# Course Syllabus

## FB 723 – Forest Biomaterials Chemistry

**SPRING 2017**

**3 Credit Hours**

### Course Description

The Organic, Polymer and Analytical chemistry for polysaccharides and other wood components will be described together with information that relates to their processing.

### Course Learning Outcomes

Upon successful completion of this course, students should be able:

## To describe the structural chemistry of the major wood polysaccharides & other components

### To describe the underlying mechanistic chemistry for major large scale lignocellulosic processing operations

## To become aware of the latest developments in wood chemistry

## To describe the tools available for their molecular structural elucidation such as:

## Traditional wet chemical methods of analysis

## State of the art Instrumental methods of analysis

# Course Deliverables

Upon completion of the course the student will be able to:

## Relate with fundamental aspects of the chemistry of the major wood components; Carbohydrates, Cellulose, Hemicelluloses and Lignin

## Be proficient with the underlying Structural, Polymer and Organic Chemical principles that define the reactivity of wood components.

## Describe the aspects of the analytical chemistry of the main wood components;

## Become aware of modern developments in wood chemistry & technology

### Course Structure

This is a lecture intensive course. The graduate students are requested to study the material beforehand as offered in the NCSU Course reserves cite The students will be responsible for printing out the information provided on the course reserves cite and come to class prepared for lectures and discussion of the material.

### Instructor

**Dr. Dimitris Argyropoulos** (Dr A) - *Instructor*
**Email:** dsargyro@ncsu.edu
**Phone:** 919-515-7708
**Fax:** 919-515-6302
**Office Location:** Biltmore Hall, Room 3104
**Office Hours:** by Appointment via e mail or in person consultation,

### Course Meetings

#### Lecture

**Days:** Tuesday, Thursday
**Time:** 10:15am - 11:30pm
**Campus:** Main
**Location:** 2104 Biltmore Hall
*This meeting is required.*

### Course Materials

#### Textbooks

No specific books are required but the material uploaded into NCSU’s course reserves are essential and need be downloaded by the students prior to each lecture and be accordingly collated.

#### Expenses

None.

### Requisites and Restrictions

#### Prerequisites[*CH 221*](http://catalog.ncsu.edu/search/?P=CH%20221)/225 and[*CH 222*](http://catalog.ncsu.edu/search/?P=CH%20222)/226 and[*CH 223*](http://catalog.ncsu.edu/search/?P=CH%20223)/227 and[*CH 224*](http://catalog.ncsu.edu/search/?P=CH%20224)/228.Co-requisites

#### Restrictions

None.

### General Education Program (GEP) Information

#### GEP Category

This course does not fulfill a General Education Program category.

#### GEP Co-requisites

This course does not fulfill a General Education Program co-requisite.

### Transportation

This course will not require students to provide their own transportation. For field trips or site visits, transportation will be provided.

### Safety & Risk Assumptions

Not Applicable

### Grading

## GRADING:

##  Class Presentations –Receive my critique 20%

##  Homework Assignments, Class quizzes 30%

##  Written Critical Account & Resubmitted Presentation 20%

##  Your Participation in class and during presentations 10%

##  Final exam 20%

#### Letter Grades

**This Course uses Standard NCSU Letter Grading:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| * A+ (≥ 95%)
* A (90 – 95)
* A- (88 – 89)
* B+ (86 – 87)
* B (80 – 85)
* B- (78 – 79)
* C+ (76 – 77)
* C (70 – 75)
* C- (68 – 69)
* D+ (66 – 67)
* D (60 – 65)
* D- (58 – 59)

 F (< 59) |  |  |  |  |
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#### Requirements for Credit-Only (S/U) Grading

In order to receive a grade of S, students are required to take all exams and quizzes, complete all assignments, and earn a grade of B- or better. Conversion from letter grading to credit only (S/U) grading is subject to university deadlines. Refer to the Registration and Records calendar for deadlines related to grading. For more details refer to <http://www.ncsu.edu/policies/academic_affairs/courses_undergrad/REG02.20.15.php>.

#### Requirements for Auditors (AU)

Audits of FB 723 are generally not permitted and must be approved by Dr. Argyropoulos . When approved, students must adhere to the university policy on audits, which may be found at the following link: <http://policies.ncsu.edu/regulation/reg-02-20-04> .

#### Policies on Incomplete Grades

Incomplete (IN) final grades will generally NOT be given for the course, except under unusual circumstances. If an Incomplete is permitted, then Dr. Argyropoulos will give the student a deadline by which the IN must be resolved – usually by the fourth week of the subsequent semester. If a deadline is not authorized by the instructor or department, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) by the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at the following link: [http://policies.ncsu.edu/regulation/reg-02-50-03](http://policies.ncsu.edu/regulation/reg-02-50-03%20) .

