Head of School
Cossey Keosai Yosi, PhD (UNIMELB, AUS); MSc (UWB, UK); BScF (PNGUoT); DipFor (FORCOL); PGCSCT (PNGUoT)

Forest Administration, Legislation and Policy & Social Forestry Section

Academic Team:

Senior Lecturer:
Cossey Keosai Yosi, PhD (UNIMELB, AUS); MSc (UWB, UK); BScF (PNGUoT); DipFor (FORCOL); PGCSCT (PNGUoT)

Forest Economics, Marketing & Trade Section

Academic Team:

Lecturers:
Haron Jeremiah, M.S (Beijing Forestry Uni, CHINA); PGDAg (PNGUoT); BScF (PNGUoT); PGCSCT (PNGUoT)

Forest Management, Engineering, Remote Sensing & GIS Section

Academic Team:

Lecturers:
Jimmy Moses, PhD (Univ. South Bohemia, CZECH REPL.); MSc (UPNG); BScH (UPNG)
Leonard Wana, MPhil (PNGUoT); BScF (PNGUoT); PGCSCT (PNGUoT)
Louis Veisami, MPhil (PNGUoT); BScF (PNGUoT); DipFor (FORCOL); Cert. For. Mngt (FTI); PGCSCT (PNGUoT)
Leroy Moripi, MPhil (PNGUoT); BScF (PNGUoT)

Forest Botany, Biology & Ecology Section

Academic Team:

Lecturers:
Billy Bau, MPhil (UPNG); PGD (UPNG); BScF (PNGUoT); PGCSCT (PNGUoT)
Diati Zure, MPhil (PNGUoT); MSc (TAIWAN); BScF (PNGUoT) – Study Leave for PhD (TAIWAN)

Wood Science, Technology & Utilization Section

Academic Team:

Professor:
Yusuf Sudo Hadi, PhD (Bogor Agric. Univ., INDONESIS); M. Agric. (Nagoya Univ., JAPAN); BSc (Bogor Agric. Univ., INDONESIA)

Lecturers:
Peter Edwin, MSc (UNIMELB, AUS); BScF (PNGUoT) – Study Leave for PhD (UNIMELB, AUS)
Benson Gusamo, MSc (UWB, UK); DiplF (FORCOL); PGCSCT (PNGUoT)

Technical Team

A/Laboratory Manager:
Winnie Tito, BScFor (PNGUoT); Cert. Lab. Mngt (RMIT, AUS)

Senior Technical Officer:
Joachim Wafewa, BScFor (PNGUoT)

Technical Officers:
Israel Penu, BScFor (PNGUoT)
Christine Pokana, BScFor (PNGUoT)
Raymond Warebu, BSc ITC (PNGUoT)

Senior Foreman Artisan:
Charlie Babob, PETT (MFM) Lae Tech (Polytech)

Administration Team:

Executive Secretary:
Priscilla Anegi, Dipl. Sec. Studies (LaeTech)

Secretary:
Barbara Steven, Dipl. BSOA (NPI PNG); Cert. Basic Sec. Studies (LTC)

Janitors:
Ben Byreng
Ismael Kaupa

A Brief Introduction to the School of Forestry and the Programs offered

The School of Forestry at the PNG University of Technology offers two separate programs. The four-year Bachelor of Science Degree in Forestry curriculum is taught both at the Taraka campus and Bulolo University College campus (BUC) while a separate three-year Diploma in Forestry program is offered exclusively at the University's Bulolo campus however, the Diploma program has been upgraded to a Degree program in 2023. Since 2019 up to now, the School of Forestry has been implementing a new curriculum of four (4) subjects per semester at the Taraka campus. From 2023 and going forward, the BUC has started to implement the Bachelor of Forest Management Degree program.

We recognise that because Forestry itself is a multi-disciplinary field that requires skills as diverse as research, management, surveying, engineering, forest inventory, wildlife management and conservation, and economics, our curriculum is equally diverse in the array of topics our students learn about in their classes. Forestry graduates are employed by an unusual variety of organisations and companies, including industry, different types of non-government organisations (NGOs), and government. Some of our graduates have become entrepreneurs and have started their own businesses, an activity that provides people with a high degree of freedom, prospects for earning a good income, and much more flexibility than those working permanently in the private and Government sectors across the country. Most important of all, our graduates are playing an important role in growing PNG's economy.

Degree Program at Taraka Campus

The School of Forestry offers the four-year academic program leading to the Bachelor of Science Degree in Forestry. The Degree program is in the subject areas of English Grammar and Composition; Mathematics; Biology; Chemistry; Physics; and Information and Technology taken during the first and second years of study. In the third; and fourth years of the Degree program, more specialised forestry science subjects are taught including Forest Management and Planning; Plantation Silviculture; GIS for Forestry; Research Methods and Analysis; Forest Economics and Trade; Agroforestry and Extension; Forest Inventory and Assessment; Forest Engineering and Timber Harvesting; Wood Science and Technology; Climate Change, Forestry and REDD+; Research Project and Publication; Wildlife Habitat and Management; Forest Products and Industries; Project and Human Resource Management; and a non-assessable subject of Professional Work Experience.

Our Degree programs are designed to produce Forest Scientists; Wood Technologist and Scientist; Plant Botanist and Taxonomist; Forestry Professionals; and entrepreneurs in the business sector. Our graduates are trained with skills to also pursue careers in industry, academia or government sectors.

The first year of our Degree program is designed to form a common foundation for our students upon which years 2, 3 and 4 of the course form more specialised fields of forest science.

Entry requirements of the Degree Program:

i) **Bachelor of Science Degree in Forestry:** Grade 12 School Leavers: SAT_P Test Score, Minimum of B grades in English; C or above in Math A; B or above in Maths B; B in Biology; B or C in Chemistry; and B or C in Physics.
ii) All non-school leavers entering into the Degree program must meet the minimum entry requirements as in school leaver requirements and upon acceptance, all non-school leavers will do entry exams instead of STAT-P test.
iii) Applicants with Diploma Certificate from a recognised Institute with Credit grades in science related subjects are invited to do entry exams before entry.
iv) Applicants with Diploma from universities outside of PNG will be selected on case-by-case basis.

Biology (Plant & Animal) offered under the Forestry Degree program is also taught to students from the School of Applied Sciences.

School of Forestry Postgraduate Program:

Currently the School of Forestry does not offer taught course Master in Forestry program however, the School offers postgraduate degrees in Master of Philosophy (MPhil) and Doctor of Philosophy (PhD) in Forestry by research.

Entry requirements for a MPhil is Bachelor's Degree or postgraduate diploma in Science with above average grades from a recognized university and for a PhD program, a taught course Master of Science degree or MPhil is required.

COURSE STRUCTURE

BACHELOR OF SCIENCE DEGREE IN FORESTRY

First Year	First Semester		
Code	**Subject**	**Contact Hours**	**Credit**
MA116	Mathematics for Nat Res. (Forestry)	6	22
CD 112	English Grammar & Composition 1	6	15
FR 111	Biology (Plant & Animal)	6	15
CS 113	Introduction to Information Technology	6	18
		24	**70**
First Year	**Second Semester**		
FR 122	Forest Botany	6	16
FR 123	Introduction to Forestry	6	15
AS 110	Chemistry for Natural Nat. Resources	6	15
PH 175	Physics for Natural Resources	6	23
*FR 124	Biology for Applied Sciences	6	
	*Service subject		
		24	**69**
Second Year	**First Semester**		
FR 211	Forest Ecology	6	15
FR 212	Forest Surveying	6	15
FR 213	Forest Mensuration	6	15
FR 214	Dendrology	6	15
		24	**60**
Second Year	**Second Semester**		
FR 225	Natural Forest Silviculture	6	15
FR 226	Forest Soils	6	15
FR 227	Forest Biodiversity	6	15
FR 228	Forest Protection (Pest, Diseases & Fire)	6	15
		24	**60**
Third Year	**First Semester**		
FR 311	GIS for Forestry	6	15
FR 312	Research Methodology Design & Analysis	6	15
FR 313	Plantation Silviculture	6	15
FR 314	Forest Management & Planning	6	15
		24	**60**
Third Year	**Second Semester**		
FR 321	Forest Economics & Trade	6	15
FR 322	Agroforestry & Extension	6	15
FR 323	Introduction to Climate Change, Forestry & REDD+	6	15
FR 324	Wood Science & Technology	6	15
		24	**60**
Fourth Year	**First Semester**		
FR411	Research Project Proposal	6	9
FR412	Multiple Forest Inventory & Assessment	6	15
FR413	Forest Engineering & Timber Harvesting	6	19
FR414	Forest Policy & Legislation	6	18
		24	**61**
Fourth Year	**Second Semester**		
FR421	Research Project & Publication	6	9
FR422	Wildlife Habitat & Management	6	15
FR423	Forest Products & Industries	6	15
FR424	Project and Human Resource Management	6	15
*FR425	Professional Work Experience		
		24	**54**

*FR425: Professional Work Experience - Work integrated Learning is undertaken in Semester 2, for Year 3 and 4 from November to February. This subject does not have any credit points however, it is assessed as satisfactory or unsatisfactory.

Graduate Statement (GS)

The Bachelor of Science in Forestry graduates has in-depth knowledge of the underpinning sciences of forestry. They possess core skills in sustainable forest ecosystem management, forest products, forest industry and social forestry. They apply their analytical skills to provide innovative solutions to complex problems. Graduates are effective communicators to diverse audiences and have a deep understanding and appreciation of moral and ethical values.

Course Learning Outcomes (CLOs)

Upon completion of this four-year Degree course, the graduates will be able to demonstrate the following attributes:

CLO1	The knowledge to manage forestry operations and apply silvicultural techniques to tropical ecosystems.
CLO2	Design and undertake integrated forestry resource surveys and apply sustainable forest management tools to manage the natural and planted forests of PNG.
CLO3	Undertake the design of adaptable and sustainable ecosystems, soil conservation and watershed management systems within changing climatic conditions.
CLO4	Plan and design infrastructure within a team environment for reduced impact logging and environment friendly forest operations.
CLO5	Devise and apply forest protection and wildlife management systems in forest communities.
CLO6	Design and conduct complex experiments, analysis and interpret data related to multi-forestry related disciplines.
CLO7	Analyze environmental, economic and social impacts from large forest operations to forestry integrated community projects.
CLO8	Develop new forest products, conduct market research and promote new and innovative wood products for the market.
CLO9	Design and transfer appropriate technology to improve forest production and product utilization within national framework policies.
CLO10	Possess the ability to communicate to a broad spectrum of audiences using multi mediums and an understanding of professional, safety and ethical responsibility.

SUBJECT DETAILS: BACHELOR OF SCIENCE DEGREE IN FORESTRY – SUBJECT SPECIFICATIONS FOR YEAR 1, 2, 3 AND 4

YEAR 1 SUBJECT SPECIFICATIONS:

FR111: BIOLOGY (PLANT AND ANIMAL)

Course (s)	Forestry (NQF Level 7)
Subject Name	Biology (Plant and Animal)
Subject Code	FR111
Duration	13 teaching weeks
Contact Hours	6 Hours per week (3 Lecture + 3 Lab.)
Credit Points	16
Delivery Mode	On campus
Prerequisites	Grade 12 Biology
Co-requisites	
Subject Coordinator	TBA

Synopsis:

This subject deals with basic theory of origins of plants and animals; cell biology, chemistry, cell respiration, enzymes, metabolic processes; bio-chemical pathways in photosynthesis; plant structure & function; plant evolution, diversity & classification; plant growth & hormones; micro-organisms (bacteria, viruses, fungi, nematodes & mycoplasmas); Outline of animal chemistry, cell, tissues and organs. Introduction to animal physiological systems; digestion, circulation, nervous, endocrine, locomotion, skeletal, respiratory, excretion and reproduction; Introduction to genetics; mitosis and meiosis, inheritance, pattern and chemistry of inheritance. Application of animal biology in forestry and agriculture.

Subject Topics:

1. Evolution, Diversity and Classification
2. Cell Types, Structure and Functions
3. Physio-chemical Processes
4. Genetics, Inheritance and Reproduction
5. Micro-organisms

Subject Outline:

Topic	Content
1. Evolution, Diversity and Classification	• Evolution of Terrestrial Plants • Plant Reproduction: Alternation of Generation • Formation of Pollen Grains and Ovules • Classification of Plant Divisions and. Groups
2. Cell Types, Structure and Functions	• Prokaryotic and Eukaryotic Cells • Plant and Animal Cells • Cell Structure, Organelles and Functions • Cell Metabolism and Enzymes • Cell Respiration
3. Physio-chemical Processes	• Ecology, Physiology and Reproduction of common endangered/endemic animal species in Papua New Guinea
4. Genetics, Inheritance and Reproduction	• External and Internal Fertilization • Genes and Chromosomes • Meiosis and Mitosis • Sex-Linked Characteristics • Animal Hormones, Tissues Organs and Functions
5. Micro-organisms	• Bacteria and Virus • Algae, Fungi and Lichens

	• Symbiotic Relationships • Microbiological Techniques

Subject Learning Outcomes (SLOs)

On completion of this subject, students should be able to:

1. Differentiate between prokaryotic and eukaryotic cells. Know and comprehend eukaryotic cell structure and basic physio-chemical processes that function in plants and animals.
2. Comprehend characteristics and importance of micro-organisms and their importance on products and ecological roles with other organisms and environment.
3. Examine and describe plant structure, function and growth hormones.
4. Explain basic principles underlying plant evolution, diversity and classification.
5. Comprehend and explain basic science and principles of genetics and inheritance including differentiation between mitosis and meiosis.
6. Know animal chemistry, and functions of tissues and organs.
7. Understand basic animal physiological systems.
8. Analyse the eco-physiology and reproduction of important or endangered species of animals which have economic, social, and ecological and conservation values in PNG.
9. Understand and demonstrate the applications of animal biology in Forestry.

Assessment Tasks and Weightings:

To obtain a pass grade in this Subject at least 50% overall and at least 30% for the Final Exam must be achieved.

Continuous Assessment:	50%
Final Exam:	50%

Students must also refer to the Subject Assessment Details.

Tests/Quiz:	26%
Assignments:	14%
Lab. Practical:	10%
Final Exam:	50%

Note: This subject is coordinated by the School of Forestry and will be taught by both the School of Forestry and the School of Agriculture.

Assessment 1 – Test 1, 7% (Plant Biology)

Assessment 2 – Test 2, 7% (Animal Biology)

Assessment 3 – Quiz 1, 6% (Plant Biology)

Assessment 4 – Quiz 2, 6% (Animal Biology)

Assessment 5 – Assignment 1, 7%: Structure and functions of different cell organelles found in a Eukaryotic cell. Individual student task: Students will be given an assignment on Plant Hormones and Functions. Strict penalty will be given for plagiarism. Students will write down functions of different plant hormones in their own words which will help them to comprehend and understand plant hormones and their functions. (Plant Biology).

Assessment 6: Assignment 2, 7%: Eco-physiology and reproduction of important animals which have economic, social, and ecological and conservation values in PNG. Individual students will be asked to do research on different important or endangered species of animals relating to their ecology, habitat, physiology and reproduction which have economic, social, ecological and conservation values in PNG and do short presentation. (Animal Biology).

Assessment 7: Practical - Enzyme Activity of Salivary Amylase (2%). Students will work in groups. They will write formal scientific laboratory report. Rubrics will be used for assessment (Plant Biology).

Assessment 8: Practical - Photosynthesis (3%). Students will work in groups. They will write formal scientific laboratory report. Rubrics will be used for assessment (Plant Biology).

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload:

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book:

Mauseth, J.D. (2014). Botany: An Introduction to Plant Biology, 5th Edition, Jones & Bartlett Learning,

References

1. Cleveland, P., Susan K., & Allan, L. (2014). Integrated Principles of Zoology. 16th Edition.
2. Cole, T.C.H., & Hilger, H.H. (2010). Angiosperm Phylogeny-Flowering Plant Systematics.
3. Mauseth, J.D. (2014). Botany: An Introduction to Plant Biology, 5th Edition, Jones & Bartlett Learning,
4. Pokon, P. (2013). FR111 Plant Sciences Lab. Manual, edited by Rapo Pokon, 2013.
5. Richard, H., Gordon, W., & Margaret, A. (2016). Animal Physiology. 4th Edition, Sinauer and Associates.
6. Roberts M.B.V. (1986). Biology: A Functional Approach. (4th Ed.).ELBS.

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

FR121: FOREST BOTANY

Course (s)	Forestry (NQF Level 7)
Subject Name	Forest Botany
Subject Code	FR121
Duration	13 teaching weeks
Contact Hours	Hours per week 6 (3 lectures +2 lab +1 project)
Credit Points	18
Delivery Mode	On campus
Prerequisites	FR111 Biology
Co-requisites	
Subject Coordinator	TBA

Synopsis:
This subject aims to extend further from Biology by focusing on tree growth, taxonomy, systematics, phylogeny, morphology, identification, herbarium, specimen collection and preservation. It also aims to develop essential skills needed to identify common plant species in forests, especially plants which are of economic and ecological importance.

