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FRAME

Savannakhet University

No _____/.....

Place, Date ____/___/___

Course Syllabus

1. Program

Title of the study programme: Wood Processing Technology

2. Course details

Course name: Advanced Kiln Drying

Course code: FOA04AKD12101

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

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

Prerequisites courses: insert the titles and codes of prerequisite courses

Semester, in which the course is taught:

Year 1		Year 2	
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**
○	☒	○	○

3. Responsible unit

3.1 Department: 01: *Dr. Bounheaung NINCHALEUNE (SKU)*, Phone: +85620 55555921. Email: bnincha@yahoo.com; Office location: Savannakhet University, Savannakhet Province, Lao PDR, permanent lecturer

3.2 *Khamphao SYPHACHANH (FOA, SKU),* Phone: +85620 5478 6212, Email:s.khamphao.sku@gmail.com Office location: Department of Forest Resource, Faulty of Agriculture and Environment, Savannakhet University, Savannakhet Province, Lao PDR,

4. Course description

The advance Kiln Drying course is designed to introduce the students to generate knowledge and skills through various lessons, practices, and field trips. Students will be expected to learn about and safely use type of kiln (Operation techniques, Temperature Operation, Type of Heating and Energy Source, Specialized Drying Approaches and kiln Type) and wood drying Evaluation of Standard Test Methods of Wood. The practices and field trips are designed to give students as much experience as possible by seminar topics and field visits respectively. The practices will also cover as many aspects of the wood working projects as possible in an entry level course.

5. Course objectives

The Master course in Advance Kiln Drying aims to provide opportunity to the students wishing to pursue professional careers in wood drying and to make themselves aware about the technology to wood drying as basic material to manufacture various useful forestry products. The course objectives include:

- Understanding of Protection of wood, method of compressing the liquid.
- Describe of Drying and construct of kiln by themselves
- Evaluate of Wood Drying and Compare Type wood drying
- Sketch Table of Wood Drying and Define Temperature before and after Drying
- Decide Standard Test of Wood.

Knowledge:

1. After completing lectures and practices, the graduate will be able to describe the possibilities of wood drying. They will be able to define and describe different types of wood drying. Graduates shall have known to understand safety of wood by using of Equipment, knowledge of the **Select** kiln, materials and methods.
2. The graduates can generate the advanced wood drying contents, practices, and discussions and they can apply the methods, various wood drying procedures, the calculation of wood moisture before and after wood drying, applying the various wood drying equipment, measuring the shrinkage, and swelling of wood, solving problems, and obstacle of wood drying, testing effectiveness of wood.

Skills:

Graduates shall be able to apply the acquired knowledge of Wood Drying recommend suitable technology for

- Leadership & Initiative kiln wood drying establishment by saving energy
- Delivering Oral Presentation Wood Drying, Use of Kiln Wood Drying, Standard Test of Wood and Protection of wood
- Interpretation & Analysis of application for appropriate kiln of wood drying
- Work Creatively with Others

Application of theories to practice:

Graduates will be able to form theories on optimal technologies to be used in Wood Drying and further down the value chains. They will be able to study a given topic within the application of Wood Drying into more depth to become experts in the field. At the same time, the graduates will be able to manage woodworking tools-based industries e.g., pulp and paper, furniture, composite boards, and plywood. Graduates could also go to research institutes to do research, or teach in universities that offer forestry degrees. They will be able to communicate their ideas and concepts to both workers who carry out the operations and to higher management of forest enterprises and wood processing field (industry).

Social knowledge and skills:

Graduates become Leadership & Initiative in Wood Drying including knowledge and skills on utilization of kiln; managers and consultants in the field of wood drying. The graduates are able to argue for different approaches to the management of wood drying from the point of view of their characteristic uses and to determine the types of kiln to use in the wood drying. They are competent to emphasize the wood drying for solution of economic, environmental and basic societal problems. Graduates will be able to continuously acquire new knowledge in wood testing and wood protection in the wood processing factories and manufactories.

5.1 Learning objectives of particular modules

The Advance kiln Drying Course is divided in to five modules such as the first is drying, the second is wood drying, the third is Table of Wood Drying, the four is Standard Test of Wood, and the last is Protection of wood.

1) Protection of wood. This module is to provide graduates to understand and practice the) Protection of wood, Method of compressing the liquid. In order to gain more understanding and deep knowledge and skills in advance kiln drying, graduates are required to participate in the fields visits to sawmills and/or wood manufactory companies.
2) Drying. This module is designed for graduates to understand, and practice with the use of various kinds of drying;
3) Wood Drying. This module is to provide graduates to understand, and practice with the use of various kinds of wood structure, Methods Used to Dry Lumber and relationship between wood and moisture.
4) Kiln Drying Schedule of Wood. This module is to provide graduates to understand and practice the Method of operation wood drying, Data Analysis and Kiln Drying Schedule of Wood
5) Standard Test of Wood. This module is to provide graduates to understand and practice the Standard Test Method for Compression Perpendicular to Grain, Standard Test Method for Compression Parallel to Grain, Standard Test Methods for Direct Moisture Content Measurement of Wood, Standard Test Method for Static Bending of Timber, Standard Test Method for Tensile and Cleavage Test of Timber, Standard Test Method for Shear Test of Wood Parallel to Grain, Standard Test Methods for Specific gravity of Wood

1. Course teaching methods

The course consists of lectures, seminars, and field practices. Graduates are required to develop projects or essays to show the dimensions of Advance kiln drying (individual and group projects). Attendance of the course lectures, seminars, and field trips is mandatory, except in cases of sickness or other health problems documented by a physician. In case of excused unattendance, students will elaborate an extra assignment on the topic of the lecture/seminar/ field trip they failed to attend.

