



Republic of the Philippines
OFFICE OF THE PRESIDENT
COMMISSION ON HIGHER EDUCATION



CHED Memorandum Order (CMO)

No. 06
Series of 2019

Subject: **POLICIES, STANDARDS AND GUIDELINES FOR BACHELOR OF SCIENCE IN FORESTRY**

In accordance with the pertinent provisions of Republic Act (RA) No. 7722, otherwise known as the "Higher Education Act of 1994", in pursuance of an outcomes based quality assurance system as advocated under CMO No. 46, s. 2012 and by virtue of Commission en Banc Resolution No. 088-2018 dated March 6, 2018 the following policies, standards and guidelines (PSGs) are hereby adopted and promulgated by the Commission.

**ARTICLE I
INTRODUCTION**

Section 1 Rationale.

Based on the *Guidelines for the Implementation of CMO No. 46, s. 2012*, this PSG implements the "shift to learning competency-based standards/outcomes-based education." It specifies the core competencies expected of BS in Forestry "regardless of the type of HEI they graduate from." However, in "recognition of the spirit of outcomes-based education and...of the typology of HEIs," this PSG also provides example of how best to achieve learning outcomes in their particular contexts and their respective missions..."

**ARTICLE II
AUTHORITY TO OPERATE**

Section 2 Government Recognition

All Private Higher Education Institutions (PHEIs) intending to offer the Bachelor of Science in Forestry program must first secure proper authority from the Commission on Higher Education (CHED) in accordance with this PSG. All PHEIs with an existing BS Forestry program are required to shift to an outcomes-based approach based on this PSG and must secure approval for such a shift. State Universities and Colleges (SUCs) and local colleges and universities should likewise strictly adhere to the provisions in these policies and standards.

ARTICLE III GENERAL PROVISIONS

Per Section 13 of RA 7722, the higher education institution shall exercise academic freedom in its curricular offerings but must comply with the minimum requirements and the specific professional courses.

Section 3 The Articles that follow give minimum standards and other requirements and prescriptions. The minimum standards are expressed as a minimum set of desired program outcomes which are given in Article IV Section 7. CHED designed a curriculum to attain such outcomes. This curriculum is shown in Article V Section 9 as a sample curriculum. The number of units of this curriculum is here prescribed as the "minimum unit requirement" under Section 13 of RA 7722. In designing the curriculum, CHED employed a curriculum map which is shown in Article V Section 10 as a sample curriculum map.

Using a learner-centered/outcomes-based approach, CHED also determined appropriate curriculum delivery methods shown in Article V Section 11. The sample course syllabi given in Article V Section 12 show some of these methods.

Based on the curriculum and the means of its delivery, CHED also determined the physical resource requirements for the library, laboratories and other facilities and the human resource requirements in terms of administration and faculty. See Article VI.

Section 4 The HEIs are allowed to design curricula suited to their own contexts and missions provided that they can demonstrate that the same leads to the attainment of the required minimum set of outcomes, albeit by a different route. In the same vein, they have latitude in terms of curriculum delivery and in terms of specification and deployment of human and physical resources as long as they can show that the attainment of the program outcomes and satisfaction of program educational objectives can be assured by the alternative means they propose.

The HEIs can use the CHED Implementation Handbook for Outcomes-Based Education (OBE) and the Institutional Sustainability Assessment (ISA) as a guide in making their submission for Sections 17 to 22 of Article VII.

These PSGs are based on the existing 12-year basic education system and on the existing GE program. They reflect the reform towards outcomes-based education, K to 12 and the new General Education Curriculum



ARTICLE IV PROGRAM SPECIFICATIONS

Section 5. Program Description

5.1. Degree Name - The degree shall be called Bachelor of Science in Forestry (BSF)

5.2. Nature of the Field of Study- The BS Forestry program promotes the scientific conversion and management of forests for judicious and sustainable use of forest products and services. The program covers four (4) fields of study namely: Forest Biological Sciences, Forest Resources Management, Social Forestry and Forest Governance and Forest Products Utilization.

5.3. Program Goals

The graduates of BS Forestry program should be able to practice the profession with competence and integrity in promoting sustainable management of forest resources and ecosystem services and conservation of soil, water and biodiversity.

5.4. Specific Professions and Allied Fields/Careers/Occupation for graduates

BS Forestry graduates can work on the following areas:

- Forest Management
- Watershed/River Basin Management
- Biodiversity Conservation
- Forest Resource Inventory
- Tree and Agroforestry Farming
- Upland Development
- Range and Pasture Development and Management
- Protected Area and Ecotourism Management
- Land-Use planning
- Research, Development and Extension
- Administration, Policy and Governance
- Educational Management
- Livelihood and Enterprise Development
- Business Management
- Environmental Impact Assessment
- Environmental Protection
- Climate Change Adaptation and Disaster Risk Reduction Management
- Forest Products Production and Utilization
- Plant Systematics
- Consultancy
- Urban Landscaping
- Teaching

Allied programs

Related programs to BSF are as follows:

1. BS in Environmental Science/Management,
2. BS in Biological Science,
3. BS in Agroforestry,



4. BS in Agriculture, and
5. BS in Agricultural Engineering
6. BS in Chemical Engineering
7. BS in Fisheries

Section 6. Program Outcomes

The minimum standards for the BS Forestry program are expressed in the following minimum set of program outcomes:

6.1 Common to all programs in all types of schools

- a. Articulate and discuss the latest developments in the specific field of practice (PQF level 6 descriptor);
- b. Effectively communicate orally and in writing using both English and Filipino;
- c. Work effectively and independently in multi-disciplinary and multi-cultural teams (PQF level 6 descriptor);
- d. Act in recognition of professional, social, and ethical responsibilities;
- e. Preserve and promote "*Filipino historical and cultural heritage*" (based on RA 7722);

6.2. Common to the discipline (Agriculture Education)

The graduates have the ability to:

- f. Generate and share knowledge relevant to specific fields in the study of agriculture;
- g. Formulate and implement agricultural development plans and programs;

6.3. Specific to sub-discipline and a major

- h. Conduct comprehensive assessment and accounting of forest ecosystem services and resources and social processes using appropriate ICT and related tools and methods
- i. Assess climate change impacts, risks and vulnerabilities, and to prepare climate change adaptation, mitigation and disaster risk reduction plan
- j. Formulate, package, implement, and evaluate forest management-related research, development and extension programs, projects and policies
- k. Interpret, assess and formulate forest related policies and law
- l. Use IT and other traditional and modern tools, approaches and methods in problem solving, planning, management and other management activities

6.4. Common to a horizontal type as defined in CMO No. 46, s. 2012

1. For professional institutions: a service orientation in one's profession
2. For colleges: an ability to participate in various types of employment, development activities, and public discourses particularly in response to the needs of the communities one serves
3. For universities: an ability to participate in the generation of new knowledge or in research and development projects



Graduates of State Universities and Colleges must, in addition, have the competencies to support “national, regional and local development plans.” (RA 7722).

A PHEI, at its option, may adopt mission-related program outcomes that are not included in the minimum set.

Section 7. Sample Performance Indicators

Performance Indicators are specific, measurable statements identifying the performance(s) required to meet the outcome; confirmable through evidence.

Program Outcome	Performance Indicator
h. Conduct comprehensive assessment and accounting of forest ecosystem services and resources and social processes using appropriate ICT and related tools and methods	<ul style="list-style-type: none"> • Plan and implement comprehensive assessment of forest ecosystem services and resources, and social processes. • Identify, measure and value forest ecosystem services and resources using appropriate ICT and related tools and methods.

The program outcomes from (h) to (l) are the minimum requirements for a graduate of the BS in Forestry program. PHEIs/LUCs/SUCs may add additional outcomes as deemed necessary and appropriate.

ARTICLE V CURRICULUM

Section 8 Curriculum Description

This curriculum is designed to prepare well-rounded forester with knowledge, skills and values in the art, business and science of forestry. The curriculum is divided into four major parts. The first part is composed of General Education courses (36 units) which is geared toward providing basic knowledge in the arts and sciences. The second part is the core courses (93 units) which will develop competence in the scientific field of forestry science and management needed by all foresters. The third and fourth parts are Thesis 6 units, Practicum 6 units, Technical Report Writing 3 units, and Problem Analysis and Research Methods 3 units, and Electives 12 units.