Subject Topics:
1. Importance and Disciplines of Botany
2. Principles of Taxonomy; Angiosperm, Phylogeny and Systematics, Tree Morphology, Terminology and Descriptions, and Dichotomous Key
3. Herbarium, Arboretum and Botanical Garden
4. Tree Growth and Development
5. Primary and Secondary Growth in Tree Stem
6. Principles of ecology

Subject Outline:

Topic	Content
1. Importance and Disciplines of Botany	• Importance of Botany • Sub-disciplines of Botany
2. Principles of Taxonomy; Angiosperm, Phylogeny and Systematics, Tree Morphology, Terminology and Descriptions, and Dichotomous Key	• Principles of Taxonomy • Inter-related fields of taxonomy • Taxonomic levels of plant classification and Documentation • Binomial nomenclature • Scientific names and Authors • Principal of Priority & Synonyms • The Type Method • Dichotomous Key • Morphological terminologies • Characteristics of different Orders of Angiosperms
3. Herbarium, Arboretum and Botanical Garden	• Function and importance of Herbarium • Plant collection, pressing, drying, mounting, field data, storage • Importance and functions of Arboretum and Botanical Gardens
4. Tree Growth and Development	• Embryogenesis • Organogenesis • Stages of tree growth • Reproductive phases • Morphological variations in growth stages
5. Primary and Secondary Growth in Tree Stem	• Growth and functions of stems • Primary meristem • Secondary meristem • Primary tissue • Secondary tissue • Periderm and bark • Wood anatomical structure and function
6. Principles of Ecology	• Basic principles and concepts of ecology • Physiology and Reproduction of common endangered/endemic animal species in Papua New Guinea

Subject Learning Outcomes (SLOs):

On completion of this subject, students should be able to:

1. Understand and comprehend principles of taxonomy and its application used in various aspects of plant classification.
2. Use tree morphological characters in tree descriptions and identification.
3. Know floral morphology and comprehend factors associated in pollination and Fertilization.
4. Understand and comprehend functions of Herbarium; techniques employed in specimen collection and storage; differentiate between Botanical Gardens and Arboretum.
5. Understand and comprehend the growth, reproductive and morphological stages of trees; differentiate between primary and secondary growth in tree stem; know specialized tissues and cells found in wood with their functions.
6. Know basic principles and concepts of plant ecology.

Assessment Tasks and Weightings:

To obtain a pass grade in this Subject at least 50% overall and at least 30% for the Final Exam must be achieved.

Continuous Assessment:	50%
Final Exam:	50%

Students must also refer to the Subject Assessment Details.

Tests & Quiz:	20%
Assignments:	10%
Lab. Practical:	10%
Project:	10%
Final Exam:	50%

Assessment 1 – Test 7%

Assessment 2 – Quiz 6%

Assessment 3 – Test 7%

Assessment 4 – Assignment (10%): Cell structure in wood and their functions. Individual students will be asked to describe and state functions of different types of tissues and cells found in wood of trees.

Assessment 5 – Practical (10%): Plant Morphology and Systematics: Individual students will observe specimens of vegetative and reproductive parts of Gymnosperms and Angiosperms and describe them. Also, students will collect plant specimens for pressing, drying and preserving for Herbarium collection.

Assessment 6 – Project (10%): A team-based project tasked to develop mini database by taking photos of trees of Unitech campus. Students will use simple webpage HTML format. Steps for designing web-based couplet and dichotomous key will be demonstrated in class prior to project. Each team member will contribute and do presentation after completing their project for description and identification of trees linked to tree photos.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism www.unitech

Student Workload:

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Mauseth, J.D. (2014). Botany: An Introduction to Plant Biology.5th Edition, Jones & Bartlett Learning.

References:

1. Cole, T.C.H., & Hilger, H.H. (2010). Angiosperm Phylogeny-Flowering Plant Systematics.
2. Conn, J.B. (1979). Botany, Training Manual for the Forestry College. Vol. 12, Office of Forests, PNG
3. Mauseth, J.D. (2014). Botany: An Introduction to Plant Biology. 5th Edition, Jones & Bartlett Learning.
4. Pokon, P. (2013). FR111 Plant Sciences Lab. Manual. edited by Rapo Pokon

Relevant Unitech Policies:

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism which can be accessed at www.unitech.ac.pg/AssessmentGuide/ and www.unitech.ac.pg/Plagiarism/

FR122: INTRODUCTION TO FORESTRY

Courses (s)	Forestry (NQF Level 7)
Subject Name	Introduction to Forestry
Subject Code	FR122
Duration	13 teaching weeks
Contact hours	Hours per week 6 (3 lect+1 tut+2 projects)
Credit Points	17
Delivery Mode	On campus
Prerequisites	Grade 12
Co requisites	
Subject Coordinator	TBA

Synopsis:

This subject provides students with an overview of the whole field of forestry so as to prepare them to appreciate the individual forestry subjects as they are taught in subsequent years. The role of professionals in a society is explored along with the social, political and economic issues may influence the role

Subject Topics:

1. An introduction to world climate and vegetation types, Climate Change, vegetation and forests of Papua New Guinea
2. Introduction to professional conducts and ethical forestry practices
3. Team Building in Forestry Teams, theories of development and the role of media communication in Foresters' world
4. Sustainable forestry practice in social, economic and political contexts
5. Social Change & Technology in economic and political context of society
6. Forestry field activities, forest assessment
7. Management and utilisation of the forest resources
8. Introductions to some specialized forests
9. Future trends in Forestry and role of research are also covered.

Subject Outline:

Topic	Content
An introduction to world climate and vegetation types	• World Climate • Climate Change • Climate, Vegetation and forests of Papua New Guinea
Introduction to professional conducts and ethical forestry practices	• Background and introduction to professional conduct in forestry • What is Ethics? • What is ethical conduct
Team Building in Forestry Teams,	• theories of development • the role of media communication in a Foresters' world
Sustainable forestry practice in social, economic and political contexts	• Embryogenesis • Organogenesis • Stages of tree growth • Reproductive phases • Morphological variations in growth stages
Social Change & Technology in	• Introduction to social change and technology in Forestry • Economic and political context of forestry

economic and political context of society	• Introduction to social and community forestry • Community livelihoods
Forestry field activities, forest assessment	• Introduction to forestry field activities • Introduction to forest assessment
Management and utilization of the forest resources	• Background, Introduction, Definitions • Why do Forest Management? • How to do Forest Management? • Forest Management Systems (overview)
Introductions to some specialized forests	• Background and introduction to specialized forests • Forests dominated by one particular tree species
Future trends in Forestry and role of research.	• The future of forest management • Problems associated with natural forest management • What is research? • Why do research • Research and Development (R & D)

Subject Learning Outcomes (SLOs):

After completing this unit students will possess the skills and knowledge to:

1. Describe the occurrence of forest in the world and PNG and the environmental conditions in which they appear
2. Demonstrate various concepts of professional and ethical conducts and practices in this contemporary forestry and development context. Including team building, relationship and stakeholder engagement behaviours in forestry and development problem solving situation.
3. Research the range of environmental, technical and social elements involved in forestry challenges.
4. Apply skills in accessing, evaluating and summarizing information to communicate ideas and present arguments.
5. Apply a variety of Forestry Practices and strategies to meet forestry needs in complex social, political, economic and environments.
6. Investigate, analyses and use a range of communication skills (speaking, writing, drawing and listening); and select and apply appropriate channels of communication in the sustainability process.

Assessment Tasks and Weightings:

Continues Assessment:	50%
Final Exam:	50%

Students must also refer to the Subject Assessment Details.

Essay Paper:	10%
Test (x2):	20%
Major Project:	20%
Final Exam:	50%

To obtain a pass grade in this Unit 50% overall must be achieved.

Unit Assessment consists of reports and a presentation as summarised below. Students must also refer to the Assignments and the Subject Assessment Guide for detailed information on each assignment.

Assignment 1 – A short Essay Paper: A concept-based essay paper outlining students' understanding of general concepts, definitions and explanations relevant to themes / topics 1 & 2 covered in the lectures. In this case it relates to introduction of world and PNG forest and climates with professional conducts and ethical practices, their roles in the society covered and team building. The essay contributes 10% towards the final grade for the subject.

Assignment 2 – Unit Test 1: A concept based closed book assessment, testing students' abilities and comprehension of various concepts covered in the lecture topics. The test contributes 10% towards the final grade for the subject.

Assignment 3 – Major Project report: A professional level project report with individual and team components that outlines and communicates the project design/initiation processes, objectives, rationale and outcomes. The major report contributes 20% towards the final grade for the subject.

Assignment 4 –Unit Test 2: concept based closed book assessment, testing students' abilities and comprehension of various concepts covered in the lecture topics. The test contributes 10% towards the final grade for the subject.

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:

The total workload for the average student is a nominal 150 hours based on a 15 week semester with 13 weeks of teaching as per PNG National Qualifications Framework

Subject Textbook:

DeVere Burton, L. (2000). Introduction to Forestry Science. Delma Publishers, Mexico

References:

1. Anderson, D. A. and Holland I.I., (1982). Forest and Forestry. Interstate Printers and Publishers, Inc., Illinois.
2. DeVere Burton, L. (2000). Introduction to Forestry Science. Delma Publishers, Mexico
3. Tesseverasinghe, K. (1988). Introduction to Forestry. PNG University of Technology, Lae.
4. Ukaga, O., Maser. C. and Reichenbach.M. (2010). Sustainable Development: Principles, Frameworks, and Case Studies (Social Environmental Sustainability). 1st Edition, CRC Press, Kindle Edition, 424pp
5. United Nations. (2017). The sustainable development goals report. Retrieved January 19, 2018. Cited:
   hptt://sdgactioncampaign.org/wpcontent/uploads/2017/07/The Sustainable Development Goals Report 2017.pdf
6. Watson, J., (2008). Media communication: an introduction to theory and process. (3rd edition), Palgrave Macmillan; Basingstoke (UK) & New York (NY).

Relevant Unitech Policies:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR123: BIOLOGY FOR APPLIED SCIENCES – SERVICE SUBJECT

Course (s):	Forestry (NQF Level 7)
Subject Name:	Biology for Applied Sciences
Subject Code:	FR123
Duration:	13 Teaching weeks
Contact Hours:	6 hours per week (3 Lecture + 3 Lab.)
Credit Points:	16
Delivery Mode:	On campus
Prerequisites:	Grade 12 Biology
Co-requisites:	
Subject Coordinator:	TBA

Synopsis:

This subject deals with basic theory of origins of plants and animals; cell biology, chemistry, cell respiration, enzymes, metabolic processes; bio-chemical pathways in photosynthesis; plant evolution, diversity & classification; plant growth; micro-organisms (bacteria, viruses, fungi, nematodes & mycoplasmas); bio-geochemical cycles; outline of animal chemistry, cell, tissues and organs. Introduction to animal physiological systems; digestion, circulation, nervous, endocrine, locomotion, skeletal, respiratory, excretion and reproduction.

Subject Topics:

1. Evolution, Diversity and Classification
2. Cell Types, Structure and Functions
3. Physio-chemical Processes
4. Introduction to Animal Physiological Systems.
5. Micro-organisms
6. Bio-geochemical Cycles

Subject Outline:

Topic	Content
Evolution, Diversity and Classification	• Evolution of Terrestrial Plants. • Plant Reproduction: Alternation of Generation • Formation of Pollen Grains and Ovules. Classification of Plant Divisions and Groups
Cell Types, Structure and Functions	• Prokaryotic and Eukaryotic Cells • Plant and Animal Cells • Cell Structure, Organelles and • Functions • Cell Metabolism and Enzymes • Cell Respiration
Physio-chemical Processes	• Extenal and Internal Fertilization • Genes and Chromosomes • Meiosis and Mitosis • Sex-Linked Characteristics • Animal Hormones. Tissues, • Organs and Functions
Introduction to Animal Physiological Systems.	• External and Internal • Fertilization • Genes and Chromosomes • Meiosis and Mitosis • Sex-Linked Characteristics • Animal Hormones. Tissues, • Organs and Functions

Micro-organisms	• Bacteria and Virus, • Algae, Fungi and Lichens • Symbiotic Relationships • Microbiological Techniques
Bio-geochemical Cycles	• Ecology, Physiology and Reproduction of common endangered, /endemic animal species in Papua New Guinea

Subject Learning Outcomes (SLOs):
On completion of this subject, students should be able to:

1. Differentiate between Prokaryotic and Eukaryotic cells. Know and comprehend eukaryotic cell structure and basic physio-chemical processes that function in plants and animals.
2. Comprehend characteristics and importance of micro-organisms and their importance on products and ecological roles with other organisms and environment.
3. Understand basic principles underlying plant evolution, diversity and classification. 4. Know some vital bio-geochemical cycles (Carbon, Oxygen, Nitrogen, Phosphorus)
5. Know animal chemistry and functions of tissues and organs.
6. Understand basic animal physiological systems.

Assessment Tasks and Weightings:

Continuous Assessment:	50%
Final Exam:	50%

Students must also refer to the Subject Assessment Details.

Tests (x2):	14%
Quizzes (x2)	12%
Assignments (x2):	14 %
Lab. Practical (x2):	10%
Final Exam:	50%

To obtain a pass grade in this Unit 50% overall must be achieved.

Note: This subject is coordinated by the School of Forestry and will be taught by both the School of Forestry and the School of Agriculture.

Assessment 1 – Test 1, 7% (Forestry staff)
Assessment 2 – Test 2, 7% (Agriculture staff)
Assessment 3 – Quiz 1, 6% (Forestry staff)
Assessment 4 – Quiz 2, 6% (Agriculture staff)
Assessment 5 – Assignment 1, 7%: Microorganisms – Essay. Individual student task: Students will be given an assignment to write comprehensive essay on specific characteristics of different microorganisms (bacteria, fungi, virus, nematodes and mycoplasmas). Strict penalty will be imposed to avoid plagiarism. Students will do literature citations to explain specific characteristics for each type of microorganisms in their own words. (Forestry staff).

Assessment 6: Assignment 2, 7%: Osmoregulation in Vertebrates – Essay. This assignment relates to Animal Physiology (Agriculture Staff)

Assessment 7: Practical - Photosynthesis (5%). Students will work in groups but have to write individual reports. The formal scientific laboratory report format must be followed to write the report. (Forestry Staff).

Assessment 8: Practical - Enzyme Activity of Salivary Amylase (5%). Students will work in groups but have to write individual reports. The formal scientific laboratory report format must be followed to write the report (Agriculture Staff).

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:
The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Textbook:
1. Mauseth J.D. (2014). Botany. An Introduction to Plant Biology, 5th Edition, Jones & Bartlett Learning.
2. FR111 Plant Sciences Lab. Manual (2013). Edited by Rapo Pokon. PNG Unitech.

References:
3. Mauseth J.D. (2014). Botany. An Introduction to Plant Biology, 5th Edition, Jones & Bartlett Learning.
4. Huxley L. M. (1999). Biology. An Australian Perspective. Oxford University Press. Roberts M.B.V. (1986). Biology: A Functional Approach. (4th Ed.). ELBS.
5. FR111 Plant Sciences Lab. Manual (2013). Edited by Rapo Pokon. PNG Unitech.
6. Cole T.C.H. & Hilger H.H. (2010). Angiosperm Phylogeny-Flowering Plant Systematics. Kew Publishing.
7. Cleveland P., Susan K., Allan L. (2014). Integrated Principles of Zoology. 16th Edition. McGraw Hill.
8. Richard H., Gordon W., Margaret A. (2016). Animal Physiology. 4th Edition. Sinauer and Associates

Relevant Unitech Policies:
It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

YEAR 2 SUBJECT SPECIFICATIONS:

FR211: FOREST ECOLOGY

Course (s)	Forestry (NQF Level 7)
Subject Name	Forest Ecology
Subject Code	FR211
Duration	13 teaching weeks
Contact hours	Hours per week 6 (3 lect+3 Prac. /Projects)
Credit Points	16
Delivery Mode	On campus
Prerequisites	FR 111 Biology & FR 122 Forest Botany
Co requisites	
Subject Coordinator	TBA

Synopsis:

This subject provides students with the basic knowledge and understanding of the different ecological processes that occur in the forest ecosystem. It builds on a study of interactions that occur between plants and their living (biotic) and non-living (abiotic) environment, and the ways in which these interactions affect the distribution and abundance of plant and animal communities in Papua New Guinea. Students are introduced to the concepts of ecology as a basis for sustainable forest management and conservation. Students are also introduced to the scientific method analysis in preparation for effective problem solving in ecology and other scientific disciplines.

