THE FEDERAL UNIVERSITY OF TECHNOLOGY, AKURE

Department of Forestry and Wood Technology

MNE509 – Mineral Processing Technology I

COURSE PARTICULARS

Course Code: MNE509

Course Title: Mineral Processing Technology II

No. of Units: 3

Course Duration: Three hours of theory and three hours of practical per week for 15 weeks.

Status: Compulsory

Email Address: ProMax2100-tech1@gmail.com

Course Webpage:

Prerequisite: MNE306, MNE411

COURSE INSTRUCTORS

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Phone:

Email:

COURSE DESCRIPTION

This course deals mainly with materials handling and other auxiliary operations in mineral processing. It covers such pre-concentration operations as run-off-mine handling, bulk material movement, stacking, blending, reclamation including all intra-plant and post-concentration operations like slurry pumping, concentrates storage, dewatering, tailings disposal, material recycling, metallurgical accounting in process plants, and other relevant operations. Review of recovery and refining flowsheets for some metals as well as environmental considerations in metallic ore processing and tailing disposal are also of primary concern in this course.

COURSE OBJECTIVES

The objectives of this course are to:

- review all unit operations in mineral processing technology and the mineral concentration processes covered in the "first course" i.e Mineral Processing Technology I.
- introduce students to the importance and principles of materials handling in the mineral processing plant with special emphasis on feeding and conveying of bulk material.
- teach students the principles and methods of dewatering, flocculation and dispersion including s*edimentation, filtration, drying* and their equipment selection criteria.
- teach students the handling techniques for run-off-mine (ROM), crushed materials, stockpile design and construction, stacking, material blending and reclamation in the mineral processing plant.
- explain to the students, holding and transport techniques for bulk solids. Conveyors and feeders; storage, holding and transport of fluids in mineral processing plants; tailings handling and disposal and various equipment required.
- acquaint students with the methods of analysis of comminution theory, selection criteria for crushing, grinding and screening equipment, selection principles for mineral concentration techniques, criteria for mineral concentration equipment selection and design, testing and evaluation of mineral beneficiation flow sheets for copper, tin, lead, zinc, iron, gold and other ores
- provide students the opportunities to acquire practical skills in concentrates handling, grade determination, recovery and loss calculation and participatory laboratory experiments.

COURSE LEARNING OUTCOMES / COMPETENCIES

Upon successful completion of this course, the student will be able to:

Knowledge based

- explain the all unit operations in mineral processing technology.
- understand the importance and principles of materials handling in the mineral processing plant with special emphasis on feeding and conveying of bulk material. Storage, holding and transport of solids and fluids in the mineral processing plant.
- Explain the methods of analysis of comminution theories, selection criteria for crushing, grinding and screening equipment, selection principles for mineral concentration techniques, criteria for mineral concentration equipment selection and design, testing and evaluation of mineral beneficiation flow sheets for copper, tin, lead, zinc, iron, gold and other metallic and non-metallic ores
- prepare metallurgical accounts with respect to recovery and loss, grade determination, blending and dilution. .

Skills

- carry out dewatering and pumping experiments.
- Design flowsheets recovery of various metals from their ores.
- Determine recovery, concentrate grades, required weights for dilusion

GRADING SYSTEM FOR THE COURSE

This course will be graded as follows:

Class Attendance	-	5%
Assignments		10%
Test(s)		15%
Practical		20%
Final Examination		50%
TOTAL		**100%**

GENERAL INSTRUCTIONS

Attendance: It is expected that every student will be in class for lectures and also participate in all practical exercises. Attendance records will be kept and used to determine each person's qualification to sit for the final examination. Any student who scored less 80% attendance may not be qualified to sit for the examination except in cases of illness or other unavoidable causes of absence, on which the student must have communicated with any of the instructors, indicating the reason for the absence.

Academic Integrity: Violations of academic integrity, including dishonesty in assignments, examinations, or other academic performances are prohibited. You are not allowed to make copies of another person's work and submit it as your own; that is plagiarism. All cases of academic dishonesty will be reported to the University Management for appropriate sanctions in accordance with the guidelines for handling students' misconduct as spelt out in the Students' Handbook.

Assignments and Group Work: Students are expected to submit assignments as scheduled. Failure to submit an assignment as at when due will earn a student zero in that assignment. Only under extenuating circumstances, for which a student has notified any of the instructors in advance, will late submission of assignments be accepted.

Code of Conduct in Lecture Rooms and Laboratories: Students should turn off their cell phones during lectures. Students are prohibited from engaging in other activities (such as texting, watching videos, *etc*.) during lectures. Food and drinks are not permitted in the laboratories.

