

DOC. #379

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ON

COURSE OUTLINE

COURSE TITLE: MECHANICAL PULPING PROCESSES

CODE NO.: PPE245-4 SEMESTER: II

COURSE: PULP & PAPER ENGINEERING TECHNOLOGY

AUTHOR: JACK BETHUNE

DATE: DECEMBER 1994 PREVIOUS OUTLINE DATED: AUGUST 1990

APPROVED:


DEAN

A. ii/M
DATE

n

..ll / j "" DEC 2 1 tm ; i // - ^

| oMULi tilt. lviMHIE

MECHANICAL PULPING PROCESSES

PPE245-4

BOURSE NAME

CODE NO.

TOTAL CREDITS: 4

PREREQUISITE(S): NONE

I. PHILOSOPHY/GOALS:

This is the first of the pulping courses. It provides the student with the underlying theory of mechanical pulping, chemi-mechanical pulping and semi chemical pulping. Raw materials are extensively discussed from the point of view of how a tree grows and the effect of fibre characteristics in pulp and paper properties. Wood harvesting and handling at the mill are also covered. In addition the effect of process parameters and equipment design on end product properties and economics are also covered as well as environmental concerns.

II. STUDENT PERFORMANCE OBJECTIVES (OUTCOMES):

Upon successful completion of this course the student will:

• Demonstrate a basic knowledge of the biology of wood, how it is structured and how a tree grows.

Demonstrate a working knowledge of the major effects of wood qualities on pulp and paper properties.

Demonstrate a knowledge of how woody raw materials are harvested, measured, transported to the mill and prepared for processing.

Demonstrate a knowledge of fibre separation during the various mechanical pulping processes.

Be able to distinguish between the various specific types of pulping processes studied.

Explain the underlying theory of mechanical, chemi-mechanical and semi chemical pulping processes.

Describe the different processes studied and how they are controlled.

Explain how the major pieces of equipment associated with these processes operate.

Discuss the economic implications of the various processes studied including environmental impacts and their economic implications.

10. Explain the effects that the pulping processes have on the properties of the pulps produced.

MECHANICAL PULPING PROCESSES

PPE245-4

COURSE NAME

CODE NO.

III. TOPICS TO BE COVERED:

1. Introduction to Raw Materials
2. Fibre Characteristics and How They Control Pulp and Paper Properties
3. Logs, Chips and Woodhandling at the Mill
4. Groundwood Pulps
5. Refiner Pulps
6. Semi Chemical Pulps

IV. LEARNING ACTIVITIES/REQUIRED RESOURCES

Topic/Unit - Introduction to Raw Materials

Learning Activities:

- The pulping process spectrum
- How trees grow
- Anatomical properties of wood - Softwood vs. Hardwood
- Chemical properties of wood
- Physical properties of wood

Resources:

Course Manual for PPE 245

CPPA Pulp and Paper Manufacturing Series - Volume 1 - "Raw Materials"

Pulp and Paper Canada Journal, TAPPI Journal, Pulp and Paper Journal

Smook - Handbook for Pulp and Paper Technologists

Topic/Unit - Fibre Characteristics and How They Control Pulp and Paper Properties

Learning Activities:

Structure of the cell wall - length, width and cell wall thickness

How anatomical, chemical, physical and processing properties affect mechanical pulping

- A discussion of papermaking and how the properties above affect tear resistance, tensile strength, stretch, bursting strength, bulk and optical properties

Resources:

Course Manual for PPE 245

CPPA Pulp and Paper Manufacturing Series - Volume 1 - "Raw Materials" and Volume 2 "Mechanical Pulping"

Pulp and Paper Journals

- Smook

MECHANICAL PULPING PROCESSES

PPE245-4

ApOURSE NAME

CODE NO.

IV. LEARNING ACTIVITIES/REQUIRED RESOURCES (continued)

Topic/Unit - Logs, Chips and Woodhandling at the Mill

Learning Activities;

- Forest Ownership and Forest Management in Canada including harvesting
- Sawmill chips, wood defects and wood transportation
- Raw material measurement, storage and reclaiming at the mill
Log sorting, slashing, debarking, chipping and chip screening and chip washing

Resources:

- Course Manual for PPE 245
- CPPA Pulp and Paper Manufacture Series Volumes 1 and 2
- Pulp and Paper Journals
- Smook

Topic/Unit - Groundwood Pulps

Learning Activities:

- History; types of grinders, process flows
- Principles of groundwood pulping
- Process variables such as wood, stone specifications, stone sharpening, stone shower conditions and operating conditions
Variations such as pressure groundwood and chemical treatment
Environmental concerns

Resources:

- Course Manual for PPE 245
- CPPA Pulp and Paper Manufacture Series Volume 2
- Pulp and Paper Journals
- Smook

m

^r

MECHANICAL PULPING PROCESSES

PPE245-4

COURSE NAME

CODE NO.

IV. LEARNING ACTIVITIES/REQUIRED RESOURCES (continued)

Topic/Unit - Refiner Pulps

Learning Activities;

- Theory of refining
- Process equipment, refiners and plates
- Process variables, feed rate and consistency, plate pattern, power
- Process variations, TMP, CTMP, CTMP, AP, etc.
- Environmental concern

Resources;

- Course Manual for PPE 245
- CPPA Pulp and Paper Manufacture Series Volume 2
- Pulp and Paper Journals
- Smook

Topic/Unit - Semi Chemical Pulps

Learning Activities:

- Principles of Semi Chemical Pulping
- The process, wood, chemicals and equipment
- NSSC, SCMP and other processes
- Pulp properties and end uses
- Economics
- Environmental Concerns

Resources:

- Course Manual for PPE 245
- CPPA Pulp and Paper Manufacture Series Volume 2
- Pulp and Paper Journals
- Smook

V. EVALUATION METHODS:

A final grade will be derived from the results of three tests and at least one assignment as calculated below.

3 tests (equal value)	90%
Assignments	10%

The grading system will be as follows:

A+ = 90-100%, A = 80-89%, B = 70-79%, C = 60-69%,
R = Less than 60%

Students with a final grade of 55-59% will be permitted to write a comprehensive supplemental exam provided they completed the required assignment.

MECHANICAL PULPING PROCESSES

PPE245-4

ApOURSE NAME

CODE NO.

VI. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the instructor.

VII. REQUIRED STUDENT RESOURCES

At the time of this writing a manual is being prepared. While it is not expected to be ready at the start of the semester it will be handed out to students as each chapter becomes available.

VIII. ADDITIONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE LIBRARY:

Smook, G.A. Handbook for Pulp & Paper Technologists, second edition, 1992, Angus Wilde Publications, Vancouver

Kowcurek, M.J. and Stevens, C.F.B. Editors Pulp and Paper Manufacture. 3rd edition, Volume 1, Properties of Fibrous Raw Materials and Their Preparation for Pulping. Joint Textbook Committee, CPPA, Montreal, 1983

Leask R.A. and Kocurek, M.J. Editors, Pulp and Paper Manufacture, 3rd edition, Volume 2, Mechanical Pulping. Joint Textbook Committee, CPPA, Montreal 1983

Periodicals:

Pulp and Paper
Pulp and Paper Canada
TAPPI Journal

IX. SPECIAL NOTES

Students with special needs (eg. physical limitations, visual impairments, hearing impairments, learning disabilities) are encouraged to discuss required accommodations confidentially with the instructor.

Your instructor reserves the right to modify the course as he/she deems necessary to meet the needs of students.