Subject Topics:

1. Introduction to Forest Ecology
2. Ecological Interactions
3. Biomes and Forest Structure
4. Forest Dynamics, Energy flow in the ecosystem and biochemical cycling
5. Global warming and its effects on the tropical rainforest
6. Conservation and application of ecology to forestry (eco-forestry)

Subject Outline:

Topic	Content
1. Introduction to Forest Ecology	• Course Outline and Introduction to Ecology • Scientific methods and skills: Referencing style, critical thinking, • Observation inferences and note taking.
2. Ecological Interactions	• Predation & parasitism • Competition and Mutualism. • Pollination ecology, seed dispersal ecology,
3. Biomes and Forest Structure	• Regions, Biomes, The Tropics • Biosphere: Global warming & its effects. • Understand the causes and effects of global warming. • Understand and appreciate the importance of ecology in forest management to achieve
4. Forest Dynamics, Energy flow in the ecosystem and biochemical cycling	• Eecosystems: Energy flow • Food chains/webs/pyramids, production ecology. • Food webs/pyramids, Production ecology. • Biochemical cycling (Nitrogen, water, Carbon). • PNG terrestrial ecosystems (mangroves forest) • elevational • Landscape
5. Global warming and its effects on the tropical rainforest	• Establish basic understanding of ecological interactions between species and populations and adaptation • Production Ecology and Food Webs

	• Life History Strategy Classification
6. Conservation and application of ecology to forestry (eco-forestry)	• Introduction to forest conservation • Application of Ecology to forestry • What is Eco-forestry

Subject Learning Outcomes (SLOs):

After completing this unit students will possess the skills and knowledge to:

1. Describe how various factors (biotic and abiotic) such as topography, climate, soils and organisms affect distribution, abundance and structure of plant communities.
2. Explain the origin, distribution, structure and floristic of Papua New Guinea forest communities.
3. Demonstrate an understanding of the impacts that various land uses, natural events and disturbances have on forest ecosystems and how forest types recover after disturbances through the process of ecological succession.
4. Describe energy flow in a community through the use of food webs and food pyramids and biochemical cycling
5. Summarize key features of the primary life history strategy classification systems
6. Become familiar with the main flower and seed/fruit characteristics for principle pollination and seed dispersal syndromes.

Assessment Tasks and Weightings:

Continues Assessment:	60%
Final Exam:	40%

Students must also refer to the Subject Assessment Details;

Practical	10%
Essay	10%
Test 1	15%
Presentation	10%
Test 2	15%
Examination	40%

To obtain a pass grade in this Unit 50% overall must be achieved.

Unit Assessment consists of; field practicals, assignments and tests as outlined below. Students must also refer to the subject assessment guide for detailed information on each assessment.

Assessment 1 – Field Practicals: Concept based (8x field practicals) assessing student's ability to actively participate and to produce a written piece in each field practical to reinforce concepts learnt in lectures. The field practicals will be administered over the duration of the semester. The field practicals contribute 10% towards the final grade for the subject.

Assessment 2 – Essay Paper: A concept-based essay paper outlining students' understanding of global warming and its effects on forest dynamics and how the tropical rainforest will respond to the effects of global warming. The essay contributes 10% towards the final grade for the subject.

Assessment 3 – Unit Test 1: A concept based closed book assessment, testing students' abilities and comprehension of various concepts covered in the lecture topics. The test contributes 15% towards the final grade for the subject.

Assessment 4 – Presentation: A concept-based presentation outlining students' ability to research important topics in ecology and to do effective power point presentations. The presentation contributes 10% towards the final grade for the subject.

Assessment 5 –Unit Test 2: concept based closed book assessment, testing students' abilities and comprehension of various concepts covered in the lecture topics. The test contributes 15% towards the final grade for the subject.

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism.

Student Workload:

The total workload for the average student is a nominal 150 hours based on a 15-week semester with 13 weeks of teaching as per PNG National Qualifications Framework

Subject Text Book:
Osborne, P. L. (2000). Tropical Ecosystems and Ecological Concepts. Cambridge Univ. Press.

References:

1. Ghazoul, J & D. Sheil (2010). Tropical Rain Forest Ecology, Diversity, and Conservation. Oxford Univ. Press.
2. Primack, R & R. Corlett (2005). Tropical Rain Forests. An Ecological and Bio geographical Comparison. Blackwell Publishing.
3. Young, R.A. & Giese, R.L. (Eds) (2003). Introduction to Forest Ecosystem Science and Management. United States, John Wiley & Sons
4. Osborne, P. L. (2000). Tropical Ecosystems and Ecological Concepts. Cambridge Univ. Press.
5. Whitmore, T.C, (1998). An Introduction to Tropical Rain Forests. Oxford Univ. Press.

Relevant Unitech Policies:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR212: FOREST SURVEYING

Course (s)	Forestry (NQF Level 7)
Subject Name	Forest Surveying
Subject Code	FR212
Duration	13 weeks
Contact hours	Hours per week 6 (3 lect+3 Prac)
Credit Points	16
Delivery Mode	On campus
Prerequisites	MA186 Mathematics for Natural Resource (Forestry)
Subject Coordinator	TBA

Synopsis:

This subject introduces students to the role that surveying plays in providing the essential methods in data collection for plans and maps, while at the same time maintaining a certain level of accuracy in the production of these maps and plans. The subject will utilize practical exercises to teach students the use of surveying equipment's and train students in the translation of maps and plans to ground surfaces. Furthermore, the subject will also train students to achieve an acceptable level of competency in basic surveying skills, such that students can successfully integrate and apply those skills in other subjects and field exercises.

Subject Topics:

1. Fundamentals of surveying;
2. Map Reading: Read and interpret maps;
3. Use of compasses, clinometers and survey chains; Calculation of horizontal and slope distance; correction for error, measurement of slope; correction for slope.
4. Closed and open traverse surveys; Recording data in a standard survey field book.
5. Precision and accuracy.
6. Drafting plans from survey data, error adjustment/corrections.
7. Introduction to GPS and Data collection using GPS

Subject Outline:

Topic	Content
1. Fundamentals of Surveying	• Introduction to Surveying • Surveying Principles • Surveying in forestry context
2. Map Reading: Read and interpret maps	• Scales for maps and plans • Standard topographic maps of scale 1:100,000 • Longitudes and Latitudes
3. Use of compasses, clinometers and survey chains	• Calculation of horizontal and slope distance; • Correction for error, • Measurement of slope; • Correction for slope.
4. Closed and open traverse surveys;	• Introduction to open and traverse surveys • Recording data in a standard survey field book.
5. Precision and accuracy.	• Describe the accuracy of various equipment and instruments used in surveying • Precision levels and methods • Performing the basic calculations in surveying
6. Drafting plans from survey data.	• Introduction to drafting • Using survey data for drafting • Error adjustment and corrections.
7. Introduction to GPS and Data collection using GPS	• Introduction to the Global Positioning System • Field data collection using GPS • Data processing • Map creation

Subject Learning Outcomes (SLOs):

After completing this unit students will possess the knowledge and skills and to:

1. Understand the basic surveying principles employed and produce maps/plans to an acceptable accuracy level.
2. Read and interpret maps and select appropriate scales for maps and plans;
3. Show proficiency in the use of compasses, clinometers and survey chains (survey Instruments); and describe the accuracy of various equipment and methods and perform the basic calculations (area, distance corrections, slope corrections) needed to analyze data from maps and plans;
4. Organize a field crew to complete a basic chain and compass survey in a forest environment, and carry out closed and open traverses using standard recording systems in a survey book.
5. Show proficiency in the use of GPS as a data collection tool for other applications in GIS

Assessment Tasks and Weightings:

Continues Assessment: 50%
Final Exam: 50%

Students must also refer to the Subject Assessment Details;

Assignment (x2) 10%
Test (x2) 20%
Major Project 20%
Examination 50%

To obtain a pass grade in this Unit 50% overall must be achieved.

Unit Assessment consists of assignments, tests and a major project that is the production a plan (map) of a designated area or a piece forested area as summarized below. Students must also refer to the Assignments and the Subject Assessment Guide for detailed information on each assignment.

Assignment 1 – Use of Compass, Clinometer, Scale, slope and distance measurement This assignment will be introduced after the students have covered topics 1 and 2 (5%).

Assignment 2 – Unit Test 1:

This test will cover all the topics that have been covered so far and will include topics 1, 2 and 3 (10%).

Assignment 3 – Calculations based on slope distance, angle calculations, coordinate calculations and area calculation (5%).

Assignment 4 – Unit Test 2:

This will include all topics covered in the course (10%).

Assignment 5 – Major Project (Map/Plan production of a designated forested area) This is a major project which will require each student must produce a map (plan) (20%).

Students will be divided into groups of 5 members each and given an area to be surveyed after collecting the necessary data the groups data will be shuffled and each group will then plot the data of the other group selected. Any discrepancies found in the data collected, the original group must go back and redo the survey.

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:

The total workload for the average student is a nominal 150 hours based on a 15 week semester with 13 weeks of teaching as per PNG National Qualifications Framework.

Subject Textbook:

Kiser, J. D. 2010. Surveying for Forestry and the Natural Resources. 2nd edition. John Bell and Assoc. Corvallis, Oregon. 276 pages.

References:

1. Kiser, J. D. 2006. Surveying for Forestry and the Natural Resources. John Bell and Assoc. Corvallis, Oregon. 209 pages.
2. Kiser, J. D. 2010. Surveying for Forestry and the Natural Resources. 2nd edition. John Bell and Assoc. Corvallis, Oregon. 276 pages.
3. Paine, D.P. and J. D. Kiser. 2003. Aerial Photography and Image Interpretation (2nd Ed.). John Wiley, Inc. New York. 632 pages.
4. Paine, D.P. and J. D. Kiser. 2012. Aerial Photography and Image Interpretation (3rd Ed.). John Wiley, Inc. New York. 632 pages.
5. Eaton, P., (1982). A Guide to Maps and Map Reading in PNG.
6. Training Manual for Forestry School, Forest Surveying, Vol. 2.
7. Wilson, R.J.P., (1983). Land Surveying. (3'd edition).

Relevant Unitech Policies:

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.og (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR213: FOREST MENSURATION

Course (s)	Forestry (NQF Level 7)
Subject Name	Forest Mensuration
Subject Code	FR213
Duration	13 weeks
Contact hours	Hours per week 6 (2 lect+2 tut+2 practicals)
Credit Points	15
Delivery Mode	On campus
Prerequisites	MA116 Mathematics for Nat Res. (Forestry) and CS 113 Introduction to Information Technology
Co requisites	
Subject Coordinator	TBA

Synopsis:

For sustainable management of forest ecosystems, foresters need to measure trees and forests accurately. This subject aims to enhance student understanding and appreciation of the need for quantitative data based on accurate measurements. The subject will cover measurement of single tree parameters such as height, diameter and basal area, and the calculation of stand variables such as predominant height, volume, and growth rate. All students must demonstrate competencies in practice and applications required in the subject. Knowledge and skills required in this subject will be gained in lectures, field practicals and the computer lab.

Subject Topics:

1. Principles of Measurement
2. Individual Tree Parameters
3. Determination of Tree Volume and Weight
4. Stand Parameters, dominant heights, stand structure, density, site quality and yield
5. Measurement of Primary Forest Products
6. Growth of the tree and stand growth
7. Stand structure, density, site quality and yield

Subject Outline:

Topic	Content
1. Principles of Measurement	• Introduction to principles of measurement • Theory and practice of measuring a forest stand • Standing tree measurement • Log measurement
Individual Tree Parameters	• Measuring tree dimensions • Diameter and dbh • Bark thickness • Tree height • Tree basal area • Tree volume calculation • Measuring crown dimensions.
Determination of Tree Volume and Weight	• Forest stand volume • Measuring a forest • Stand tables and volume tables
Stand Parameters	• Dominant tree heights • Stand structure • Density, site quality and yield • Site index and crown cover.
Measurement of Primary Forest Products	• Introduction to Primary Forest Products • Timber Sawn timber • Biomass

Growth of the tree and stand growth	• Establishing and measuring field plots • Recording data from plots • Draw maps • Use of different measuring instruments.
Stand structure, density, site quality and yield	• Introduction to stand structure of tropical forest • Total tree height and site quality • Measuring yield

Subject Learning Outcomes (SLOs):

On completion of this subject, students will be able to:

1. Describe basic tree geometry, stem form and taper, defects, and know the various methods for accurately measuring and calculating volume height, length, diameter and basal area for individual trees, and stands;
2. Measure tree and stand parameters in the field, record the data; accurately, and process it to derive stand variables;
3. Measure logs using different available methods;
4. Quantify different forms of lumber; and
5. Display competencies in using various measuring instruments.

Assessment Tasks and Weightings:

Continues Assessment:	50%
Final Exam:	50%

Students must also refer to the Subject Assessment Details;

Essay	10%
Test 1	15%
Practical	10%
Test 2	15%
Examination	50%

To obtain a pass grade in this Unit 50% overall must be achieved.

Unit Assessment consists of reports and a presentation as summarised below. Students must also refer to the Assignments and the Subject Assessment Guide for detailed information on each assignment.

Assessment Task 1- A short Essay Paper: An essay will be given with a specified word length. This will enable students to do as much information retrieval and integration, and presentation of these information succinctly and critically. The essay contributes 10% towards the final grade for the subject.

Assessment Task 2- Unit Test 1: A concept based closed book assessment, testing students' abilities and comprehension of various concepts covered in the lecture topics. The test will be given in midway through the course. The test contributes 15% towards the final grade for the subject.

Assessment Task 3- Field Practical Report: Professionally present data and information in a form consistent with technical report writing. This assessment task contributes 10% towards the final grade for the subject.

Assessment Task 4 - Test 2: concept based closed book assessment, testing students' abilities and comprehension of various concepts covered in the lecture topics. The test will be given in midway through the course, when the semester is about to end. The test contributes 15% towards the final grade for the subject.

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.og

Student Workload:

The total workload for the average student is a nominal 150 hours based on a 15 week semester with 13 weeks of teaching as per PNG National Qualifications Framework

Subject Textbook:

Philip, M.S., (1994). Measuring Trees and Forests. CAB International.

References:

1. Bertram, H., T. W. Beers, and J. A. Kershaw Jr. (2003). Forest Mensuration, 4th ed. Wiley & Sons, New Jersey.
2. Philip, M.S., (1994). Measuring Trees and Forests. CAB International.
3. West, P. W. (2009). Tree and Forest Measurement. 2nd ed. Springer, Berlin.

Relevant Unitech Policies:

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.og (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR214: DENDROLOGY

Course (s)	Forestry (NQF Level 7)
Subject Name	Dendrology
Subject Code	FR214
Duration	13 teaching weeks
Contact Hours	Hours per week 6 (2 lecture +2 tut +2 field)
Credit Points	15
Delivery Mode	On campus
Prerequisites	FR121 Forest Botany; FR111 Biology (Animal and Plant Biology)
Co-requisites	
Subject Coordinator	TBA

Synopsis:

This subject deals with tree identification and students will be exposed to techniques using morphological, ecological, and phonological traits (characteristics) useful in the identification of commercial trees of Papua New Guinea. This subject also aims to provide students with the technical skills that will enable them to accurately identify the commercial tree species.

Subject Topics:

1. Introduction, classification (systematics) and nomenclature.
2. Identification techniques and terminology in tree identification.
3. Gymnosperms (Conifer ales and Gentiles), the characteristics of families and genera.
4. Angiosperms (about 25 Orders of commercial trees), the characteristics of families and genera.

Subject Outline:

Topic	Content
Introduction, classification (systematics) and nomenclature.	• Introduction to classification and nomenclature • Classification (systematics) • Plant classification and division, gymnosperms, angiosperms, and other order of proteales.
Identification techniques and terminology in tree identification.	• Introduction to plant and tree identification • Plant and tree Identification techniques • Terminology used and applied in tree and plant identification
Gymnosperms	• What are Gymnosperms • Coniferales and Gnetales • The characteristics of families and genera.

Angiosperms.	• What are Angiosperms? • The 25 Orders of commercial trees • The characteristics of families and genera

Subject Learning Outcomes (SLOs):

On completion of this subject, students should be able to:

1. Know and list characteristics useful in distinguishing timber tree families and genera.
2. Know the scientific (family, genus and species) and trade / common names of each timber species studied in the field.
3. Identify and name each tree species studied in the field using different tree characteristics such as the overall appearance of the trees and the types of bark, wood, twig, fruit, leaf, habit, or any combination of these or other characteristics like the distinct odour and the colour of the sap.
4. Describe the tree morphology and common botanical features that aid in tree identification in PNG and construct identification keys.
5. Understand and explain the differences in the characters and relationship among the families of the commercial timber trees in PNG.
6. Use the herbarium to identify specimens of commercial timber trees of PNG as well as use of dichotomous and multi-access keys for tree identification.

Assessment Tasks and Weightings:

Continues Assessment:	50%
Final Exam:	50%

Students must also refer to the Subject Assessment Details;

Quizzes:	6%
Tests (Theory):	10%
Tests (Lab):	30%
Assignment(s):	4%
Final Exam:	50% (lab exam, 30%; theory exam, 20%)

To obtain a pass grade in this Subject, at least 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

The assessment strategy is designed to test all subject learning outcomes (SLO's). Students must demonstrate successful achievement of these learning outcomes to pass the subject.

Assessment 1 – Quiz 1, 3%: An assessment that test students' ability to know the scientific names (family, genus, species) and common / trade names of trees that are studied based on photos and slides of the trees shown on power point.

Assessment 2 – Test 1 (Lab), 10%: An assessment that test students' ability to identify live specimens of 20 to 25 trees using the tree characteristics, and correctly writing the scientific names (family, genus, species) and common / trade names of trees.

