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

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BTech GEOLOGY, 2015/2016 SESSION

COURSE: GEL 512 (APPLIED GEOPHYSICS) UNIT: 3

DATE: 8th April, 2016. Time Allowed: 2hours 45minutes.

Instructions: Answer Question 1 (practical) and any other one question from section A, and two questions from section B.

SECTION A

1 Practical

(a) The following data were generated from two different geological formations.

s/No	Electrode spacing AB/2	V/I=R_a	V/I=R_b	K	SITE ρ_a	
					A	B
1	1.00	306.8	287.3	2.36		
2	2.00	74.6	38.6	11.8		
3	3.00	29.5	13.7	27.5		
4	5.00	9.8	3.6	77.8		
5	6.00	6.5	2.3	112		
6	6.00	13.1	1.3	55		
7	8.00	5.8	2.3	99		
8	10.00	4.4	1.3	156		
9	10.00	11.6	3.6	58.9		
10	15.00	4.6	1.4	137		
11	20.00	2.3	1.0	247		
12	30.00	1.2	0.76	562		
13	40.00	0.689	0.75	1001		
14	40.00	2.7	1.0	323		
15	50.00	1.9	0.8	512		
16	60.00	1.3	0.73	742		
17	70.00	1.1	0.63	1014		
18	80.00	10.9	0.60	1329		
19	80.00	1.8	1.24	647		
20	90.00	1.4	0.97	825		
21	100.00	1.2	0.85	1024		

Fill in the table and answer the following questions:

(i) Which geophysical method's data is given above?
(ii) Plot the appropriate graphs
(iii) What is the approximate depth of the overburden?
(iv) At about what apparent depth are you likely to encounter aquifer in both formations?
(v) At about what depth are you likely to stop drilling (if the two sites are to be drilled)?
(vi) How many layer(s) can you find from your graphs?
(vii) Write the geological name(s) of the layer(s) you may find.
(viii) Will the data give productive boreholes? Justify your answer.

2 Write short notes on the following:

(i) Principles of Induced Polarisation
(ii) Mechanisms of Self Potential
(iii) The problems of ambiguity in geophysical interpretation.
(iv) The limitations of electromagnetic, resistivity and induced polarization surveying methods.

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(a) State the dependent physical property of the following geophysical methods: Gravity, Magnetic, Seismic, Resistivity, Spontaneous Potential, Induced Polarisation and Elecromagnetic methods.
(b) How will you search for water in a basement terrain?
(c) Arrange the following: gabbro; galena; ilmenite; magnetite and chalcopyrite in order of
(i) increasing density
(ii) decreasing resistivity and
(iii) increasing susceptibility.

SECTION B

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(a) Define reflection coefficient in the situation where a compressional wave is normally incident on a seismic interface, and express it using Zoeppritz's equation.
(b) Discuss the concept of interval velocity, and relate it to time-average equation.
(c) The following data is obtained from reflection experiment in a sedimentary basin:

DEPTH (FEET)	TWO-WAY TRAVEL TIME (ms)
4020	1088
4610	1260
4810	1308
5800	1516
6400	1692
7000	1818
7600	1938
8200	2060
8500	2106
8810	2156
8987	2184
9100	2216
9400	2226

From the data, determine:

(i) Interval velocity between 5800 and 7000 feet
(ii) Time-average velocity for the entire sedimentary sequence

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(a) Derive an expression for the total travel time of a refracted wave due to a single horizontal refractor.
(b) A single ended refraction survey performed to determine the depth to an underlying horizontal refractor reveals a top layer velocity of 3.0 km/s and a refractor velocity of 5.0 km/s. The cross-over distance is found to be 500m. What is the refractor depth?

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(a) Explain the concept of seismic stratigraphy and the two principles upon which it is based.
(b) Give a detailed discussion on seismic sequence.
(c) Trace out the deepest unconformity on the attached reflection section.
(d) Describe the reflection terminations that characterize it.

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