GEOPHYSICS

GEO 111-4

References:

"Principles of Applied Geophysics" - Parasnis

"Geophysical Prospecting" - Dobin

"Interpretation Theory in Applied Geophysics" - Grant & West

Introduction to Geophysics" - Garland

"Geophysical Case Histories" - CIM Congress Volume

Bulletins by manufacturers and consulting firms.

Number	Periods	Topic Description	Reference
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, permeabili - Instruments used for magnetic measurements - compass, Fluxgate magnetometer, proton precession magnetometer - Magnetic fields of idealized ore bodies sphere, horizontal cylinder, vertical slabs, generalized forms - Ground magnetic surveys base stations field stations, notes instrument adjustment - 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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Geological Technician Program

Course Objectives

1. The student must be able to recite the following theories as applied to mineral exploration:

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

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

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

3. To plot and make an elementary interpretation of field data obtained in a Magnetometer and Scintillometer Survey.

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

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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 definition for Radioactivity and Isotopes.

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

33) to describe β & γ - radiation and to describe a method of making these types of radiation visible.

34) to calculate the decay series for Uranium, Thorium and Potassium, when the type of radiation is given.

35) to describe the working principle of a Geiger counter.

36) to describe the working principle of a Scintillometer.

37) to be able to distinguish and to determine the amount of Uranium, Thorium and Potassium present in Hand specimens by using a Scintillation defector.

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.