Assessment 3 – Test 1 (Theory), 5%: An assessment that is based on the theory taught in class and lectures; testing students' ability and comprehension of characteristics of families and genera / species studied in the field and in class during lectures.

Assessment 4 – Assignment 1, 4%: An assessment whereby students are tasked to construct a dichotomous key of several species of trees covered in the lab practicals to comprehend the concept of classification based on tree characteristics and relationship amongst the families and genera.

Assessment 5 – Quiz 2, 3%: An assessment that test students' ability to know the scientific names (family, genus, species) and common / trade names of trees that are studied based on photos and slides of the trees shown on power point.

Assessment 6 – Test 2 (Lab), 10%: An assessment that test students' ability to identify live specimens of 20 to 25 trees using the tree characteristics studied, and correctly writing the scientific names (family, genus, species) and common / trade names of trees.

Assessment 7 – Test 2 (Theory), 5%: An assessment that is based on the theory taught in class and lectures; testing students' ability and comprehension of characteristics of families and genera / species studied in the field and in class lectures.

Assessment 8 – Test 3 (Lab), 10%: An assessment that test students' ability to identify live specimens of 20 to 25 trees using the tree characteristics studied, and correctly writing the scientific names (family, genus, species) and common / trade names of trees.

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text Book:

1. Havel, J. J. (1975). Training Manual – Forest Botany Part 2 Botanical Taxonomy.
2. Havel, J. J. (1975). Training Manual – Forest Botany Part 2 Terminology.
3. Johns, R.J. (1976). Common Trees of PNG, Training Manual for Forestry College. Parts 1 to 12.

References:

1. Beentje, H. (2010). The Kew Plant Glossary: An Illustrated Dictionary of Plant Terms. Royal Botanic Gardens Kew.
2. Gledhill, D. (2008). The Names of Plants. 4th ed. Cambridge Univ. Press.
3. Höft, R. (1992). Plants of New Guinea and the Solomon Islands. Dictionary of the Genera and Families of Flowering Plants and Ferns.
4. Forman, L., and Bridson, D. (1989). The Herbarium Handbook. Royal Botanic Gardens, Kew, UK.

Readings:

1. An Update of the Angiosperm Phylogeny Group Classification for the Orders and Families of Flowering Plants: APG IV. Botanical Journal of the Linnean Society, 2016, **181**, 1-20 pages.
2. Angiosperm Phylogeny-Flowering Plant Systematics Chart.

Relevant Unitech Policies:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg
(http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules
(http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR221: NATURAL FOREST SILVICULTURE

Course (s)	Forestry (NQF Level 7)
Subject Name	Natural Forest Silviculture
Subject Code	FR221
Duration	13 Teaching weeks
Contact Hours	6 Hours per week (3 Lecture + 2 tut + 1 Prac)
Credit Points	18
Delivery Mode	On campus
Prerequisites	FR 123 Introduction to Forestry; FR 211 Forest Ecology
Co requisites	
Subject Coordinator	TBA

Synopsis:

This subject aims to apply the principles established in FR 123 Introduction to Forestry; FR 211 Forest Ecology. The subject is designed to enable students to develop an appropriate silvicultural plan for a nominated natural forest type. It also aims to explain how silvicultural concepts may be related to the application of the *Papua New Guinea Logging Code of Practice* and to show how timber harvesting may be used as a silvicultural tool. The subject also further aims to develop the principles and practices of natural forest silviculture by the application of ecological theory and in particular to illustrate how a knowledge of forest dynamics is used to control the growing stock in forests managed for wood production; and promote an understanding of how satisfying the silvicultural requirements of commercially desirable tree species can affect the output of non-wood goods and services from natural forests.

Subject Topics:

1. Natural forest definition; classification; influences and importance; stand structure; and composition
2. Introduction to natural forest silviculture and silviculture techniques
3. Silvicultural systems; type of harvesting systems; polycyclic and monocyclic systems
4. Silvicultural condition of forest stands
5. Natural forest regeneration
6. Forest dynamics: growth and yield of natural forest, PSPs and yield forecasting
7. Silviculture and sustainable forest management
8. PNG Logging Code of Practice and Timber Certification
9. Natural forest management and current status of logged over secondary forests in PNG

Subject outline:

Topic	Content
Natural forest definition; classification; influences and importance; stand structure; and composition	• Definition of natural forests • Distribution of tropical forests • Forest classification, influences and importance • stand structure and composition
Introduction to natural forest silviculture and silviculture techniques	• Definition, • Silviculture techniques, • Locality factors,
Silvicultural systems; type of harvesting systems; polycyclic and monocyclic systems	• Type of harvesting systems • Polycyclic Systems • Monocyclic Systems • Advantages and Disadvantages of silvicultural systems.

Silvicultural condition of forest stands	• Diagnostic sampling • Soil seed bank • Regeneration potential of forest stands
Natural forest regeneration	• Artificial regeneration • Natural regeneration • Assisted natural regeneration • Soil seed bank • Forest gaps • Enrichment Planting • Timber stand improvement
Forest dynamics: growth and yield of natural forest, PSPs and yield forecasting	• Growth and yield • PSPs • Site factors • Forest Fires and tree mortality, • Yield forecasting
Silviculture and sustainable forest management	• Ecological Benefit • Biomass • Climate change • Non-timber forest products • Minor forest products
PNG Logging Code of Practice and Timber Certification	• Silvicultural practices in minimising damages. • Forest Certification • Certification • Reduced Impact Logging.
Natural forest management and current status of logged over secondary forests in PNG	• Introduction to secondary forests • What is logged-over forest • Current status of logged over secondary forests in PNG

Subject Learning Outcomes (SLOs):

After completing this subject, students should be able to:

1. Show an appreciation of the factors and processes, including the role of animals, that determine the structure and floristic of rainforest communities.
2. Demonstrate knowledge of the major formations of wet tropical rainforests and their geographical distributions;
3. Outline silvicultural systems that have been developed for use in tropical rainforests, and their application to forest management in Papua New Guinea
4. Apply appropriate silvicultural methods within the framework provided by the PNG Logging Code of Practice
5. Assess the relative costs and efficiency of various silvicultural operations

Assessment Tasks and Weightings:

Assessment of this subject constitutes a 50% Continuous Assessment and 50% Final Examination.

Continuous assessments:	50%
Final Examination:	50%

Students must also refer to the Subject Assessment Details;

Assignment (x 2)	10%
Tests (x 2)	30 %
Practical (x 1)	10%
Final Examination	50%

To obtain a pass grade in this Subject, 50% overall must be achieved. The details of the Assessment are given below. Subject Assessment consists of two assignments; two tests; one Practical; and the final examination as detailed below;

Assessment 1. Assignment # 1: Individualised assignment report based on selection logging system as applied in tropical forests and the minimum diameter cutting limit as applied in PNG context. The objective of this Assignment is

for the student to understand the Selection Logging System (SLS) practiced in tropical forests and how a minimum diameter cutting limit is implemented during timber harvesting operations (5%).

Assessment 2. Assignment # 2: Individualised assignment report based on comparison of forest stands with the application of similarity indices. Students are provided with real dataset of stand tables from PNG's PSP network (e.g.: Oomsis and Gabensis forests) to calculate the similarity indices in order to compare the forest stands in those two forest types (5%).

Assessment 3. Test # 1: Individualised testing of a student's ability to understand the definition of natural forests in relation to FAO's forest definition and PNG's new forest definition; silviculture of natural forests; and main silvicultural systems applicable for natural forest management in the tropics (15%).

Assessment 4. Test # 2: Individualised testing of student's ability to understand the dynamics of natural forest and the associated factors that influence and control natural forest condition including; regeneration mechanisms; species diversity; and forest succession (15%).

Assessment 5. Practical # 1: Group work for students to interact with each other; do research; and present the outcome of their findings with reference to the silviculture and timber harvesting practices applied by the Timber Industry as per the PNG Logging Code of Practice (1996/2014) (10%).

Assessment 6. Final Examination: Individualised testing in the form of a final examination to assess and evaluate the ability of the student to understand; apply; and demonstrate the FR225 course undertaken in the second year of the BSc in Forestry Degree Program (50%).

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:
The total workload for the average student is a nominal 150 hours based on a 15 week semester with 13 weeks of teaching as per PNG National Qualifications Framework

Subject Textbook:

1. Whitmore, T.C. and Hadley M., (1991). Rainforest Regeneration and Management; Man and the Biosphere Series Vol.6, Parthenon Publishing.
2. Whitmore, T.C., (1998). An Introduction to Tropical Rainforests, Oxford University Press, Oxford.

References:

1. FAO, Silvicultural Systems of Tropical Forests Forestry Paper No. Gomez-Pompa,
2. Hilton, RGB, (1984). A Manual of Silviculture for the Indigenous Forest of Papua New Guinea, School of Forestry, Unitech, Lae
3. McKinty, MH., (1999), Silviculture of Mixed Tropical Forests, School of Forestry, Unitech, Lae
4. Smith, D., (1986), The Practice of Silviculture, Eight Edition, John Wiley & Sons, Canada
5. Dawkins, HC, MBE,(1958), The Management of Natural Tropical High Forest with special reference to Uganda, Imperial Forestry Institute, University of Oxford, UK
6. Johns, R.J (1977) The Vegetative of PNG – training manual for the Forestry College, Vol. 10, Bulolo (reprinted 1884)
7. Srivastava, MB, (1997), Introduction to Forestry, Vikas Publishing House, PVT, ND Paijmans, K. (1976), New Guinea Vegetation, ANU Press Canberra

Relevant Unitech Policies:

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism.
(http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules
(http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR222: FOREST SOILS

Course (s)	Forestry (NQF Level 7)
Subject Name	Forest Soils
Subject Code	FR222
Duration	13 teaching weeks
Contact Hours	Hours per week 6 (2 lectures + 2 laboratory + 2 field)
Credit Points	15
Delivery Mode	On campus
Prerequisites	FR 211 Forest Ecology. AS 110 Chemistry for Natural Resource, FR111 Biology,
Co-requisites	
Subject Coordinator	TBA

Synopsis:

This subject is a compulsory subject and teaches soil science for forestry. It focuses on building knowledge and skills applicable in other forestry subjects like silviculture, agroforestry and forest management. The subject covers soil genesis, soil system processes, soil properties, soil biota, plant's nutrition and soil management. An important component of soil science, soil carbon is added to give students an impression of its key role in the carbon cycle, soil quality and its importance in climate change and other monitoring programs as a sensitive indicator for mitigation and adaptation strategies.

Subject Topics:

1. Introduction to Soil Science: history of soil science, soil forming processes, weathering and types of weathering.
2. Soil System Processes: Soil physical, chemical and biological processes, Pedogenic processes, Soil profile formation and description.
3. Soil Carbon key role in the carbon cycle, soil quality and its importance in climate change or other monitoring programs as a sensitive indicator for mitigation and adaptation strategies.
4. Soil Physical Properties: soil physical properties and environmental factors, soil sampling techniques, and methods in assessing soil physical properties.
5. Soil Chemical Properties, Organic Matter, Soil Water and Erosion and Plant Nutrition: Chemical properties of different soil types and conditions, soil nutrient and nutrient availability to plants.
6. Soil Biota, Soil Problems: Role of Soil Organisms, causes of soil problems, techniques for improving soil conditions.
7. Soil Management: Soil Survey, Soil Classification and Soil Mapping, major soil types of different geographical locations and Soil Amendments or Management.

Subject Outline:

Topic	Content
Introduction to Soil Science	• History of soil science, • Soil forming processes, • Weathering and types of weathering.
Soil System Processes	• Soil physical, chemical and biological processes, • Pedogenic processes, • Soil profile formation and description.
Soil Carbon key role in the carbon cycle	• Soil quality and its importance in climate change or other monitoring programs as a sensitive indicator for mitigation and adaptation strategies.
Soil Physical Properties	• Soil physical properties and environmental factors, • Soil sampling techniques, • Methods for assessing soil physical properties.
Soil Chemical Properties	• Chemical properties of different soil types and conditions, • Soil nutrient and nutrient availability to plants.

	• Organic Matter, Soil Water and Erosion and Plant Nutrition
Soil Biota, Soil Problems	• Role of Soil Organisms, • Causes of soil problems, • Techniques for improving soil conditions.
Soil Management	• Soil Survey, • Soil Classification and Soil Mapping, • Major soil types of different geographical locations • Soil Amendments or Management

Subject Learning Outcomes (SLOs):

On completion of this subject, students will be able to:

1. Describe soil forming processes and how they are influenced by climate, landscape, organisms, relief, parent material, and time.
2. Detect and describe the variation in soils profiles, and how different profiles affect plant growth.
3. Relate soil physical, chemical and biological properties to soil stability, water retention, plant health and availability of plant nutrients.
4. Discuss soil erosion processes and erosion control methods in forest management.
5. Describe the types of soils commonly found in PNG and their characteristics and the soil classification, interpretation and mapping practices
6. Describe the role of soil carbon in maintaining carbon cycle, soil quality and climate change as indicator for mitigation and adaptation strategies

Assessment Tasks and Weightings:

Assessment of this subject is Continuous Assessment is 60% and Final Exam comprises 40%.

Continuous Assessment:	60%
Final Examination:	40%

Students must also refer to the Subject Assessment Details;

Test 1	10%
Test 2	10 %
Lab Practical	20%
Major Field Practical	20%
Final Examination	40%

To obtain a pass grade in this Subject, at least 50% overall must be achieved. The assessment strategy is designed to test all subject learning outcomes (SLO's). Students must demonstrate successful achievement of these learning outcomes to pass the subject.

Students must also refer to the Subject Assessment Details.

Assessment 1 – Test #1 (10%): Given to individual students with the intention to establish the quality, performance, or reliability of their knowledge and understanding on the genesis of soil, major factors that affects soil formation, functions and roles of soil in the ecosystem, soil system processes and effect of weathering in soil formation.

Assessment 2 – Test #2 (10%): Given to individual students with the intention to establish the quality, performance, or reliability of their knowledge and understanding on the role of carbon in soil quality and its importance in mitigating climate change globally, soil physical properties and its interpretation.

Assessment 3 – Laboratory Practicals (20%): Group work in which students will have the autonomy and responsibility to do in-house experiments, discuss and argue on their findings and later do write-ups or complete post lab exercise, depending on the nature of the experiment. Lab sessions will be conducted on weekly basis. Lab experiments includes various in test on various soil physical & chemical properties such as texture, colour, structure, consistence & consistency, bulk density, particle density, pH, colloids & CEC, soil nutrients and soil carbon. Other

experiments include identifying nutrition deficiency by assessing various plants performance through leaves, shoots or roots. (10%)

Assessment 4 – Major Field Practical (20%): Group work in which student interact with each other, do prior research and then assess soil profiles in situ with reference to USDA soil profile assessment methods (e.g. Soil Profiling at Manki Tower, Bulolo District). The main objective of this training is for students to integrate what they have learnt and employed these skills and knowledge through observations and detail analysis, basic in situ tests on soil physical and morphological characteristics of horizons, and making educated intuition on common trends observed, and also giving a terse but precise description of the site of study. A final report will be submitted by each individual based on the data in which their group obtained to assess the presentation, interpretation, correlation and explanation of their findings in which students put through writing. Finally, to assess the validity of the data, if such field training can be replicated later. Importantly, attendance and participation comprise

5% of this assessment with 15% comes from student's write-ups.

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Textbook:

Fitzpatrick, E.A (1986), Introduction to Soil Science (2nd Edition), Longman, London, UK

References:

1. Fisher, R. and Binkley D (2000), Ecology and Management of Forest Soils (3rd Edition), John Willey & Sons, New York, USA.
2. Fitzpatrick, E.A (1986), Introduction to Soil Science (2nd Edition), Longman, London, UK
3. Soil Survey Staff (2014), Soil Survey Field and Laboratory Methods Manual, Soil Survey Investigations Report No. 51, Version 2.0. R. Burt and Soil Survey Staff (Ed.). U.S. Department of Agriculture, Natural Resources Conservation Service
4. Soil Map of New Guinea, University of Wagenigen, The Netherlands.
5. Nimiago, Patrick L. "Assessment of Forest Soil Carbon Stock in Papua New Guinea." ACIAR proceedings 135.1447-0837 (2011): 100-04. Print.
6. Vashum, Kuimi T., and S. Jayakumar. "Methods to Estimate Above-Ground Biomass and Carbon Stock in Natural Forests - A Review." Ecosystem & Echography 2.4 (2012). Print.
7. Grace, John. "Understanding and Managing the Global Carbon Cycle." Journal of Ecology 92.2 (2014): 180-202. Print.
8. PNG Forest Authority and FAO, (2018). 1st National Forest Inventory Papua New Guinea: Field Manual, NFI Technical Working Group with Assistance from Forestry Department, FAO, 68pp
9. Nimiago. P, Nalish.S, Moripi.L, Gamung.M, Takai. G, Pomoso.P, Abe. H, McIntosh.P and Doyle. (2019). Field guide for sampling and describing soils in the National Forest Inventory. Forest Research Institute, Lae, PNGFA & FAO NFI Project. Port Moresby, 44pp.

