THE FEDERAL UNIVERSITY OF TECHNOLOGY, AKURE

Department of Forestry and Wood Technology

MNE306 – Mineral Processing Technology I

COURSE PARTICULARS

Course Code:	MNE306
Course Title:	Mineral Processing Technology I
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:	AGY203, CHE202

COURSE INSTRUCTORS

Dr. E. O. Ajaka

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COURSE DESCRIPTION

This course deals with the classification of minerals (metallic, non-metallic, industrial, etc,) with respect to processing and the preparation of ores for separation of valuable minerals in them. It explains in practical and theoretical terms, the principles of operation of the various methods of minerals concentration/processing, equipment used and their installation principles, flowsheets development, and calculation of recovery and grades.

COURSE OBJECTIVES

The objectives of this course are to:

- review the nature of mineral occurrences and ore composition analytical techniques,
- introduce students to the principles of ore comminution, liberation and particle size analysis,
- teach students the various methods of mineral separation and equipment required,
- acquaint students with the various ancillary operations and equipment in the mineral processing the plant, and
- provide students the opportunities to acquire practical skills in mineral separation through participatory laboratory experiments and field activities.

COURSE LEARNING OUTCOMES / COMPETENCIES

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

(Knowledge based)

- explain the structures and textures of minerals and their significance in mineral genesis and treatment.
- understand ore compositional analyses by chemical and mineralogical techniques
- explain the basic comminution and liberation theories and particle size presentation by various methods.
- Understand the principles of mineral separation by heavy medium, magnetic, gravity, flotation, leaching, biological recovery processes and other separation techniques including the physical and mechanical processes of amalgamation and agglomeration.
- prepare metallurgical mass balance – recovery, grade and loss.

(Skills)

- prepare specimens for mineral compositional analysis by petrographic observation.
- Identify mineral components of an ore under different light conditions in the petrographic microscope.
- carry out basic laboratory experiments on ore comminution and particle liberation presents particle sizing data technically.
- skillfully carry out bench scale recovery tests on heavy medium, magnetic, gravity, flotation, leaching, biological recovery processes and other separation processes.
- develop process flowsheet for a mineral processing plant and determine recovery, losses and grades.
- carry out quick tests for identification of some metals.

GRADING SYSTEM FOR THE COURSE

This course will be graded as follows:

Class Attendance	- %
Assignments	10%
Test(s)	15%
Practical	25%
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 case 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.

e.g. $$\psi = \frac{M}{V}$$

Where:

ψ – $Density\ (kgm^{-3})$

V – $Volume\ (m^3)$

M – $Mass\ (kg)$

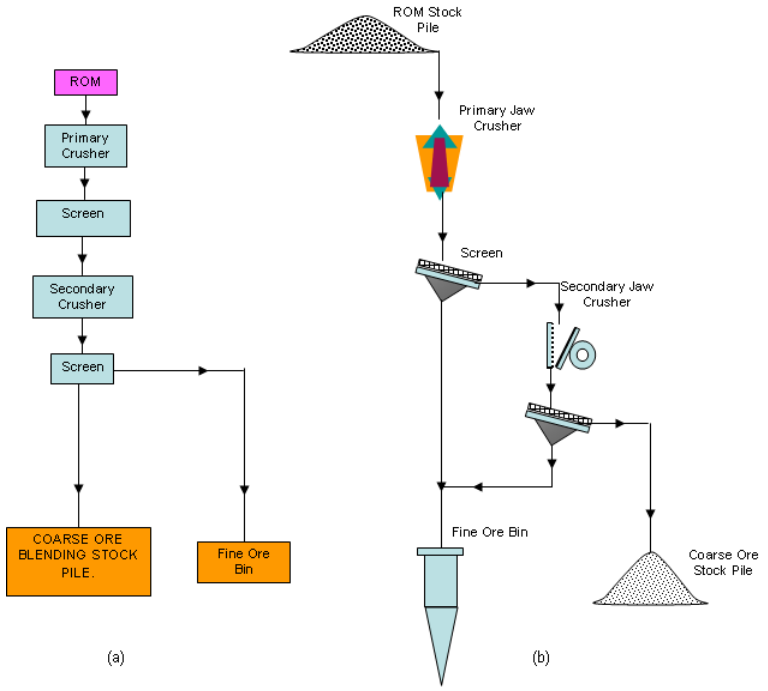

Figure 1: Flowsheet and Schematic Diagram for a Comminution Circuit

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 & 2	MINERALS, ORES AND ROCKS Review of structures and textures of mineral and their significance in mineral genesis and treatment.	The exercise here will include physical identification of rocks and minerals.
	Selected practical sessions in rock identification.	
3 & 4	ORE COMPOSITIONAL ANALYSIS ➢ *Review of ore composition analytical techniques* ➢ *Quantitative and quantitative assaying* ➢ *Micrographic analysis* ➢ *Instrumental Compositional Analysis*	
	Laboratory practical in ore microscopy	Group Assignments
5 – 7	COMMINUTION AND LIBERATION Principles of Comminution ➢ Crushing and Crushers ➢ Grinding and Mills ➢ Comminution Circuit and Layout ➢ Laws of Comminution Comminution and Liberation Particle Classification ➢ Screening ➢ Classification in fluid Media ➢ Particle Size Analysis ➢ Aggregates Production ➢ Crushing Plant Design and installation	This section includes several assignments and laboratory practical from which some are selected for the students in a particular session
	Selected Laboratory Practical in Comminution and Liberation.	Test
8 - 12	MINERAL CONCENTRATION TECHNIQUES ➢ Heavy Medium Separation ➢ magnetic Separation Methods ➢ Electrostatic and High Tension Separation ➢ Gravity Separation ➢ Flotation, Agglomeration and Amalgamation. ➢ Leaching ➢ Biological Recovery Processes.	This section also includes several laboratory practical sessions from which some are selected for the students.
	.Selected Laboratory Practical in Comminution and Liberation.	Test
13 & 14	PREPARATION OF METALLURGICAL MASS BALANCE ➢ Sampling, recovery, grade and metallurgical losses. ➢ Flowsheet development.	
15	REVISION	