.
ii. the principles and limitations of self-potential surveying method.
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3. (a) State the resistivity equation for Werner configuration and proof the resistivity equation: $\rho = \frac{\pi r^2}{I} \cdot \frac{\Delta V}{\Delta r}$

(b) Draw the:
i. four electrode array.
ii Werner configuration and Schlumberger configuration.

(c) i. Explain the term apparent resistivity.
ii. What are the limitations of Induced Polarization surveying method?

SECTION B

1) a. State the Law of Universal Gravitation.
b. State Newton's Second Law.
c. Using the Law of Universal Gravitation and Newton's Second Law, derive an expression for the acceleration of gravity.
d. A spherical cavity of radius 8 m has its centre 15 m below the surface. If the cavity is full of water and is in rocks of density 2400 kg/m^3, what is the maximum size of its anomaly?

2) a. Calculate the acceleration due to gravity, g, on Mars to the nearest 0.01 m/s^2. Assume: mass of Mars is 6.42×10^{23} kg. Mars radius is 3397 km, and the universal gravitational constant is 6.67x10-11 m$^3 \cdot$kg$^{-1} \cdot$s^{-2}.

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FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF PHYSICAL SCIENCES
DEPARTMENT OF GEOLOGY

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BTECH (GEOLOGY), 2016/2017 SESSION

COURSE: GEL 324 (PRINCIPLES OF GEOPHYSICS) UNIT: 2

DATE: 19TH OCTOBER, 2017 **TIME ALLOWED**: 2 Hours

INSTRUCTIONS: Answer Question 1 (practical) and two other questions, at least one from each section.

SECTION A

1. The data below was generated from a geological formation during one of the GEL 324 practical fieldwork.

Fill in the table and answer the following questions.

S/No	Electrode spacing AB/2	MN/2	V/I=R	K	ρ_a
1	1.00	0.50	279.66	2.36	659.98
2	2.00	0.50	62.83	11.80	741.39
3	3.00	0.50	18.84	27.50	518.10
4	5.00	0.50	4.10	77.80	318.98
5	6.00	0.50	1.67	112.00	187.04
6	6.00	0.50	4.49	55.00	246.95
7	8.00	1.00	2.26	99.00	223.74
8	10.00	1.00	1.26	156.00	196.56
9	10.00	2.50	3.19	58.90	187.89
10	15.00	2.50	1.20	137.00	164.40
11	20.00	2.50	0.70	247.00	172.90
12	30.00	2.50	0.34	562.00	191.08
13	40.00	2.50	0.24	1001.00	240.24
14	40.00	7.50	0.76	323.00	245.48
15	50.00	7.50	0.51	512.00	261.12
16	60.00	7.50	0.40	742.00	296.80
17	70.00	7.50	0.33	1014.00	334.62
18	80.00	7.50	0.27	1329.00	358.83
19	80.00	15.00	0.57	647.00	368.79
20	90.00	15.00	0.48	825.00	396.00
21	100.00	15.00	0.43	1024.00	440.32

a. i. Define the physical parameters used in the table.
ii. Plot the appropriate graph.
iii. What is the approximate thickness of overburden?
iv. Deduce the number of layers existing in the subsurface.
v. Write the geological name(s) of the existing layer(s).

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i. If the subsurface is to be explored, at what depth will you encounter [illegible] rock?

ii. If the subsurface is drilled will the data give productive/economic [illegible]?

iii. What are the major problems encountered during the practical fieldwork exercise

2 (a) Name a geophysical surveying method and how you will use it to solve water problem in F.U.T. Minna, Bosso Campus?

(b) Outline:

i. state the differences between Schlumberger and Wenner array methods
ii. the principles and limitations of self-potential surveying method
iii. the application and limitations of electric resistivity surveying method

3 (a) Arrange the following in decreasing electrical resistivity
Shale, clay, rhyolite, granite, limestone, galena, magnetite, chalcopyrite

(b) State the resistivity equation for ~~Wenner~~ Schlumberger configuration and proof the resistivity equation: $\rho = 2\pi aR$

(c) Explain the term apparent resistivity

SECTION B

4. (a) State the Law of Universal Gravitation.