2. Teaching plan

Week	Content	Method/activity	Hour
1	**Introduction to Advanced Kiln Drying Course:** - Drying - Wood Drying - Kiln Drying Schedule of Wood - Standard Test of Wood - Protection of wood	Lecturer provides instruction on lesson plan, course description, expected learning outcomes	2
2	**Theories**		2
	Module 1: Protection of wood		
	- possibilities of drying and hydrothermal treatment of wood Method of wood treatment	Lecture, [Student-Centered] Group discussion	
	Practice		2
	Module 1: Protection of wood		
	Seminar topic: possibilities of drying and hydrothermal treatment of wood and wood materials. Work in groups, students will work on a scientific essay related to drying and hydrothermal modification of wood	student group work and group discussion Case studies,	
3	**Theories**		2
	Module 1: Protection of wood		
	- Natural drying - Kiln-drying Hydrothermal modification of wood	Lecture, [Student-Centered] Group discussion	
	Practice		2
	Module 1: Protection of wood		
	Seminar topic: possibilities of drying and hydrothermal treatment of wood and wood materials.	Defense and acquaintance of other groups from the outputs of a scientific essay (short discussion)	
4	**Theories**		2
	Module 2: Drying		

	- Definition of Drying - Moisture rate - Capacity of the absorption of the moisture material with mobility mechanism.	Lecturer provides the use of kiln drying Teaching Methods [Student-Centered] Brainstorming	
	Practice		2
	Module 2: Drying		
	Seminar topic: The change of the moisture rate with temperature of raw material	Lecturer provides the use of kiln drying	
5	**Theories**		**2**
	Module 2: Drying		
	- Velocity rate in drying - Type of kiln with application option	Lecturer provides the use of kiln drying [Student-Centered] Brainstorming	
	Practice		**2**
	Module 2: Drying		
	- **Seminar topic:** the first Calculation of kiln size and procedure for saving energy	Case studies, Laboratory experiments	
6	**Theories**		2
	Module 3: Wood Drying		
	- Wood Drying - Methods Used to Dry Lumber	Presentation on the Lumber stack arrangement with air circulation [Student-Centered] Brainstorming	
	Practice		**2**
	Module 3: Wood Drying		
	Seminar topic: Relation between the wood stack arrangement and air circulation	Case studies, Laboratory experiments	
7	**Theories**		**2**
	Module 3: Wood Drying		

	- Benefit of Use to Dry Lumber - Wood Stack Size - Sticker	Lecture, discussion, With video [Student-Centered] Brainstorming	
	Practice		**2**
	Module 3: Wood Drying		
	Seminar topic: Good Wood arrangement and wood stacking in right position inside of kiln for wood drying.	Case studies, Laboratory experiments	
8	**Theories**		**2**
	Module 3: Wood Drying		
	Problem, obstacle, and maintenance of wood drying with kiln	Lecture, discussion [Student-Centered] Brainstorming	
	Practice		**2**
	Module 3: Wood Drying		
	Seminar topic: the point of Consideration for wood air drying and wood drying	Case studies, Laboratory experiments	
9	**Theories**		**2**
	Module 4: Kiln Drying Schedule of Wood		
	- Objective for Scheduling of Wood drying - Method for operation of wood drying	Lecture, discussion [Student-Centered] Brainstorming	
	Practice		**2**
	Module 4: Kiln Drying Schedule of Wood		
	Seminar topic: Preparation wood sample and experimenting	Presentation on preparation of instruction to weighing, and placing wood into the kiln, check on early stage of wood split, Honeycomb, Deformation after wood drying. Case studies, Laboratory experiments	
10	**Theories**		**2**
	Module 4: Kiln Drying Schedule of Wood		

	Data analysis	Lecture, discussion [Student-Centered] Discussion groups	
	Practice		
	Module 4: Kiln Drying Schedule of Wood		
	Seminar topic: Grading level of wood split, Honeycomb, Deformation of wood sample	Case studies, Laboratory experiments	**2**
11	**Theories**		
	Module 4: Kiln Drying Schedule of Wood		
	Exam: Kiln Drying Schedule of Wood	Lecture, [Student-Centered] Group discussion	**2**
	Practice		
	Module 4: Kiln Drying Schedule of Wood		
	Seminar topic: Blunder through wood drying	Group discussions, Individual consultations of students with tutors regarding the elaboration of the assignment	**2**
12	**Theories**		
	Midterm-Examination	Writing exam	**2**
	Practice		
	Midterm-Examination	Student presentations	**2**
13	**Theories**		
	Module 5: Standard Test of Wood		
	- Standard Test Method for Compression Perpendicular to Grain - Standard Test Method for Compression Parallel to Grain	Lecture, [Student-Centered] Group discussion	**2**
	Practice		
	Module 5: Standard Test of Wood		
	Seminar topic: Preparation of sample, experiment, calculation, result report, Grading criteria and acceptance of inaccuracy	RA	**2**
14	**Theories**		
	Module 5: Standard Test of Wood		**2**

