



# THE FEDERAL UNIVERSITY OF TECHNOLOGY, AKURE

## *Department of Chemistry*

### CHE 515–Wood Pulp and Paper Chemistry

#### COURSE PARTICULARS

**Course Code:** CHE515

**Course Title:** Wood Pulp and Paper Chemistry

**No. of Units:** 2

**Course Duration:** Two hours of theory per week for 15 weeks.

**Status:** Compulsory

**Course Email Address:**

**Course Webpage:**

**Prerequisite:** NIL

#### COURSE INSTRUCTORS

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and

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#### COURSE DESCRIPTION

This course seeks to introduce the undergraduate students in the department of chemistry and other related fields to the science and technology involved in the utilization of wood as chief raw materials for the production of wood pulp, paper, wood- and pulp- based value-added products. Basic topics to be covered in this course include: an overview of wood production from different types of forests; wood as renewable natural resource; wood chemistry; wood pulping processes; pulp bleaching; paper production and recycling.

## COURSE OBJECTIVES

The objectives of this course are to:

- introduce students to the use of wood, non-woody and agricultural waste as viable industrial raw material;
- introduce students to the basic chemistry of wood and separation of basic wood components, through various chemical, mechanical and chemo mechanical methods; and
- take the students through various chemical reaction methods for wood components modification and their uses.

## COURSE LEARNING OUTCOMES / COMPETENCIES

Upon successful completion of this course, the student will be able to:

*(Knowledge based)*

- develop know-how to provide technology for the adoption of alternative raw materials for industrial purposes as they face future industrial challenges;
- know the basic chemical structures of wood and being able to separated them;
- learn the details of the chemistry of pulping and bleaching; and
- understand the purpose and procedures for chemical modification of wood based raw materials for industrial uses

## GRADING SYSTEM FOR THE COURSE

This course will be graded as follows:

Class Attendance	05%
Assignments	15%
Test(s)	20%
<u>Final Examination</u>	<u>60%</u>
<b><u>TOTAL</u></b>	<b><u>100%</u></b>

## GENERAL INSTRUCTIONS

**Attendance:** It is expected that every student will be in class for lectures. Attendance records will be kept and used to determine each person's qualification to sit for the final examination. In case of illness or other unavoidable cause of absence, the student must communicate as soon as possible with any of the instructors, indicating the reason for the absence.

**Academic Integrity:** Violations of academic integrity, including dishonesty in assignments, examinations, or other academic performances are prohibited. You are not allowed to make copies of another person's work and submit it as your own; that is plagiarism. All cases of academic dishonesty will be reported to the University Management for appropriate sanctions in accordance with the guidelines for handling students' misconduct as spelt out in the Students' Handbook.

**Assignments and Group Work:** Students are expected to submit assignments as scheduled. Failure to submit an assignment as at when due will earn you zero for that assignment. Only under extenuating circumstances, for which a student has notified any of the instructors in advance, will late submission of assignments be permitted.

**Code of Conduct in Lecture Rooms and Laboratories:** Students should turn off their cell phones during lectures. Students are prohibited from engaging in other activities (such as texting, watching videos, *etc.*) during lectures. Food and drinks are not permitted in the laboratories.

## READING LIST

<sup>1</sup>Robert, J. C., (1991). Paper Chemistry. Published by Blackie Academic and Professional, Chapman and Hall, WesterCleddens Road, Bishopbriggs, Glasgow.

<sup>1</sup>Shukla, S.D. and Pandey, G.N., (1979): Published by Vikas Publishing House PVT LTD. New Delhi. 268p.

<sup>3</sup>Sharma, B.K. (2006): Industrial Chemistry. KRISHA Prakashan Media (P) Ltd., Darya Ganj, Delhi. 1191p

<sup>4</sup>Philip, J. C., (2002): Survey of Industrial. Kluwe Academic / Plenum Publishers, New York, Boston, Dordrecht, London, Moscow.

<sup>4</sup>Martin, B. H., (2006): Handbook of Chemical Technology and Pollution Control. 3<sup>rd</sup> Edition. Elsevier Science and Technology Book

### Legend

- 1- Available in the University Library
- 2- Available in Departmental/School Libraries
- 3- Available on the Internet.
- 4- Available as Personal Collection
- 5- Available in local bookshops.

## COURSE OUTLINE

Week	Topic	Remarks
1	Introduction and Course Overview Forest Conservation, Exploitation and Afforestation	During this first class, the students are introduced to course and were taught on the importance and adverse effects of conservation of forest, exploitation and afforestation.
2	<b>Wood : A renewable resource</b> <ul style="list-style-type: none"> <li>• Different types of wood</li> <li>• Paper making characteristics of soft- and hard-wood</li> <li>• Sources of promising non-woody species as alternative fiber source</li> </ul>	Students will know types of wood that exist and what makes a wood to be good raw material for paper making. Students should be able to provide alternative raw materials for existing ones in their future industrial challenges
4	<b>Wood Chemistry</b> <ul style="list-style-type: none"> <li>• Holocellulose(cellulose and hemicellulose)</li> <li>• Lignin</li> <li>• Extractives</li> <li>• Inorganic matters</li> </ul>	Students would be taught the different chemical compositions of wood, their sub-monomer and their functions as related to wood.
5	<b>Wood Preparation for Pulping</b> <ul style="list-style-type: none"> <li>• Wood Preparation</li> <li>• debarking</li> <li>• Chipping</li> <li>• Sieving</li> </ul>	Wood harvesting , transportation, drying, debarking, grinding, sieving and storage as a method for preparing wood for pulping would be introduced to students
6&7	<b>Wood pulping processes :Part A</b> Mechanical pulping <ul style="list-style-type: none"> <li>• Stone ground-wood</li> <li>• Chip refiner ground-wood</li> <li>• Thermo-mechanical pulping</li> <li>• Chemo-mechanical pulping</li> </ul>	Students will be expected to understand the concept of mechanical pulping, differences in the various methods and the end use of the obtained products.
<b>MID-SEMESTER TEST</b>		
8& 9	<b>Wood pulping processes :Part B</b> Chemical pulping <ul style="list-style-type: none"> <li>• Sulphite pulping</li> <li>• Kraft pulping</li> <li>• Alkaline pulping</li> <li>• Organosolv pulping</li> </ul>	Students will be expected to understand the concept of chemical pulping, differences in the various methods and the end use of the obtained products.
10 &11	Pulping Screening and Cleaning Chemical recovery in Kraft pulping	To teach students the method of isolating and purifying pulp fiber after pulping processes and the environmental methods of spent liquor treatment for recovery of

		useful chemical and reuseable of the recovered chemicals
12 & 13	<p style="text-align: center;"><b>Pulp Bleaching</b></p> <ul style="list-style-type: none"> <li>• Mechanical pulp bleaching</li> <li>• Chemical pulp bleaching</li> </ul>	Students are expected to know the: the aim of bleaching; chemistry of chemical reaction of bleaching technology; and the end use of product for which a particular bleaching method must be used
14	Revision and Test	Students are expected to ask questions on aspect of the course that is not well understood and test would be given to evaluate the student
15	Solving the test questions	Test question would be treated in order to clear any grey area and to prepare the students for the coming Examination.