

I. COURSE DESCRIPTION:

This course deals with the technical aspects of pulp purification and includes the processes of pulp washing, screening, cleaning and bleaching. The technologies of each of these types of processes will be investigated though the major emphasis will be on bleaching. Screening requirements, equipment and basic theories will be covered. Process conditions, fundamental flow diagrams and material balances will be discussed. Removal of contaminants from pulp by washing or cleaning systems will be studied in terms of equipment and process conditions. Pulp bleaching for mechanical pulps (lignin preserving bleaching) will be studied in terms of basic theories, process types, conditions and process flows.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student will demonstrate the ability to:

1. Indicate a knowledge of the principles of screening theory and common screening equipment.
Potential Elements of the Performance:
 - Draw and label a schematic of a typical screen.
 - List the common type of screen plate perforations.
 - Name several types of coarse screens.
 - Explain why shower water is added to rotary screens.
 - List the drawbacks of vibratory screens.
 - Name the main operating force in most coarse screens.
 - List the criteria that stiff fibres must meet to travel through screen openings.
 - Explain the effects of stock flow, shower water and consistency on screen operation.
 - Explain the function of the rotor in a pressure screen.
 - Discuss the environmental impact of a screen room.
 - Explain how screen plates are characterized.
 - Explain what happens to the material rejected by bull screens in a mechanical pulp mill.
 - List the process variables that affect screen performance.
 - Calculate reject rate, cleanliness efficiency and screen quotient.

2. Indicate a knowledge of washing mechanisms and washer designs.

Potential Elements of the Performance:

- Explain why pulp is washed.
 - List the two main washing mechanisms and explain how each works.
 - Explain how a vacuum washer works.
 - Explain how some washers combine dilution/extraction and displacement.
 - Explain the effect of temperature, pressure differential and shower dilution water volume on washer efficiency.
 - Distinguish between countercurrent and cross flow washer sequences.
 - Explain the greatest environmental impact of washers in a pulp mill.
 - List the two main factors which influence the effectiveness of dilution/extraction washing.
 - Explain why a thune press is a dilution/extraction washer.
 - Name two types of combination washers.
 - Describe the operation of a combination washer.
 - List five process variables that affect the operation of a washing system.
 - Perform calculations on dilution factor, wash liquor ratio, washer yield and displacement ratio.
3. Indicate a knowledge of centricleaners, their operating principles and basic design.

Potential Elements of the Performance:

- Explain why cleaners are used.
- Name the physical property that cleaning is based upon.
- Explain the difference between forward and reverse cleaners.
- Describe how cleaners separate fibres from dirt.
- Explain, in general terms, how cone design affects cleaner operation.
- Explain how reject rate affects cleaner operation.
- Define pressure drop and explain its effect on cleaner operation.
- Explain how consistency effects cleaner operation.
- Explain why it is necessary to use several cleaning stages.
- Explain why it is necessary to sewer some material from the cleaner system.

- Describe how cleaner efficiency is measured.
 - List the four forces that cause separation in a cleaner.
4. Indicate a knowledge of the principles of lignin preserving bleaching.

Potential Elements of the Performance:

- Explain where the colour is found in wood.
- Define chromophores.
- Explain why lignin preserving bleaching is used.
- Explain brightness reversion.
- Define reductive and oxidative bleaching.
- Explain how pH effects bleaching.
- Explain the effect of chemical charge, temperature, retention time and consistency on bleaching.
- Explain the function of chelating agents.
- Explain how pH is controlled in peroxide bleaching.
- Draw a diagram of a hydrosulphite bleaching process.
- Draw a diagram of a peroxide bleaching process.
- Define two stage bleaching.
- Name the two types of bleaching reactions and the chemicals employed in each.
- List the seven process variables that affect lignin preserving bleaching.
- Explain what happens if pH is too high and what happens if it is too low in peroxide bleaching.
- List the temperature used for hydrosulphite bleaching and that used for peroxide bleaching.
- Explain how temperature and reaction time are inter-related.
- Cite the normal retention time for hydrosulphite bleaching and the normal for peroxide bleaching.
- Explain why sulphur dioxide is used in peroxide bleaching.
- Explain how wood species affects lignin preserving bleaching.
- List the preferred conditions for hydrosulphite bleaching.

III. TOPICS:

1. Screening
2. Washing
3. Cleaning
4. Bleaching

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Tunney, A., Sugden, A., and Bethune, J., Bleaching, Screening and Cleaning: Mechanical Pulps, Course Manual PPE 122, Sault College of Applied Arts and Technology, Sault Ste. Marie, 2002

V. EVALUATION PROCESS/GRADING SYSTEM:

A final grade for this course will be based upon the results of two tests weighted equally.

For testing purposes, the course will be divided as follows:

Test #1 on Module 1
Test #2 on Module 2

The following semester grades will be assigned to students in postsecondary courses:

<u>Grade</u>	<u>Definition</u>	<u>Grade Point Equivalent</u>
A+	90 - 100%	4.00
A	80 - 89%	4.00
B	70 - 79%	3.00
C	60 - 69%	2.00
D	50 – 59%	1.00
F (Fail)	49% or below	0.00
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field/clinical placement or non-graded subject areas.	
U	Unsatisfactory achievement in field/clinical placement or non-graded subject areas.	
X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.	
NR	Grade not reported to Registrar's office.	
W	Student has withdrawn from the course without academic penalty.	

Under special circumstances, students with a final grade of 45-49% could be allowed to write a supplementary exam for maximum possible grade of "D" provided they obtain a minimum grade of 60 % in one of the regular tests.

VI. SPECIAL NOTES:

Special Needs:

If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your instructor and/or the Special Needs office. Visit Room E1204 or call Extension 493, 717, or 491 so that support services can be arranged for you.

Retention of course outlines:

It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

Plagiarism:

Students should refer to the definition of "academic dishonesty" in *Student Rights and Responsibilities*. Students who engage in "academic dishonesty" will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course/program, as may be decided by the professor/dean. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

Course outline amendments:

The Professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

Substitute course information is available in the registrar's office.

VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the professor. Credit for prior learning will be given upon successful completion of a challenge exam or portfolio.

VIII. DIRECT CREDIT TRANSFERS:

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean's secretary. Students will be required to provide a transcript and course outline related to the course in question.