

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO



Sault College

COURSE OUTLINE

COURSE TITLE: PULP & PAPER SCIENCE

CODE NO. : PPE 157

SEMESTER:

PROGRAM: PULP & PAPER

AUTHOR: BILL HEITANEN

DATE: JANUARY **PREVIOUS OUTLINE DATED:**
2002

APPROVED:

DEAN

DATE

TOTAL CREDITS: 4

PREREQUISITE(S):

HOURS/WEEK:

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I. COURSE DESCRIPTION:

This course deals with the scientific fundamentals from the chemistry and physics disciplines which are the basis for understanding the technologies used in the pulp and paper industry. The course material is split in approximately equal portions between chemistry and physics fundamentals.

Chemical fundamentals to be covered include the following: atomic theory, chemical elements and the Periodic Table, chemical solutions used in the industry, simple chemical reactions from the pulping process, factors controlling chemical reaction rates, balancing chemical reactions involved in the pulping process, and the concepts of acids and bases. The course also introduces the students to organic chemistry and the system used for naming organic chemicals so that the students will gain a basic understanding of organic chemistry and chemicals which are common place in the pulp and paper industry and their lives. The course material uses practical examples where ever possible from the chemistry of pulp and papermaking.

Fundamentals to be covered from the physics discipline include the concepts of mass, weight, volume, density, specific gravity, force and momentum, pressure systems for solids, liquids and gases, forms of energy, work, simple machines such as levers, gears and pulleys, and the basics of electricity and hydraulic systems. All of these concepts are taught with an emphasis placed on applications in the pulp and paper industry.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1. Indicate a basic knowledge of the properties of matter.

Potential Elements of the Performance:

- differentiate between mass and weight of an object
- calculate the weight of an object given its mass
- calculate the volume of various containers knowing their dimensions
- calculate the density of a substance
- convert a volume of substance to the mass of the substance
- differentiate between compounds and elements
- differentiate between physical and chemical changes

2. Indicate a basic knowledge of the chemical theories dealing with Atoms and Molecules

Potential Elements of the Performance:

- describe Dalton's First Atomic Theory and its updates
 - differentiate between the subatomic particles, Protons, Neutrons and Electrons
 - describe the relative size of the Atom and the components of the Atom
 - describe the composition of the first Ten chemical elements
 - differentiate between Atomic number and Mass number
 - define the term Atomic Mass Scale
 - describe what is meant by the terms Molecule and Ion
 - explain the concept of Isotopes of elements and the symbolism used for identifying the various isotopes of an element
 - explain the concept of Energy Levels in the electronic arrangement of atoms
 - explain the concept of Valence Electrons in the atom
 - differentiate between Ionic and Covalent Bonding in atoms in molecules
 - describe the difference between Cations and Anions
 - write and understand simple Chemical Formulas
 - Name simple Binary Compounds
3. Demonstrate an understanding of the basic concepts of Chemical Elements and Compounds.

Potential Elements of the Performance:

- describe the chemical elements that make up the major part of the top 10 miles of the earth's crust
- describe both the chemical and physical properties that differentiate metals, non-metals and metalloids
- describe the behaviour of gases and the effect of pressure and temperature on the volume of a gas
- calculate the density and specific gravity of a gas
- define Standard Temperature and Pressure (STP)
- describe the difference between the Centigrade and Kelvin temperature scales and be able to convert from one scale to the other
- describe how the elements are arranged in the Periodic Table and why they are grouped in this manner
- describe what differentiates Organic from Inorganic Compounds
- describe the basics of naming Organic Compounds

- differentiate between the Alkane, Alkene and Alkyne families of organics
- describe what identifies the Alcohol Family of organics and the difference between Ethanol and Rubbing Alcohol
- describe the major types of biological compounds and what makes the main component of wood fibre or pulp cellulose

4. Demonstrate a basic understanding of the various types of Chemical Reactions

Potential Elements of the Performance:

- describe the four types of chemical reactions and how they differ
- describe the basic properties of Acids and Bases
- describe how acids and bases can be chemically prepared or produced
- describe what a Neutralization Reaction means and what the products of the reaction will be
- describe what Chemical Salts are
- understand the pH Scale and what it measures
- describe what the term Heat of Reaction means
- write and balance simple chemical reactions given only the word equation
- calculate the Oxidation Number and Oxidation State of an atom
- describe the terms Oxidation, Reduction, Oxidizing Agent and Reducing Agent

