PSEN 115

Pulp and Paper Laboratory Methods

Spring 2019
Lecture & Discussion [M W: 10:00am - 10:50am];
Lab [M: 02:00pm- 04:50pm]

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Office Hours: M R (11 am - 12 pm).

Overview

Pulp and paper tests and evaluations are essential to pulp and paper manufacturing and converting. TAPPI standards are wildly applied in North American pulp and paper industry. As future process engineers, students are required to practice the popular pulp and paper tests following by the TAPPI standards. All of laboratory tests are completed by a group.

3 Credit Hours. 2 Hrs lecture and 3 Hrs lab per week.
Prerequisite: CHEM 105 or consult instructor.

Goals

Perform laboratory techniques and testing procedures used in the pulp and paper industry.

Demonstrate writing skills at a level appropriate for a process engineering internship.

Demonstrate the ability to work with data in Excel™.

Begin to develop data analysis skills.

Demonstrate the ability to work cooperatively in groups.

Course Topics

1. Pulping.
2. Pulp evaluation.
3. Handsheet preparation
4. Handsheet mechanical and optical properties.
5. Pilot paper machine run.
6. Retention.
7. Deinking.
8. Pilot paper machine production evaluation.
9. Pilot machine fun run (or field trip).

ABET Student Outcomes

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

3. an ability to communicate effectively with a range of audiences

4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

Materials

- Garry Smook (2015). "Handbook for Pulp and Paper Technologists," 4th Ed, TAPPI Press (textbook, rental).
- TAPPI standards (available on CANVAS).
- Other materials provided by instructor, and CANVAS course contents and references.

Classroom

Lecture & Discussion: A207, Science building.

Laboratory: D135, Science building

Spring Break

March 18th-22nd

TAPPI PaperCon

May 5th-8th

Exams

Midterm: 10th week

Final Exam: May 14th

6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

8. Knowledge of the science and technology used in the paper industry.

Computer and Calculator

Students must have the ability to use a spreadsheet (MS Excel) and a modern scientific calculator.

Classroom policy

Electronics, such as smart phone, tablet and laptop, are prohibited in the classroom and lab.

Students are not allowed to work on other course assignments during lectures and labs.

General Lecture and Laboratory Procedures, and Safety Rules

A lecture is given before each experiment that concentrates on their technical background, methods and applications.The laboratory procedure and instruction will be also provided. Students need to do literature review before each lab.

Laboratory safety is priority. Students must follow the laboratory safety rules and lab instructions. Students will be asked to leave the laboratory if he/she fails to follow the safety protocol. No grade will be given.

Gather and record all information necessary to complete your report. You may be asked to demonstrate lab skills for evaluation.

In the following lecture, instructor will summarize the previous lab, answer questions, instruct students on data analysis, data interpretation and lab report preparation.

Laboratory Report

The experiments are complished by a team. Each team should have a team leader for each lab.

Each student must submit an individual report for each experiment in the CANVAS. Accepted file formats include MS Word, Excel, PowerPoint. Adobe PDF file is not acceptable.

The reports must follow provided engineering report templates.

Report will be evaluated in five categories; they are English skills, organization, format, scholarship and technical competence; see details below. Citation is not required, however, it's a good manner to have in your report.

You have one week to complete each lab report. Please upload it to the coresponding assignment folder in the CANVAS before next exercise. No grade for late report.

Plagiarism on home work and report is forbidden. Students will be reported immdiately to the Office of the Dean of Students and department. No grade will be given to each part.

Students must keep their lab reports until the end of semester. The university provides free sever space - "OneDrive."

Laboratory report evaluation

Performance Criteria	Exceptional	Acceptable	Marginal	Unacceptable
English skills	Excellent, well written report	Good use of grammar	Generally okay, some lapses in grammar	Poor use of the English language
Organization	Very good organization, report is easy to follow	Good, logical organization	Generally okay, some careless errors	Sloppy, lack of attention to details
Report format	Few instances of noncompliance with required format	Good use of the required format	Generally okay, some lapses in format	Report did not comply with format
Scholarship	Well researched report, used many sources to support discussion effectively, complete coverage of topic	Good use of reference material to support discussion , some parts left out of topic	Minimal use of reference material , inadequate coverage of topic	No use of reference material evident , topic not addressed
Technical competence	Very good, solid understanding of processes, good use of appropriate technical vocabulary in explanations	Good understanding of processes, use of some technical language in explanations	Adequate understanding of processes, use of low level vocabulary in explanations	Poor basic understanding of processes

Exams

Each student will take one oral exam on one randomly assigned lab, either at the midle of semester, or at the end of semester.

Unless arranged in advance, students must take the exam on the assigned day or no credit will be given.

Evaluation

Grades is assigned based on a percentage of total points earned in the semester.

Lab skill evaluation and preparation: 15% (Skill evaluation is ONLY for lab 2, 3 and 4, evaluation rubric in following table. Lab preparation evaluation is randomly selected).

Laboratory reports: 70% inlcuding eight brief reports (80 pts each) and one process diagram (60 pts).

Oral exam: 15%.

Extra credits may be available in the forms of unannounced quizzes, extra practice problem or report.

Letter grades will be assigned based on the student's overall score, following the university guideline.

A (4.0, 93%), A- (3.67, 90%), B+ (3.33, 87%), B (3.00, 83%), B- (2.37, 80%),

C+ (2.33, 77%), C (2.00, 73%), C- (1.67, 70%), D+ (1.33, 67%), D (1, 60%), F (0.00, < 60%).

