ENGEL-GEO-111-3

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: GEOPHYSICS I

Code No.: GEO 111-3

Program: GEOLOGICAL ENGINEERING TECHNICIAN

Semester: ONE

Date: MAY 14, 1984

Author: M. ENGEL

New: ______ Revision: X

APPROVED: ______________________ ______________

Chairperson Date

CALENDAR DESCRIPTION

Geophysics I	GEO 111-3
Course Name	Course Number

PHILOSOPHY/GOALS:

This course provides the student with an introduction to the basic physical properties of the earth. Emphasis will be on exploration geophysics and the student will be familiar with the application and operation of magnetometers, hammer seismographs and gamma ray spectrometers. The plotting and elementary interpretation of data will be taught in the course.

METHOD OF ASSESSMENT (GRADING METHOD):

Three written tests of equal value (25% each) - 3 x 25 = 75%

Three geophysical reports using data obtained from field exercises.

2 Magnetometers surveys (10% each) - 2 x 10 = 20%

1 Seismic Survey (5%) = 5%

100%

The student has to participate in all field exercises.

A = 80 or better
B = 70 - 79%
C = 60 - 69%
D = 45 - 59%

TEXTBOOK(S):

Practical Geophysics for the Exploration Geologist
Northwest Mining Association.
ISBN 0-931986-01-X

<u>TEXT REFERENCES</u>:

<u>Principles of Applied Geophysics</u> - Parasnis

<u>Geophysical Prospecting</u> - Dobin

<u>Interpretation Theory in Applied Geophysics</u> - Grant & West

<u>Introduction to Geophysics</u> - Garland

<u>Geophysical Case Histories</u> - CIM Congress Volume

Bulletins by manufacturers and consulting firms.

NUMBER	PERIODS	TOPIC DESCRIPTION
1	2	Introduction - Historical outline and relation to other earth sciences - Properties used - Application of Geophysics today; mining, petroleum, engineering, and military uses - References and sources of information
2	24	Magnetic Methods - The earth's magnetic field and the magnetic properties or rocks and ores, poles, permanent field, secular variation, magnetic storms, susceptibility, permeability - Instruments used for magnetic measurements - compass, fluxgate magnetometer, proton precession magnetometer, gradiometer - Magnetic fields of idealized ore bodies sphere, horizontal cylinder, vertical slabs, generalized forms - Ground magnetic surveys base stations field stations - Field practice using fluxgate magnetometers - Interpretation of field data and estimation of shape, size, orientation and grade of anomalous bodies.
3	14	Seismic Methods - Types of elastic waves, body and surface waves - Detection of earthquake waves - Reflection seismic method - Refraction seismic method. Field practice using seismic hammer method. - Interpretation of seismic waves. Multiple and dipping layer methods.
4	6	Radioactivity - Radioactive decay and radiation, geiger counters and scintillometers - Prospecting for radioactive minerals - Radiometric surveying - Core logging
5	2	Fluorescence - Use of the ultra violet mineral light in prospecting for fluorescent minerals.
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GENERAL COURSE OBJECTIVES:

1. The student must be able to recite the physical principles used by the the following geophysical exploration methods.

    a) Magnetic field theories
    b) Seismology
    c) Radioactive decay
    d) Fluorescence

2. The student must be able to operate and be able to recite the working principles of the following instruments:

    a) Fluxgate Magnetometer
    b) Proton Precession Magnetometer
    c) Hammer Seismograph
    d) Scintillometer
    e) Ultra violet light

3. The student must be able to make elementary interpretation of field data obtained in a Magnetometer, Scintillometer and Hammer Seismograph Survey.

4. Prepare a geophysical report on a property interpreting a Magnetometer survey and correlating the finds to the geology.

SPECIFIC COURSE OBJECTIVES:

The student should be able to:

1. Give a definition of Geophysics and Geophysical Prospecting.

2. Give a definition of a geophysical anomaly.

3. Name and describe briefly five different geophysical prospecting methods.

4. Give the formulas for magnetic force, magnetic field strength and magnetic field intensity and explain the meaning of the physical units used.

5. Draw the magnetic field lines for a bar magnet, and show the field lines around Para-, Dia- and Ferromagnetic materials and explain the reason for the field line pattern.

6. To draw the magnetic field lines surrounding the earth, showing the location of the magnetic poles, the magneto pause and the Van Allen Radiation belts.

6a. To name ferromagnetic minerals and to outline the amount of magnetic minerals in rocks.

7. Show in a diagram the components of the Earth's magnetic field for different localities on earth.

8. Show in a diagram the angles of declination and inclination.

9. To explain the meaning of Isogonic, Isophoric, Isoclinal and Isodynamic lines.

10. To explain the operation of a Fluxgate Magnetometer.

11. To explain the operation of a Proton Precession Magnetometer.

12. To operate a Fluxgate Magnetometer under field conditions.

13. To operate a Proton Precession Magnetometer under field conditions.

14. To lay out a grid of a magnetometer survey and to establish base stations for the survey.

15. To do magnetometer surveys on three different properties.

16. To do diurnal corrections and to explain the types of diurnal changes which can occur.

17. To present the survey data in report form, including the contouring of the data and drawing magnetic profiles along the survey lines.

18. To be able to interpret the measured data in respect of width, length, strike and dip of the ore body.

19. To be able to do depth determinations by using the half width and slope method.

20. To name the types of waves created in the ground by a Seismic Survey and to describe their motion and to comment on their velocities.

21. To explain the velocities of seismic waves, such as density of the ground, its shear and bulk modulus.

22. To describe the equipment used in a seismic survey and to describe the lay out of the equipment for a survey.

23. To describe the survey principle of a Reflection and Refraction survey.

24. To show the wave paths of direct waves, reflected and refracted waves in the ground.

25. To name Huygen's Principle, Fermat's Principle and Snell's Law of Refraction.

26. To do a seismic hammer survey and to present the data on a time-distance-diagram.

27. To determine the depth of horizontal layers by using a formula and a nomogran for 2 and 3 layer cases.

28. To determine the critical distance and the wave velocities in a time-distance-diagram.

29. To determine the dip angle of inclined layers by using a formula and a nomogram.

30. To interpret features such as dykes, faults and changes in rock type from time-distance-diagrams.

31. To give a defintion for Radioactivity and Isotopes.

32. To describe Protons, Neutrons and Electrons in respect of their mass and electrical charge.

33. To describe , & - radiation and to describe their application to exploration.

34. To calculate the decay series for uranium, thorium and potassium, when the type of radiaiton is given.

35. To describe the working principle of a Scintillometer.

36. To describe the working principle of a Spectrometer.

37. To be able to distinguish and to determine the amount of uranium, thorium and potassium present in hand specimens by using a Spectrometer.

38. To plot and contour data of radiation surveys and to convert the obtained (c.p.s.) counts per second into parts per million (p.p.m.).

39. To give a definition of Fluorescence.

40. To describe the principle of Fluorescence.

41. To name and identify fluorescent minerals by using an Ultraviolet lamp.