APPLIED SCIENCE AND MANAGEMENT DIVISION
GEOL 204
School of Science
Fall, 2018

COURSE OUTLINE

GEOL204

MINING COMPUTING

3 **CREDITS**

PREPARED BY: Joel Cubley, Instructor DATE: June 1, 2018

APPROVED BY: Margaret Dumkee, Dean DATE: June 1, 2018

APPROVED BY ACADEMIC COUNCIL: May 2014

The Course Outline Template is approved by the Academic Council on June 20, 2018.

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MINING COMPUTING

INSTRUCTOR: Dr. Joel Cubley	**OFFICE HOURS:** F (2:30 – 4:30 p.m.)
OFFICE LOCATION: T1090	**CLASSROOM:** M111
E-MAIL: jcubley@yukoncollege.yk.ca	**TIME:** M (1 – 4 p.m.)
TELEPHONE: (867) 456-8605	**DATES:** September 5 – December 20, 2018

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 Physical 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 be able 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.

COURSE FORMAT

This course is delivered as one 3-hour laboratory session each week. All instruction will take place in the Geological Technology Laboratory (T1090), with students working on provided laptop computers. Software *will not* be installed on students' personal computers as licenses are limited. Students may work in the laboratory after hours, provided they document their use of the facility and are authorized by the program coordinator and Yukon College Security office.

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 & Participation

Attendance and participation in laboratory sessions is critical to successful completion of this course, though all module introductions will be provided on Moodle. 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 a OneDrive or Dropbox folder that is shared with the course instructor. Supporting spreadsheets and data files must be submitted in addition to the final graphics or models.

Assignments are due at the start of lecture on the date assigned by the instructor. Late assignments will be graded based on the following scheme: a deduction of 10% per day up until a total deduction of 50% is reached, following that, assignments must be submitted prior to the date that the instructor hands back the graded assignment (set by the instructor), unless otherwise indicated by the instructor.

Tests

There are no exams for this course.

EVALUATION

Metrics	Weight	Due Date
Weekly homework assignments	100% (~8% apiece)	Thirteen assignments are given equal weight. Each assignment is due at the start of the following laboratory class.
Total	100%	

REQUIRED TEXTBOOKS AND MATERIALS

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

ACADEMIC AND STUDENT CONDUCT

Information on academic standing and student rights and responsibilities can be found in the current Academic Regulations that are posted on the Student Services/ Admissions & Registration web page.

PLAGIARISM

Plagiarism is a serious academic offence. Plagiarism occurs when a student submits work for credit that includes the words, ideas, or data of others, without citing the source from which the material is taken. Plagiarism can be the deliberate use of a whole piece of work, but more frequently it occurs when students fail to acknowledge and document sources from which they have taken material according to an accepted manuscript style (e.g., APA, CSE, MLA, etc.). Students may use sources which are public domain or licensed under Creative Commons; however, academic documentation standards must still be followed. Except with explicit permission of the instructor, resubmitting work 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.

YUKON FIRST NATIONS CORE COMPETENCY

Yukon College recognizes that a greater understanding and awareness of Yukon First Nations history, culture and journey towards self-determination will help to build positive relationships among all Yukon citizens. As a result, to graduate from ANY Yukon College program, you will be required to achieve core competency in knowledge of Yukon First Nations. For details, please see www.yukoncollege.yk.ca/yfnccr.

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) 456-8629 or lac@yukoncollege.yk.ca.

THE LORENE ROBERTSON WRITING CENTRE

All students are encouraged to make the Writing Centre a regular part of the writing process for coursework. The Lorene Robertson Writing Centre is staffed by helpful writing coaches from across the College and offers one-on-one appointments to students in need of writing support.

The Lorene Robertson Writing Centre can help you:

- Get started on an assignment and focus your ideas
- Outline and plan your assignment
- Write clearly, logically and effectively
- Address specific needs and writing problems
- Revise the first and final drafts of your project
- Gain confidence in your writing

For in-person appointments, the Centre coaching office is located in the Academic Support Centre in room A2302. You can also participate in coaching appointments over the phone or online. see the Academic Support Centre schedule for English and writing support times.

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 publicly 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/.kml 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, Vulcan)*
6	**DC resistivity and IP modeling**: data management and reduction, data inversion, 2D sections and 3D modelling. *(Vulcan 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, Vulcan)*
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. (*Vulcan, Leapfrog, ArcGIS)*
9	**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. *(Vulcan, Leapfrog)*

10	**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. *(Vulcan, Leapfrog)*
11	**Isosurfaces and interpolants:** creating 3D models of geochemical (e.g.
	ore grades) and geophysical parameters (e.g. high-conductivity zones) in the subsurface. *(Vulcan, Leapfrog)*
12	**Drillhole planning**: siting future drillholes and modelling anticipated intersections with developed geological and orebody models. *(Vulcan, Leapfrog)*
13	**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. (*Vulcan)*