I reserve the right to adjust the student grades based on the overall performance and attendecne.

Laboratory skill evaluation

Performance Criteria	Exceptional	Acceptable	Marginal	Unacceptable
Safety	Observes good laboratory safety procedures. Vigilant; points out unsafe situations where applicable.	Observes good laboratory safety procedures	Unsafe lab procedures observed infrequently	Practices unsafe, risky behaviors in lab
Follow instructions	Follows instructions accurately with no assistance	Follows instructions accurately with minimal assistance	Follows instructions accurately with some assistance	Does not follow instructions; needs constant supervision
Skill in manipulating equipment	Competent and methodical in manipulating equipment	Needs assistance with complex processes	Needs assistance with routine processes	Misuses equipment
Attitude	Eager to learn; diligent, interested	Average interest and diligence	Somewhat indifferent	Shows no interest in lab activities
Ability to learn	Learns very quickly (explain 1x)	Learns readily (explain 2x)	Below average (explain 3x)	Slow to learn procedures (explain >=4)
Accuracy of results		Within TAPPI specification		Not within TAPPI specification

Attendance

Attendance to all of lectures and labs is mandatory. Student must inform the instructor his/her absence before the class with a valid reason and proof.

Policy on Cheating and Misconduct in Class

Any incident of cheating and/or misconduct in the classroom that threatens the continuance of a teaching and learning environment in the classroom of will be handled through the University's Disciplinary Standards and Procedures. For the most accurate information regarding these standards and procedures please refer to the web site: http://www.uwsp.edu/dos/Pages/Academic-Misconduct.aspx. In particular, consult UWSP Chapter 14 (Academic Misconduct) and UWSP Chapter 18 (Conduct on University Lands).

Engineers must behave ethically; the safety of the public depends on not only on the competence, but also on the honesty and integrity of engineering professionals. Engineers may, at times, come under strong pressures to commit unethical acts, and the results can be tragic. At a university, one important ethical requirement is that the work upon which you are graded be your own, and not someone else's. Though group work and collaboration on homework exercises is strongly encouraged, students are cautioned against any type of unethical conduct, including copying during exams, presentation of false documentation for medical excuses, or use of stand-ins on exams and quizzes. Storage of factual information on handhold calculators, for use in closed-book exams, is also expressly forbidden.

American with Disabilities Act (ADA)

UWSP has specific policies for students with disability. If you have a disability, please inform the instructor or department.

Laboratory Exercise Descriptions

These are brief descriptions of the laboratories for this semester. The reading assignments are from Smook book.

Lab 1 – Pulping (pp. 76-85)

In this activity, you will conduct a chemical pulping experiment with wood. The resulting mass of fibers will be refined and screened. You will wash and prepare the pulp for storage until the next lab session.

Lab 2 – Pulp Evaluation (pp. 85, 346-348)

Using the appropriate TAPPI test methods, you will measure the kappa number and TAPPI viscosity of the pulp that you prepared in Lab 1.

Lab 3 – Handsheet Preparation (pp. 348-351, 193-207)

During this laboratory you will slurry and refine samples of commercial pulp for various lengths of time in a Valley Beater. You will prepare handsheets of the unrefined pulp as well as of the pulps after 15, 30, and 60 minutes of beating time for subsequent laboratory evaluation. You will also measure the drainage characteristics of these pulps during this lab.

Lab 4 – Handsheet Mechanical and Optical Properties (pp. 351-357)

You will perform a series of tests on the handsheets produced during Lab 3 to determine key mechanical and optical properties. Mechanical tests will include Tensile, Zero-Span Tensile, Tear, Burst, and porosity. Optical tests will include brightness, opacity, gloss and color. A comparison of test results of the "as received" samples with those of different beating times will demonstrate some of the effects of refining on pulp fibers. Optical testing of colored commercial papers will demonstrate the color measurement coordinate system.

Lab 5 – Pilot Paper Machine Run #1 (chapters 16 and 17)

This activity will provide the students with an opportunity to observe the operation of the pilot paper machine and to participate, on a limited basis, in this operation. The paper machine run will produce 75 gram per square meter (20#) copy/printer paper for testing during the next lab session. You will measure retention on the pilot paper machine to determine how efficiently our machine retains solids.

Lab 6 – De-Inking (Chapter 14, pp. 215-218)

In this lab you will re-pulp and de-ink printed post-consumer waste paper. You will produce handsheets of the de-inked fiber and evaluate the brightness, color, and dirt count.

Lab 7 – Test Pilot Paper Machine Production (pp. 351-357, 224-225)

In this lab students will test the paper produced on the pilot paper machine as well as samples of a commercial 75gram per square meter (20#) copy paper. Tests will include machine direction (MD) and cross direction (CD) tensile and tear, top-side and bottom-side burst. You will compare pilot paper machine production to commercial paper. You will also compare the sizing levels of the paper produced in lab 5 with commercial paper samples. You will use the Cobb Size Tester to measure the sizing levels of the various paper samples.

Lab 8 – Retention (pp. 223-227)

This activity will reinforce the concept of retention as it relates to papermaking. You will measure retention two different ways using laboratory equipment (Britt jar).

Lab 9 – Pilot Paper Machine Run #2

The goal of this activity is to choose a type of paper to make on the pilot paper machine. Dr. Gong will work with the class to design and produce a specific grade of paper to introduce the concept of paper design. You will take data during the run that will allow you to calculate mass balances on the stock preparation and forming areas of the paper machine.