Section 9 Sample Curriculum

General Education (GE) courses	36 units
1. GE 1: Understanding the Self	3
2. GE 2: Readings in Philippine History	3
3. GE 3: The Contemporary World	3
4. GE 4: Mathematics in the Modern World	3
5. GE 5: Purposive Communication	3
6. GE 6: Art Appreciation	3



7. GE 7: Science, Technology and Society	3
8. GE 8: Ethics	3
9. GE Electives	9
10. Mandated Course (Life and Works of Rizal)	3

Core Courses

1. Forest Biological Sciences	24 Units
a. Forest Ecology	3
b. Morphology, Taxonomy and Dendrology	5
c. Forest Wildlife and Biodiversity Conservation	3
d. Forest Genetics and Tree Improvement	3
e. Forest Health and Protection	4
f. Tree Physiology	3
g. Protected Area Management	3
2. Forest Resources Management	42 Units
a. Introduction to Forestry	3
b. Forest Surveying and Engineering	4
c. Silviculture I – Forest Nurseries and Plantation Development	3
d. Silviculture II – Silvicultural Systems	3
e. Forest Resource Economics	3
f. Forest Ecosystems Resource Accounting and Valuation	4
g. Integrated Forest Resources Management	3
h. Forest Enterprise Development and Management	3
i. Watershed Management	3
j. Tropical Forestry and Climate Change	3
k. Geology and Forest Soils	3
l. Geo-spatial Methods in Forestry	3
m. Forestry Statistics and Measurements	4
3. Social Forestry and Forest Governance	15 Units
a. Social Forestry and Community Based Natural Resources Management	3
b. Forest Governance and Policy	3
c. Forest Laws and Regulations	3
d. Forestry Extension, Communication and Knowledge Management	3
e. Agroforestry and Sustainable Upland Development	3
4. Forest Products Utilization	12 Units
a. Wood Structure and Identification	3
b. Properties and Utilization of Wood Products	3
c. Properties and Utilization of Non-Wood Products	3
d. Production Management in Forest-Based Industries	3



Thesis and Practicum	18 Units
a. Technical Report Writing	3
b. Problem Analysis and Research Methods	3
c. Thesis	6
d. Practicum	6

Electives	12 Units
a. Multiple-Use Management	3
b. Range Management	3
c. Ecotourism and Outdoor Recreation Management	3
d. Environmental Impact Assessment	3
e. International Forestry Practice	3
f. Urban Forestry and Landscaping	3
g. Restoration of Degraded Ecosystems	3
h. Chemistry of Forest Products	3
*Choose four (4) from any of the subjects	

Sum total of units of the Curriculum (Minimum)

GE	36
Core	93
Thesis and Practicum	18
Electives	12
Physical Education (PE)	8
National Service Training Program (NSTP)	6
TOTAL	173

9.1 Sample Program of Study

The institution may enrich the sample/model program of study depending on the needs of the industry, provided that all prescribed courses/competencies required in the curriculum outline are offered and prerequisites and co-requisites are observed.

The program study herein is only an example. HEIs may use this sample and modify it according to its needs. They may also add other preferred courses.

First Year

First Semester	Units	Lect. Hrs.	Lab. Hrs.
GE 1	3	3	0
Introduction to Forestry	3	3	0
GE 2	3	3	0
GE 3	3	3	0
GE 4	3	3	0
GE 5	3	3	0
PE 1	2		
NSTP	3		
Total	23		

Second Semester	Units	Lect. Hrs.	Lab. Hrs.
GE 6	3	3	
GE 7	3	3	0
GE 8	3	3	0
GE Elective 1	3	3	
GE Elective 2	3	3	0
Forest Ecology	3	2	3
PE 2	2		
NSTP	3		
Total	23		



Second Year

First Semester	Units	Lect. Hrs.	Lab. Hrs.	Second Semester	Units	Lect. Hrs.	Lab. Hrs.
GE Elective 3	3	3	0	Technical Report Writing	3	1	6
Morphology, Taxonomy and Dendrology	5	2		Wood Structure and Identification	3	2	3
Life and Works of Rizal	3	3	0	Geology and Forest Soils	3	2	3
Forest Surveying and Engineering	4	2	6	Forestry Statistics and Measurements	4	2	6
Tree Physiology	3	3	0	Properties and Utilization of Wood Products	3	2	3
Geospatial Methods in Forestry	3	2	3				
PE 3	2			PE 4	2		
Total	23			Total	18		

Third Year

First Semester	Units	Lect. Hrs.	Lab. Hrs.	Second Semester	Units	Lect. Hrs.	Lab. Hrs.
Forest Health and Protection	4	2	6	Silviculture II – Silvicultural Systems	3	2	3
Silviculture I – Forest Nurseries and Plantation Development	3	2	3	Protected Area Management	3	3	0
Social Forestry and Community-Based Natural Resources Management	3	3	0	Tropical Forestry and Climate Change	3	3	0
Problem Analysis and Research Methods	3	3	0	Forest Governance and Policy	3	2	6
Forest Resource Economics	3	3		Integrated Forest Resources Management	3	3	0
Elective 1	3			Forest Enterprise Development and Management	3	2	3
Thesis (Outline)	1			Elective 2	3		
Total	20			Total	21		

Summer Class - Practicum – 6 Units



Fourth Year

First Semester	Units	Lect. Hrs.	Lab. Hrs.
Forest Wildlife and Biodiversity Conservation	3	2	3
Forest Laws and Regulations	3	3	0
Properties and Utilization of Non-Wood Products	3	2	3
Watershed Management	3	2	3
Forest Ecosystems Resource Accounting and Valuation	4	3	0
Thesis	3		
Elective 3	3		
Total	22		

Second Semester	Units	Lect. Hrs.	Lab. Hrs.
Forest Genetics and Tree Improvement	3	2	3
Forestry Extension, Communication and Knowledge Management	3	2	3
Production Management in Forest-Based Industries	3	3	0
Agroforestry Systems and Sustainable Upland Development	3	2	3
Thesis	2		
Elective 4	3		
Total	17		

Summary:

1 st Year	
1 st Sem	23
2 nd Sem	23
2 nd Year	
1 st Sem	23
2 nd Sem	18

Summer – 6 units Practicum

3 rd Year	
1 st Sem	20
2 nd Sem	21
4 th Year	
1 st Sem	22
2 nd Sem	17

Total 173

Section 10 Sample Curriculum Map (Please see Annex B)

Section 11 Sample Means of Curriculum Delivery

The BS in Forestry curriculum adheres to a learner-centered paradigm. It begins with clearly stated competencies students must acquire and demonstrate at the end of the four-year program. Appropriate teaching-learning strategies facilitate the acquisition of these competencies. Under this paradigm, students are the subjects of the learning process enabling them to achieve their full potential.



The teaching-learning process is interactive, participatory, collaborative and experiential. The teacher is a mentor, facilitator and collaborator.

The following methodologies/strategies may be used:

- Lecture / discussion
- Use of collaborative / active learning strategies such as games, role play, project-based learning, dialogues, journals, buzz sessions, brain storming, concept mapping, think-pair-share, counsel brainstorming exercise
- Demonstration
- Exposure trip (local or international)
- Community/Industry immersion/Practicum
- Self-assessment
- Reflective learning experience
- Case analysis/Thesis/Research Study
- Simulation
- Community/Industry mapping exercise
- Critique or reflections Partnership and linkage

Section 12 Sample Syllabi (Please see Annex C)

ARTICLE VI REQUIRED RESOURCES

Section 13 Administration

13.1 Unit/Department Chair

- a. At least Masteral Degree in Forestry or allied programs;
- b. With at least three years teaching experience and two years experience in research/and or extension work; and
- c. Must be a registered professional in forestry or allied programs, as applicable

13.2 Duties and Responsibilities

Unit/Department Chair

- a. Acts as administrator of his department;
- b. Carry-out the implementation of the Policies, Standards for his particular department;
- c. Formulates and implements research and extension projects for the department;
- d. Oversees the welfare of the students to achieve academic excellence and ensure that they shall benefit on the courses offered by the department;
- e. Implements plans and programs on resource generation and mobilization



Section 14 Faculty

14.1 Qualifications

A. Qualification of Faculty

1. At least a BS degree in Forestry or any of the allied programs as identified in Section 4. However, for the major courses at least a master's degree is required.
2. A minimum of 50% of the faculty must have a Master's degree in forestry or any of the allied programs as identified in Section 4.
3. Must be a registered professional in forestry or allied programs, as applicable.

- B. **Employment Status** - The institution shall maintain a minimum of 12 regular faculty teaching the BSF program of which 75% is full-time.

C. Faculty Development

The institution is advised to have a system of faculty development. It should encourage the faculty to:

1. Pursue graduate studies,
2. Attend seminars, symposia and conferences for continuing education,
3. Undertake research activities and to publish their research outputs,
4. Give lectures and present papers in national/international conferences, symposia and seminars, and
5. Attend trainings and workshops on teaching methods under the area of specialization.

The institution is also advised to provide opportunities and incentives such as:

1. Tuition subsidy for graduate studies
2. Study leave with pay
3. Deloading to finish a thesis or carry out research activities
4. Travel grants for academic development activities such as special skills training and attendance in national/ international conferences, symposia and seminars.
5. Awards & recognition to noteworthy achievements in teaching, research and extension

Section 15 Library

Library personnel, facilities and holdings should conform to existing CHED requirements for libraries which are embodied in a separate CHED issuance. The library must maintain a collection of updated and appropriate textbooks and references used for the core courses in the curriculum. Library resources should complement curriculum delivery to optimize the achievement of the program outcomes for BS in Forestry program.



Section 16 Laboratory and Physical Facilities

a. Laboratory requirements

Forest Laboratory. At least 50 hectares of forests should be available for instruction and research purposes. Higher Education Institutions that are unable to meet the minimum requirements are given five (5) years from the implementation of this PSG to enter into Memorandum of Agreement (MOA) or other agreements with the Department of Environment and Natural Resources and other forest-related government agencies for access to and use of public forests for education and research purposes.

Laboratories should conform to existing requirements as specified by law (RA 6541, "The National Building Code of the Philippines" and Presidential Decree 856, "Code of Sanitation of the Philippines"). List of required and recommended equipment are listed in the course specifications found in Attachment B.

b. Class Size

1. For lecture classes - Ideal size is 35 students per class, maximum is 50.
2. For laboratory and research classes - Maximum of 30 students per class
3. Special lectures with class size more than 50 may be allowed as long as the needed facilities are provided (e.g., large classroom, audiovisual equipment, and ventilation and cooling system).

c. Educational Technology Centers

The institution should provide facilities to allow preparation, presentation and viewing of audio-visual materials to support instruction.