#### Late Assignments

Assignments turned in after the specified time may or may not be accepted by the instructor, and they may be subject to grade penalties.

### Attendance Policy

#### Attendance

It is not expected that any student can do well in FB 723 (or even pass the course) without regular class attendance. A roll will be passed out in random class sessions. Quizzes and homework missed during an unexcused absence can NOT be made up.

Excused absences are accepted only for cases of emergency, documented illness or incapacitation, or extenuating circumstances as described by the NCSU policy detailed at the following link: [http://policies.ncsu.edu/regulation/reg-02-20-03](http://policies.ncsu.edu/regulation/reg-02-20-03%20) .

Any excused absence requires that the student provide adequate written documentation by the start of the first class period following the period of absence. Students are expected to make up all work missed during the excused absence period.

### Academic Integrity

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at

<http://policies.ncsu.edu/policy/pol-11-35-01>

All work (quizzes, tests, projects, homework, etc.) will be conducted in accordance with the Code of Student Conduct.

Any students caught cheating or plagiarizing or helping others to do so will be subject to disciplinary action, including failing of the course and referral to the NCSU judicial system. It is understood that the student’s signature on any test or assignment means that the student neither gave nor received unauthorized aid. ***Taking the weekly quizzes while in the presence of or in communication with another student in the course will be considered cheating.***

#### Academic Honesty

See <http://policies.ncsu.edu/policy/pol-11-35-01> (Section 8) for a detailed explanation of academic honesty/dishonesty.

#### Honor Pledge

Your signature or printed name on any test or assignment indicates "I have neither given nor received unauthorized aid on this test or assignment."

### Electronically- or Web-based Course Components

1. E-mail -- This course will rely heavily on the use of students’ Unity e-mail accounts. General notices, assignments, and other course activities will be transmitted through these e-mail accounts. Students are responsible for a) checking their account each day for course announcements or other activities; and b) keeping their account current (e.g. not filled up) so that it can receive messages from the instructor. Failure to meet course requirements due to failure to meet these e-mail account responsibilities will not be excused.

### Accommodations for Disabilities

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, student must register with the Disability Services Office (<http://www.ncsu.edu/dso>) located at 1900 Student Health Center, Campus Box 7509, 515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation at <http://policies.ncsu.edu/regulation/reg-04-20-06> .

### Non-Discrimination Policy

NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at [http://policies.ncsu.edu/policy/pol-04-25-05](http://policies.ncsu.edu/policy/pol-04-25-05%20) . Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 515-3148.

## Course Schedule

# Week 1 Chemistry of Carbohydrates, Isomerism, Chirality, Conformations Carbohydrate Reactivity; Glucosides, Ethers, Acetals

# Week 2 Carbohydrate, Oxidations, Reductions, Hydrolyses Oligosaccharides; Disaccharides, Cellulose & Hemicelluloses

# Week 3 Polysaccharides, Fundamental Polymer Considerations Structure-Property Relations, Thermal Transitions,

# Week 4,5 Lignin Biosynthesis & Structure

# Week 4,5 Analytical Methods 1, UV, Mass Spectroscopy,  Analytical Methods 2, NMR Principles,  New Lignin Structures, Dibenzodioxocins, Reactivity

# Week 6,7 Analytical Methods 3, NMR Principles

# Nitrobenzene & KMnO4 Oxidations, DFRC

# Analytical Methods 4, Pyrolysis-GC, MALDI/TOFF

# Week 7,8 Lignin-Carbohydrate Complex, Nature, Elucidation Procedures

# Delignification Pretreatment Chemistry, Topochemistry, Delignification Pretreatment , Reaction Mechanisms 1;

# Week 7, 8 Delignification, Pretreatment Reaction Mechanisms 2;

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#  March Spring Break

#  Week 9 Chemistry Structure of Technical Lignins

 Oxidation Chemistry as applied to Lignocellulosics

#  Week 10 Chemistry of Hexeneuronic Acids; Technology

# Week 11 Chemistry, Reaction Mechanisms

# Process Innovations

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##  Week 12 Oxygen & Peroxide Effects on Cellulose and Lignin,

## Radical Reactions on Carbohydrates; Mechanisms

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##  Week 13,14 Principles of Oxidation Chemistry, Understanding Radical Reactivity

## Green Chemistry in the FB Arena;

## Oxidative Delignification Chemistry of Oxidative Enzymes i.e Laccases

##  Week 14 Special Topics a Class Discussion

## Activation and Catalysis of Oxidative Pretreatments & Delignification

##  Final exam (First week in May; Specific Date to be Decided