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FACULTY: BASIC AND APPLIED SCIENCES
DEPARTMENT: PHYSICAL AND CHEMICAL SCIENCES
SECOND SEMESTER EXAMINATIONS
2016/2017 ACADEMIC SESSION

COURSE TITLE: ELECTROMAGNETIC PROSPECTING METHODS

COURSE CODE: AGP 422

DURATION: 2 Hrs 30 minutes **COURSE UNITS: 3 units**

TOTAL MARKS: 60 MARKS

HOD's SIGNATURE

Matriculation Number: _____

INSTRUCTIONS:

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

1a On what bases are electromagnetic methods (EM) classified?

1b 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

- Apply the Fraser Filter on the above measured data to obtain the Filtered-Real components at all the measuring stations.
- Plot the Raw Real and the Filtered Real components against distance on a linear graph
- Identify, with reasons, the location (s) of the causative bodies on the profiles
- Why will you prefer to use the raw data for the accurate location of the causative bodies.

(15 marks)

2a Define Skin Depth.

2b Calculate the depth of electromagnetic fields with frequencies 500 Hz and 20 KHz:

- Massive limestone with a conductivity of $2.5 \times 10^{-4} \text{ Sm}^{-1}$.
- Wet sandstone with conductivity of 10^{-1} Sm^{-1} .
- How does the depth of penetration of electromagnetic field vary with frequency of prospecting?

iv. How does your answer to (iv) influence the choice of frequencies in airborne electromagnetic methods?

(15 marks)

3a State (with the SI units) the four field vectors that are used to describe an electromagnetic field.

3b State the equations that relate the vectors stated in 2 (a) above to their sources, distribution of electric charge density ρ_e (C/m^3) and electric current density i (A/m^2).

3c Explain the physical meaning of each of the equations stated in 2 (b) above.

(15 marks)

4a Briefly explain the principle of GPR

4b Explain how GPR wave interact with subsurface features.

4c Enumerate the advantages and limitations of GPR.

(15 marks)

5a Briefly explain the effects of topography on VLF observations.

5b Outline the EM methods under the dip-angle EM system.

5c Sketch and explain the generalized set up of an EM induction system.

(15 marks)