ARTICLE VII COMPLIANCE OF HEIS

Using the *CHED Implementation Handbook for OBE and ISA* as reference, an HEI shall develop the following items which will be submitted to CHED when they apply for a permit for a new program:

Section 17. The complete set of program outcomes, including its proposed additional program outcomes.

Section 18. Its proposed curriculum and its justification including a curriculum map.

Section 19. Proposed performance indicators for each outcome. Proposed measurement for system for the level of attainment of each indicator

Section 20. Proposed outcomes-based syllabus for each course.



Section 21. Proposed system of program assessment and evaluation

Section 22. Proposed system of program Continuous Quality Improvement (CQI).

**ARTICLE VIII
TRANSITORY, REPEALING AND EFFECTIVITY PROVISIONS**

Section 23 Transitory Provision

All private HEIs, state universities and colleges (SUCs) and local universities and colleges (LUCs) with existing authorization to operate the Bachelor of Science in Forestry program are hereby given a period of three (3) years from the effectivity thereof to fully comply with all the requirements in this CMO. However, the prescribed minimum curricular requirements in this CMO shall be implemented starting Academic Year 2019-2020.

Section 24 Repealing Cause

Any provision of this Order, which may thereafter be held invalid, shall not affect the remaining provisions.

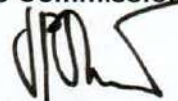
All CHED issuances or parts thereof inconsistent with the provision in this CMO shall deemed be modified and repealed.

Section 25 Effectivity Clause

This CMO shall take effect fifteen (15) days after publication in the Official Gazette or in a newspaper of national circulation. This CMO shall be implemented beginning Academic Year 2019-2020.

Quezon City, Philippines August 20, 2019

For the Commission:



J. PROSPERO E. DE VERA III, DPA
Chairman



Attachments:

- Annex A – Duties and Competencies of a Forester
- Annex B – Sample Curriculum Mapping
- Annex C – Sample Course Syllabus
- Annex D – Course Specifications



ANNEX A
PROFILE OF DUTIES AND COMPETENCIES OF A FORESTER

Duty	Competency			
A. Establish and manage forest resources using appropriate technologies	1. Know the nature and dynamics of various types of ecosystems in the forest.	2. Know the dynamics of forest ecosystems-human/society interactions	3. Know the sustainable management of natural, coastal, protection and plantation forest.	4. Know how to rehabilitate and restore degraded or denuded forest lands
	5. Manage forests to meet global standards (i.e., ISO certification)	6. Able to apply techniques on financial and economic aspects of forestry		
B. Visualize, interpret and apply geospatial methods in forest and other natural resources	1. Able to encode, identify, analyze, interpret and validate thematic data and information	2. Able to propose decision options for land use (LU) planning, resource allocation, policy decisions, etc.		
C. Formulate and implement forest policies, laws, rules and regulations	1. Know forest laws and regulations and its documentation procedures	2. Know the legal procedures in the apprehension and prosecution of violators of forest laws and regulations	3. Know the procedures in the formulation of forest policies, laws, rules and regulations	
D. Develop and implement integrated forest management plans and programs	1. Able to relate the forestry sub system with the other components of socio-bio-physical system	2. Able to use the strength, weakness, opportunities and threat (SWOT) analysis and other forms of systems analyses	3. Able to identify and implement solutions to problems using systems frameworks	4. Demonstrate integrative and collaborative skills in problem solving
	5. Prepare integrated resource plans and programs			
E. Maintain socio-cultural-ecological balance through conservation and sustainable development	1. Able to identify and assess the socio-bio-ecological status of existing resources	2. Demonstrate knowledge on policies, regulations and standards	3. Able to design and implement appropriate conservation and sustainable development plans, programs and projects	



Duties	Competencies			
F. Conduct research	1. Identify research problems, prepare corresponding proposal and identify funding sources for research	2. Apply research methodologies	3. Able to process, analyze, prepare and interpret data/results	4. Able to write and present progress and final reports
G. Demonstrate awareness of the importance of the living and preserved collections	1. Able to identify, name and classify the flora and fauna	2. Able to advocate biodiversity conservation	3. Know the anthropological values of living and preserved collection	4. Able to establish and manage botanical gardens, wildlife sanctuaries and natural museums
H. Source and process information through information and communication technology (ICT) and other means	1. Able to use a computer and application software	2. Able to identify and use other sources of information	3. Able to synthesize information for its appropriate use	4. Demonstrate ability to network
	5. Able to organize and use databases	6. Able to apply traditional and advanced communication technology		
I. Teach forestry principles and applications	1. Demonstrate mastery of subject matter	2. Know how to teach effectively	3. Able to use the strength, weakness, opportunities and threat (SWOT) analysis and other forms of systems analyses	4. Develop teaching materials
J. Design, mobilize, and implement information, education and communication (IEC) projects/programs	1. Familiarization with project management cycle and basic IEC processes	2. Able to assess the IEC needs of the clientele and stakeholders	3. Able to design and implement IEC programs using multi-media and other technologies	4. Able to monitor, evaluate and redesign IEC programs
K. Adapt, transfer and promote appropriate forestry technologies	1. Knowledgeable of technology transfer methods	2. Able to explain the technical aspects and uses of appropriate forestry technologies	3. Able to design and implement appropriate technology transfer programs	4. Able to apply appropriate technology and assessment methods involving social, technical, economic, environmental and political aspects



Duties	Competencies			
	5. Able to monitor and evaluate impacts of forestry technology programs			
L. Develop forest-based enterprise	1. Knowledgeable of forest-based enterprises	2. Able to undertake feasibility studies and write proposals and business plans	3. Able to identify sources of funding for enterprises	4. Able to integrate product development and marketing
M. Supervise forest-based processing operations	1. Knowledgeable on materials, property and processing technologies	2. Able to integrate non-forest-based to forest-based enterprise	3. Able to apply ergonomics to forest-based operations	4. Knowledgeable in environmental standards and mitigating measures
	5. Able to monitor and evaluate processes and products			
N. Supervise forest personnel/activities	1. Knowledge on human behavior	2. Know and understand the principles of personnel management	3. Able to apply supervisory manpower skills	4. Know how to enhance personnel productivity and performance
	5. Able to prepare accomplishment reports of the various activities		6. Know labor laws	
O. Practice professional ethics	1. Know ethical standards of the forestry profession		2. Observe/apply forestry ethical standards	
P. Establish interpersonal, institutional relationships	1. Know and understand individual and organizational behavior	2. Able to demonstrate empathy	3. Able to effectively work with others	4. Able to recognize and acknowledge where credit is due
	5. Able to demonstrate skills in managing and resolving conflict			
Q. Communicate effectively	1. Able to demonstrate good level of confidence	2. Able to express oneself effectively both orally and in writing	3. Proficient in subject matter	4. Know and able to use appropriate communication strategies in any situation
	5. Must have a good sense of humor	6. Must be a good listener and observer	7. Able to wear appropriate attire and practice appropriate grooming	



ANNEX B SAMPLE CURRICULUM MAPPING

Curriculum map is "a matrix relating all the courses listed in the program curriculum with one or more of the declared program outcomes."

The HEIs/LUCs/SUCs shall create a complete curriculum map of their current existing BS in Forestry Curriculum.

The graduate of the BS in Forestry program should have developed the ability to:

- a. Articulate and discuss the latest developments in the specific field of practice (PQF level 6 descriptor);
- b. Effectively communicate orally and in writing using both English and Filipino;
- c. Work effectively and independently in multi-disciplinary and multi-cultural teams (PQF level 6 descriptor);
- d. Act in recognition of professional, social, and ethical responsibilities;
- e. Preserve and promote "*Filipino historical and cultural heritage*" (based on RA 7722);
- f. Generate and share knowledge relevant to specific fields in the study of agriculture;
- g. Formulate and implement of agricultural developments plans and programs;
- h. Conduct comprehensive assessment and accounting of forest ecosystem services and resources and social processes using appropriate ICT and related tools and methods
- i. Assess climate change impacts, risks and vulnerabilities, and to prepare climate change adaptation, mitigation and disaster risk reduction plan
- j. Formulate, package, implement, and evaluate forest management-related research, development and extension programs, projects and policies
- k. Interpret, assess and formulate forest related policies and law
- l. Use IT and other traditional and modern tools, approaches and methods in problem solving, planning, management and other management activities

Legend:

