

Ministry of Education and Sports

Savannakhet University

Faculty of agriculture and Environment

No _____/.....

Place, Date ____/____/____

Course Syllabus

1 Program

Title of the study programme: Wood Processing Technology

2 Course details

Course name: Wood Chemistry

Course code: FOA04WCH11104

Number of credits (hours/week): 3(2-2-2)

Course type (tick the appropriate box): Required, Elective, Other, if other please explain:

Prerequisites courses:

Semester, in which the course is taught: *tick the appropriate box below*

Year 1		Year 2	
Semester 1	Semester 2	Semester 1	Semester 2
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3 Responsible unit: Office of post-Graduate study

3.1 Department: Department of Forestry Resource

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4 Course description

The course gives students the knowledge of basic wood chemical constituents (cellulose, lignin, hemicelluloses, and extractives) and the chemical utilization of wood, bark, and wood preservatives.

5 Course objectives

The study course to create an understanding to the students the basic chemistry of wood, from the chemical composition of wood and its analytical methods, and analyses and interpretations of the physicochemical properties of wood-based on the structure of wood as a biopolymer. The study course gives idea of the structure and chemical properties of the main components-cellulose, hemicellulose, lignin include utilization of wood and wood component in the wood industry. The study course deals with the chemistry of extractives and chemical processing of wood.

Knowledge: Upon successful completion of the course, graduates shall have knowledge on woody chemistry from lectures, seminars, group working projects, assignments, laboratory and field trips. They will obtain to know chemical constituents of wood, distinguish the chemical properties of the main components of wood: cellulose, hemi-cellulose, lignin, extractives in wood-bark, and utilization of wood and wood component in the wood industry.

Skills: Graduates must be able to use the acquired knowledge to estimation of extractives from wood-bark such as estimation of dyes and dyeing trials on different fabrics, isolation of wood chemical constituents, and estimation of cellulose, hemicelluloses, lignin and extractives in wood. On the other hand, graduates must be able to apply knowledge from this course in operating manufactory of wood products.

Application of theories to practice: Graduates must be able to apply theories on woody chemistry e.g., paper production, plywood, dyes. In addition, can also apply knowledge in the management of wood products and maintenance to be effective.

Social knowledge and skills: Graduates will be analyze form opinions on optimal technologies to be used in the preservation of wood products, projects on process and product management. including knowledge and skills on utilization of hand tools in wood-industrial machines in the wood processing manufactories.

5.1 Learning objectives of particular modules

Wood chemistry course is divided into seven chapters such as:

(1) Chemical constituents of wood and bark: This chapter is designed for graduates to understand natural and structure and cell wall layer of wood. Practice with estimation of extractives in wood-bark;

(2) Structure and chemical properties cellulose: This chapter is to provide graduates to understand and can explain structure, function, and properties of cellulose. Practice with the analysis

(3) Lignin in plants: This chapter is to provide graduates to understand and can explain structure, function, and characteristics of lignin. Practice with the analysis estimation of lignin in lab-room;

(4) Structure and properties of hemicellulose: This chapter is to provide graduates to understand and can explain structure, function, and properties of hemicellulose. Practice with the analysis estimation of hemicellulose in lab-room is estimation of cellulose in lab-room;

(5) Basic chemistry of extractives: This chapter is to provide graduates to understand and can explain definition, types, structure, and of extractives. Practice with the analysis estimation of extractive in lab-room;

(6) Improving the performance properties of wood: This chapter is to provide graduates to understand and can explain physical properties, mechanical properties, and chemical modification of wood, and

6 Course teaching methods

The course consists of lectures, lab and field practices. Graduates are required to essays or lab experiments (individual and group work). Attendance of the course lectures, practices, and field trips is mandatory, except in cases of sickness or other health problems documented by a physician. In case of excused intendance, students will elaborate an extra assignment on the topic of the lecture/experiments/ field trip they failed to attend.

7 Teaching plan

Week	Content	Method/activity	Hour
1	<p>Welcome ad introduction to the woody chemistry course</p> <ul style="list-style-type: none"> - Chemical constituents of wood and bark - Structure and chemical properties cellulose - Lignin in plants - Structure and properties of hemicellulose - Basic chemistry of extractives - Improving the performance properties of wood 	- Lecturer provides instruction on lesson plan, course description, expected learning outcomes	2
2	Theories		2
	Module 1: Chemical constituents of wood and bark		
	<ul style="list-style-type: none"> - General introduction of wood - Natural and structure of wood 	Lecture, discussion, and lecture material images	2
	Practice		
	Module 1: Chemical constituents of wood and bark		
Seminar topic: Safety issues when you work in lab-room	Group discussion and student presentations		
3	Theories		2
	Module 1: Chemical constituents of wood and bark		
	Cell wall layer of wood	Presentation of the cell wall layer of wood through lecture, and video	2
	Practice		