(b) Calculate the acceleration due to gravity (g) on Mars to the nearest 0.01 ms^{-2}. Given that: Mass of Mars = 6.42×10^{23} kg
Radius of Mars = 3397 km
Universal gravitational constant = 6.67×10^{-11} $m^3 . Kg^{-1} s^{-2}$

Make sure that you are clear in showing why the acceleration due to gravity only depends on mass of Mars and not on any object's mass.

(c) Gravity measurement requires an extensive data processing procedure to map and isolate specific gravity anomalies. List four of the most common applied corrections and attempt explanations for them.

5. a. Explain the term "Magnetic Geophysical exploration".
b. Discuss some of the major applications of magnetic geophysical exploration.
c. Give the full meaning of IGRF and write very short note on its application.

International Geomagnetic Reference Field

It is used as Correction of earth global field

Correction + global effect of magnetic Surveying (your

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FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND SCIENCE EDUCATION

DEPARTMENT OF GEOLOGY

SECOND SEMESTER EXAMINATION 2007/2008 SESSION

COURSE CODE: GEL 324

COURSE TITLE: PRINCIPLES GEOPHYSICS

UNIT: 2 TIME ALLOWED: 2 HOURS

DATE: 6TH OF OCTOBER, 2008

INSTRUCTIONS: ANSWER QUESTION NUMBER 1, 2 AND ANY OTHER QUESTION.

1. Table 1 below is the readings from the VES done for the borehole point drilled at the professorial quarters of Federal University of Technology, Minna in the year 1999. Due to obstructions, the sounding was stopped at 50m AB/2.

Table 1 Readings from the VES done for the borehole point drilled at the professorial quarters of Federal University of Technology, Minna.

S/No.	Electrode Spacing		Resistance (Ω)	Calculated Geometric Factor, K	ρ_a = Apparent Resistivity (Ω-m)
	AB/2 (m)	MN/2(m)			
1	1	0.50	40.80	2.36	
2	2	0.50	15.46	11.8	
3	3	0.50	5.91	27.5	
4	5	0.50	1.915	77.8	
5	6	0.50	1.103	112	
6	6	1.00	2.45	55	
7	8	1.00	1.16	99	
8	10	1.00	0.725	156	
9	10	2.50	1.087	58.9	
10	15	2.50	1.029	137	
11	20	2.50	0.788	247	
12	30	2.50	0.525	562	
13	40	2.50	0.367	1001	
14	40	7.50	1.199	323	
15	50	7.50	0.932	512	

$\rho_a = R/C$

$\rho = \frac{2\pi r}{q} = \frac{2 \times 3.142 \times 40}{2.36}$

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a) Calculate the apparent resistivity (ρ_a) and fill in the resistivity column of the table.

b) Plot the graph of apparent resistivity against electrode spacing.

c) At what apparent depth would you expect water?

d) At what depth would you advise the borehole to be terminated? (20 marks)

2a) Define Geophysics

2b) Define Bouquer anomaly

2c) Study table 2 below and fill in the spaces with their appropriate physical properties and applications.

Applications

1. Hydrocarbon exploration (coal, gas, oil)
2. Regional geological studies (over an area of 100 km^2)
3. Exploration / Development of mineral deposits
4. Engineering site investigations
5. Hydrogeological investigations
6. Location and definition of burned metallic objects.

Table 2 Appropriate physical properties and applications.

Geophysical Method	Dependent Physical Property	1	2	3	4	5	6
Gravity ✓	Density	P P	S S	P P	P S	P	P M
Magnetic	Susceptibility	M S	P M	S S	M M	M M S	P
Resistivity	Resistance	M S	M S	P P	P P	P P	S P
Spontaneous potential	potential Different	M (M)	M M	P M	M M	M M	P

Write P for primary method

S for secondary method and M may be used but not necessarily the best approaches again, write the appropriate physical properties to which each method relates. (25 marks).

