AGP 303 – Self Potential, Induced Polarization & Electrical Prospecting Methods

COURSE PARTICULARS

Course Code: AGP 303  
Course Title: Self Potential, Induced Polarization & Electrical Prospecting Methods  
No. of Units: 3  
Course Duration: Two hours of theory and one hour of Practical per week for 15 weeks.  
Status: Compulsory  
Course Email Address: agp303@gmail.com  
Course Webpage: NIL  
Prerequisite: MTS 202, PHY 201, 202

COURSE INSTRUCTORS

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COURSE DESCRIPTION

This course is an introductory to electrical resistivity geophysical prospecting method. The students would be introduced into how the principle of electrical resistivity can be utilized for subsurface investigations with a view to applying it to near surface features delineations. Furthermore, the students would also be introduced to the application of the method to groundwater studies, engineering site investigations, environmental studies and mineral explorations. The techniques to be covered include the self potential, the induced polarization and the electrical resistivity techniques.
COURSE OBJECTIVES

The objectives of this course are to:

- introduce students to electrical resistivity prospecting methods and their applications in investigating subsurface Conditions; and
- provide students with opportunities to develop basic acquisition, processing and interpretation skills using the electrical methods.

COURSE LEARNING OUTCOMES / COMPETENCIES

Upon successful completion of the course, the student will be able to:

(Knowledge based)

- understand the various electrical prospecting methods applicable in geophysical exploration.
- explain the basic principles of Self Potential, Induced Polarization and Electrical Resistivity Methods;
- explain the field procedures applicable to each methods;

(Skills)

- plotting of curves necessary for qualitative interpretation
- use computer assisted interpretation techniques;
- use master and auxillary curves for the purpose of curve matching;
- understand the instrumentation and set up the different electrode arrays on the field; and
- acquisition of data on the field.

GRADING SYSTEM FOR THE COURSE

This course will be graded as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Class Attendance</td>
<td>10%</td>
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<tr>
<td>Assignments</td>
<td>10%</td>
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<td>Test(s)</td>
<td>20%</td>
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<tr>
<td>Final Examination</td>
<td>60%</td>
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<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
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GENERAL INSTRUCTIONS

Attendance: It is expected that every student will be in class for lectures and also participate in all practical exercises. Attendance records will be kept and used to determine each person’s qualification to sit for the final examination. In case of illness or other unavoidable cause of absence, the student must communicate as soon as possible with any of the instructors, indicating the reason for the absence.

Academic Integrity: Violations of academic integrity, including dishonesty in assignments, examinations, or other academic performances are prohibited. You are not allowed to make copies of another person’s work and submit it as your own; that is plagiarism. All cases of academic dishonesty will be reported to the University Management for appropriate sanctions in accordance with the guidelines for handling students’ misconduct as spelt out in the Students’ Handbook.

Assignments and Group Work: Students are expected to submit assignments as scheduled. Failure to submit an assignment as at when due will earn you zero for that assignment. Only under extenuating circumstances, for which a student has notified any of the instructors in advance, will late submission of assignments be permitted.

Code of Conduct in Lecture Rooms and Laboratories: Students should turn off their cell phones during lectures. Students are prohibited from engaging in other activities (such as texting, watching videos, etc.) during lectures. Food and drinks are not permitted in the laboratories.

READING LIST


Legend
1- Available in the University Library
2- Available in Departmental/School Libraries
3- Available on the Internet.
4- Available as Personal Collection
5- Available in local bookshops.
# COURSE OUTLINE

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<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Remarks</th>
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| 1    | Introduction and Course Overview  
Types of Natural Self Potential (SP) | During this first class, the expectation of the students from the course will also be documented. |
| 2    | Origin of SP  
- Galvanic Cell Theory  
- pH Theory  
- Sato& Mooney Half Cell Theory | The theories behind the origin of SP are discussed and the limitations of these theories. |
| 3 & 4 | Instrumentation and Field Procedures  
- Non-polarizing Electrodes  
- Connecting Wires  
- Measuring Meter  
- Gradient/Leap frog/ Fixed Electrode Array  
- Total Field/ Fixed Based Array  
- Operational Advantages and Disadvantages  
- Noise Sources | The instrumentation and field procedures will be discussed in detail. A practical follow up will be made to allow the students the opportunity of familiarising themselves with the equipment and the field layout. |
| 5&6  | Data Processing, Interpretation and Applications of SP method in Geophysical Exploration  
- Qualitative Interpretation  
- Semi-Quantitative Interpretation- Geometric and Analytical  
- Applications of SP in Geological Mapping, Groundwater, Engineering, mineral exploration, Environmental and Geothermal Studies | Exercises will involve plotting of profiles, Quick look interpretation from the profiles. Comparison between field profiles and maps with theoretically generated SP profiles and Maps. Students will understand the various applications of SP to geophysical investigation. |
| 7    | Induced Polarization Phenomenon  
- Membrane Polarization  
- Electrode Polarization  
- Time& Frequency Domain IP  
- Chargeability& Frequency Effects  
- Percentage Frequency Effects  
- Metal Factors & Phase Measurements | Students will understand the Origin of IP and the factors affecting the magnitude of membrane and electrode polarization. |
| 8&9  | Field Procedures, Data Processing, Interpretations and Applications of IP Method  
- Frequency domain Equipment  
- Time domain Equipment  
- Horizontal Profiling (HP)  
- Vertical Electrical Sounding (VES)  
- Combined HP & VES  
- Qualitative, Semi-Quantitative and Quantitative Interpretation Technique.  
- Applications in Mineral exploration | Practical class on the field procedures and processing of IP data |

**MID-SEMESTER TEST**
<table>
<thead>
<tr>
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<th>Environmental studies and Groundwater Investigation.</th>
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<tr>
<td>10 &amp; 11</td>
<td>Electrical Resistivities of Rocks and Minerals</td>
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<td>- Elementary Theory of Electrical Resistivity Method</td>
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<td>- Potentials in Homogenous Media</td>
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<td>- Single Current Source at Depth &amp; at Surface</td>
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<td>- Laplace’s Equation</td>
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<td>- Apparent Resistivity</td>
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<td>- Electrode Arrays</td>
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<td>Assignment will be given on how to develop apparent resistivity equation for pole-dipole, dipole-dipole, square array and half schlumberger array.</td>
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<td>12, 13 &amp; 14</td>
<td>Field Procedures, Interpretation and Applications</td>
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<td>- Resistivity Profiling</td>
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<td>- Depth Sounding Techniques</td>
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<td>- Manual Technique of Interpretation</td>
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<td>- Computer Assisted Interpretation</td>
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<td>- Applications - mineral exploration, Geothermal studies, Groundwater, Engineering and environmental studies.</td>
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<td>Practical Classes on the field and treatment of case histories will broaden the horizon of the students about the procedures of data acquisition, processing and Interpretation.</td>
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<td>15</td>
<td>REVISION</td>
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<td>This is the week preceding the final examination. At this time, evaluation will be done to assess how far the students’ expectations for the course have been met.</td>
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