	Module 1: Chemical constituents of wood and bark		
	Laboratory: Estimation of extractives in wood-bark	- Lab-room discussions - Assignment of student work (group work on the analysis estimation of extractives in wood-bark)	
4	Theories		2
	Module 2: Structure and chemical properties cellulose		
	- Cellulose in wood - Cellulose structure - Cellulose function	Lecture, discussion, and question-answer	
	Practice		2
	Module 2: Structure and chemical properties cellulose		
Laboratory: Analysis estimation of cellulose	- Lab-room discussions - Assignment of student work (group work on the analysis estimation of cellulose) - Student presentations		
5	Theories		2
	Module 2: Structure and chemical properties cellulose		
	- Cellulose type - Cellulose properties	Lecture, discussion, video of cellulose operation	
	Practice		2
	Module 2: Structure and chemical properties cellulose		
Laboratory: Analysis estimation of cellulose	- Lab-room discussions - Assignment of student work (group work on		



		the analysis estimation of cellulose) - Student presentations	
6	Theories		2
	Module 3: Lignin in plants		
	- Lignin structure - Lignin function	Lecture, discussion, pictures of lignin structure	
	Practice		2
	Module 3: Lignin in plants		
	Laboratory: Analysis estimation of lignin	- Lab-room discussions - Assignment of student work (group work on the analysis estimation of lignin) - Student presentations	
7	Theories		2
	Module 3: Lignin in plants		
	Characteristics of lignin	Lecture, discussion	
	Practice		2
Module 3: Lignin in plants			
	Laboratory: Analysis estimation of lignin	- Lab-room discussions - Assignment of student work (group work on the analysis estimation of lignin) - Student presentations	
8	Module 4: Structure and properties of hemicellulose		



	<ul style="list-style-type: none"> - Hemicellulose structure - Hemicellulose composition 	Lecture, discussion, pictures of hemicellulose structure	
	Practice		2
	Module 4: Structure and properties of hemicellulose		
	Laboratory: Analysis estimation of hemicellulose	<ul style="list-style-type: none"> - Lab-room discussions - Assignment of student work (group work on the analysis estimation of hemicellulose) - Student presentations 	
9	Theories		2
	Module 4: Structure and properties of hemicellulose		
	<ul style="list-style-type: none"> - Hemicellulose function in cell wall - Hemicellulose properties 	Lecture, discussion of hemicellulose properties	
	Practice		2
	Module 4: Structure and properties of hemicellulose		
	Laboratory: Analysis estimation of hemicellulose	<ul style="list-style-type: none"> - Lab-room discussions - Assignment of student work (group work on the analysis estimation of hemicellulose) - Student presentations 	
10	Theories		2
	Module 5. Basic chemistry of extractives		
	<ul style="list-style-type: none"> - Extractives definition - Extractives in wood 	Lecture, discussion, video on extractives in wood	



	Practice		2
	Module 5. Basic chemistry of extractives		
	I Laboratory: Analysis estimation of extractives	<ul style="list-style-type: none"> - Lab-room discussions - Assignment of student work (group work on the analysis estimation of extractives) - Student presentations 	
11	Theories		2
	Module 5. Basic chemistry of extractives		
	<ul style="list-style-type: none"> - Types of wood extractives - The function of wood extractives 	Lecture, discussion,	
	Practice		2
	Module 5. Basic chemistry of extractives		
	Laboratory: Analysis estimation of extractives	<ul style="list-style-type: none"> - Lab-room discussions - Assignment of student work (group work on the analysis estimation of extractives) - Student presentations 	
12	Theories		2
	Midterm-Examination	Writing exam	
	Practice		4
		Midterm-examination	Group work: analysis estimation of cellulose/, hemicellulose/, lignin/, extractives (one group/ one sample)
13	Theories		2



	Module 6: Improving the performance properties of wood		
	- Physical properties of wood - Mechanical properties of wood	Lecture, discussion	
	Practice		
	Module 6: Improving the performance properties of wood		2
	Assignment topic: Compare the properties of the wood is baked at different temperatures	Group work on compare the properties of the wood is baked at different temperatures	
14	Theories		2
	Module 6: Improving the performance properties of wood		
	- Define chemical treatment of wood - The relationship between the moisture content and strength of wood	Lecture, discussion, demonstration video on machine operation and technological process	
	Practice		2
	Module 6: Improving the performance properties of wood		
	Assignment topic: Compare the properties of the wood is baked at different temperatures	Group work on compare the properties of the wood is baked at different temperatures	
15	Theories		2
	Module 6: Improving the performance properties of wood		
	- The alkaline degradation of wood (soft wood and hard wood) - The effect of chemicals on wood and chemical resistance of wood	Lecture, discussion, pictures, video	
	Practice		2
Module 6: Improving the performance properties of wood			



