APPLIED SCIENCE AND MANAGAMENT DIVISION
Mineral Processing
3 Credit Course
Winter, 2015

MINERAL PROCESSING

INSTRUCTOR: TBA

OFFICE HOURS: TBA

OFFICE LOCATION: TBA

CLASSROOM: Lecture in C1511, Lab in T1090

E-MAIL: TBA

TIME: Lecture on Tues. and Thurs. 1PM to 2:30PM
Lab on Thursdays 2:30PM to 4:00PM

TELEPHONE: TBA

DATES: January 5th to April 24th, 2015

COURSE DESCRIPTION

An increasing demand for metals in a growing global economy is being met with decreasing ore grades, requiring more efficient mineral extraction and recovery techniques. This course reviews the fundamental principles, conventions, and terminology of mineral processing and metallurgy. At the start of the course, students learn how to assess the mineral properties utilized in separation of ore from gangue. The stages of processing are then examined in detail from initial classification, crushing, and grinding to dewatering and tailings disposal. The student is presented with an introduction to current operating issues and circuit design considerations, as well as the efficiency of different concentration approaches. Students will gain an understanding of the suitability of processing techniques for particular deposit types and individual commodities. The environmental implications and sustainability issues surrounding individual processing techniques will be discussed, as well as specific safety requirements.

PREREQUISITES

Academic mathematics 12 (OR Yukon College equivalent, MATH 060), GEOL105 (Bedrock Geology) and CHEM 110 (Structure of Matter) OR permission from the instructor.

EQUIVALENCY OR TRANSFERABILITY

In progress.

LEARNING OUTCOMES

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

- explain the implications of mineralogical characteristics for mineral processing requirements, and link these characteristics to the properties of individual metals based on their electronic structure and their position within the periodic table
- identify key sustainability issues in mineral processing and explain their impact on mineral processing decision-making
- provide an overview of major classes of mineral processing equipment, their typical applications, and the types of projects in which they are used
- describe basic flowsheets for physical separation processes in various industries, including mineral sands, coal, iron ore, and base metal processing
- demonstrate competencies in basic laboratory-scale processing and metallurgical testing, including froth flotation testing, crushing, grinding, screening and classification, and particle size analysis
- calculate, compile, and interpret grade and recovery information

DELIVERY METHODS

This course consists of two 1.5-hour lectures per week, plus a 1.5-hour weekly lab section. Lectures will be conducted primarily in the classroom setting but will also utilize lab and computer lab facilities as required. Lab sections will be held in the Geological Technology program's lab facilities (T1090).

COURSE REQUIREMENTS

Attendance and Participation

Students are strongly encouraged to attend all lectures and lab classes. Hands-on exercises conducted during class time cannot be completed after-hours unless prior permission from the instructor is obtained.

Assignments

The main assessments for this course are weekly lab assignments. These assignments will be due at the start of the next lab class unless otherwise indicated by the instructor. Successful completion of these lab assignments is critical for understanding and reinforcing course material.

Tests/Exams

There will be only one exam in this course, a final lecture theory exam delivered during the final

exam period. Competencies in hands-on laboratory work will be assessed throughout the course and are not targeted during the formal exam. A student must pass both the lab and lecture components to receive course credit.

Two short quizzes will be administered at the 1/3 and 2/3 completion intervals in the course. These will be closed-book quizzes that test all material up to that point in the course.

EVALUATION

Tests and Assignments	*Weight*	*Dates*
Weekly lab assignments	60% (12 assignments, 5% each)	Each assignment due at the start of the following lab period.
Final lecture exam	20%	During the final exam period.
Lecture quizzes (2)	20% (10% each)	Completed during class time at the 1/3 and 2/3 course completion intervals.
Total	100%	

The letter-grading scheme used in this course is the standard Yukon College scheme.

TEXTBOOKS AND MATERIALS

There is one required textbook for this course, as well as recommended textbooks that will be utilized on a limited basis throughout the course. All texts are available on reserve at the Yukon College Library.

Required textbook

Wills BA, Napier-Munn TJ. 2006. Wills' mineral processing technology. 7th ed. New York: Elsevier. 444 p.

Recommended textbooks

Darling P. 2011. SME mining engineering handbook. 3rd ed. United States of America: Society for Mining, Metallurgy, and Exploration, Inc. 1839 p.

Fuerstenau MC, Han KN (eds.). 2003. Principles of mineral processing. United States of America: Society for Mining, Metallurgy, and Exploration, Inc. 573 p.

Fuerstenau MC, Jameson G, Yoon, RH (eds.). 2007. Froth flotation: A century of innovation. United States of America: Society for Mining, Metallurgy, and Exploration, Inc. 891 p.

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.

COURSE TOPIC OUTLINE

Module	Topic
1	**Introduction to mineral processing:** mineral properties utilized in separation; importance of concentrating operations; mineral processing methods; typical flowsheets; environmental consequences of mineral processing.
2	**Ore handling:** ore transportation and storage; feeding; mechanical and pneumatic conveying systems; removal of harmful materials.
3	**Particle size analysis:** methods of particle size measurement and shape classification; mathematical and graphical treatment of particle distributions.
4	**Comminution:** principles of comminution and comminution theory; grindability; comminution equipment; simulation of processes and circuits.
5	**Crushing and grinding:** primary and secondary crushers; crushing circuits and controls; tumbling and stirred mills; grinding circuits.
6	**Screening and classification:** types of screens; factors affecting screen performance; principles of classification; classifier types.
7	**Gravity concentration:** principles of gravity separation; types of separators and concentrators; free settling; particle acceleration and particle shape.
8	**Dense medium separation:** dense medium compositions; heavy liquid testing; partition curves; centrifugal separators and DMS circuits.
9	**Froth flotation:** principles of flotation; collectors, frothers and regulators; reagents and conditioning; typical flotation separations.
10	**Solid-liquid separation:** separation of slurries into solid and liquid fractions by thickening, filtration and drying; separation equipment; major influences on solid-liquid separation.
11	**Magnetic and electrical separation, ore sorting:** magnetic and electronic separation principles.
12	**Hydrometallurgy:** principles of hydrometallurgy; factors influencing leaching rates; bacterial leaching; methods of solution purification and recovery of metals from solution; reaction kinetics.
13	**Tailings disposal:** methods of tailings disposal and contaminant control
14	**Metallurgical accounting, control and simulation**: sampling and weighing ore; slurry streams; circuit design and optimization; mass balancing methods.