I- Introduce

P- Practice

D- Demonstrate



Core Courses	Units	A	b	c	d	e	f	g	h	i	j	k	l
Forest Ecology	3	I		P			P			I	I		P
Morphology, Taxonomy and Dendrology	5						I		P			I	
Forest Wildlife and Biodiversity Conservation	3	I	P	P	I	I	P			I	P	I	P
Forest Genetics and Tree Improvement	1	I					D			I	P		P
Forest Health and Protection	4	I	P	P	I	I	D			P	P	I	P
Tree Physiology	3	I					D			I	P		P
Introduction to Forestry	3	I		I	I	I	I			I	I	I	I
Forest Surveying and Engineering	3	I		P			D			I	P		P
Silviculture I – Forest Nurseries and Plantation	3	I		P			D			I	P	I	P
Silviculture II – Silvicultural Systems	3	I		P			D			I	P	I	P
Forest Resource Economics	3	I		P	I		P	P	P	P	P	P	P
Forestry Statistics and Measurements	3	I		P			I			I	I	I	P
Integrated Forest Resources Management	3	I	P	P	I		P	P	P	P	P	P	P
Forest Enterprise Development and Management	3	I	P	P	I		P	P	P	I	D	P	P
Watershed Management	3	I	I	P	I		P	P		P	P	P	P
Geology and Forest Soils	3	I		P			P			I	P		P
Geospatial Methods in Forestry	3								P	P	P		P
Social Forestry and Community-Based Natural Resources Management	3	I	P	P	D	I	I			P	P	P	P
Forest Governance and Policy	3	I	P	P	P	I	I			I	P	P	P
Forest Laws and Regulations	3	I	P	P	P	I	I			I	P	P	P
Forestry Extension, Communication and Knowledge Management	3	I	D	P	D	D	P			P	P	P	P



Agroforestry and Sustainable Upland Development	3	I	I	P	I	D	P	P		P	P	P	P
Forest Ecosystems Resource Accounting and Valuation	4								P	P	P		I
Wood Structure and Identification	3						I			I	I		P
Properties and Utilization of Wood Products	3	I					I			I	I		P
Properties and Utilization of Non-Wood Products	3								I	D	P		
Production Management in Forest-Based Industries	3	I		P			P	P	P	I	P	P	P
Technical Report Writing	3		D		I		I				I		D
Problem Analysis and Research Methods	3						I			I	P		D
Thesis	6		P	D	D		D				D	I	P
Practicum	6	P	P	P	D				D	D	P	I	P
Electives													
Multiple Use Management	3	I		P	P	D	D	P		P	P	P	P
Ecotourism and Outdoor Recreation Management	3	I		P	P		D	P	P	P	P	P	P
Range Management	3	I		P	P		D	P	P	P	P	P	P
Environmental Impact Assessment	3	I	P	P	P	I	D			I	P	P	P
International Forestry Practice	3	I	D	P	D		P				P		P
Urban Forestry and Landscaping	3									P	D	I	P
Restoration of Degraded Ecosystems	3						P		P	I	P		P
Chemistry of Forest Products	3								P		D		P



**ANNEX C
SAMPLE COURSE SYLLABUS**

Course Name	Forest Ecosystems Resource Accounting and Valuation			
Course Description	Economics of production, distribution and consumption of forest products and services, economic analysis of forestry projects, accounting and valuation of forest ecosystems services			
No. Units	4			
Prerequisite	Forest Resource Economics			
Performance Indicator	Course Intended Learning Outcome	Topic	Tools in Learning Activity	Assessment Tool
1. Ability to identify, measure and value forest ecosystem services and resources using appropriate ICT and related tools and methods.	Identify, and measure forest ecosystem services and resources	a. Review of forest economics and measurements.	Lecture and discussion	Written and Oral Examination.
		b. Environment and natural resources accounting	Hands-on exercises	Practical Exam and Laboratory exercises.
	Value forest ecosystem services and resources	a. Approaches and techniques in resource valuation of market goods	Lecture and discussion	Written examination.
		b. Approaches and techniques in valuation of non-market goods.	Field exercises, class projects	Field reports and class project report.



ANNEX D
COURSE SPECIFICATIONS
FOREST BIOLOGICAL SCIENCE

Course Name	FOREST ECOLOGY
Course Description	Biological interaction of forest components, energy flow and trophic levels, principles of limiting factors and succession, principles and methods of forest dynamics and vegetational development with emphasis on tropical rain forest; the ecological impact of man
Course Objectives	<ol style="list-style-type: none"> 1. Describe the nature and dynamics of various types of ecosystems in the forest 2. Describe the interaction between and among biological and physical components in relation to forest productivity and sustainability 3. Discuss the ecological impacts of anthropogenic activity in forest ecosystems 4. Identify methods of studying the dynamics of forest ecosystem
Number of Units for Lecture and Laboratory	3 units (2 units lect., and 1 unit lab.)
Number of Contact Hours per Week	5 hrs a week (2 hrs; 3 hrs lab)
Prerequisites	General Botany and Zoology
Course Outline	<ol style="list-style-type: none"> 1. Introduction <ol style="list-style-type: none"> A. Definition of Terms <ul style="list-style-type: none"> ▪ Ecology ▪ Ecosystem ▪ Etc B. Importance and Relevance of Forest Ecology 2. Forest as an Ecosystem <ol style="list-style-type: none"> A. Types of Ecosystem B. Biological and Physical Interaction C. Energy Flow and Tropic Levels 3. Principles and Methods of Forest Dynamics <ol style="list-style-type: none"> A. Succession B. Ecosystem Development 4. Ecological Impacts of Anthropogenic Activities 5. Forest Influences
Laboratory Equipment	Steel tape -5 Computer - 5 GPS -5 Camera -1 Densitometer -5 Light meter -5 Convection Oven -1 Analytical Balance -3 Soil Auger -3
	Odum, E.P. 1971 Fundamentals of Ecology. Puri, G.S. et al. 1982 Forest Ecology, Vol, 1, 2 nd Ed. Oxford



Course Name	MORPHOLOGY, TAXONOMY AND DENDROLOGY
Course Description	Structure, classification and identification of woody and non-woody plants
Course Objectives	<ol style="list-style-type: none"> 1. Describe the methods of classifying, naming and identifying woody and non-woody plants 2. Discuss the past and current plant classification system in particular woody and non-woody plants 3. Identify commonly known woody and non-woody plants in natural stands and plantations
Number of Units for Lecture and Laboratory	4 units (2 units lect. and 6 units Lab)
Number of Contact Hours per Week	8 hrs a week (2 hrs lect. and 6 hrs lab)
Prerequisites	General Botany
Course Outline	<ol style="list-style-type: none"> 1. Introduction <ol style="list-style-type: none"> A. Definition of Terms B. Importance, Relevance and Roles of Morphology, Taxonomy, and Dendrology in Forestry 2. Past and Current System of Plant Classification 3. Components of Plant Taxonomy <ol style="list-style-type: none"> A. Classification B. Nomenclature/Identification C. Description 4. Methods of Classifying, Naming and Identifying Woody and Non-Woody Plants
Laboratory Equipment	Ladder - 2 Pruning saw - 2 Pruning shear with long handle - 2 Oven - 1 Herbarium cabinets - 2 Pressers - 4 sets
Texts and References	Classification System of the Angiosperm Phylogeny Group 1998, Annals of the Missouri Botanical Gardens: 85: 531-553 Brummit, R.K. 1992 Vascular Plant Families and Genera Fernando E.S. 2000 Checklist of Species in FBS 21 (taxonomy of Forest Plants, 8 th Ed., Dept of Forest Biological Sciences, UPLB-CFNR, College, Laguna Hutchinson, J. 1959. Families of Flowering Plants. Vol I Dicotyledons 2 nd ed Oxford Hutchinson, J. 1959. Families of Flowering Plants. Vol II, Monocotyledons, Oxford Rojo, J.P. 1999. Revised Lexicon of Philippine Trees. FPRDI



Course Name	FOREST WILDLIFE AND BIODIVERSITY
Course Description	Survey of Philippine flora and fauna, biology and ecology of selected species, with emphasis on indigenous species; Principles concepts and practice of biodiversity conservation in forest ecosystems
Course Objectives	<ol style="list-style-type: none"> 1. Identify Philippine flora and fauna (endangered, extinct, rare, threatened species etc.) 2. Describe the biology and ecology of selected Philippine flora and fauna 3. Discuss or describe methods, procedures of assessment and survey of Philippine flora and fauna 4. Basic feeding and breeding of selected Philippine flora and fauna 5. Enumerate and discuss the principles and strategies of biodiversity conservation 6. Design, implement and monitor appropriate conservation and preservation for biodiversity 7. Discuss the current policy and regulation on wildlife conservation and management
Number of Units for Lecture and Laboratory	3 units (2 units lect., and 1 unit lab.)
Number of Contact Hours per Week	5 hrs a week (2 hrs lect.; 3 hrs lab)
Prerequisites	General Botany, Zoology, Forest Ecology
Course Outline	<ol style="list-style-type: none"> 1. Introduction <ol style="list-style-type: none"> A. Relevance of Wildlife to Forestry B. Different Wildlife Indigenous, Endangered, Extinct, Commercially used species, etc. 2. Ecology, Biology, Breeding and Feeding Habits of Selected Wildlife Species with Commercial Values 3. Methods/Procedures in Determination of Wildlife Population, Distribution and Composition Including Habitat Assessment and Establishment of Wildlife Sanctuaries 4. Principles and concepts of biodiversity 6. Approaches/strategies in biodiversity 7. Planning and management of biodiversity 8. Current Trends and Practices on Biodiversity Conservation 9. Treatises, Agreements, Laws on Wildlife Management and Conservation
Laboratory Equipment	Clippers - 4 Dissection kit - 2 Hatchet - 4 Mesh net - 4 Traps - 10 Binoculars - 5
Texts and References	Survey of Philippine Flora and Fauna Ecology of Selected Wildlife Species Philippine Biodiversity. 1997. An assessment and plan of action