	Laboratory: Resistance to chemical attack of wood	Group work on compare resistance to chemical attack between hard and softwood	
16	Theories		2
	Module 6: Improving the performance properties of wood		
	- Distinguish between chemical resistance of soft wood and hard wood - Requirement of wood properties for various products	Lecture, discussion, pictures, video	
	Practice		2
	Module 6: Improving the performance properties of wood		
Laboratory: Resistance to chemical attack of wood	Group work on compare resistance to chemical attack between hard and softwood		
17	Theories		8
	Field trip		
	Practice		8
	Field trip		
17	Theories		8
	Field trip		
	Practice		8
	Field trip		
18	Theories		2
	Final examination		
	Practice		2
	Final examination		

8 Material needs

8.1 Course equipment

- Microscope,
- Digital weighing scale,
- notebook,
- calculator,

- mobile phone,
- internet wifi,

8.2 Information sources

- Libraries
- Website-internet
- Laboratory

9 References

9.1 Compulsory reading list

R. M. Rowell, Chapter 22 Chemical Modification of Wood.

https://www.fpl.fs.fed.us/documnts/pdf2007/fpl_2007_rowell005.pdf

Hom S.K., Ganguly S., Bhoru Y.U., Samani A. (2020): Effect of chemical modification on dimensional stability of *Pinus radiata* D. Don using acetic anhydride.

https://www.agriculturejournals.cz/publicFiles/13_2020-JFS.pdf

David Sheng-Yang Wang, Wood Chemistry – Fundamentals and Application

<http://web.nchu.edu.tw/pweb/users/taiwanfir/lesson/1255.pdf>

Yasumitsu Uraki and Yasumitsu Uraki, 2015, Utilization of wood cell wall components

<https://jwoodscience.springeropen.com/articles/10.1007/s10086-015-1492-9>

Reginaldo A. Festucci-Buselli¹, Wagner C. Otonil and Chandrashekhar P. Joshi, 2007. Structure, organization, and functions of cellulose synthase complexes in higher plants.

<https://www.scielo.br/j/bjpp/a/vmmVqXp7W3ZLrVDWhJLs8BL/?format=pdf&lang=en>

Inl Labs KL, 2021. Wood Chemistry KL Diploma Syllabus for Wood & Paper 3rd Sem 2015 Revision SITTR.

<https://www.inspirenignite.com/kl/3124-wood-chemistry-kl-diploma-syllabus-for-wood-paper-3rd-sem-2015-revision-sitttr/>

Bowyer, JL, Shmulsky, R & Haygreen., JG 2007, Forest products and wood science, Fifth edn, Blackwell, Iowa, USA.

Ozarska, B 2000, 'Product performance requirement for wood products for high value end-uses', paper presented to IUFRO conference, Launceston, Tasmania..

9.2 Suggested reading list

Roger M. Rowell, 2005. Handbook of wood chemistry and wood composites.

[https://www.researchgate.net/publication/230771042_Handbook_Of_Wood_Chemistry_A
nd_Wood_Composites](https://www.researchgate.net/publication/230771042_Handbook_Of_Wood_Chemistry_And_Wood_Composites)

Eero Sjöström, 1993. Wood chemistry : fundamentals and applications.

[https://www.worldcat.org/title/wood-chemistry-fundamentals-and-applications/oclc/8968
46591](https://www.worldcat.org/title/wood-chemistry-fundamentals-and-applications/oclc/896846591)

Eero Sjöström; R Alén, 1999. Analytical methods in wood chemistry, pulping and papermaking.

[https://www.worldcat.org/title/analytical-methods-in-wood-chemistry-pulping-and-
papermaking/oclc/301618065&referer=brief_results](https://www.worldcat.org/title/analytical-methods-in-wood-chemistry-pulping-and-papermaking/oclc/301618065&referer=brief_results)

Yashpal Singh. Wood product and utilization.

[file:///C:/Users/Acer/Downloads/Documents/12042020171305Wood%20product%20and%
20utilization.pdf](file:///C:/Users/Acer/Downloads/Documents/12042020171305Wood%20product%20and%20utilization.pdf)

10 Assessment of students

10.1 Description of assessment

- lecturing
- Assignment providing and submitting report

10.2 Grade distribution and student assessment

- Attendance 10%
- Reporting 35%
- Midterm examination 20%
- Final examination 35%

Grading scale

Grade		Total score	Scale
Symbol	Verbal grade		
A	(Excellent)	80-100	4.00
B+	(Very Good)	75-79	3.50



B	(Good)	70-74	3.00
C+	(Fairly Good)	65-69	2.50
C	(Fair)	60-64	2.00
D+	(Poor)	55-59	1.50
D	(Very Poor)	50-54	1.00
F	(Fail)	0-49	0.00
I	(Incomplete)		

Place, Date/...../.....