	1)	2	3	4	5	6
G	P	S	S	S	S	M
M	S	S	S	S	M	P
R^2	S	P	P	P	P	S
SP	M	M	M S	M +	S	S

P S P P P P

S S P P P P

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FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF NATURAL AND APPLIED SCIENCE
DEPARTMENT OF GEOLOGY
SECOND SEMESTER EXAMINATION FOR THE DEGREE OF B.TECH GEOLOGY
2013/2014 SESSION
COURSE CODE: GEL 324 COURSE TITLE: PRINCIPLES OF GEOPHYSIC
UNIT: 3
INSTRUCTION: ANSWER 3 QUESTIONS IN ALL. ANSWER QUESTION 1 AND EITHER QUESTION 2 OR 3 AND ANSWER QUESTION 4 OR 5
TIME ALLOWED: 2 ½ HOURS DATE: 21st OCTOBER, 2014

1a. Define Geophysics

b. As a student of Geology, you have been asked to solve the problem of water by drilling borehole in Gidan Kwanu Campus.

i. Name a Geophysical surveying method and outline how you may use it to solve this problem?

ii. List 3 advantages and 2 disadvantages of the method chosen.

c. In the just concluded Geophysics Practical (GEL 324P) field work, the following data was got by one of the two groups.

Current electrode spacing	1	2	3	5	6	6	8	10
Resistance	97.456	3.814	1.600	0.669	0.473	0.927	0.596	0.385
Current electrode spacing	10	15	20	30	40	40	50	60
Resistance	0.866	0.547	0.360	0.221	0.153	0.479	0.434	0.201
Current electrode spacing	70	80	80	90	100	100	150	-
Resistance	0.305	0.259	0.535	0.485	0.466	0.637	0.403	-

Use the materials provided to enter this data and answer the following questions?

i What is the approximate thickness of the overburden ?

ii. How many geoelectric layers can you infer? Write the names of the lithologies expected?

iii. At what depth are you likely to encounter the first aquifer? or fresh rock?

iv. At what depth are you expecting the borehole to be terminated and why?

v. At the end of drilling, will the borehole be a productive or an abortive one? Why?

d. Complete the table below with respect to geophysical surveying methods, their dependent physical properties and their main applications.

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Geophysical Method	Physical Property	Application
Gravity	Density	1,2
Seismic	? Wave or speed of sound	?
Resistivity	? Resistance	?
S.P	?? Potential differences	?

i. Location and delineation of buried metallic objects

ii. Hydrogeological investigation

iii. Exploration of mineral deposit

iv. Regional geological studies (over areas of $100km^2$)

v. Hydrocarbon exploration (coal, gas, oil).

2 Write short notes on

a. body waves and surface waves

b the origin of S.P

c state the difference between Werner and Schlumberger Array Configuration.

d. apparent resistivity.

e. resistivity of rocks and minerals

3 a. Draw:

i The four electrode array

ii Werner array and

iii Schlumberger array configurations.

b. Proof the resistivity equation $\rho=2\pi$ ad (V/I)

c. Arrange the following mineral/rocks in

(i). decreasing apparent resistivity

(ii). increasing density

(iii). P-wave velocities

Gabbro, sulphide ores, limestone, shales and granite. Write the units of these three quantities.

d. What are the elements of and the applications of seismic surveying method?

4 a. Calculate the gravitational force between two lead spheres of radius 10cm in contact with one another.

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$G = 6.6 \times 10^{-11}\ m^3 kg^{-1} s^{-2}$; Density of lead = 11,300 kg m^{-3}

b. Explain the advantages and disadvantages of aeromagnetic surveys in comparison to ground level ones?

c. Sketch the anomaly of a dipole at different latitudes. What is the significance of the shapes of these anomalies?

Q 4. Write short notes on the physical properties of rocks.

b. What is Bouguer Anomaly? Briefly explain the pertinent corrections needed to derive this anomaly.

c. Discuss the underlisted methods used in the advanced processing of magnetic data.

i. Reduction to the pole

ii. Upward and downward continuation

iii. Pseudogravity

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