APPLIED SCIENCE AND MANAGEMENT DIVISION
Mining Computing
1.5 Credit Course
Fall, 2014

MINING COMPUTING

INSTRUCTOR: Dr. Joel Cubley

OFFICE HOURS: Instructor available upon request.

OFFICE LOCATION: T1090

CLASSROOM: T1090

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TIME: Tuesdays (1-4pm)

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DATES: September 9 – December 19, 2014

COURSE DESCRIPTION

A wide range of geological, geochemical, and geophysical datasets are produced during mineral exploration and mining. These datasets require reduction, processing and display to draw conclusions and make recommendations. This course provides an introduction to computer programs and modeling techniques commonly used in mineral exploration and mining. A number of software platforms are introduced, as well as linkages between those programs. Course topics include resource delineation and estimation, presentation of geochemical survey data, orebody block modeling, drillhole display and analysis, geophysical data processing, and utilization of public geologic and geophysical GIS data.

PREREQUISITES

Successful completion of Introduction to GIS (GEOG250) and Bedrock Geology (GEOL105) is required. Completion of Mining Industry Overview (GEOL112) and familiarity with Microsoft Excel are strongly recommended.

EQUIVALENCY OR TRANSFERABILITY

In progress

LEARNING OUTCOMES

Upon successful completion of the course, students will have demonstrated the ability to

- reduce and display geochemical data geospatially and in a variety of discriminant diagrams
- correctly grid and contour geochemical and geophysical XYZ data, selecting the appropriate gridding method based on survey design and data point distribution
- construct digital geologic maps in ArcGIS incorporating field data and publically available GIS datasets; use correct structural and lithologic symbology sets
- plot, query and filter drillhole data; present drillhole data in 2D diagrams (fence diagrams and strip logs) and 3D models
- construct 3D geologic models of ore bodies, stratigraphic sequences, intrusions, etc. based on drillhole intercepts, orientated core data, and structural measurements
- develop resource estimates based on ore body block modelling; generate cross sections and polygonal models to aid in resource delineation.

DELIVERY METHODS

This course is delivered as one 3-hour laboratory session each week. All instruction will take place in College computer labs or on laptop computers made available to students. Software *will not* be installed on students' personal computers as licenses are limited.

COURSE FORMAT

A new computing topic will be presented each week. Students will be presented with a workflow demonstration by the instructor, and then complete a short activity during class time. Students will then apply acquired skills to complete a weekly homework exercise. Depending on the topic, the homework assignment may target datasets students are working on for their independent research project (GEOL207) or use smaller datasets provided by the instructor.

ASSESSMENTS

Attendance

Attendance and participation in laboratory sessions comprises a major component of a student's course grade. Workflow demonstrations will not be repeated for students unless extenuating circumstances apply.

Assignments

Students are required to complete thirteen homework assignments. All assignments should be submitted in digital format by uploading them to the course website. Supporting spreadsheets and data files must be submitted in addition to the final graphics or models.

Exams

There are no exams for this course.

EVALUATION

Metrics	Weight	Due Date
Participation	20%	Attendance and participation in class discussion is recorded each week and credit given to attendees.
Weekly homework assignments	80%	Thirteen assignments given equal weight. Each assignment is due at the start of the following laboratory class.
Total	100%	

The letter-grading scheme used in this course is the standard Yukon College scheme. Final grades will be rounded up to the nearest decimal place and assigned a letter grade based on this scheme.

REQUIRED TEXTBOOKS

There is no required textbook for this course. Software manuals will be made available by the instructor for student reference.

PLAGIARISM

Plagiarism is a serious academic offence. Plagiarism occurs when students present the words of someone else as their own. Plagiarism can be the deliberate use of a whole piece of another person's writing, but more frequently it occurs when students fail to acknowledge and document sources from which they have taken material. Whenever the words, research or ideas of others are directly quoted or paraphrased, they must be documented according to an accepted manuscript style (e.g., APA, CSE, MLA, etc.). Resubmitting a paper which has previously received credit is also considered plagiarism. Students who plagiarize material for assignments will receive a mark of zero (F) on the assignment and may fail the course. Plagiarism may also result in dismissal from a program of study or the College.

ACADEMIC ACCOMMODATION

Reasonable accommodations are available for students requiring an academic accommodation to fully participate in this class. These accommodations are available for students with a documented disability, chronic condition or any other grounds specified in section 8.0 of the Yukon College Academic Regulations (available on the Yukon College website). It is the student's responsibility to seek these accommodations. If a student requires an academic accommodation, he/she should contact the Learning Assistance Centre (LAC) at (867) 668-8785 or lassist@yukoncollege.yk.ca.

TOPIC OUTLINE

Supporting computer programs for each module are indicated.

Module	*Topic*
1	**GIS for geologic mapping:** displaying structural symbols and rock units, creating map layers and topographic profiles, using layer files to preserve symbology, transferring data between GPS and GIS systems. *(ArcGIS)*
2	**Utilizing public GIS datasets:** locating and utilizing publically available geographical, geological, and geophysical datasets to construct integrated project base maps and inform broad exploration strategies. *(ArcGIS, QGIS)*
3	**Google Earth**: using Google Earth imagery for mineral exploration and mapping; manipulating and creating .kmz files; creating attribute and ranked variable maps; transferring data between GIS and Google Earth platforms. *(ArcGIS, Google Earth)*
4	**Geochemical data**: displaying soil, stream sediment, and water quality data on regional and property maps using common reporting techniques; plotting geochemical data in a range of standard plots including XY scatter, probability, ternary, and pie charts; histograms and turkey box plots. *(ArcGIS, ioGAS, Microsoft Excel)*
5	**Gridding of 2D survey data**: introduction to gridding algorithms (e.g. kriging, minimum curvature, etc.) for XYZ geophysical and geochemical data, applicability of particular algorithms for specific survey designs; integration of gridded data with GIS. *(ArcGIS, Geosoft)*
6	**DC resistivity and IP modeling**: data management and reduction, data inversion, 2D sections and 3D modelling. *(Geosoft and Res2D/3DInv)*
7	**Magnetic survey data**: diurnal magnetic field variation corrections, integration of base station and survey magnetometer data; noise reduction and smoothing routines. *(Magmap2000, Geosoft)*
8	**Digital terrain models**: using sample and drill collar locations, as well as GPS track data to create detailed topographic maps of a project area; creating 3D surfaces from 2D GIS vector data. *(Leapfrog Geo, Geosoft, ArcGIS)*
8	**Drillhole data**: plotting drillhole data in 3D models, querying and filtering drillhole data; data formats for importing and managing large drillhole datasets; fence diagrams and strip logs. *(Leapfrog Geo, Geosoft)*
9	**Geologic models**: creating 3D geologic models using a combination of drillhole and surface data; defining stratigraphic units; incorporating igneous bodies and fault zones; volume calculations. *(Leapfrog Geo, Geosoft)*
10	**Isosurfaces and interpolants:** creating 3D models of geochemical (e.g. ore grades) and geophysical parameters (e.g. high-conductivity zones) in the subsurface. *(Geosoft, Leapfrog Geo)*
11	**Resource estimates:** development of resource estimates based on orebody block modelling; discussion of required geological database components; computer generation of cross sections and polygonal models to aid in resource delineation. *(Geosoft, Leapfrog Geo)*