Course Name	FOREST HEALTH AND PROTECTION
Course Description	The common and important destructive agents of forest plants and forest products, their characteristics and management. Emphasis on integrated pest management
Course Objectives	1. Describe destructive agents of forest plants and forest products 2. Discuss tree management (monitoring, prevention and control) of destructive agents 3. Describe current trends in predicting pests and diseases incidence
Number of Units for Lecture and Laboratory	3 units (2 units lect., and 1 unit lab.)
Number of Contact Hours per Week	5 hrs a week (2 hrs lect. 3 hrs lab)
Prerequisites	None
Course Outline	1. Morphology and Biology of Common Forest Pests and Diseases 2. Principles of Pests and Disease Control and Management A. Biological B. Cultural C. Chemical 3. Methods of Diagnosing Pests and Diseases in Forests 4. Methods of Predicting Incidence of Pests and Diseases in Natural Nurseries, Forest and Plantation and Forest Product in Service
Laboratory Equipment	Compound Microscope -10 units/class Insect box (pins, etc.) – 5 sets/class Stereo microscope - 5 units/class Autoclave/pressure cooker – 1 Dissecting Kit - 5 sets/class Incubator - 1 Isolation room - 1 Oven/hot air sterilizer - 1
Texts and References	Eusebio, Plant Pathology Elzinga, R.J.1981. Fundamentals of Entomology. 2 nd Ed. Prentice Hall

Course Name	TREE PHYSIOLOGY
Course Description	Nutrition, metabolism, growth and reproduction of trees
Course Objectives	1. Discuss how trees grow and reproduce 2. Identify physiological processes contributing to growth and development of trees 3. Discuss recent developments in tree nutrition and reproduction
Number of Units for Lecture and Laboratory	3 units (2 units lect., and 1 unit lab.)
Number of Contact Hours per Week	5 hrs a week (2 hrs lect.; 3 hrs lab)
Prerequisites	General Botany and General Chemistry
Course Outline	1. Introduction 2. Importance, Relevance and Roles of Tree to Forestry 3. Physiological Processes A. Absorption B. Translocation C. Photosynthesis



	D. Respiration E. Other Metabolic Processes 4. Growth and Development of Trees A. Germination B. Maturation C. Reproduction 5. Tree Nutrition 6. Recent Developments A. Biofertilizers B. Sioculture C. Secondary Metabolite Production
Laboratory Equipment	Analytical balance - 1 Bunsen burner - 7 Hydrometer - 1 pH meter - 1 Screen house - 1 Tool and equipment shed -1
Texts and References	Kramer, P.J. 1960. Physiology of Trees. McGraw-Hill Bidwel, R.G.S. 1979. Plant Physiology. 2 nd ed. Macmillan Publishing Co. Inc New York.

Course Name	FOREST GENETICS AND TREE IMPROVEMENT
Course Description	Mechanism of tree heredity and variation, cytogenetic, mutation, nature of genes, population genetics and evolution genetics, and biometrical procedures.
Number of Units for Lecture and Laboratory	3 units (2 units lect., and 1 unit lab.)
Number of Contact Hours per Week	5 hrs a week (2 hrs lect.; 3 hrs lab)
Prerequisites	General Botany
Course Outline	<ol style="list-style-type: none"> 1. Importance and relevance of forest genetics and tree improvement 2. Gene and gene expressions 3. Principles of tree heredity 4. Evolution and sources of variation in trees 5. Principles of population genetics 6. Tree improvement methods and development
Texts and References	Wright, J.W. 1976. Introduction to Forest Genetics. Academy Press, Inc Zobel, B.J. and J.T. Talbert. Applied Forest Tree Improvement, John Wiley and Sons

Course Name	PROTECTED AREA MANAGEMENT
Course Description	General concepts and principles on protected area management
Number of Units for Lecture and Laboratory	3 units (3 hours lecture)
Number of Contact Hours per Week	3 hr a week (3 hr)
Prerequisites	Forest Ecology
Course Outline	<ol style="list-style-type: none"> 1) Importance and relevance of protected area management 2) Concepts and principles on protected area management 3) Definition and classification of protected areas 4) Common methods for monitoring and research on biodiversity and ecosystems 5) Policy and governance on protected area management
Texts and References	NIPAS Law and IRR National Biodiversity Strategies and Action Plan Biodiversity Conservation, Healey and Sinha



Course Name	INTRODUCTION TO FORESTRY
Course Description	A survey of the whole field of forestry, including the nature of forest resources and their importance to man and his needs; uses of forest and its place in local, national and world economy; the place of forestry among the professions; the nature of education in forestry and discussion of principal subject matter fields.
No of Units Lect./Lab	3 units (3 units lect.)
No. of Contact Hrs Per Week	3 hrs lect.
Course Outline (Major Topics)	<ol style="list-style-type: none"> 1. Forestry and the socio-biophysical system 2. Basic forestry concepts 3. General introduction to Philippine Forestry 4. The role of forestry in environmental protection and national development 5. Introduction to sustainable forest management

Course Name	SILVICULTURE I – FOREST NURSERIES AND PLANTATION
Course Description	Establishment and management of tree and non-tree nurseries, plantation and agroforestry farms, and timber stand improvement
Course Objectives	<ol style="list-style-type: none"> 1. Discuss how to establish tree and non-tree nurseries, plantations and agroforestry farms 2. Discuss management strategies and approaches applicable to tree and non-tree nurseries 3. Effectively apply the principles of establishing tree and non-tree nurseries, plantation and agroforestry farm 4. Identify current trends and international standards in plantation establishment and management e.g. Forest Certification, ISO, etc.
Number of Units for Lecture and Laboratory	3 units (2 units lect. and 1 Unit lab)
Number of Contact Hours per Week	5 hrs (2 hrs lect. and 3 hrs lab)
Prerequisites	Forest Ecology, Forest Soil
Course Outline	<ol style="list-style-type: none"> 1. Introduction <ol style="list-style-type: none"> A. Definition of Terms B. Basic Concept and Principles of Artificial Regeneration 2. Basics of Nursery Establishment and Management 3. Plantation Establishment and Management 4. Cultural Practices in Tree Plantation <ol style="list-style-type: none"> A. Pruning B. Cutting 5. Establishment and Management of Agroforestry Farm 6. Current Trends and International Standards
Laboratory Equipment	Pruning saw – 2 Bow saw - 2 Analytical balance - 1 Budding knife - 5 Light meter - 1 pH meter - 1 Pruning tools - 5 Set of sieves - 1 Shovel, spade, hoe - 5 Soil analysis kit - 1 Spring balance - 1 Water sprinkler - 2 Weighing scale – 1
Texts and References	Agpaoa, A. 1975. Introduction to Reforestation and Erosion Control for the Philippines Daniel, T. W. et al. 1979. Principles of Silviculture. McGraw Hill, Inc MacDicker, K.G. and N.T. Vergara. Agroforestry: Classification and Management. John Wiley and Sons Delizo, T.C. 1978. Forest Nurseries and Plantations for the Philippines. CF, UPLB



Course Name	SILVICULTURE II –SILVICULTURAL SYSTEM
Course Description	Silvicultural and regeneration methods and their application in tropical forest units with emphasis on the forests of the Philippines
Course Objectives	1. Discuss the relationship between forest, forest stand and their dynamics 2. Understand and discuss silvicultural methods 3. Describe principles and methods in the improvement of natural residual stand
Number of Units for Lecture and Laboratory	3 units (2 units lect. and 1 Unit lab)
Number of Contact Hours per Week	5 hrs (2 hrs lect. and 3 hrs lab)
Prerequisites	Silviculture I
Course Outline	1. Introduction A. Definition of Terms B. The Forest and Stand as Basic Units of Silviculture 2. Basic Principles and Concepts of Silviculture A. Silvics as foundation of Silviculture 3. Silvicultural System/Regeneration Method A. Clear Cutting B. Seed Tree C. Shelter Wood D. Selection and Support E. etc. 4. Improvement of Residual Stand
Laboratory Equipment	Analytical balance - 1 Budding knife - 5 Light meter - 1 pH meter - 1 Pruning tools - 5 Set of sieves - 1 Shovel, spade, hoe - 5 Soil analysis kit - 1 Spring balance - 1 Water sprinkler - 2 Weighing scale - 1
Texts and References	Agpaoa, A. 1975. Introduction to Reforestation and Erosion Control for the Philippines Smith, D.M. 1962. The Practice of Silviculture. 7 th ed. John Wiley and Sons

Course Name	GEOLOGY AND FOREST SOILS
Course Description	Geology, formation and development of land forms; physical, chemical and biological characteristics of forest soils;
No of Units Lect./Lab	3 units (2 units lect., and 1 unit lab.)
No. of Contact Hrs Per Wk	5 hrs a week (2 hrs lect.; 3 hrs lab)
Prerequisites	General Chemistry
Course Outline (Major Topics)	1. Physical Geology A. Types and origin of different rocks 2. Formation and Development of Land forms A. Weathering process B. Erosion and sedimentation C. Other formation and development process of land form 3. Soil Formation and Development 4. Types of Forest Soil 5. Soil Characteristics A. Physical B. Chemical C. Biological 6. Introduction to soil Classification and Taxonomy 7. Soil degradation and control; maintenance and improvement of soil fertility and production 8. Soil Conservation and Rehabilitation
References	Wilde, S.A. 1958. Forest Soils: Their Properties and Relation to Silviculture. The Ronald Press Company. New York