- Laboratory assignments are due three days after the laboratory period without exception. Late reports without valid excuse will not be accepted.
- Attendance at practical sessions other than that to which a student is assigned is not permitted unless prior arrangements have been made with the practical instructor.
- The main objective of the laboratory practical sessions in mineral processing is to give students, "hands on" demonstration of methodologies used in mineral concentration processes. To fulfill this objective, the laboratory practical rely on an understanding of the purpose behind each experiment and the theoretical background to the practical.
- A brief, legible and concise write up is therefore expected in a standard laboratory report and this must follow good engineering laboratory reporting format (using notations, charts, flowsheets, schematic diagrams and other visual illustrations - Figure 1).
- Work will be done either individually or in groups with laboratory reports being submitted individually or as group depending on the preference of the Assessors. Thus each student is expected to contribute to each group work.

- Students are expected to have read the laboratory experiment procedures and note applicable sessions of the text prior to each laboratory experiment.
- Absence at practical sessions to which a student is assigned implies that the student will have an opportunity to attend such practical section the next available semester.
- All symbols used for representation of values must be clearly defined with their units.
- $$W_M = \frac{X_d - X_c}{X_m - X_d} x\, W_C \text{ ....} Eqn.\ 5.2$$
- Where

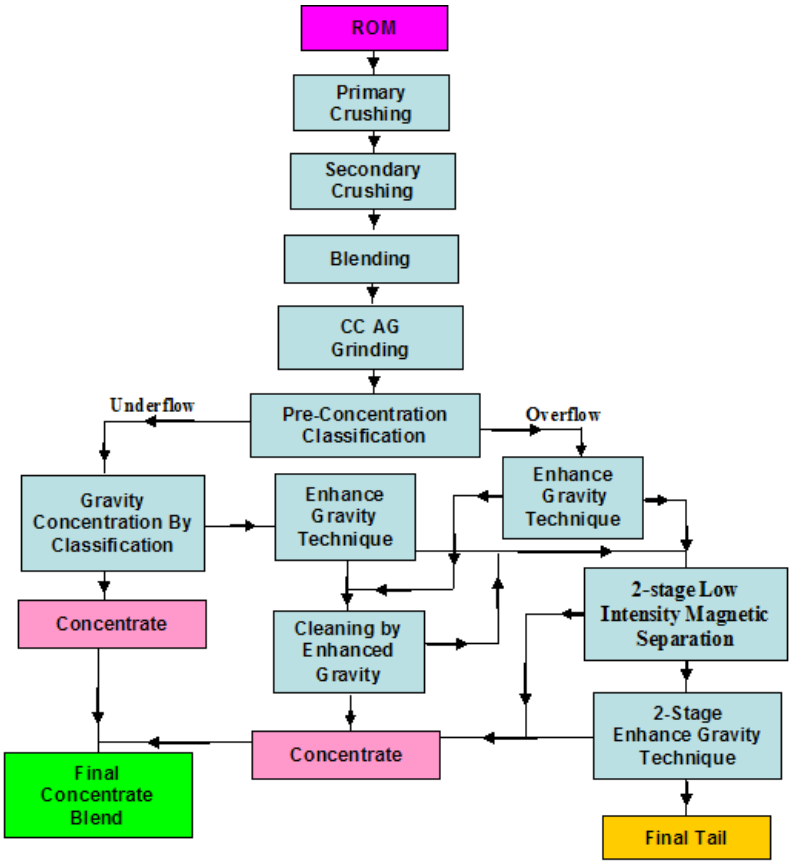
$W_M = required weight of\ material\ for dilution\ (tonnes)$

