

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY
SAULT STE MARIE, ON



COURSE OUTLINE

Course Title; RAW MATERIALS

Code No.; PPE 154-4

Semester; 1

Program; PULP & PAPER MAKING OPERATIONS

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Date; JAN. 1999

Previous Outline Date: APRIL 1990

Approved;

J. DeRosario
Dean

1/3/99
Date

Total Credits: 4

Prerequisite(s): NONE

Length of Course: 16 WEEKS

Total Credit Hours: 48

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& Technology Studies, (705) 759-2554, Ext. 642.

RAW MATERIALS

PPE 154-4

COURSE NAME

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I. COURSE DESCRIPTION:

This course will provide the student with the information required to understand the biology of wood, how its quality affects pulp & paper properties, how it is grown and harvested, how it is processed at the mill and how it is stored.

H. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

(Generic Skills Learning Outcomes placement on the course outline will be determined and communicated at a later date.)

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

1) Understand Canada's forests

Potential Elements of the Performance:

- indicate how many km² of productive forest land there are in Canada
- relate the effects of extreme temperatures and low rainfall of central Canada on our forests
- define a forest region
- name the forest regions and their locations
- describe mean annual increment
- indicate why glucose and chlorophyll are important to the tree
- state the difference between primary and secondary growth
- describe how the cells of a tree divide
- calculate the maximum size mill possible without depleting the forest

2) Understand the structure of a tree

Potential Elements of the Performance:

- define xylem, phloem, nucleus, cell wall, ray cells, and lumen
- name the three functions of cells in wood
- discuss why ray cells are a concern in the manufacture of pulp & paper
- explain the difference between diffuse porous and ring porous hardwoods
- list three ways that hemicelluloses differ from cellulose
- calculate the specific gravity of a block of wood
- list four factors that contribute to the specific gravity of wood
- calculate solids content and moisture content of wood
- define bound water

**n. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE
(Continued)**

3) Understand the structure of a fibre

Potential Elements of the Performance:

- define a microfibril and macrofibril
- calculate the number of fibres in a given weight of pulp
- identify the various layers of a fibre wall
- explain the term fibril angle
- discuss the problems caused by vessels in papermaking
- show where the shortest fibres are found in a tree and discuss their implications on quality of pulp
- explain fibre flexibility index
- discuss why wood specific gravity is important
- explain runkel ratio and why it is important to burst strength
- discuss the significance of variations in a mill's wood supply

4) Understand how wood and fibre characteristics control pulp and paper properties

Potential Elements of the Performance:

- explain where the heat comes from in mechanical pulping
- explain why this heat is important
- explain glass transition temperature
- discuss the effect of thick cell walls on the energy consumption in mechanical pulping
- name three negative effects caused by pitch in mechanical pulping
- name three negative effects of using high density wood in mechanical pulping
- discuss the effects that wood porosity has on chemical pulping
- discuss the effects of specific gravity on residual lignin content in kraft pulps
- name three factors that control tear strength of paper
- explain the difference between machine direction stretch and cross direction stretch in paper

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE (Continued)

5) Understand how the mill's raw materials are procured

Potential Elements of the Performance:

- explain the difference between crown land and private ownership
- explain the differences between land ownership in Canada and the United States
- discuss how forest management areas are managed
- explain stumpage fees
- discuss arguments for private ownership of forest land in Canada
- explain the difference between physically accessible and economically accessible forest land
- discuss the factors that affect economic accessibility
- give reasons why river drives were ended in Ontario
- explain why mechanical harvesting is used
- discuss factors limiting efficiency of mechanical harvesting
- explain why a kraft mill would prefer to use sawmill ships
- discuss the problems caused by crooked logs in a mill
- discuss defects in wood and their affect on pulp quality

6) Understand wood handling at the mill

Potential Elements of the Performance:

- explain the usefulness of small woody raw material inventories
- conduct a case study on mill raw material requirements
- explain why a mill measures the wood raw materials it receives
- discuss the quality properties a mill would measure on its woody raw materials
calculate chip dryness
- list three conditions log storage piles should meet
- explain FIFO
- discuss different types of chip unloading equipment
- discuss the technical reasons for paving chip storage pads

**H. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE
(Continued)**

- 7) Understand how wood is prepared for pulping

Potential Elements of the Performance:

- explain why a mill would use log sorting
- discuss problems that decayed wood could cause in a pulp mill
- discuss the quality problems associated with large branch stubs on logs
- explain the purpose of a slasher
- explain how a drum debarker works
- explain the difference between cambial shear and cutterhead debarkers
- calculate amount of bark needed to heat a given quantity of water
- discuss the function and purpose of a bark press
- list three factors that control chip length in a disc chipper
- name three technical problems caused by boomed chips
- give four technical reasons for removing thick or long chips from the digester feed
- discuss the differences between a flat inclined gyratory screen and a disc screen

HI. TOPICS:

- 1) Introduction to the course
- 2) What you need to know about Canadian forests
- 3) All you ever wanted to know about wood
- 4) Fibres and other useful stuff
- 5) How wood and fibre characteristics control pulp and paper properties
- 6) Logs and chips: the mill's bulk raw materials
- 7) Wood handling at the mill
- 8) Preparing wood for pulping

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IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Sugden, A.E. "Study Guide for PPE 154 Raw Materials"
Sault College of Applied Arts & Technology, Sault Ste. Marie, 1990

V. EVALUATION PROCESS/GRADING SYSTEM

A final grade in this course will be based on the results of four tests weighted equally. 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 between 55-59 will be allowed to write a supplemental exam.

VI. SPECIAL NOTES:

- Special Needs
If you are a student with special needs (eg. physical limitations, visual impairments, hearing impairments, learning disabilities), you are encouraged to discuss required accommodations with the instructor and/or contact the Special Needs Office, Room E1204, Ext. 493, 717, 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 post-secondary institutions.
- Disclaimer for Meeting the Needs of the Learners
- Substitute Course Information is available at the Registrar's Office.
- Any Other Special Notes appropriate to your course.

VH. PRIOR LEARNING ASSESSMENT

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