Course Name	FOREST RESOURCE ECONOMICS
Course Description	Economics of production, distribution and consumption of forest products and services, economic analysis of forestry projects
No of Units Lect./Lab	3 units (2 units lect. and 1 Unit lab)
No. of Contact hr Per Week	5 hr (2 hr lect. and 3 hr lab)
Prerequisites	General Economics
Course Outline (Major Topics)	<ol style="list-style-type: none"> 1. Introduction to forest economics 2. Approaches and techniques in economic measurements and valuation of natural resources 3. Forest products/ production economics 4. Economics of non-timber products in forestry 5. Marketing of forest products and services 6. Economic and financial analyses of forestry projects 7. Environmental Valuation and MBI
Lab Equipment	PC - 5 units
References	Douglas, J. 1983. A Re-Appraisal of Forestry Development in Developing Countries Sharma, L.C. 1980. Forest Economics, Planning and Management Gregory, G. 1972. Forest Resource Economics

Course Name	FORESTRY STATISTICS AND MEASUREMENTS
Course Description	Elements of forest mensuration; forest and forest products measurements; tree measurements and volume determination; forest inventory; and basic computer applications; forest sampling; timber inventory planning
Course Objectives	<ol style="list-style-type: none"> 1. Understand the basic concepts and methods involved in the measurement of tree variables 2. Familiarization with different instruments used in forest and forest products measurements 3. Overview of biodiversity assessment techniques 4. Overview of forest sampling and inventory 5. Know basic computer applications
No of Units Lect./Lab	4 units (2 units lect. and 2 units lab)
No. of Contact Hrs Per Wk	8 hrs (2 hrs lect. and 6 hrs lab)
Prerequisites	Elementary Statistics
Course Outline (Major Topics)	<ol style="list-style-type: none"> 1. Fundamental Concepts of Measurements 2. Elements of Sampling and Descriptive Statistics 3. Measurement of Tree Variables 4. Growth, Yield And Age Measurements 5. Area Measurements 6. Forest Sampling and Inventory 7. Experimental Design; Regression and Correlation
Laboratory Equipment	PC -5 units GPS -5 units Digital Hypsometer -5 units Range Finder -5 units Digital Caliper -5 units
References	Harnet D.L. 1982. Statistical Methods. Addison-Wesley Publishing Company FORI, 1978 Seminar-Workshop on Basic Statistics in Forestry Research Spurr, S.H. 1952. Forest Inventory. The Ronald Press Company Husch, B. 1972. Forest Mensuration. The Ronald Press Company



Course Name	INTEGRATED FOREST RESOURCES MANAGEMENT
Course Description	Environmental management systems; Principles and concepts of environmental management and planning; methodologies, indicators and operational issues on environmental planning and management; monitoring and evaluation of environmental projects
No of Units Lect./Lab	3 units (2 units lect. and 1 units lab)
No. of Contact Hrs Per Wk	5 hrs (2 hrs lect. and 3 hrs lab)
Course Outline (Major Topics)	<ol style="list-style-type: none"> 1. Principles in forest research management 2. Decision tools and their applications 3. Forest resource management systems and strategies 4. Concepts of sustainable forest management 5. Environmental problem and analysis 6. Designing and planning SD/forestry schemes 7. Carrying capacity and other SD concepts 8. Analysis and validation of sustainability in natural resource management projects in forestry
Laboratory Equipment	PC -5 units GPS -5 units Digital Hypsometer -5 units Range Finder -5 units Digital Caliper -5 units
References	Duerr, W. et al. 1975. Forest Resource Management: Decision-Making Principles and cases. Dorney, L. 1989. The Professional Practice of Environmental Management. Springer-Verlag, Inc. IEMSD-SEI. 1998. A Source book of Sustainable Development Indicators

Course Name	FOREST ENTERPRISE DEVELOPMENT AND MANAGEMENT
Course Description	Economic and business management concepts and principles and their application to forestry including small-scale forest-based enterprise with focus on management, planning, directing and control of enterprise
Course Objectives	Describe the concepts, principles and application and application of economic and business management.
No of Units Lect./Lab	3 units (3 units lect.)
No. of Contact hr Per Week	3 hr (3 hr lect.)
Prerequisites	Forest Economics
Course Outline (Major Topics)	<ol style="list-style-type: none"> 1. Economic and business concepts and principles 2. Entrepreneurship 3. Management Study 4. Marketing management 5. Technical/production and taxation studies 6. Financial management 7. Small-scale forest-based enterprise
Lab Equipment	PC-5 units
References	Rich. 1970. Marketing of Forest Products: Texts and Cases PIDS, 1983. Studies on the Wood-Based Furniture, Leather Products and Foot Wear Manufacturing Industries of the Philippines, PIDS Working Paper 83-01



Course Name	WATERSHED MANAGEMENT
Course Description	Regulation, use, conservation practices and treatment of the aggregate resources of a drainage basin for the production of water and control of erosion, streamflow and floods. Rehabilitation and land-use planning
No of Units Lect./Lab	3 units (2 units lect. and 1 Unit lab)
No. of Contact hr Per Wk	5 hrs (2 hr lect. and 3 hr lab)
Prerequisites	Geology and Forest Soils
Course Outline (Major Topics)	<ol style="list-style-type: none"> 1. General Introduction 2. Watershed characteristics 3. Watershed meteorology and hydrology 4. Water Augmentation 5. Soil Erosion 6. Water Quality Management and Monitoring 7. Watershed Management /Land use Planning 8. Watershed protection (including fire protection) 9. Special Topics
Laboratory Equipment	PC -5 units GPS -5 units Digital Hypsometer -5 units Range Finder -5 units Digital Caliper -5 units Flow meter -1 unit Multiparameter Water Quality Meter -1 unit Soil Sampler/Auger -1 unit
References	<ol style="list-style-type: none"> 1. Brooks, K. N., P.F. Ffolliott, H. M. Gregersen, and J. L. Thames. 1991. Hydrology and the Management of Watersheds. Iowa State University. Press. Ames, Iowa. 2. Hewlett, J. D. 1982. Principles of Hydrology. University of Georgia Press. Athens, Georgia. 3. Gray, D. M. 1970. Handbook of the Principles of Hydrology. A general text with special emphasis on Canadian conditions. Port Washington, NY. 4. Linsley, R. K., Jr., M. A. Kohler, and J. L. Paulhus. 1982. Hydrology for Engineers. McGraw-Hill Co., New York. 5. PCARRD-DOST-DENR-FMB-DA-UPLB-CFNR-FDC/ENFOR. 1999. Guidelines for Watershed Management and Development in the Philippines. Los Baños, Laguna. 241 p. 6. Satterlund, D. R. 1972. Wildland Watershed Management. The Ronald Press Co., New York. 7. FAO. 2006. The New Generation of Watershed Management Programmes and Projects. Forestry Paper 150. Food and Agricultural Organization. Rome. 8. Darghouth, S., C. Ward, G. Gambarelli, E. Styger, and J. Roux. 2008. Watershed Management Approaches, Policies, and Operations: Lessons for Scaling Up. Paper No. 11. The World Bank. New York.



Course Name	FOREST ECOSYSTEMS RESOURCE ACCOUNTING AND VALUATION
Course Description	Introduction to accounting and valuation of forest resources and ecosystem services
No of Units Lect./Lab	3 units (3 units lecture)
No. of Contact hr Per Week	3 hr (3 hr lecture)
Prerequisites	Forest Economics
Course Outline (Major Topics)	<ol style="list-style-type: none"> 1. General Introduction 2. Review of Forestry Economics 3. General concepts and principles of forest resources accounting and valuation 4. Methods and techniques in forest resources accounting 5. Methods and techniques in forest resources valuation 6. Special topics
Laboratory Equipment	PC -5 units
References	<p>Costanza, R., d' Arge, R., deGroot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G.,</p> <p>Sutton, P. & van den Belt, M. 1997. The value of the world' s ecosystem services and natural capital. <i>Nature</i>, 387:253-260.</p> <p>Bishop, J.T. 1999. Valuing Forests: A Review of Methods and Applications in Developing Countries. World Bank. UK.</p>

Course Name	TROPICAL FORESTRY AND CLIMATE CHANGE
Course Description	Influences of Climate Change on Tropical Forestry
No of Units Lect./Lab	3 units (3 units lecture)
No. of Contact hr Per Week	3 hr (3 hr lecture)
Prerequisites	Forest Ecology
Course Outline (Major Topics)	<ol style="list-style-type: none"> 1. General Introduction 2. Basic concepts on climate change and climate variability 3. Review of key features of tropical forests and state of tropical forestry in the Philippines 4. Assessment of influences and impacts of climate change on forest ecosystems and forestry 5. Assessment of adaptation to climate change of forests and in forestry 6. Assessment of climate change mitigation roles of forestry 7. Special topics
Laboratory Equipment	PC -5 units GPS -5 units
References	<p>Comiso, J.C.; C.A. Blanche; T.I. Sarigumba; M.V.O. Espaldon; and F.P.</p> <p>Lansigan. 2014. Changing Philippine Climate. UP Press.</p> <p>IPCC. 2013. Climate Change 2013. The Physical Basis</p> <p>IPCC. 2014. Climate Change 2014. Impacts, Adaptation and Vulnerability</p> <p>IPCC. 2014. Climate Change 2014. Mitigation of Climate Change</p>