Relevant Unitech Policies:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR223: FOREST BIODIVERSITY

Course(s)	Forestry (NQF Level 7)
Subject Name	Forest Biodiversity
Subject Code	FR223
Duration	13 teaching weeks
Contact Hours	Hours per week 6 (3 lectures +1 tut +2 field)
Credit Points	17
Delivery Mode	On campus
Prerequisites	FR111 Biology. FR122 Forest Botany; FR211 Forest Ecology; FR214 Dendrology;
Co-requisites	
Subject Coordinator	TBA

Synopsis:

This subject deals with one of PNG's most unique natural resources – its biological diversity; focusing on how it is expressed in PNG's forest ecosystems and to educate students on PNG's biodiversity while providing a strong interdisciplinary approach in applying biodiversity conservation for development. Students should develop an appreciation of PNG's world class biodiversity treasure, with a focus on the living species of forest habitats; a knowledge base of what biodiversity is and what factors relate to exceptionally species-rich areas, what threatens biodiversity today (especially in PNG), and what approaches exist for sustainably managing PNG's biological diversity. This subject enables students to develop skills in undertaking biodiversity assessments, analysing biodiversity data and interpreting the results.

Subject Topics:

1. Introduction to biodiversity (organization of biodiversity, the global biodiversity breakdown by taxa, conservation biology as a discipline, and history of global biodiversity including 6th biodiversity extinctions (crisis)).
2. Biodiversity trends (factors influencing patterns of biodiversity, biodiversity hotspots, PNG as biodiversity hotspot).
3. Biodiversity crisis, threats, biodiversity benefits and values.
4. Biodiversity measurements (biodiversity surveys and protocols (e.g. National Forest Inventory protocols), biodiversity indices, alpha, beta, gamma diversity, biodiversity indicators, keystone and flagship species).
5. Biodiversity protection and conservation (history of protected areas, protection options for PNG, global and PNG legislation for biodiversity protection, sustainable forest management and reduced impact logging practices, forest certification, REDD+, payment for environmental services, role of education in biodiversity protection).
6. Bio prospecting and intellectual property rights.

Subject Outline:

Topic	Content
Introduction to Biodiversity	• Introduction to biodiversity • Organization of biodiversity, • The global biodiversity breakdown by taxa, • Conservation biology as a discipline, • History of global biodiversity including 6th biodiversity extinctions (crisis).
Biodiversity trends	• Factors influencing patterns of biodiversity, • Biodiversity hotspots, • PNG as biodiversity hotspot.
Biodiversity crisis, threats, biodiversity benefits and values.	• What is biodiversity crisis • What Threatens biodiversity • The benefits and values of biodiversity
Biodiversity measurements	• Biodiversity surveys and protocols (e.g. National Forest Inventory protocols), • Biodiversity indices, alpha, beta, gamma diversity, • Biodiversity indicators,

	• Keystone and flagship species.
Biodiversity protection and conservation	• History of protected areas, • Protection options for PNG, • Global and PNG legislation for biodiversity protection, • Sustainable forest management and reduced impact logging practices, • Forest certification, REDD+, • Payment for environmental services, • Role of education in biodiversity protection.
Bio prospecting and intellectual property rights.	• International legislations associated with biodiversity protection • National legislations associated with biodiversity protection • The conservation of biological diversity (CBD) • Introduction to Intellectual Property Rights

Subject Learning Outcomes (SLOs):

On completion of this subject, students should be able to:

1. Understand the concept of biological diversity in forests, and appreciate the need for its conservation.
2. Describe the nature of PNG's exceptional biodiversity treasure, and what plant and animal groups are especially unique.
3. Explain why PNG is so rich in biodiversity and how biodiversity is been lost in PNG.
4. Undertake population surveys of plants and animals, make collections of representative specimens, analyses and interpret biodiversity trends, monitor and quantify threats to species and population survival.
5. Understand strategies and plans by which a PNG forest biodiversity can be better secured and managed for the benefit of present and future generations.

Assessment Tasks and Weightings:

Continues Assessment:	50%
Final Exam:	50%

Students must also refer to the Subject Assessment Details.

Tests:	40%
Assignments:	4%
Field. Practical:	6%
Final Examination	50%

To obtain a pass grade in this Subject, at least 50% overall must be achieved.

The assessment strategy is designed to test all subject learning outcomes (SLO's). Students must demonstrate successful achievement of these learning outcomes to pass the subject.

Assessment 1 – Test 1, 10%: A concept based closed book assessment, testing students' abilities and comprehension of biodiversity concepts that relate to introduction of biodiversity covered in the lecture topics.

Assessment 2 – Test 2, 10%: A concept based closed book assessment, testing students' abilities and comprehension of various concepts relating to biodiversity trends covered in the lecture topics.

Assessment 3 – Test 3, 10%: A concept based closed book assessment, testing students' abilities and comprehension of various concepts that relate to biodiversity crisis, threats and biodiversity benefits covered in the lecture topics.

Assessment 4 – Assignment 1, 4%: Biodiversity measurements. Assessment covers biodiversity measurements whereby students are required to determine spatial scales of biodiversity measurements – alpha and beta diversity. This assessment is a component of class exercises.

Assessment 5 – Field Practical, 6%: Biodiversity survey. Assignment is based on field practical where students are exposed to actual field work whereby, they undertake biodiversity surveys / assessments, collect voucher specimens of flora and fauna, naming of species and determining diversity of a forest areas under study and making comparisons using biodiversity indices to determine alpha and beta diversity trends in biodiversity.

Assessment 6 – Test 4, 10%: A concept based closed book assessment, testing students' abilities and comprehension of various concepts relating to biodiversity protection, conservation and bio prospecting covered in the lecture topics.

Relevant Unitech Policies:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

Student Workload:

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Textbook:

Gaston, J.K and Spicer, I.J (2005). Biodiversity: An Introduction. Second edition. Blackwell Publishing

References:

1. Alcorn, J. B. (Ed), 1993. Papua New Guinea Conservation Needs Assessment Vol. 1. Biodiversity Support Program, Government of Papua New Guinea, Department of Environment and Conservation. Corporate Press Inc., Landover, Maryland.
2. Beehler, B.M. (Ed), 1993. Papua New Guinea Conservation Needs Assessment Vol. 2. Biodiversity Support Program, Government of Papua New Guinea, Department of Environment and Conservation. Corporate Press Inc., Landover, Maryland.
3. Gaston, J.K and Spicer, I.J (2005). Biodiversity: An Introduction. Second edition. Blackwell Publishing
4. Ghazoul, J. & D. Sheil (2010). Tropical Rain Forest Ecology, Diversity, and Conservation. Oxford Univ. Press.
5. Mack, A.L and Wright, D.D. (2011). Training Manual for Field Biologist in Papua New Guinea.
6. Maturin, A.E. (2004). Measuring Biological Diversity. Blackwell Publishing.
7. Miller, G.T and Spoolman, E.S. (2009). Essentials of Ecology. 5th Edition.
8. Papua New Guinea Department of Conservation (2014). Papua New Guinea's 5th National Report to Convention on Biological Diversity. September 2014. Port Moresby. pp. 144.
9. Government of PNG (2017). PNG National REDD+ Strategy 2017-2027. pp. 45.
10. PNGFA & FAO (2018) National Forest Inventory Papua New Guinea Field Manual, NFI Technical Working Group, PNGFA and FAO
11. Sekhran, N & S. Miller (1996). Papua New Guinea Country Study on Biological Diversity. PNG Dept. Environment & Conservation, Conservation Resource Centre; Africa Centre for Resources & Environment.
12. Tripathi, C.Y. and Pandey, K.A. (2017). Bio prospecting of Phytodiversity for New Therapeutic Products: Trends, Potential and Challenges. Organic and Medicinal Chemistry International Journal. Volume 2, Issue 1. pp. 7.
13. Singh, S.K., Sharma, M. and Pandey, A. (2017). Biodiversity Threats and Conservation. Environ. Sci. & Eng. Vol.2. pp 1-36.

Relevant Unitech Policies:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR224: FOREST PROTECTION

Course (s)	Forestry (NQF Level 7)
Subject Name	Forest Protection (Pest, Disease & Fire)
Subject Code	FR224
Duration	13 Weeks
Contact Hours	6 hours (3 Lect, 1 Tut, 2 Prac)
Credit Points	17
Delivery Mode	on Campus
Prerequisites	FR111 Biology, FR211 Forest Ecology,
Co-requisites	
Subject Coordinator	TBA

Synopsis:

This subject deals with protecting the Forests against fire and different pests and diseases. It creates an understanding of the ecological and environmental consequences caused by burning. It also adds an understanding of biology and ecology of common forest pests and diseases, and their impact on wood production and their appropriate control and preventive measures.

Subject Topics:

1. Ecological and environmental consequences of fire
2. Weather and Meteorological events
3. Operation of a weather station
4. Elements of combustion
5. Approaches to fire suppression
6. Biology of important insect pests of forest plantations
7. Factors driving pest outbreaks
8. Impacts of pests and diseases on wood production and forest conservation
9. Economics of pest outbreak and control
10. Control Measures of pest outbreaks
11. Plant Pathogens

Subject Outline:

Topic	Content
Ecological and environmental consequences of fire	• Introduction to forest fires • Consequences and impacts of fires • Impact of fires on the ecology and environment
Weather and Meteorological events	• Introduction to weather and meteorological events • Weather patterns • El Nino dry period
Operation of a weather station	• What is a weather station? • The Stevenson Screen • Instruments used in a weather station • Weather data
Elements of combustion	• What is combustion • Factors affecting combustion • Role of oxygen in combustion
Approaches to fire suppression	• Causes of fires • Forest fires • Types of forest fires • Intensity and impacts of forest fires

Biology of important insect pests of forest plantations	• Biology of important insect pests of forest plantations in PNG • Major group of insects • Population dynamics • Biology of important insect pests of forests trees • Biology of major pathogens. • Host parasite relationships
Factors driving pest outbreaks	• What is pest outbreak? • Introduction to pest outbreaks • Factors driving pest outbreaks
Impacts of pests and diseases on wood production and forest conservation	• Impacts of pests and diseases on wood production • Impacts of pests and diseases on forest conservation
Economics of pest outbreak and control	• Economics of pest outbreak and control • Control Measures of pest outbreaks
Control Measures of pest outbreaks	• Introduction to control measures of pest outbreaks. • The integrated pest management system.
Plant Pathogens	• Introduction to plant pathogens • Basic classification of fungal pathogens • Plant Pathogens Assessment. • Soil-borne plant pathogens • Epidemiology and control • Life cycle and control of vertebrate pests of forest trees in Papua New Guinea

Subject Learning Outcomes (SLOs):

On completion of this subject, students should be able to:

1. Show an understanding of the role of fire in tropical ecosystems and discuss the ecological and environmental consequence of fire in Papua New Guinea.
2. Outline the principles of combustion and fire behavior and discuss the effects of topography, fuel type and quantity and weather.
3. Maintain and operate a weather station report and keep records of temperature, humidity, rainfall, wind speed and fire danger rating.
4. Know biology of major insect pests of forest plantations in Papua New Guinea.
5. Understand biotic and abiotic factors that drive pest outbreaks.
6. Describe the impact of pests and diseases on wood production and forest conservation.
7. Know appropriate control measures and understand ways of devising applicable IPM for pest outbreaks to maintain and/or restore health and vigor of forests managed for wood production or biological conservation.
8. Synthesize and apply Economics of pest outbreak-control relevant to forest plantations.
9. Know common characteristics of pathogens that cause diseases in forest plantations.

Assessment Tasks and Weightings:

Continuous assessment:	50%
Final Exam:	50%

Students must also refer to the subject assessment details.

Tests:	30%
Assignments:	10%
Report:	10%
Final Examination:	50%

To obtain a pass grade in this subject, 50% overall must be achieved.

The assessment strategy is designed to test all subject learning outcomes (SLO's). Students must demonstrate successful achievement of these learning outcomes to pass the subject.

Assessment 1 – Test 1

Assessment 2 – Test 2

Assessment 3 – Quiz 1

Assessment 4 – Quiz 2

Assessment 5 – Assignment 1(5%): What is fire and how it can be suppressed using personal protective equipment?'

Assessment 6 – Assignment 2 (5%): Discuss the impact of pests and diseases on forest plantation.

Assessment 7 – Report 1(5%): Students will do a practical visit to the Bulolo National Forest Plantation where they will go through a drilling process on how to use fire hoses and other PPE. After this, the students will write a report based on what they learnt during the practical visit.

Assessment 8 – Report 2 (5%): Students will visit NAQIA on quarantine of exotic pests and diseases to write a report

It is important that all students familiarize themselves with the University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Subject Textbook:

Schneider, M.F. (1991) Entomology. A Textbook for students, Agriculturalists and Foresters in Papua New Guinea. Bulolo Univ. College, PNG

References:

1. Franklin, P.D. (1980) Forest Fire Protection, Training Manual for Forestry Training College, vol.14.
2. Luke, R.H. and McArthur, A.G., (1986). Bushfires in Australia, Australian Govt. Publishing service.
3. Schneider, M.F. (1991) Entomology. A Textbook for students, Agriculturalists and Foresters in Papua New Guinea. Bulolo Univ. College, PNG.

Relevant Unitech Policies:

It is important that all students familiarize themselves with the University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

YEAR 3 SUBJECT SPECIFICATIONS:

FR311: GIS FOR NATURAL RESOURCE MANAGEMENT AND FORESTRY

Course (s)	Forestry (NQF Level 7)
Subject Name	GIS for Natural Resource Management & Forestry
Subject Code	FR311
Duration	13 Teaching weeks
Contact hours	Hours per week 6 (3 lect+3 Pract)
Credit Points	16
Delivery Mode	On campus
Prerequisites	FR211 Forest Surveying
Subject Coordinator	TBA

Synopsis:

This subject will provide students with the basic concept of remote sensing and Geographic Information System (GIS), their applications in Papua New Guinea as tool in Decision making, Planning, modelling and Management of the vast natural resource with particular emphasis on forestry and other related fields.

Subject Topics:

1. Introduction to remote sensing
2. Concept of GIS and GIS data Model
3. Raster GIS & Vector GIS
4. Image enhancement and classification
5. Data Query & Analysis and Spatial Modelling
6. Statistical Analysis and Accuracy Assessments
7. Natural Resource Management Applications & Software's
8. Case Studies

Subject Outline:

Topic	Content
Introduction to remote sensing	• Definition and stages • Interaction of EMR with atmosphere and earth surface features • Signature curve of different object • Resolution and multi-band concept
Concept of GIS and GIS data Model	• Concept of GIS • Spatial and non-spatial data • Meta Data • Characteristics of raster data and structure • Raster data encoding Vector data source • Type of vector data • Characteristics of vector data and structure • · Attribute data model
Raster GIS & Vector GIS	• Raster data analysis- Spatial • Interpolation, local – Focal-Zonal • Analysis, Shortest path Analysis • Vector data Analysis- Overlay: Union, • Iintersection, Buffering, Manipulation
Image enhancement and classification	• Visual and digital image • interpretation • Land Classification-Supervise and Unsupervised Classification • NDVI
Data Query & Analysis and Spatial Modelling	• Data input, design and output • Data analysis and management

Statistical Analysis and Accuracy Assessments	• Application of statistical software and analysis in GIS • Accuracy assessment in mapping
Natural Resource Management Applications & Software's	• PNG geographic datasets and digital mapping sources • Natural resource management applications • Disaster management and analysis.
Case Studies	• Case studies of selected forest areas • Case studies of selected natural resource management areas

Subject Learning Outcomes (SLOs):

After completing this unit students will possess the knowledge and skills and to:

1. Explain the concept and principles of remote sensing and geographic information systems (GIS);
2. Describe the uses of remotely sensed datasets including air photo interpretation;
3. Use a GIS for basic data input, manipulation, management, query & analysis, visualization, and compilation of maps and spatial data statistics;
4. Use the main natural resources databases developed in Papua New Guinea and other international organizations and agencies;
5. Demonstrate the application of remote sensing and GIS in natural resources management in forestry and other related fields.

Assessment Tasks and Weightings:

Continues Assessment: 50%

Final Exam: 50%

Students must also refer to the Subject Assessment Details.

Test 1	15%
Assignment 1	5%
Assignment 2	5%
Test 2	15%
Assignment 3	10%
Final Examination	50%

To obtain a pass grade in this Unit 50% overall must be achieved.

Unit Assessment consists of assignments, tests and a major project that is the production of a plan (map) of a designated area or a piece of forested area as summarized below. Students must also refer to the Assignments and the Subject Assessment Guide for detailed information on each assignment.

Assessment 1 – Unit Test 1: This assignment will be introduced after the students have covered topics 1, 2 and 3. This test will account for 15% of CA.

Assessment 2 – This is Assignment 1 which will require students to use a GPS for boundary surveys and the eventual production of a map describing the boundary of an area and will be submitted in Week 7. The assignment will account for 5% of CA.

Assessment 3 – This is Assignment 2 which students will be required to classify a forest Management Area into different vegetation types. The assignment will account for 5% of the CA.