5. Understand the concepts of Mass, Weight, Density and Specific Gravity as they apply to Physics

Potential Elements of the Performance:

- describe and use the concepts of mass, weight, volume, density and specific gravity
- state the difference between mass and weight, both theoretically and numerically
- when given any two of the quantities, mass, weight, volume, or density, calculate all of the other quantities
- state the value for the Acceleration Due To Gravity in both the SI and USCS Systems of measure
- be able to convert flow rates between the SI and USCS units of measure

- given the mass and volume of displacement, calculate the density and specific gravity of a substance
- solve problems using weight or mass density and specific gravity

6. Demonstrate an understanding of the mechanics concepts of Force and Pressure

Potential Elements of the Performance:

- describe the relationship among force, mass and acceleration, and give the units for each
- define the units, newton and Pascal
- demonstrate, by definition and example, the difference between mass and weight, and between speed and velocity
- state Newton's Laws of Motion and give an example of an application of each law
- solve problems for force, mass or acceleration when given any two of these quantities
- state Pascal's Law and give an example of its application

7. Demonstrate a basic understanding of the concepts of Work, Energy and Power

Potential Elements of the Performance:

- write and apply the formula for determining Work done
- determine the difference between Potential and Kinetic Energy
- write and apply the formula for both Kinetic and Potential Energy
- write and apply the formula for Power

8. Demonstrate a basic understanding of the concepts of Simple Machines and work with some common simple machines we rely on in our regular lives

Potential Elements of the Performance:

- describe a Simple Machine and its operation
- write and apply formulas for computing the Efficiency of a simple machine in terms of the work done
- determine both the Actual and Ideal Mechanical Advantage of a simple machine
- draw a diagram of each of the following simple machines and write a formula for computing then calculate the mechanical advantage of each: lever, wheel and axle, inclined plane, wedge, screw, gear, pulley system, and belt drive system

9. Demonstrate a basic understanding of the concepts of Electricity and Electrical Systems

Potential Elements of the Performance:

- name the units for a quantity of Electrons, Electric Current, and Electromotive Force
- apply the formula derived from the above definitions
- differentiate between Series and Parallel electrical circuits
- name and apply the units of Electrical Power
- apply the units of electrical measurement
- calculate the Electrical Power for several electrical appliances

10. Demonstrate a basic knowledge of the concepts of Fluid Power and Hydraulic Systems

Potential Elements of Performance:

- write and apply a formula for calculating the Mechanical Advantage of a Hydraulic Press in terms of input and output forces or areas
- state Archimedes's Principle and apply it in determining the Buoyant Force on an object
- write and apply the formula for predicting the Rate of Flow of a Fluid in terms of its Velocity and Cross-sectional Area
- discuss the change in Velocity of a fluid and Fluid Pressure as the cross-sectional area of a pipe changes

III. TOPICS:

1. The properties of matter
2. Atoms and Molecules
3. Chemical elements and compounds
4. Chemical reactions
5. Mass, weight, density and specific gravity
6. Force and pressure
7. Work, energy and power
8. Simple machines
9. Electricity
10. Hydraulic systems

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Heitanen, W., Course Manual for PPE 157, Sault College of Applied Arts & Technology, Sault Ste Marie, 2002

V. EVALUATION PROCESS/GRADING SYSTEM:

The final grade in this course will be based on the results of four tests, weighted equally. For testing purposes, the course will be divided as follows:

Test #1 :	Module 1, Lessons 1 and 2
Test #2 :	Module 1, Lessons 3 and 4
Test #3 :	Module 2, Lessons 1, 2 and 3
Test #4 :	Module 2, Lessons 4, 5 and 6

Students with a final grade between 55 - 59 will be allowed to write a supplemental exam on the **entire course**. If you pass the supplemental exam you will be given a **“C” grade** for the course regardless of how well you do on the exam.

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%	3.75
B	70 - 79%	3.00
C	60 - 69%	2.00
R (Repeat)	59% or below	0.00
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field placement or non-graded subject areas.	
U	Unsatisfactory achievement in field placement or non-graded subject areas.	
X	A temporary grade. This is used in limited situations with extenuating circumstances giving a student additional time to complete the requirements for a course (see <i>Policies & Procedures Manual – Deferred Grades and Make-up</i>).	
NR	Grade not reported to Registrar's office. This is used to facilitate transcript	

preparation when, for extenuating circumstances, it has not been possible for the faculty member to report grades.

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.