Course Name	GEOSPATIAL METHODS IN FORESTRY
Course Description	Concepts and principles on GIS and applications in forestry
No of Units Lect./Lab	3 units (2 units lect. and 1 Unit lab)
No. of Contact hr Per Week	5 hr (2 hr lect. and 3 hr lab)
Prerequisites	Trigonometry
Course Outline (Major Topics)	<ol style="list-style-type: none"> 1. General concepts and principles on GIS 2. Data classification, structure and collection 3. Geo-referencing systems 4. GIS-based techniques and methods 5. GIS applications in forestry and natural resources management 6. Special topics
Laboratory Equipment	PC -5 units GPS -5 units
References	<p>Bantayan, Nathaniel C., EA Combalicer, CL Tiburan, Jr., LD Barua and JJ Dida. 2015. GIS in the Philippines – Principles and Applications in Forestry and Natural Resources. Second Edition. UP Los Banos. 168 p.</p> <p>Mitchell, A. 2012. The ESRI Guide to GIS Analysis: Modeling Suitability, Movement and Interaction. ESRI Press, Redlands California. 419 pp.</p>

Course Name	SOCIAL FORESTRY AND COMMUNITY-BASED NATURAL RESOURCES MANAGEMENT
Course Description	Dynamics of human-forest ecosystems interaction; principles, concepts and approaches of community organizing and development, forestry extension, social impact assessment, and other participatory approaches to forest and natural resources management (BASIC)
Number of units for Lecture and Laboratory	3 units; 3 hrs lect.
Number of Contact Hours per Week	3 hrs a week.
Course Outline	<ol style="list-style-type: none"> 1. Dynamics of human – forest ecosystems interaction 2. Principles, concepts and approaches of community organizing, forest extension, social impact, assessment & other participatory approaches to forest & natural resources management 3. Community forestry and agroforestry programs
Texts and References	<p>UNDP-FAD-EPI, 1984. Community Forestry: Some Aspects Upland Development Program-DENR.1991. Handbook on Community Training Programs</p> <p>Vergara, N.T. and R.A. Fernandez. 1989. Social Forestry in Asia: Factors that influence Program Implementation</p> <p>Gregersen, H. et al. 1989. The Role of Social Forestry in Sustainable Development</p>



Course Name	FOREST GOVERNANCE AND POLICY
Course Description	
Number of units for Lecture and Laboratory	3 units lecture
Number of Contact Hours per Week	3 hrs a week
Course Outline	Importance of forest governance Knowledge, skills and attitude in forest governance Professional ethics and values Forest organization Link with LGUs and civic action groups
Texts and References	DENR, 1995 and 1997 Compilation of Environmental and Natural Resources Policy

Course Name	FOREST LAWS AND REGULATION
Course Description	Laws, rules and regulation, legal procedures and forestry administrative orders relative to the conservation and utilization of forest and natural resources, including international protocols, treaties, convention and commitments; Analysis of Philippine and other laws and policies; and administration of forest institution
Course Objectives	To identify and analyze/review Philippine forestry policies, and laws, and administration of the forestry institutions
Number of units for Lecture and Laboratory	3 units; 3 hrs lect.
Number of Contact Hours per Week	3 hrs a week.
Course Outline	1. History of forestry in the Philippines 2. Constitutional provisions 3. Importance of forest governance 4. Forestry Legislation A. Presidential Proclamation B. DAOs C. LOIs D. Decrees E. Executive Orders 5. Forest Protection 6. Enforcement Forest Laws
Texts and References	FDC, 1982. Integrated Forestry System of the Philippines. CF, UPLB Cruz, C.A. 1984. Policy Issues on Commercial Forest Management DENR, 1997, Compilation of Environmental and Natural Resources Policy Issuance Code of Ethics for Foresters

Course Name	FORESTRY EXTENSION, COMMUNICATION AND KNOWLEDGE MANAGEMENT
Course Description	Theories, principles and methods of IEC/extension as applied to forestry and natural resources management; analysis of IEC/extension programs in forestry and natural resources management (BASIC)
Number of units for Lecture and Laboratory	3 units; 3 hrs lect.
Number of Contact Hours per Week	3 hrs a week.
Course Outline	1. Theories, principles & methods of IEC/extension 2. Analysis of IEC/extension programs in forestry & natural resources 3. Planning, design, mobilizing for implementation/action and evaluation of IEC 4. Programs in forestry & natural resources
Texts and References	DENR, 1996. Basic Community Organizing Hand Book for Community-Based Forest Management programs



Course Name	AGROFORESTRY AND SUSTAINABLE UPLAND DEVELOPMENT
Course Description	Agroforestry as a strategy in sustainable upland development
No of Units Lect./Lab	3 units (2 units lecture and 1 unit lab)
No. of Contact hr Per Week	5 hr (2 hr lecture and 3 hr lab)
Prerequisites	Silviculture
Course Outline (Major Topics)	<ol style="list-style-type: none"> 1. General Introduction 2. Principles and concepts of agroforestry 3. Types and classification of agroforestry systems in the Philippines 4. Roles of trees and agricultural crops in agroforestry systems 5. Land management and soil husbandry practices in agroforestry 6. Preparation of agroforestry development plan 7. Special topics
Laboratory Equipment	PC -5 units GPS -5 units Digital Hypsometer -5 units Range Finder -5 units Digital Caliper -5 units Soil Sampler/Auger -1 unit
References	Atangana, A., Khasa, D., Scott, D., and Degrande, A. 2014. Tropical Agroforestry. Springer Dordrehct Heidelberg, London, York. Lasco, R.D. and Visco, R.G. Introduction to Agroforestry. <i>A Lecture Syllabus</i> . 2003. Philippine Agroforestry Research and Education Network and the UPLB Institute of Agroforestry. UPLB, College, Laguna, Philippines

Course Name	WOOD STRUCTURE AND IDENTIFICATION
Course Description	Gross and microscopic structure of wood; wood identification and natural defects.
Course Objective	<ol style="list-style-type: none"> 1. Explain the formation of wood and its structure in a living tree. 2. Recognize and describe the appearances and functions of the major cell types that comprise the wood. 3. Describe cell wall structures; growth related defects and their significance. 4. Identify various wood species based on their physical and structural characteristics. 5. Relate wood structure to wood properties and utilization.
No. of Units for Lect. and Lab	3 units (1 unit lect., and 2 units lab.)
No. of Contact Hrs Per Week	7 hrs per week (1 hr lect. and 6 hrs lab)
Course Outline	<ol style="list-style-type: none"> 1. Introduction <ol style="list-style-type: none"> a. The importance of the course b. Basis of wood identification c. Properties common to all wood 2. Plant Origin Of Wood <ol style="list-style-type: none"> a. Types of plants producing wood b. Plant classification c. The role of Timber-producing trees in plant classification 2. Tree Growth <ol style="list-style-type: none"> a. The Stem b. Tree-Trunk Development 3. The Woody Plant Cell <ol style="list-style-type: none"> a. Chemical components of the plant cell-wall b. Structural units of the cell wall c. The cell-wall layers d. Modification or Sculpturing of the cell-wall



	<ol style="list-style-type: none"> 4. The Minute Structure Of Softwoods (Coniferous Wood) <ol style="list-style-type: none"> a. Longitudinal Prosenchymatous Elements b. Longitudinal Parenchymatous Elements c. Transverse Prosenchymatous Elements d. Transverse Parenchymatous Elements e. Rays of Coniferous Woods f. Resin Canals in Conifers g. Crystalliferous Woods Elements in Conifers 5. The Minute Structure Of Hardwoods (Porous Woods) <ol style="list-style-type: none"> a. Elements of porous woods b. Longitudinal Prosenchymatous Elements (Porous Wood) c. Longitudinal Parenchymatous Elements (Porous Wood) d. Transverse Parenchymatous Elements (Porous Wood) e. Gum Canals in Porous Wood 6. Natural Defects In Wood <ol style="list-style-type: none"> a. Knots b. Cross-grain c. Reaction wood d. Growth Stresses e. Brashness f. Pitch Defects g. Bark Pockets
Laboratory Equipment	<ol style="list-style-type: none"> 1. Microscopes 2. Hand Lens 3. Knife 4. Wood Samples
Text and References	<ol style="list-style-type: none"> 1. Asian Development Bank. 1994. The Forestry Sector in the Philippines. 2. Brown, Panshin and Forsaith. 1949. Textbook of Wood Tech. Vol. 1 3. Cote, W.A. (editor). 1965 Cellular Ultrastructure of Woody Plants. Syracuse University Press, New York. 4. Dech, H. Timber, Its Structure and Properties. 5. De Vela, America, Meniado and Lopez. Guide to Wood Identification. 6. Findly, Walter Philip Kennedy. 1975. Tomber Properties and Uses. 7. Haygreen, J. 1989. Forest Products and Wood Science. Iowa University Press; Ames, Iowa 8. Haygreen, J. 1989. Forest Products and Wood Science. 2nd ed. 9. Jane, F.W. 1955. The Structure of Wood. 10. Kollman and Cote. 1975. Principles of Wood Science and Technology 11. Kribs, D.A. 1959. Commercial Foreign Woods in the American Market. 12. Lantican, C.B and C. B. Madamba .1979 Laboratory Manual in Wood Structure and Identification. 13. Mediado, et al.1975. wood Identification Handbook for Philippine Timbers. Vol. 2 FORPRIDECOM 14. Panshin and de Zeeuw. 1970. Textbook of Wood Tech. Vol. 1 15. Reyes, L. 1938. Philippine Woods. 16. Wangaard, F.F. (editor). 1979. Wood: Its Structure and Properties.