Assessment 4 – Unit Test 2: This will include all topics covered in 4, 5 and 6 of the course. This test will account for 15% of CA.

Assessment 5 – This is assignment 3 which students are required to do a spatial modelling of a given scenario. This will account for 10% of CA.

Assessment 6 – Final Exam: Cover all the topics in a semester will account for 50%

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:

The total workload for the average student is a nominal 150 hours based on a 15 weeks semester with 13 weeks of teaching as per PNG National Qualifications Framework.

Subject Textbook:

Burrough, P.A. 1986. Principles of geographic information systems for land resources assessment. Oxford, UK: Oxford University Press.

References:

1. Paine, D.P. and J. D. Kiser. 2012. Aerial Photography and Image Interpretation (3rd Ed.). John Wiley, Inc. New York. 632 pages.
2. Anderson, J. M., and E. M. Mikhail.1998. Surveying: Theory and practice. 2d Ed. New York: McGraw-Hill.
3. Avery, T. E., and G. L. Berlin. 1992. Fundamentals of remote sensing and air-photo interpretation. 5th Ed. New York: Macmillan.
4. Burrough, P.A. 1986. Principles of geographic information systems for land resources assessment. Oxford, UK: Oxford University Press.
5. Amando, A., (1999). GIS Applications in Tropical Forestry. Toowoomba Distance Education Centre, Qld.
6. Atkinson, P.M., (1998). Advances in Remote Sensing and GIS Analysis. Wiley Publications, Chichester.
7. Burrough, P.A., (1986).Principles of Geographical Information Systems for Land Resources Assessment. Clarendon Press, Oxford.
8. Vatasan, G., and Vatasan, N, (ND).Practical Photointerpretation for Foresters in Papua New Guinea. Forestry Department, PNG University of technology, Lae.
9. Remote Sensing & GIS Applications, cited: on http://ecoursesonline.iasri.res.in/mod/page/view.php?id=124940
10. Luca Congedo (2020). From GIS to Remote Sensing. Cited: https://fromgistors.blogspot.com/2015/05/brief-introduction-to-remote-sensing.html

Relevant Unitech Policies:

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR312: RESEARCH METHODS, DESIGN AND ANALYSIS

Course (s)	Forestry (NQF Level 7)
Subject Name	Research Methodology + Design and Analysis
Subject Code	FR312
Duration	13 Teaching weeks
Contact Hours	6 hours per week (3 lect. +2 tut. +1proj.)
Credit Points	18
Delivery Mode	On campus
Prerequisites	MA116, CS113
Co-requisites	
Subject Coordinator	TBA

Synopsis:

The purpose of this new subject is to equip students with strategies and methods for execution and communication of studies and investigations in forestry research. The course is to give the students the theoretical and practical skills to conduct, analyse and present written research tasks in Forestry and related Natural sciences; and to give insight and understanding of research methodology. It provides fundamental understanding of different scientific research methods, techniques and scientific knowledge. It also enables students, irrespective of their research focus, in developing the most appropriate methodology for their research studies. Students will learn how to evaluate the elements of academic research, title, abstract, literature review, methodology, results and discussion of a research manuscript. Desirable and undesirable qualities of each element will be discussed**.**

Subject Topics:

1. Types of Research and designs
2. Hypothesis setting
3. Experimental design including randomised block layout, Latin square, Split plot, types of forest nutritional trials
4. Population and Samples and plot types and sizes
5. Sampling methods
6. Randomisation and replication
7. Data analyses techniques and presentation of research results
8. How to evaluate the elements of academic research, title, abstract, literature review, methodology, results and discussion of a research manuscript.

Subject Outline:

Topic	Content
Types of Research and designs	• Introduction • Research Concepts • What drives research? • Defining the questions • Finding the answers • Ownership
Hypothesis setting	• Introduction • Example of Hypotheses • Design experiments to test hypothesis • Basic concepts of Testing Hypotheses • The Null and the Alternative Hypotheses • The two types of Errors and the power function of a test
Experimental design	• Introduction • Application of trial types in nutritional studies • The addition trial - theory • The omission trial - theory • The site potential trial – theory

	• The factorial trial – theory
Population and Samples and plot types and sizes	• Introduction • Reasons for sampling • Major uses of sampling techniques • Sampling methods • Simple random sampling • Systematic sampling • Stratified sampling • Cluster sampling • Sample size • Estimation of the population mean
Sampling methods	• Understanding the variability of a mean • An example of using excel spreadsheet • Estimating sample size without a computer • Estimation of replication for testing the difference between treatment means. • Sampling without replacement
Randomization and replication,	• Commonly used trial designs • Complete randomized design • Randomized block design • Latin square design • Split-plot design • Alpha designs • Examples of experimental designs used commonly in forestry research • Some Practical Notes
Data analyses techniques and presentation of research results	• Introduction • Selection of the appropriate Tests • Assumptions for parametric tests • Definitions of basic statistical terms. • Tests of Association • Test for differences between means • Chi-square test for independence • The T-test • The Paired T- test • Analysis of Variation (ANOVA)
How to evaluate the elements of academic research	• Elements of a Research Proposal • Elements of a Research Manuscript • Oral Presentation • Written Presentation

Subject Learning Outcomes (SLOs):

On completion of this subject students will be able to

1. Demonstrate the use of modern scientific research methods;
2. Utilize skills relating to the process of conducting science and apply the scientific method;
3. Prepare scientific research plans and proposals; and
4. Convey ideas, scientific knowledge and experimental outcomes through written and oral presentation

Assessment Tasks and Weightings:

Assessment:

Continuous	- 50%
Written Examination	- 50%

Students must also refer to the Subject Assessment Details.

Major Project	25%
Test 1	10%
Test 2	10%
Mock Exam	5%
Final Examination	50%

To obtain a pass grade in this Subject at least 50% overall must be achieved.
The assessment strategy is designed to test all subject learning outcomes (SLO's). Students must demonstrate successful achievement of these learning outcomes to pass the subject.

Assessment 1 – Major Project

Part 1- Project Concept Report: A team-based report outlining team formation and member roles, project selection, team and member action plan and a schedule of future activities to achieve the final design outcome. The report contributes **5%** towards the final grade for the subject.

Part 2- Progress Report: Team based report outlining team progress in achieving design outcomes in line with the team schedule submitted in the Project Concept Report. Variations to the original schedule will be identified and justified. The Progress Report contributes **5%** towards the final grade for the subject.

Part 3- Final Report: A professional level report with individual and team components that outlines and communicates the design processes, rationale and outcomes. The Final Report contributes **10%** towards the final grade for the subject.

Part 4 - Audio Visual Presentation**:** An audio-visual presentation of design outcomes that contains the salient feature of the Final Report. All team members will contribute. The presentation contributes **5%** towards the final grade for the subject.

Assessment 2 – Test 1 Covers topics 1 to 4 contributes **10%**

Assessment 3 – Test 2 Covers topics 5 to 8 contributes **10%**

Assessment 4 – Mock Exam covers all the topics covered in a semester contributes **5%**

Assessment 5 – Final exam covers all the topics covered in a semester contributes **50%**

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Textbook:

Lindsay, D., (1995). A guide to scientific writing, a manual for students and research workers, 2nd Edition, Longman Cheshire, Pty Ltd, Melbourne, Australia, 85pp.

References:

1) Bhattacharyya, G.K and Johnson, R.A., (1977). Statistical Concepts and Methods, John Wiley & Sons, New York, 639 pp
2) Box, G.E.P, Hunter, J.S and Hunter, W.G., (2005). Statistics for experimenters: design, innovation, and discovery, 2nd Edition, John Wiley & Sons, New Jersey, USA, 639pp
3) Jayaraman, K., (1999). A statistical Manual for forestry research, FAO FORSPA , Bangkok, 231pp: (pdf file)
4) Lindsay, D., (1995). A guide to scientific writing, a manual for students and research workers, 2nd Edition, Longman Cheshire, Pty Ltd, Melbourne, Australia, 85pp.
5) Webb, M.J and Hambleton, A., (1996). Fundamentals of Research and Research Thinking, A manual on Tree Nutrition Research Methods. A Training Course, Held at the University of the South Pacific, Apia Campus, Western Samoa, 2-12 July 1996 FAO, UNDP, FORSPA. 50pp
6) Quinn, G, P and Keough, M, J., (2002). Experimental design and data analysis for biologists, Cambridge University Press, Cambridge, UK,537pp.(pdf file)

7) Youdeowei, A., Stapleton, P. and Obubo, R., (eds.) (2012). Scientific Writing for Agricultural Research Scientists –A Training Resource Manual, Wageningen, the Netherlands: CTA. 192p
8) ICRA, (2010). Proposal Formulation– Key Concepts. ICRA learning resource, http: www.icraedu.org, 8p.

Relevant Unitech Policies:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR313: PLANTATION SILVICULTURE

Course (s)	Forestry (NQF Level 7)
Subject Name	Plantation Silviculture
Subject Code	FR313
Duration	13 Teaching weeks
Contact Hours	6 Hours per week (2.5hrs lecture + 1hr tutorial + 2.5hrs practical)
Credit Points	16
Delivery Mode	On campus
Prerequisites	Complete year 1 and Year 2 subjects
Co-requisites	FR311, FR312
Subject Coordinator	TBA

Synopsis:

This is a compulsory and a core subject in forestry learning that teaches the understanding and art of regenerating an artificial forest in the tropics, especially a commercial forest plantation – its planning, establishment, care and management of a planted forest. A forest tree nursery as an important component attached to forest plantation developments also forms the basis of this subject – again its establishment, care and management techniques. The subject therefore aims to;

a) Draw understanding in the importance of planted forests in the tropics, especially commercial tree plantations and nurseries.
b) Familiarise students with the range of available silvicultural techniques in propagating, nursing and cultivating them, and in their care and management.
c) Develop the expertise and manual skills needed to apply these silvicultural techniques in the establishment, operation and management of commercial tree plantations and nurseries.
d) Develop an appreciation of silvicultural research to provide the skills needed to maintain and assess simple nursery and field experiments.

Subject Topics:

1. Introduction to Plantation Silviculture – Types of planted forests, their values and the importance of commercial plantations.
2. Plant Propagation Techniques – Sexual & asexual reproduction in plants and methods of plant materials collection, storage and propagation.
3. Forest Tree Breeding Program – Choice of species, selection and steps in tree improvement.
4. Forest Tree Nurseries – Planning and establishments, operations, care and protection.
5. Forest Plantations – Planning and establishments, operations, care and protection.
6. Forest Plantation Assessment and Inventory – Survival, growth, yield and costs.

Subject Outline:

Topic	Content
Introduction to Plantation Silviculture	• Introduction to Plantation Silviculture • Plantation silviculture • Types of planted forests, their values • The importance of commercial plantations.
Plant Propagation Techniques	• Introduction to plant propagation • Sexual & asexual reproduction in plants • Methods of plant materials collection, • Plant material storage and propagation.
Forest Tree Breeding Program	• Choice of species, • Species Selection • Steps in tree species improvement.

Forest Tree Nurseries	• Nursery Planning and establishments, • Nursery Operations, • Nursery Care and protection.
Forest Plantations	• Importance of tree plantation • Policy and plantation development • Forest Plantation Planning and establishments, • Plantation operations, • Forest Plantation care and protection.
Forest Plantation Assessment and Inventory	• Survival, • growth, • yield and costs of forest plantation management.

Subject Learning Outcomes (SLOs):

On completion of this subject, students should be able to;

1. Show an appreciation on the social, ecological and economical values and importance of planted forests.
2. Demonstrate knowledge on the establishment and operations of forest tree nurseries, and, apply the associated nursery treatments, techniques and experiments in collecting, storing and propagating nursery plant materials from seeds and vegetative parts.
3. Demonstrate knowledge on the establishment and operations of forest tree plantations, and apply the associated silvicultural practices, steps and experiments in screening, improving and protecting the plantation species.
4. Assess the survival, growth, yield and costs of forest plantations.

Assessment Tasks and Weightings:

Continuous	50%
Examination	50%

Students must also refer to the Subject Assessment Details.

Essay Report 1	10%
Test 1	10%
Test 2	10%
Essay Report 2	10%
Essay Report 3	10%
Final Examination	50%

To obtain a pass grade in this subject a 50% overall must be achieved.

Continuous assessment consists of assignments, tests and reports as summarised below. Students must also refer to the assignments and the subject assessment guide for detailed information on each assignment.

Assessment Tasks	Assessment Type	Assessment descriptions
1	Essay Report 1	Essay on plantation silvicultural practices relating to sustainable yield Management (10%).
2	Test 1	Covering topics on nursery and plant propagation (10%)
3	Test 2	Covering topics on plantation and tree breeding (10%)
4	Essay Report 2	Scientific report on nursery seed propagation and vegetative propagation experiments (10%).
5	Essay Report 3	Technical report on planning, implementing and assessing plantation silvicultural practices (10%).
6	Final Exam	Cover all the topics in this semester (50%)

Note:

It is important that all students familiarise themselves with the PNG University of Technology Assessment guidelines including those on plagiarism at www.unitech.ac.pg.

Student Workload:

The total workload for the average student is a nominal 150 hours based on a 15-week semester with 13 weeks of teaching as per PNG National Qualifications Framework

Subject Text Book:

1. Romijn, K.D., [1986]. Plantation Silviculture, Training Manual for the Papua New Guinea Forestry College, Bulolo, Papua New Guinea.
2. Evans, J., [1992]. Plantation Forestry in the Tropics, 2nd ed., Oxford University Press, Oxford.

References:

1. Camean, W.H., J.T., Hahn J.T. and Jacobs, R.D., [1989]. Site index curves for forest tree species in the Eastern United States, General Technical Report NC-128, USDA Forest Service, North Central Forest Experiment Station.
2. Evans, J., (ed.) [2009]. Planted forests: uses, impacts and sustainability, CAB International & FAO.
3. Evans, J., [1999]. Sustainability of forest plantations. The Evidence, Department for International Development (DFID), London, UK.
4. Gunn, B., Aigiwa, A., Bosimbi, D., Brammall, B., Jarua, L and Uwamariya, A., [2004]. Seed Handling and Propagation of Papua New Guinea's Tree Species, CSIRO Forestry and Forest Products, Canberra.
5. International Congress on Planted Forests, [2013]. Planted forests are a vital resource for future green economies. Summary Report of the 3rd International Congress on Planted Forests. Bordeaux, Dublin, Porto, Estoril.
6. ITTO, [1993]. Guidelines for the establishment and sustainable management of planted tropical forests. Policy Development Series 4, Yokohama, Japan.
7. Longman, K.A., and Wilson, R.H.F., [2002]. Tropical Trees: Propagation and Planting Manuals, Commonwealth Science Council, CSIRO, Australia, Volume 1.
8. Mulawarman, J.M., Roshetko, S.M and Irianto, D., [2003]. Tree Seed Management – Seed Sources, Seed Collection and Seed Handling: A Field Manual for Field Workers and Farmers, International Centre for Research in Agroforestry (ICRAF) and Winrock International, Bogor, Indonesia. 54p.
9. Shepherd, K.R., [1986]. Plantation Silviculture, Kluwer Academic Publishers, AH Dordrecht, The Netherlands.
10. Tiarks, A., Nambiar, E.K.S. and Cossalter, C., [1998]. Site management and productivity in tropical forest plantations. Occasional Paper no. 16, CIFOR, Jakarta, Indonesia.
11. Wormald, Wormald, T.J., [1992]. Mixed and pure forest plantations in the tropics and subtropics. FAO Forestry Paper 103, Rome, Italy.

Relevant Unitech Policies:

It is important that all students familiarise themselves with the PNG University of Technology Assessment guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR314: FOREST MANAGEMENT AND PLANNING

Course (s)	Forestry (NQF Level 7)
Subject Name	Forest Management & Planning
Subject Code	FR314
Duration	13 Teaching weeks
Contact Hours	6 hours per week (3 Lecture + 2 tut + 1 Pract)
Credit Points	18
Delivery Mode	On campus
Prerequisites	FR 23 Introduction to Forestry, FR225 Natural Forest Silviculture, FR226 Forest Soils, FR227 Forest Biodiversity, FR228 Forest Protection (Pest Diseases & Fire).
Co requisites	FR311 GIS for Natural Resource Management in Forestry
Subject Coordinator	TBA

Synopsis:

To understand the principles and processes of forest planning in the context of the management of natural forests and plantations as applied in PNG.