	- Standard Test Methods for Direct Moisture Content Measurement of Wood - Standard Test Method for Static Bending of Timber	Lecture, [Student-Centered] Group discussion	
	Practice		
	Module 5: Standard Test of Wood		
	Seminar topic: Preparation of sample, experiment, calculation, result report, Grading criteria and acceptance of inaccuracy	Assignment of student work, and group discussion Case studies, Laboratory experiments	**2**
15	**Theories**		
	Module 5: Standard Test of Wood		
	- Standard Test Method for Tensile and Cleavage Test of Timber - Standard Test Method for Shear Test of Wood Parallel to Grain	Lecture, [Student-Centered] Group discussion	**2**
	Practice		
	Module 5: Standard Test of Wood		
	Seminar topic: Preparation of sample, experiment, calculation, result report, Grading criteria and acceptance of inaccuracy	Assignment of student work, and group discussion Case studies, Laboratory experiments	**2**
16	**Theories**		
	Module 5: Standard Test of Wood		
	Standard Test Methods for Specific Gravity of Wood	Lecture, [Student-Centered] Group discussion	**2**
	Practice		
	Module 5: Standard Test of Wood		
	Seminar topic: Preparation of sample, experiment, calculation, result report, Grading criteria and acceptance of inaccuracy	Assignment of student work, and group discussion Case studies, Laboratory experiments	**2**
17	**Theories**		**8**
	Field trip/ Assignment		
	Practice		**8**

	Field trip/ Assignment		
18	**Theories**		**2**
	Final examination		
	Practice		**2**
	Final examination		

3. Material needs

8.1 Course equipment: link to equipment needs/purchases as part of the project

- Belt Sander ,
- Table Circular Saws,
- Electric Kilns,
- MOISTURE METER,
- Computer Control Wood Testing Machine Static Bending Test,
- Digital weighing scale FC-si/FC-i
- Universal Testing Machine
- Dial gauge
- Vernier
- Gauge Length
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8.2 Information sources

- Libraries
- Website-internet

✓ Lab-rooms

4. References

9.1 Compulsory reading list

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ບາງລັກ ເຊດຖະສີງ ແລະ ສຸຊາດາ ສຸທິສີສີງ, 2004. ການນຳໃຊ້ປະໂຫຍດໄມ້ຂັ້ນພື້ນຖານ, ສຳນັກການວິໄຈການຈັດການປ່າໄມ້ ແລະ ຜະລິດຕະຜົນໄມ້, ກົມປ່າໄມ້. ໜ້າ 1-4.

ທິລະ ວິຫົນ, ... ການຄຳນວນປະລິມານຮັບນ້ຳຢາໃນການອັດນ້ຳຢາໄມ້ຢາງພາລາ, ບົດຄວາມປ່າໄມ້, ໜ້າ 52-53

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Asian Timber Technology Center, 1988. Lecture Note for Wood Drying Course, KL., Malaysia

The Malaysian Timber Industry Board, 1986. 100 Malaysia Timber.

GH Pratt, 1985. Timber Drying Manual, Building Research Establishment Report, Princes Risborough Laboratory, Buckinghamshire, UK.

J.L. Bachrich, 1980. Dry Kiln Handbook, H.A. Simone (International) Ltd., Canada.

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https://87r.blogspot.com/2011/04/blog-post_9659.html
https://www.onestockhome.com/th/knowledge/wood-how-to-maintain
https://www.sakwoodworks.com/treatment
https://www.youtube.com/watch?v=rY4XumZANv4
http://usapallet.net. Review on 29 November 2021

9.2 Suggested reading list

American Society of Testing Materials ASTM D 143: Standard Test Methods for Small Clear Specimens of Timber
Department of Forestry, 2011. Table of Wood Drying pp 1-17
http://forprod.forest.go.th/forprod/Tips/DETAILS/woodkilning.htm. Review on 29 November 2021
http://www.onlinewoodmarket.com. Review on 29 November 2021
http://woodworkinginthai.blogspot.com/2013/08/blog-post_7924.html. Review on 29 November 2021
http://www.prizeofwood.com/POWI_2011/article_detail.php?main=4&sub=3&id=13. Review on 29 November 2021

5. Assessment of students

10.1 Description of assessment

- Attendance 10 %
- Reporting 30 %
- Midterm examination 30 %
- Final examination 30 %

10.2 Grade distribution and student assessment

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 ...../...../.....