Course Name	PROPERTIES AND UTILIZATION OF WOOD FOREST PRODUCTS
Course Description	Physical, mechanical and chemical properties of wood and non-wood products; manufacturing processes and utilization technologies for forest products.
Course Objective	At the end of the course, the students should be able to: <ol style="list-style-type: none"> 1. Discuss the physical, mechanical and chemical properties of wood and selected non-timber forest products; and 2. Discuss the different processes in the conversion of these materials into commercial important consumer goods.
No. of Units for Lect. and Lab	3 units, (3 lect., 3 lab)
No. of Contact Hrs Per Week	6 hours a week
Course Outline	<ol style="list-style-type: none"> 1. Introduction <ol style="list-style-type: none"> a. Review of wood structure (softwoods and hardwood) b. Comparison between normal abnormal wood, mature and juvenile wood c. Classification of forest products d. Significance of sustenance forest products utilization 2. Properties Of Wood And Fibrous Non-Wood Forest Products <ol style="list-style-type: none"> a. Chemical compositions and properties b. Physical properties c. Mechanical properties 3. Silvicultural/Forest Management Practices And Their Influence On the properties of Forest 4. Processing Operations In Forest Based-Industries <ol style="list-style-type: none"> a. Transforming logs into lumber, veneer and plywood b. Seasoning of wood, bamboo and rattan <ol style="list-style-type: none"> i) wood chemistry ii) wood seasoning iii) Wood preservation c. Preservative treatment of wood, bamboo and rattan d. Manufacture of wood composition boards e. Technology of making pulp and paper f. Manufacture of furniture and secondary wood products g. Community level processing 5. Other Non-Wood Forest Products <ol style="list-style-type: none"> a. Exudates and extractives b. Palms, grasses and vines c. Food and medicinal forest plants 6. Woodfuel And Biomass Energy <ol style="list-style-type: none"> a. Biomass energy, their sources and utilization b. Fuelwood and charcoal production c. Dendro-energy and other industrial wood energy generation 7. Government policies affecting consumption and utilization of forest products
Laboratory Equipment	<ol style="list-style-type: none"> 1. Oven 2. Vernier Caliper 3. Weighing balance 4. Sawmill 5. Dry kiln 6. Treating Cylinder
Text and References	<ol style="list-style-type: none"> 1. Razal, R.A. Mga Produktong Gubat at Agham Kahoy. Sentro ng Wikang Filipino. 2. Haygreen and Bowyer. 1989 (2nd ed.) Forest Prodcuts and Wood Science. Iowa State University Press. 3. Tesoro, Bello and Pollisco. 1977. Forest Products and Industries of the Philippines.



Course Name	PROPERTIES AND UTILIZATION OF NON-WOOD FOREST PRODUCTS
Course Description	Physical, mechanical and chemical properties of non-wood products; manufacturing processes and utilization technologies for non-wood forest products.
Course Objective	At the end of the course, the students should be able to: 1. Discuss the physical, mechanical and chemical properties of selected non-wood forest products; and 2. Discuss the different processes in the conversion of these materials into commercial important consumer goods.
No. of Units for Lect. and Lab	3 units, (3 lect., 3 lab)
No. of Contact Hrs Per Week	6 hours a week
Course Outline	1. Introduction a. Classification of non-wood forest products b. Significance of non-wood forest products utilization 2. Properties of Non-Wood Forest Products a. Chemical compositions and properties b. Physical properties c. Mechanical properties 3. Silvicultural/Forest Management Practices And Their Influence On the Properties of Non-Wood Forest Products 4. Processing Operations a. Seasoning of bamboo, rattan and other non-wood forest products b. Preservative treatment of bamboo and rattan 5. Other Non-Wood Forest Products a. Exudates and extractives b. Palms, grasses and vines c. Food and medicinal forest plants 6. Woodfuel And Biomass Energy a. Biomass energy, their sources and utilization b. Fuelwood and charcoal production c. Dendro-energy and other industrial wood energy generation 7. Government policies affecting consumption and utilization of forest products
Laboratory Equipment	1.Oven 2.Vernier Caliper 3.Weighing balance 4.Sawmill 5.Dry kiln 6.Treating Cylinder
Text and References	3. Razal, R.A. Mga Produktong Gubat at Agham Kahoy. Sentro ng Wikang Filipino. 4. Haygreen and Bowyer. 1989 (2nd ed.) Forest Prodcuts and Wood Science. Iowa State University Press. 5. Tesoro, Bello and Pollisco. 1977. Forest Products and Industries of the Philippines.



Course Name	CHEMISTRY OF FOREST PRODUCTS
Course Description	Chemistry of wood; pulping and paper-making principles; cellulose derived products
Course Objective	At the end of the course, students should be able to: <ol style="list-style-type: none"> 1. identify and characterize the different chemical components of wood; 2. discuss the formation and distribution of the chemical components in the cell wall; 3. describe the structure of the chemical components of the cell wall; 4. discuss the reactivities of the cell wall components toward pulping and paper-making chemicals; and 5. isolate the individual cell components.
No. of Units for Lect. and Lab	3 units (2 class 3 lab)
No. of Contact Hrs Per Week	5 hours a week
Course Outline	<ol style="list-style-type: none"> I. Introduction – General Consideration; Importance of Wood Chemistry. II. Chemical Composition and Analysis of Wood <ol style="list-style-type: none"> 1. Classes of compounds present in wood 2. Separation of wood components 3. Analysis of wood III. Brief Review of Organic and Carbohydrate Chemistry. IV. Chemistry of Wood Components <ol style="list-style-type: none"> A. CELLULOSES <ol style="list-style-type: none"> 1. Formation and location in the cell wall 2. Isolation 3. Structure <ol style="list-style-type: none"> a. Macromolecular structure of cellulose b. Physical structure c. Molecular structure 4. Solubility of Cellulose 5. Cellulose reactions 6. Cellulose derivatives B. HEMICELLULOSES <ol style="list-style-type: none"> 1. Classification and location 2. Isolation 3. Structure <ol style="list-style-type: none"> a. Hardwood hemicelluloses b. Softwood hemicelluloses 4. Reactivity C. OTHER WOOD POLYSACCHARIDE <ol style="list-style-type: none"> 1. Pectin 2. Starch D. LIGNIN <ol style="list-style-type: none"> 1. Formation and distribution in the cell wall 2. Isolation <ol style="list-style-type: none"> a. Preparation of the plant material b. Native lignin c. Insoluble lignin 3. Lignin Determination Methods <ol style="list-style-type: none"> a. Direct Methods b. Indirect Methods 4. Structure 5. Reactivity <ol style="list-style-type: none"> a. Oxidation b. Hydrolysis



	6. Wood Extractives 6) Formation and location in the wood structure 7) Influence of extractives on wood properties 8) Structure 9) Chemical classification 10) Reactivity towards pulping chemicals
Laboratory Equipment	1. Analytical Balance 2. Correction Oven 3. Muffle Furnace 4. Grinder (Wiley Mill) 5. Soxhlet Extraction Apparatus 6. Porcelain Crucible 7. Fritted glass crucible
Text and References	1. Browning, B.L. 1963. The Chemistry of Wood. 2. Browning, B. L 1967. Methods of Wood Chemistry.

Course Name	PRODUCTION MANAGEMENT IN FOREST-BASED INDUSTRIES
Course Description	Planning of production requirements, routing, scheduling, dispatching and inspection; control of materials, methods, machines, tooling and operation times
No. of Units for Lect. and Lab	3 units,(2 lect. 3 lab)
No. of Contact Hrs Per Week	5 hours a week
Course Outline	I. INTRODUCTION a. The Product and operation function II. ORGANIZATION a. Philosophy of organization b. Organization Structure III. FACILITIES LAYOUT AND MATERIALS HANDLING a. The departmental arrangement b. The detailed layout and materials handling IV. PRODUCTION FORECAST a. General observations on sales forecast b. Sales forecast methods V. PRODUCTION PLANNING a. The basis of production Planning b. Production Planning, a basis for financial planning c. Determination of factor-of-production requirements VI. PRODUCTION SCHEDULING a. Factors governing scheduling of production VII. PRODUCTION REPORTING a. Recording requirement b. Types of records necessary in production c. Reporting VIII. PRODUCTION CONTROL a. Production control in intermittent manufacturing b. Production control in continuous manufacturing c. Linear programming d. Critical path scheduling IX. INVENTORY CONTROL a. Relevant factors in inventory control b. Inventory under certainty c. Inventory control under risk and uncertainty
Text and References	1. Baldwin, R.F. Operations Management in the Forest Products Industry. Miller Freeman Publication. 1984. 2. Bowman, D.M. and F. M. Fillerup. Organization and Planning. McGraw-Hill Book Company, Inc. 1963. 3. Macniece, E.H. Production Forecasting, Planning, and Control. 3 rd edition. John Wiley and Sons, Inc. 1966. 4. Mayer, R.R. Production and Operations management. 3 rd edition. McGraw-Hill Book Company. 1975.