This subject provides students with:

a) An overview of forest management planning, with many of the interacting aspects of forest management situations, stand-level decisions and economic measures to help compare development options.
b) A better understanding of management science tools to support decision making in forest management.
c) Gain a better understanding of current forest management planning requirements in Papua New Guinea (and the region).
d) Understanding on the rationale for developing, planning and managing sound forest investments
e) Understanding of the techniques of assessing resources for purposes of management planning.
f) Knowledge in the process of developing, monitoring and revising a forest management plan

Subject Topics:

1. Introduction to Forest Management Planning Principles and Practices,
2. Production of Timber from natural and planted forests,
3. Making decisions in forest management,
4. Forest management planning,
5. Natural forest management in PNG,
6. Emerging issues affecting forest management planning in PNG,
7. The future of forestry and future forest management,
8. Forest Management Planning Process,
9. Elements of Forest Management planning,
10. Management Plans- LMS, Forest Working Plans, Forest Classification

Subject Outline:

Topic	Content
Introduction to Forest Management Planning Principles and Practices,	• General introduction to the Principles and Practices of land-use planning, relevant to Forest Management Planning in the world and PNG in particular. • History of forest management planning in PNG • Current Policies and Laws relating to forest management in PNG. • Forest management objectives in PNG
Production of Timber from natural and planted forests,	• Elements of forest management • Stand structure, growth and yield • Growth modelling
Making decisions in forest management,	• Problem identification and finding solutions • Project evaluations and planning alternatives • Valuation of timber and other non-timber products

Forest management planning,	• Tree and stand decisions • Forest regulations • Management schedules • Harvest schedules
Natural forest management in PNG,	• Natural forest management objectives in PNG • National forestry development guidelines • Forest inventory mapping tool (FIM) • National forest inventory • Environmental impact assessments (EIAs) and environmental impact statements (EIS).
Emerging issues affecting forest management planning in PNG,	• Climate change • Carbon sequestration • Timber certification • Biodiversity conservation • Land ownership • Non-timber forest products • Illegal logging • Special agriculture business leases (SABL) and Land grabbing
The future of forestry and future forest management,	• Current and emerging challenges to forest management in Papua New Guinea. • Emerging global trends in forest management
Forest Management Planning Process,	• Forest Management Planning - Global Context • FAO FRA 2015 Data. • Guidelines for Forest Management Planning • Yield Prediction • Types of Yield Prediction Models • Examples of Yield Prediction Models • Determining Annual Allowable Cut (AAC) • Methods of Determining AAC • Yield Regulation
Elements of Forest Management planning,	• Goals and objectives of forest planning • Information and data used for forest planning • Two-time horizons of planning
Management Plans- LMS, Forest Working Plans, Forest Classification	• PNG Provincial Forest Plans • The National Forest Plan • Annual Plans and Set-up plans for timber companies • Medium-term Plans • Five-year forest working plans for timber companies • Strategic Planning in Forestry

Subject Learning Outcomes (SLOs):

After completing this subject, students should be able to:

1. Describe planning processes required to manage natural forests and plantations in
2. Papua New Guinea, from logging coup level to Provincial and National levels;
3. Compare and contrast the methods used to prepare plans at the national, provincial, forest management area and logging coupe levels;
4. Understand the requirements of carrying out environmental impact assessments (EIAs) and preparation of environmental impact statements (EISs) as prescribed under the Environment Act 2000 (and amendments).
5. Describe planning processes required to manage natural and planted (plantations) forests in Papua New Guinea, from logging coup level to Provincial and National levels;
6. Compare and contrast the methods used to prepare plans at the provincial, forest management area and logging coupe levels;
7. Design forest inventory procedures aiming at development of management plans for different forest types and develop, monitor and revise management plans for different types of forest operations in PNG

Assessment Tasks and Weightings:

Assessment of this subject constitutes a 50% Continuous Assessment and 50% Final Examination:

Continuous assessments:	50%
Final Examination:	50%

The details of the Assessment are given below;

Assignment (x 2)	14%
Tests (x 2)	24 %
Major Practical (x 1)	12%
Final Examination	50%

To obtain a pass grade in this Subject, 50% overall must be achieved.

Subject Assessment consists of two assignments; two tests; one Practical; and the final examination as detailed below;

Assessment 1: Assignment # 1: Individualised assignment report based on a case study of Ramu Block 3 FMA Annual Allowable Cut (AAC) as applied in tropical forests in the region (including Malaysia, Indonesia and the Philippines) and also in PNG context. The objective of this Assignment is for the student to understand the empirical equation for determining AAC developed by FAO as applied in tropical forest management and planning and how an AAC is calculated in an FMA and large-scale timber harvesting operations (7%).

Assessment 2: Assignment # 2: Individualised assignment report based on a case study of the Morobe Provincial Forest Plan 2008-2013. Students are provided with a real example of a Provincial Forest Plan for them to acquaint themselves with the structure and format of how a Provincial Forest Plan is formulated in PNG context (7%).

Assessment 3: Test # 1: Individualised testing of a student's ability to understand the principles, practices and the major components of a Forest Management Plan in a global context and some of the practices and real examples as applied in tropical forest management and planning in PNG context (12%).

Assessment 4: Test # 2: Individualised testing of student's ability to understand the requirements of the National Forest Plan and National Forest Inventory in PNG and the legislations that support forest management and planning in the country (12%).

Assessment 5: Practical # 1: This is a major practical assessment consisting of group work for students to interact with each other; do research; and present the outcome of their findings with reference to a case study to review and evaluate the Five-Year Forest Working Plan and One Year Annual Operational Plan of the Rai Coast TRP/FMA project in Madang province (12%).

Assessment 6: Final Examination: Individualised testing in the form of a final examination to assess and evaluate the ability of the student to understand; apply; and demonstrate the FR314 course undertaken in the third year in semester me of the BSc in Forestry Degree Program (50%).

Note:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:

The total workload for the average student is a nominal 150 hours based on a 15 week semester with 13 weeks of teaching as per PNG National Qualifications Framework

Subject text book:

1. Fox J.C., Keenan R.J., Brack C.L. and Saulei S. (Ed's) 2011. Native forest management in Papua New Guinea: advances in assessment, modelling and decision-making. ACIAR Proceedings No. 135. Australian Centre for International Agricultural Research: Canberra.
2. Bellamy, J.A., and McAlpine, J.R. (1995). Papua New Guinea Inventory of Natural Resources, Population Distribution and Land Use Handbook. (2nd Ed.). PNGRIS Publication No.6, AusAID, Canberra.
3. Sharma, N.P., (1992). Managing the World's Forests: looking for the balance between Conservation and development. World Bank, Washington DC.

References:

1. FAO, 2015. Global Forest Resource Assessment 2015. How are the World's Forests Changing? Second Edition, Rome?
2. ACIAR, 2005. Improved Forest Inventory and Strategic Forest Planning in Papua New Guinea. ACIAR Project FST98-118, Canberra.
3. Anon (1992). A blueprint for sustainable use of forest: definitions and indicators of progress.
4. State Forests of NSW Management Plans including Grafton, MP 29, summary of MP29, Managing State Forests, Grafton, MPS-7, Eden Native Forests, MP23, various dates.
5. PNG Forest Authority. National Forest Plan, Provincial Forest Plans (various).
6. National Forest policy 1991 and Forestry Act 1991 (and amendments).
7. PNG Forest Authority, (1995). Planning, Monitoring and Control Procedures for Natural Forest Logging Operations under Timber Permit, PNG Forest Authority, Port Moresby.
8. PNG Forest Authority and PNG Department of Environment and Conservation, (1995). Papua New Guinea Logging Code of Practice, PNG Forest Authority, Port Moresby.
9. PNG Forest Authority, (1996). National Forest Plan. PNG Forest Authority, Port Moresby.
10. FAO (2022). Global Forest Resource Assessment cited: http://www.fao.org/forestry/en/fra/

Relevant Unitech Policies:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination).

FR321: FOREST ECONOMICS AND TRADE

Course (s)	Forestry (NQF Level 7)
Subject Name	Forest Economics and Trade
Subject Code	FR321
Duration	13 Teaching weeks
Contact hours	Hours per week 6 (4 lect+2 Tutorials)
Credit Points	21
Delivery Mode	On campus
Prerequisites	Nil
Subject Coordinator	TBA

Synopsis:

This subject will provide the students with understanding of foundation economics and trade principles, theories and their applications to forest management and development. The need for decision making in forestry management, development and marketing requires professional to have basic but essential knowledge and skills in economics and trade.

Subject Topics:

1. Introduction to Economics and Trade
2. Economic Systems and Market structures
3. Theory of Supply and Demand
4. Production Theory in forestry
5. Capital theory in forestry
6. Forest Resource valuation
7. Principles of forest product development
8. International Trade and Theories
9. Forest Product Production, supply and consumption trends
10. Forest Economics and Trade Policies

Subject Outline:

Topic	Content
Introduction to Economics and Trade	• Foundation of Economics and Trade • Forest Economic concepts and perspectives • Theories of Economics and their application to forest management • Market economies and role of government
Economic Systems and Market structures	• Perfect and imperfect market structures • Cost curves • Production curves • Elasticity
Theory of Supply and Demand	• Introduction to Supply and demand • Timber supply demand and Pricing • Cost of production and economies of scale
Production Theory in forestry	• Principles of least cost production • Principles of compounding and discounting and their applications in time series
Capital theory in forestry	• Introduction to capital theory in forestry • Economic rent • Interest • Compounding and discounting
Forest Resource valuation	• Introduction to Forest Resource Valuation • Valuation of forests and trees • Risk • Alternative investment opportunities • Cost benefit analysis

Principles of forest product development	• Internal rate of return • Present net value • Forest rent • Soil expectation value
International Trade and Theories	• National and international trade • Trade barriers • Utility and Externalities
Forest Product Production, supply and consumption trends	• Scarcity • Consumer choice • Economic systems and resource allocation,
Forest Economics and Trade Policies	• Government policies • Key concepts of marketing and trade • Forest trade and trends in PNG • Key regional and domestic policies affecting trade of forest products

Subject Learning Outcomes (SLOs):

After completing this unit students will possess the knowledge and (or) skills to:

1. Explain the basic principles, theories and concepts in economics and trade
2. Explain and reason principles, theories and concepts in economics and trade in view of forest resource management and development
3. Explain and be able to utilize the processes and administrative procedures in exporting and importing forest products;
4. Apply techniques of least cost production, capital budgeting, project valuation in forest resource management
5. Understand the interrelating role of changing economic factors, forest policy and trade and apply them in decision making.

Assessment Tasks and Weightings:

Continues Assessment: 50%

Final Exam: 50%

Students must also refer to the Subject Assessment Details.

Test 1	10%
Tutorial 1	5%
Tutorial 2	5%
Lab	5%
Test 2	10%
Major Report	15%
Final Examination	50%

To obtain a pass grade in this subject a 50% overall must be achieved.

Continuous assessment consists of assignments, tests and reports as summarised below. Students must also refer to the assignments and the subject assessment guide for detailed information on each assessment.

Unit Assessment consists of 2 tests, 2 tutorials, 1 lab and a major essay on the trade of forest products in PNG.

Assessment 1 – Unit Test 1: This assessment will cover topics 1-5 testing student's ability to explain and understand topics covered. It will also include calculations to support decision making in production systems. This test will account for 10% of the CA.

Assessment 2 – Tutorials 1 and 2: These tutorials will be on capital budgeting techniques and forest project valuations respectively. Each tutorial will carry a weight of 5% total of 10% CA.

Assessment 3 – Lab Exercise This lab will enable students to know how to valuate forest plantations using B/C ratio, NPV and IRR using Excel spreadsheets. It also enables students to realise the relationship between BCR, NPV and IRR as criterions used in project valuations.

Laboratory: The lab will account for 5% of the CA.

Assessment 4 – Unit Test 2: This will include all topics covered in 6 - 10 of the course. This test will include calculations in capital budgeting and project valuation and explanations or understanding of concepts covered in topics 6 – 10. Test 2 will account for 10% of the CA.

Assessment 5 – Major Essay

Report: This essay report will be based on topics from 1-3 and 8-10. Each student is required to a 4000-word report on the trade of Forest products in PNG. The report should research into forest products sectoral economy, product trends, end-use markets and domestic and regional trade policies. The report will account for 15% of the CA.

Assessment 6 – Final Exam covers topics covered in a semester will account for 50% of the overall points

Relevant Unitech Policies:

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism.

(http://www.unitech.ac.pg/unitech/policies/academic-integrity and also examination rules http://www.unitech.ac.pg/unitech/policies/procedures-university-examination

Student Workload:

The total workload for the average student is a nominal 150 hours based on a 15 weeks semester with 13 weeks of teaching as per PNG National Qualifications Framework.

Subject Textbook:

Zhang D and Pearse P., (2011). Forest Economics. University of British Columbia, UBC press, Canada

References:

1. Zhang D and Pearse P., (2011). Forest Economics. University of British Columbia, UBC press, Canada
2. Perman R, Ma Y, McGilvray J, Common M., (1999). Natural Resource and Environmental Economics. Pearson Education Inc, New York. Accessible online: https://www.uio.no/studier/emner/sv/oekonomi/ECON4925/h16/pensumliste/txtbook_3.e d_att00106.pdf
3. Kemperer W., (2003). Forest Resource economics and Finance. McGraw Hills, USA 4. Tietenberg T., (2000). Environmental and Natural Resource Economics (fifth edition). Addison Wesley Longman Inc, New York
5. Johnson A and Smith R., (1988). Forest Product Trade: Market trends and technical Developments. University of Washington, USA
6. Bourke J., (1988). Trade in Forest Products: A study based on the Barriers faced by Developing Countries. FAO publication, Rome.
7. Suranovic S., (2007). International Trade Theory and Policy. Accessible online: http://internationalecon.com/Trade/T-toc.php
8. Schimtz A., (2012). International Trade: Theory and Policy. Accessible online: https://saylordotorg.github.io/text_international-trade-theory-and-policy/index.html

Relevant Unitech Policies:

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism.

(http://www.unitech.ac.pg/unitech/policies/academic-integrity and also examination rules http://www.unitech.ac.pg/unitech/policies/procedures-university-examination

FR322: AGROFORESTRY AND EXTENSION

Course (s)	Forestry (NQF Level 7)
Subject Name	Agroforestry and Extension
Subject Code	FR322
Duration	13 Teaching weeks
Contact Hours	6 hours per week (2 Lecture + 2 tut + 2 Lab + field)
Credit Points	15
Delivery Mode	On campus
Prerequisites	FR123 Introduction to Forestry, FR211 Forest Ecology, FR225 Natural Forest Silviculture, FR314 Forest Management & Planning.
Co-requisites	
Subject Coordinator	TBA

Synopsis:

This subject tries to emphasize better understanding of tropical sustainable land use systems in forestry and agriculture. It includes understanding of social issues regarding land use and how best technical information on land use can be communicated effectively through all levels of societies within PNG and the Pacific.

Subject Topics:

1. Concept, historical development and principles of Agroforestry
2. Identification and classification of agroforestry systems
3. Tree, crop and soil interactions
4. Social, economic and environmental considerations of agroforestry systems in the tropics
5. Planning and management, and evaluation of agroforestry systems & community extension projects.
6. Climate change adaptation and mitigation potential of agroforestry systems
7. Concept, principles and models of Forestry Extension.

Subject Outline:

Topic	Content
Concept, historical development and principles of Agroforestry	• Introduction and background to Agro-forestry • Concepts of Agro-forestry • Historical developments of Agro-forestry • Principles of Agro-forestry
Identification and classification of agroforestry systems	• Difference between Agro-forestry and other Land use systems in forestry • Identification and classification of Agro-forestry systems
Tree, crop and soil interactions	• Introduction to tree crop and soil interactions • Role of soil nutrients in Agro-forestry systems • Interaction between tree crops and soil in Agro-forestry systems
Social, economic and environmental considerations of agroforestry systems in the tropics	• Agro-forestry and rural livelihoods • Social, economic and environmental considerations of Agro-forestry systems in the tropics
Planning and management, and evaluation of agroforestry systems & community extension projects.	• Planning and management of community extension projects • Importance and role of Forestry Extension in agroforestry development
Climate change adaptation and	• Impacts of climate change on Agro-forestry systems • Climate change adaptation in Agro-forestry systems • Climate change mitigation potential of Agro-forestry systems

mitigation potential of agroforestry systems	
Concept, principles and models of Forestry Extension	• Methods and models of Forestry Extension • Planning and management of Forestry Extension projects • Extension and policy support in PNG

Subject Learning Outcomes (SLOs):

After completing this unit students will possess the skills and knowledge to:

1. Identify and classify an agroforestry system (AGFS) from other land use systems (LUS)
2. Understand opportunities and challenges of AGFS compared to other LUS in PNG and the Pacific
3. Understand relationships between land, plants and people as the major components in any LUS
4. Identify and evaluate impacts of AGFS
5. Effectively communicate technical information at National level down to the local level using various communication methods

Assessment Tasks (AT) and Weightings:

Continuous Assessment (CA): 50%
Final Examination: 50%

Students must also refer to the Subject Assessment Details.

Test (x2)	20%
Assignment (x2)	10%
Laboratory	10%
Fieldwork Report	10%
Final Examination	50%

To obtain a pass grade in this Unit 50% overall must be achieved.

Unit Assessment consists of tests, quizzes, assignment, project and final exam. Students must also refer to the Assignments and the Subject Assessment Guide for detailed information on each assignment.

Assessment 1. Tests: Two class room tests to judge individual student's understanding through descriptive questions on the topics covered and suggested by the lecturer (20%).

Assessment 2. Assignment: Two individual review report by the students on a subject related topic as suggested by the lecturer (10%).