$X_d = Targeted or new grade\ (\%)$

- $X_c = grade\ of\ concentrate to be diluted\ (\%)$

$X_m = grade of\ material\ for dilution\ (\%)$

$W_c = weight\ of\ concentrate to be diluted\ (\%)$



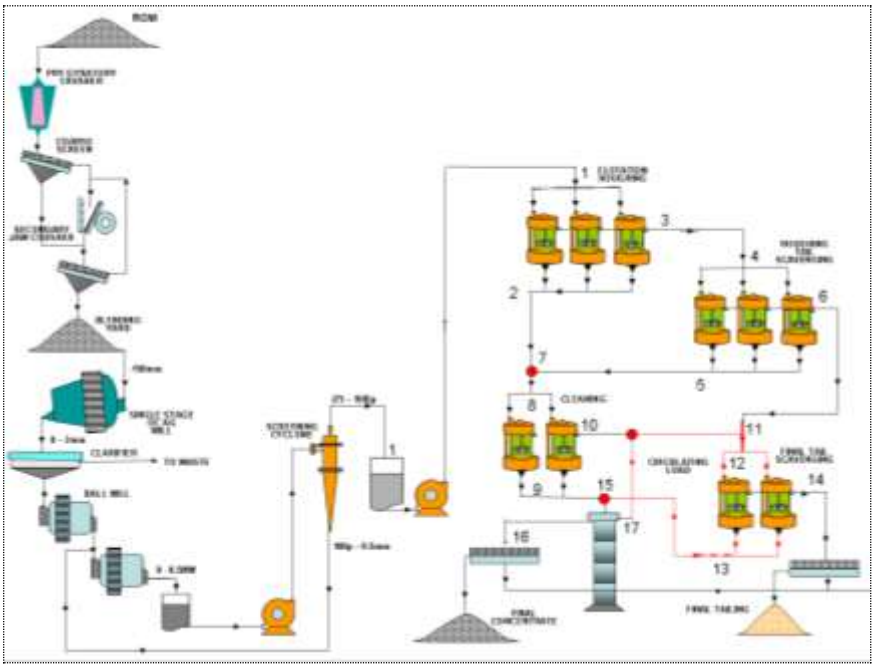


Figure 1: Flowsheet and Schematic Diagram for a Comminution Circuit

READING LIST

[3,4] Andrew Mular, Doug Halbe and Derek Barratt,(2003): Mineral Processing Plant Design, Practice and Control Proceedings Vosl. & 2. Society for Mining, Metallurgy and Exploration Inc. (SME), Littleton, USA.

[3,4] Daniel Sbárbaro · René del Villar ,(2010): Advanced Control and Supervision of Mineral Processing Plants Advances in Industrial Control. Springer-Verlag London Limited, 2010

[3,4] Alastair J. Sinclair and Garston H. Blackwell, (2004): Applied Mineral Inventory Estimation. Cambidge University Press, 20 . Cambridge, UK. http://www.cambridge.org

[1]Kelly G. E and Spottistwood J. D, (1982): Introduction to Mineral Processing. John Wiley and Sons. New York

[1]Barry A. Wills, Tim Napier-Munn (2006): Mineral Processing Technology. An Introduction to the Practical Aspects of Ore Treatment and Mineral Recovery. : Elsevier Science & Technology Books.

[3]Jan Drzymala, (2007): Mineral Processing. Foundations of theory and practice of minerallurgy Wroclaw University of Technology, Wroclaw.

Legend

1- Available in the University Library
2- Available in Departmental/School Libraries
3- Available on the Internet.
4- Available as Personal Collection
5- Available in local bookshops.

COURSE OUTLINE

Week	Topic	Remarks
1	REVIEW OF COURSE PRE-REQUISITES Review of unit operations in mineral processing technology and mineral concentration processes covered in the "first course" Mineral Processing Technology I – MNE306; including the dynamics of particle movement in fluid media.	
	Review assessment	
2-4	AUXILIARY OPERATIONS Introduction to auxiliary operations in mineral processing and materials handling principles. **Dewatering:** Methods of dewatering, flocculation and dispersion *Sedimentation* - theory and practice of thickening and clarification, design of sedimentation units and selection of equipment. *Filtration* - filtration processes. Filtration process design, filters selection and filter cake handling. *Drying*- thermal dewatering, calcinations, sintering, pelletizing, briquetting.	
	Selected laboratory practical in dewatering	Group Assignments
5	Excursion for plant visits and mineral samples collection	This is an important aspect of the course which provides students opportunities to see mineral processing plants in operation and to collect samples for practical demonstration in the lab.
6 – 9	MATERIALS HANDLING Run-off-mine (ROM) and crushed materials handling- stockpile design and construction, stacking, material blending and reclamation. Bulk Materials Handling Methods – Holding and transport of bulk solids. Conveyors and feeders. Storage, holding and transport of fluids in mineral processing plants. Tailings handling and disposal.	
	Selected laboratory practical in materials handling.	Test
10 – 14	PLANT PRACTICE Analysis of comminution theory. Selection criteria for crushing, grinding and screening equipment. Selection principles for mineral concentration techniques. Selection criteria for mineral concentration equipment. Design, testing and evaluation of mineral beneficiation flow sheets for copper, tin, lead, zinc, iron, gold and other ores.	

	Concentrates handling, grade determination, recovery and loss.	
	.Selected Laboratory Practicals	
15	REVISION	