

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: PAPER MANUFACTURE

Code No.: PPE 161-6 Semester: II

Program: PULP AND PAPERMAKING OPERATIONS

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Date: NOVEMBER 1991 Previous Outline Dated: MARCH 19 89

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Date

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**TOTAL CREDIT HOURS: 96**

**I. PHILOSOPHY/GOALS:**

The course is designed to provide the student with the basic knowledge of the entire papermaking process. It begins with a study of the nature of the fibres and a review of pulp methodology. The area of stock preparations where the fibers are mechanically and chemically treated, is studied in detail. From stock preparation, the furnish is delivered through the approach flow system to the paper machine.

The three main areas of the paper machine are studied: formation, pressing and drying. The theory of each process will be discussed, as well as, equipment and paper machine clothing. The size press operation and reeling section of the machine will be outlined. Paper quality and physical testing will be studied as a conclusion to the course.

In addition to the above, the operational environment (paper machine operator positions and line-of-progression) will be reviewed with the student.

**II. STUDENT PERFORMANCE OBJECTIVES:**

The overall educational objective of this course is that the student will be able to demonstrate knowledge of all parts of the papermaking process from stock preparation to the reel. The specific objectives of the course include the following:

1. Demonstrate knowledge of the nature of fibres and how they are modified during refining or beating.
2. Demonstrate knowledge of the many and various techniques and equipment used in stock preparation.
3. Demonstrate knowledge of basic stock proportioning and additive mixing systems.
4. Demonstrate knowledge of means of delivering stock to the forming wire for fourdrinier, twin-wire, and cylinder machines.
5. Demonstrate knowledge of stock dewatering systems such as foils, suction boxes, couch roll etc.
6. Demonstrate knowledge of machine clothing such as forming fabrics, vW press felts and dryer fabrics.

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**II. STUDENT PERFORMANCE OBJECTIVES:** (cont'd)

7. Demonstrate knowledge of drying theory and structure and operation of paper dryers.
8. Demonstrate knowledge of size presses and reel section.
9. Demonstrate knowledge of on-line machine control systems and the effects of machine conditions on paper quality.

**III. TOPICS TO BE COVERED:**

1. Papermaking An Overview and Background.
2. Stock Preparation.
3. Additives used in paper manufacture.
4. The Approach Flow System.
5. Formation Section of a Paper Machine.
6. Press Section.
7. Dryer and Reel Sections.
8. Paper Quality.

**IV. LEARNING ACTIVITIES:**

NATURE OF PRESENTATION:

This course will be given for 5 hours per week. Much of the material will be presented in a lecture format with the remainder in the form of exercises and assignments.

If a mill tour can be arranged, all details will be outlined. A tour will be scheduled in conjunction with class time if possible.

The following is an outline of the learning activities and should be used as a guide to study and class preparation. Additional assignments may be handed out in class to supplement existing assignments.

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IV. LEARNING ACTIVITIES:

<u>WEEK</u>	<u>TOPIC</u>	<u>COURSE MANUAL</u>	<u>SMOOK BOOK</u>
1	<u>Unit 1</u> Introduction - Course Outline Overview and Background Introduction to Papermaking	Study Ch. 1, pp. 1-2	Study Ch. 1, p. 1-3 Ch.13 Intro p.179 Ch.15 Intro p.202 Ch.16 Intro p.208 Ch.17 Intro p.244
	Fibrous Raw Materials for papermaking The Nature of Fibers Review of pulping methodology- Unit 1 - Review	Study Ch. 1, pp. 3-4 Complete Review pp. 5-6	Study Ch.1, pp. 3-8 Ch.2, pp. 9-19 Ch.4, pp. 35-43
	<u>Unit 2</u> Stock Preparation Overview Pulping Refining and Beating Additives Acids and Bases Alum Sizing Agents Starches Wet strength resins Fillers (clays, etc.) Dyes and pigments Defoamers Drainage Aids Pitch control Agents Slimicides Retention Aids Proportioning Unit 2 - Review	Study Ch. 2 pp. 7-8 pp. 8-11 p. 11 Study Table 2-1 p. 12 p. 15 p. 13, Assgn #1, p. 14 p. 16 pp. 17-21 pp. 22-24	Study Ch. 13 Intro p. 179 4fc pp. 179-1W pp. 181-190 Table 15-1,p.203 p. 204 pp. 204-205 p. 263 p. 205-206 p. 206 p. 206 p. 207 pp. 202-203 pp. 190-191
	<b>TEST 1 (Units 1 and 2)</b>		

