# ELIZADE UNIVERSITY

## ILARA-MOKIN

## ONDO STATE

FACULTY: Basic and Applied Sciences
DEPARTMENT: Physical and Chemical Sciences
SECOND SEMESTER EXAMINATIONS
2017/2018 ACADEMIC SESSION

COURSE CODE: AGP 422

COURSE TITLE: ELECTROMAGNETIC PROSPECING METHODS

DURATION: 2 Hrs : 30 minutes

HOD's SIGNATURE

TOTAL MARKS: 60 MARKS

Matriculation Number: _____

INSTRUCTIONS:

1. Write your matriculation number in the space provided above and also on the cover page of the exam booklet.
2. This question paper consists of 3 pages including this page.
3. Answer all questions in the exam booklet provided.
4. At the end of this examination, place the question paper inside the exam booklet.
5. **Answer questions 1 and 5 and any other two questions.**
6. **Make use of the graph sheet where necessary.**

# ELIZADE UNIVERSITY
## FACULTY OF BASIC AND APPLIED SCIENCES
### DEPARTMENT: PHYSICAL AND CHEMICAL SCIENCES
PROGRAMME: APPLIED GEOPHYSICS  EXAM TITLE: DEGREE EXAMINATION
COURSE CODE & TITLE: AGP 422 – ELECTROMAGNETIC PROSPECTING METHODS
TIME ALLOWED: 2Hrs : 30 minutes     SEMESTER/SESSION: 2nd / 2017/2018
INSTRUCTIONS:   Answer Questions 1 and 5 and any other Two Questions

1a   Calculate the depth of penetration of electromagnetic fields with frequencies of 10, 500 and 2000 kHz in:
   i.     Wet sandstone with a conductivity of $10^{-1}$ $Sm^{-1}$
   ii.    Massive limestone with a conductivity of $2.5 \times 10^{-4}$ $Sm^{-1}$
   iii.   Granite with a conductivity of $10^{-6}$ $Sm^{-1}$
   iv.    How does the depth of penetration of electromagnetic field vary with frequency of prospecting?
   v.     How does your answer to (iv) influence the choice of frequencies in airborne electromagnetic methods?
1b   State 5 drawbacks of the electromagnetic method.
1c   For good conductors, draw the direction of the major axis of the ellipse of polarization corresponding to the resultant of the primary and secondary electromagnetic field directions.
                                                                                    (15 marks)

2a   State (with the SI units) the four field vectors that are used to describe an electromagnetic field.
2b   State the equations that relate the vectors stated in 2 (a) above to their sources, distribution of electric charge density $\rho_c$ ($c/m^3$) and electric current density i ($A/m^2$).
2c   Explain the physical meaning of each of the equations stated in 2 (b) above.
                                                                                    (15 marks)

3a   Sketch the typical anomaly curves for tilt-angle profiles resulting from (a) vertical and (b) horizontal transmitter loops.
3b   Explain with the aid of diagrams the different field arrays / coil configuration system employed in TDEM.
3c   A terrain conductivity meter (EM31) was employed in the mapping of near surface gasoline polluted area due to pipeline explosion in part of Lagos State. Discuss the field procedures, data acquisition and analysis / interpretation, and presentation of results.

                                                                                    (15 marks)

4a   Enumerate the advantages and limitations of GPR
4b   Explain how GPR wave interact with subsurface features.
4c   Briefly explain the principle of GPR
                                                                                    (15 marks)

5a     On what bases are electromagnetic methods (EM) classified?

5b     The tilt angles (Raw Real) measured at a regular interval of 10 m during VLF-EM surveys of an area are presented in the Table 1 below:

Table 1: Very Low Frequency Electromagnetic Profiling Data

| S/N | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dist (m) | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 |
| Raw Real | -2.9 | -4.4 | -1.1 | 5.5 | 2.5 | -4.0 | -2.7 | 0.9 | 0.7 | -2.8 | 1.4 | 2.9 | 1.5 | -0.9 | 3.3 | -0.9 |

(i) Apply the Fraser Filter on the above measured data to obtain the Filtered-Real components at all the measuring stations.

(ii) Plot the Raw Real and the Filtered Real components against distance on a linear graph

(iii) Identify, with reasons, the location (s) of the causative bodies on the profiles

(iv) Why will you prefer to use the raw data for the accurate location of the causative bodies.

5c     State two advantages of EM over ER (Electrical Resistivity).

(15 marks)