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**IV. LEARNING ACTIVITIES: (cont'd)**

<u>WEEK</u>	<u>TOPIC</u>	<u>COURSE MANUAL</u>	<u>SMOOK BOOK</u>
6	<u>Unit 3</u> The Approach System Flow Spreader	Study pp. 25-33 p. 34	Study Ch.16 ,pp.209- 212 pp.213-214
	Headbox Slice Unit 3 - Review	pp. 35-39 pp. 40-41 pp. 42-43	pp. 212-219
	<u>Unit 4</u> Formation Drainage Elements Forming Fabric White Water Collection & Return Twin Wire Forming Multi-ply Paperboard Manufacture Unit 4 - Review	Study pp. 44-48 pp. 49-51 pp. 48 pp. 52-54	Study p.219 pp. 219-222 pp. 222-223 pp. 227-229 pp. 224-227 pp. 274-281
	<b>TEST 2 (Units 3 and 4)</b>		
10	<u>Unit 5</u> Pressing Pressing Theory Press Designs Press Clothing Vacuum System Unit 5 - Review	Study p- 56 pp 56-58 pp 59-61 pp 62-63 pp. 64-6 6	Study pp 229-231 pp 232-233 pp 234-238 pp 238-242 p- 242
11	Unit 6 Drying Theory Dryer Designs	Study pp. 68-71 pp. 72-75	Study pp. 244-250 pp. 282-283 pp. 296-297
12	Pocket Ventilation Hood Ventilation Dryer Felts Unit 6 - Review	p. 76 pp. 77-79	<b>PP</b> 250-252 p- 252 p- 250
	<b>TEST 3 (Units 5 and 6)</b>		

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**IV. LEARNING ACTIVITIES:** (cont'd)

WEEK	TOPIC	COURSE MANUAL	SMOOK BOOK
13	<u>Unit 7</u> Size-Press Reeling Cross machine measurement	pp. 80-82 p. 82 & p,	p. 262 p. 258
14	<u>Unit 8</u> Quality- Unit 8 - Review	pp. 85-87 p. 88	pp. 313-31
15	<b>TEST 4 (Units 7 and 8)</b>		

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**V. EVALUATION METHODS:**

Students will be graded on the basis of their performance in four (4) tests, each with equal weighting (25%). The instructor reserves the right to issue quizzes and appropriate adjustments will be made to the unit grade.

Units 1 and 2	25%
Units 3 and 4	25%
Units 5 and 6	25%
Units 7 and 8	25%
TOTAL	100%

The final grade for the course will be awarded on the following percentage basis:

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

Students having a final standing of R and who have a course average of at least 50% may be permitted to write a supplemental exam covering the entire course.

**VI. REQUIRED STUDENT RESOURCES:**

Paper Manufacture - Study Guide 1991, A manual developed by the Distance Education Department and available in the College Bookstore.

Handbook for Pulp & Paper Technologists, G. A. Smook, Joint Textbook Committee of the Paper Industry. Available in College Bookstore.

**VII. ADDITIONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE LIBRARY:**

Stacks

Paper and Paper Board, J. E. Kline, Manufacturing and Converting Fundamentals. TS1090 K54 (1982)

Volume II, Paper, Pulp and Paper Science and Technology, Edited by C. E. Libby. TS1105 P99 (1962)

Paper Machine Felts and Fabrics, Albany International. F4A4 (1976).

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**VII. ADDITIONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE LIBRARY:**

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Reference Section

Handbook of Pulp and Paper Terminology, G. A. Smook, A Guide to Industrial and Technological Usage. TS1085 S66 (1990)

Handbook of Pulp and Paper Technology, K. W. Britt, TS1105 B59 (1964)

Volume III, Papermaking and Paperboard making, Pulp and Paper Manufacture, Second Edition. TS1105 J65 (1969)

**VIII. SPECIAL NOTES:**

Students with special needs (e.g. 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.