Assessment 3. Laboratory: Group laboratory work to compare soil samples collected from different agroforestry systems (10%).

Assessment 4. Fieldwork: Group fieldwork and presentation of report through a professional level report and seminar on a subject related topic as suggested by the lecturer (10%).

Assessment 5. Final Exam: Final exam at the end of the semester to judge individual student's understanding through both short/quiz and descriptive questions on the subject matters (50%).

Note:
It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:

The total workload for the average student is a nominal 150 hours based on a 15-week semester with 13 weeks of teaching as per PNG National Qualifications Framework.

Subject Textbook:

P.K.Ramachandran. Nair (1993). An introduction to Agroforestry in the tropics. Kaluwer publishers, Boston, USA

References:

1. P.K.Ramachandran. Nair (1993). An introduction to Agroforestry in the tropics. Kaluwer publishers, Boston, USA
2. Clarke, W.C., and Thaman, R.R., (Eds) (1993). Agroforestry in the Pacific Islands: Systems for sustainability. United Nations University Press, Tokyo.
3. Frost, F., Forge, K., and Balck, A.W., (2000).Extension and Advisory Strategies for Agroforestry. Rural Industries Research and Development Corporation.AusAID/RIRDC Publication No. 00/184, Australia.
4. L.W. Hanson, B.J. Allen, R.M. Bourke and T.J. McCarthy (2001). Papua New Guinea Rural Development Handbook. The Australian National University, PNG.
5. Lerner, D., and Schramm, W., (eds.) (1967).Communication and Changes in the Developing Countries. East West Centre Press, Honolulu.
6. Nolan, P., and Lenski, G., (1999). Human Societies: an introduction to Macrosociology (8th ed.). McGraw-Hill College, New York.
7. Ray, G.L., (1976). Extension Communication and Management. R. Publishing Corp., Delhi.
8. Sharma, N.P., (ed.) (1992). Managing the World's Forests: Looking for the balance between conservation and development. World Bank, Washington, D.C.

Relevant Unitech Policies:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR323: CLIMATE CHANGE, REDD+ AND FORESTRY

Course (s)	Forestry (NQF Level 7)
Subject Name	Climate Change, REDD+ and Forestry
Subject Code	FR323
Duration	13 Teaching weeks
Contact Hours	6 hours per week (2 Lecture + 2 tut + 2 Proj.)
Credit Points	15
Delivery Mode	On campus
Prerequisites	FR123 Introduction to Forestry, AS114 Chemistry for Natural Resources, PH114 Physics for Natural Resources, FR 211 Forest Ecology
Co-requisites	
Subject Coordinator	TBA

Synopsis:

This is an introductory course to climate change that presents and briefly reviews a wide range of climate change topics, including causes, effects, and responses to climate change, REDD+ and the role of forestry in mitigating and adapting climate change. The level of detail in each of the covered topics is calibrated to current issues in the region. The syllabus explains how and why the climate is changing, the effects of climate change on people and the environment and responses and adaptation to climate change. Assignment will involve individual extensive literature review and submission of a professional level report. The project will incorporate an extensive literature review and group presentation through a professional level report and seminar.

Subject Topics:

1. How and why the climate is changing
2. The effects of climate change on people and the environment
3. Reponses and adaptation to climate change
4. REDD+ and forestry in Papua New Guinea

Subject Outline:

Topic	Content
How and why the climate is changing	• Introduction to Climate Science and Climate Change • The Causes and Effects of Climate Change • Climate Intensification: Droughts and Floods
The effects of climate change on people and the environment	• Introduction to Climate Change Impacts • Sea Level Rise • Climate Change and Water Resources: Effects
Reponses and adaptation to climate change	• Climate Change and Forest Management • Climate Change and Water Resources • Responses and Adaptation • Principles and Practice of Climate Vulnerability Assessment • Dealing with Uncertainties in Climate Change
REDD+ and forestry in Papua New Guinea	• Introduction to REDD+ • Bioenergy and the Forest • Communication and Engagement

Subject Learning Outcomes (SLOs):

After completing this unit students will possess the skills and knowledge to:

1. Explain the components, drivers, and interactions of climate, globally and in PNG.
2. Explain the causes and effects of climate change and the relationship between human activities and climate change, with emphasis on forest ecosystems and conservation.
3. Assess the impact of human activities due to climate change on forest ecosystem services and socio-economic systems.
4. Understand the concept and theories of REDD+ globally and how PNG can be benefitted from REDD+ and forestry.
5. Propose potential responses and solutions to climate change issues, and be able to assess their feasibility and potential effectiveness.
6. Collect, interpret and present information and current knowledge on climate change.
7. Communicate strategies to mitigate and adapt to climate change to a variety of audiences.

Assessment Tasks (AT) and Weightings:

Continuous Assessment (CA)	50%
Final Examination	50%

Students must also refer to the Subject Assessment Details.

Test (x2)	20%
Quizzes (x2)	10%
Assignment	10%
Major Project	10%
Final Examination	50%

To obtain a pass grade in this Unit 50% overall must be achieved.

Unit Assessment consists of tests, quizzes, assignment, project and final exam. Students must also refer to the Assignments and the Subject Assessment Guide for detailed information on each assignment:

Assessment 1. Tests: Two class room tests to judge individual student's understanding through descriptive questions on the topics covered and suggested by the lecturer (20%).

Assessment 2. Quizzes: Two class room quizzes to judge individual student's understanding through short/quiz type questions on the topics covered and suggested by the lecturer (10%).

Assessment 3. Assignment: Individual review report by the students on a subject related topic as suggested by the lecturer (10%).

Assessment 4. Project: Group review work and presentation through a professional level report and seminar on a subject related topic as suggested by the lecturer (10%).

Assessment 5. Final Exam: Final exam at the end of the semester to judge individual student's understanding through both short/quiz and descriptive questions on the subject matters (50%).

Note:

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:

The total workload for the average student is a nominal 150 hours based on a 15-week semester with 13 weeks of teaching as per PNG National Qualifications Framework.

Subject Textbook:

World Bank. 2013. Turn Down the Heat: Climate Extremes, Regional Impacts and the Case for resilience. Washington, DC. © World Bank.

References:

1. IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Accessible on line: https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_SPM_FINAL.pdf
2. World Bank. 2013. Turn Down the Heat: Climate Extremes, Regional Impacts and the Case for resilience. Washington, DC. © World Bank.
3. http://documents1.worldbank.org/curated/en/975911468163736818/pdf/784240WP0Full0 0D0CONF0to0June19090L.pdf
4. Houghton, John. 2009 Global Warming: The Complete Briefing. Accessible online at: http://www.amazon.com/Global-Warming-The-Complete-Briefing/dp/0521709164
5. USDA Forest Service. 2020. Climate Change Resource Center Accessible online: https://www.fs.usda.gov/ccrc/education/climate-primer
6. USAD Forest Service. 2020. Climate Basics - Frequently Asked Questions. Accessible online: http://www.fs.usda.gov/ccrc/climate-basics/climate-faq
7. Foukal, P., C. Frohlich, H. Spruit, and T. M. L. Wigley. 2006. Variations in solar luminosity and their effect on the Earth's climate. Nature 443: 161-166.
8. Skeptical Science, 2020. Explaining climate change science & rebutting global warming misinformation cite online: https://www.skepticalscience.com/
9. Skeptical Science. 2020.Global Warming & Climate Change Myths. Accessible online: https://www.skepticalscience.com/argument.php

Relevant Unitech Policies:

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism.

(http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR324: WOOD SCIENCE AND TECHNOLOGY

Course	Forestry (NQF Level 7)
Subject Name	Wood Science & Technology
Subject Code	FR324
Duration	13 Teaching weeks
Contact Hours	6 hours per week (2 Lecture + 2 Tut + 2 lab + field)
Credit Points	15
Delivery Mode	On campus
Prerequisites	FR123 Introduction to Forestry, FR122 Forest Botany, AS114 Chemistry for Natural Resources, PH114 Physics for Natural Resources, FR214 Dendrology, FR211 Forest Ecology, FR225 Natural Forest Silviculture.
Co-requisites	
Subject Coordinator	TBA

Synopsis:

This subject relates to wood anatomy, the structure and chemistry of wood, wood properties and how these properties affect the various end-uses of wood products.

Subject Topics:

1. Origin and nature of wood
2. Wood formation
3. Wood anatomy and microscopic cell structure
4. Wood chemistry and ultrastructures
5. Wood properties including physical, mechanical and other properties important for the use of different commercial and non-commercial timber species of Papua New Guinea.
6. Wood utilization including drying, preservation and wood processing.

Subject Outline:

Topic	Content
Origin and nature of wood	• Origin and nature of wood • Primary growth • Secondary growth
Wood formation	• Wood formation in a wood • Reaction wood • Juvenile & mature wood • Wood bark
Wood anatomy and microscopic cell structure	• Macro anatomical features • Micro anatomical features • Wood cell types
Wood chemistry and ultra-structures	• Wood chemistry • Cell wall ultra-structure • Extractives
Wood properties	• Physical, mechanical and other properties • Strength Properties • Importance of the use of different commercial and non-commercial timber species of Papua New Guinea.
Wood utilization	• Wood drying, • Wood preservation • Wood processing.

Subject Learning Outcomes (SLOs):

1. After completing this unit students will possess the skills and knowledge to:
2. Identify the wood representatives of the major groups of forest trees, both hardwoods and softwoods, based on macroscopic and microscopic characteristics of wood.
3. Demonstrate the understanding of the relationships between wood anatomy and properties of wood
4. Explain how the structure and chemistry of the cell wall of trees affects product making and end use including susceptibility to insect attack and fungal decay
5. Application of strength properties into design and development of new wood products for various end-uses.
6. Explain the importance of drying and preservation of wood to increase the service life of wood.

Assessment Tasks (AT) and Weightings:

Continuous Assessment (CA):	50%
Examination:	50%

Students must also refer to the Subject Assessment Details.

Test (x2)	20%
Assignment (x2)	10%
Laboratory (x2)	10%
Fieldwork Report	10%
Final Examination	50%

To obtain a pass grade in this Unit 50% overall must be achieved.

Unit Assessment consists of tests, quizzes, assignment, project and final exam. Students must also refer to the Assignments and the Subject Assessment Guide for detailed information on each assignment.

Assessment 1. Tests: Two class room tests to judge individual student's understanding through descriptive questions on the topics covered and suggested by the lecturer (20%).

Assessment 2. Assignment: Two individual review report by the students on a subject related topic as suggested by the lecturer (10%).

Assessment 3. Laboratory: Two Individual reports based on laboratory practicals to identify wood samples, measuring wood physical and mechanical properties, wood decay/termite resistant tests, and/or isolation of wood extractives (10%).

Assessment 4. Fieldwork: Two field practicals and presentation of individual professional level reports based on field tours organized by the lecturer (10%).

Assessment 5. Final Exam: Final exam at the end of the semester to judge individual student's understanding through both short/quiz and descriptive questions on the subject matters (50%).

Note:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism.

Student Workload:

The total workload for the average student is a nominal 150 hours based on a 15-week semester with 13 weeks of teaching as per PNG National Qualifications Framework

Subject text book:

1. Panshin A.J. & De Zeeuw C., Text Book of Wood Technology. McGraw-Hill, New York, 1980.
2. Shmulsky, R., Forest Products & Wood Science: an introduction (Sixth edition). WilleyBlackwell,
3. Desch H., Timber: Its structure, Properties and Utilization. CRC Press; 7 Sub edition, 1996.
4. Bowyer, J.L., Shmulsky, R. & Haygreen, J.G. Forest Products & Wood Science: an introduction (Fifth edition). Blackwell Publishing, 2007.

References:

1. Eddowes, P.J., Commercial timbers of Papua New Guinea, 1977.
2. Oteng-Amoako, A.A., Macroscopic Wood Identification Manual for Papua New Guinean Timbers, Forest Research Institute Publication No. 1, 1990.
3. Oteng-Amoako, A.A., Photo micrographic Atlas of Papua New Guinea Timbers: with IAWA Microscopic Hardwood Identification Features, JICA/FRI Publication No. 3, 1992.
4. Bootle K.P., Wood in Australia, properties and uses, McGraw-Hill Book Co., 1993.
5. Tisseverasinghe, A.E.K., A Manual of Timber Utilization for Ceylon, 1971.
6. AFRDI, Australian Timber Seasoning Manual, Third Edition, Forest and Wood Products Research and Development Corporation, 1997.
7. Kollmann F.F.P., & Cote W.A., "Principles of Wood Science & Technology I Solid Wood" Springer-Verlag New York Inc. 1968.
8. NISIT, PNGS 1293:2012, Preservation specification for sawn and round timber, 2012

Relevant Unitech Policies:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

YEAR 4 SUBJECT SPECIFICATIONS:

FR411: RESEARCH PROJECT PROPOSAL

Course (s)	Bachelor of Science in Forestry (NQF Level 7)
Subject Name	Research Project Proposal
Subject Code	FR411
Duration	14 Teaching weeks
Contact Hours	6 Hours per week (2hrs tutorials, 4 hrs. project)
Credit Points	9
Delivery Mode	On campus
Prerequisites	FR312
Subject Coordinator	TBA

Synopsis

This subject will provide the students with understanding of scientific research and application of scientific methods to solve real life problems in forestry and related areas. It specifically guides students on how they can develop research proposals.

Subject Topics

1. Introduction to scientific research proposal writing Research idea conception
2. Research Design and Analysis
3. Scientific Referencing
4. Use of power point for scientific information presentation
5. Techniques in oral presentation of scientific data
6. Use of posters to develop research abstracts

Subject Outline:

Topic	Content
Introduction to scientific research proposal writing Research idea conception	• Introduction to research proposal writing • Know what research proposal is and understand the importance of proposals to project implementation and outcomes delivery • Know how to formulate a research title, problem statement, hypothesis, aims and objectives.
Research Design and Analysis	• Know and apply research designs learnt in FR312 to respective research modes • Know and apply respective data analysis methods to different datasets • Know and apply different data analysis software • Know different types and styles of referencing
Scientific Referencing	• Introduction to Referencing • Types and styles of scientific referencing • The APA referencing style and guide • Use of proper referencing style using accepted referencing standards
Use of power point for scientific information presentation	• Introduction to use of Power point for scientific presentation • Power point as a tool for presenting scientific information • Power point presentation techniques
Techniques in oral presentation of scientific data	• What is oral presentation • What to present in an oral presentation • What not to present in an oral presentation
Use of posters to develop research abstracts	• Presentation of scientific information using Posters • What is research abstract • Guide for Poster presentation

Subject Learning Outcomes (SLOs)

After completing this unit students will possess the skills and knowledge to:

1. Come up with a research question that is hypothesis-testable.
2. Use Google Scholar and other internet search engines to retrieve relevant primary literature related to the research question.
3. Create an organized and comprehensive literature review which provides background on what is known already related to the research question.
4. Put together a written project proposal, using conventional formats.
5. Create effective power point presentations and poster displays to present the proposal, and later the findings of the research.

Assessment Tasks (AT) and Weightings

Continues Assessment (CA**):** 100%
Examination : No Examination

Students must also refer to the Subject Assessment Details.

Written Proposal	10%
Oral Proposal Presentation	20%
Final Proposal Report	70%

To obtain a pass grade in this Unit 50% overall must be achieved.
Unit Assessment consists of draft proposal report (10%), proposal oral presentation (20%) and final proposal report (70%)

Assessment Task 1 – Draft written proposal: Students are required to submit a draft of their proposal to be assessed by their respective supervisors to prepare the students for proposal oral presentation and final proposal write up. The draft proposal will account for 10% of the CA.

Assessment Task 2 – Oral proposal presentation: After the assessment of the draft proposal, students are required to give a 15 minutes oral defence of their proposals in the presence of the faculty. The proposal presentation accounts for 20% CA

Assessment Task 3 – Final proposal report: Taking into account comments and corrections from supervisors and faculty staff, students will submit the final written proposal to their respective supervisors for assessment which accounts for 70% of the CA.

Note:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism.

Student Workload:

The total workload for the average student is a nominal 150 hours based on a 14 week semester with 13 weeks of teaching as per PNG National Qualifications Framework

Subject Textbook:
Bright Wilson Jnr (2003). An Introduction to Scientific Research. Dover Publications, Inc. New York

References:

1. Bright Wilson Jnr (2003). **An Introduction to Scientific Research**. Dover Publications, Inc. New York
2. John Crewel (2914). **Research Design: Qualitative, Quantitative and Mixed Method Approaches**. Sage Publication Inc, California, USA. Download at: http://www.drbrambedkarcollege.ac.in/sites/default/files/Research-Design_Qualitative-Quantitative-and-Mixed-Methods-Approaches.pdf
3. Graham Basten (2010**). Introduction to scientific research projects**. Ventus Publishing ApS. Download at: http://web.ftvs.cuni.cz/hendl/metodologie/introduction-to-scientific-research-projects.pdf
4. Snooks and Co. (2002). **Style manual**. John Willey and Sons Australia Ltd.

Relevant Unitech Policies:
It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR412: MULTIPURPOSE FOREST INVENTORY AND ASSESSMENT

Course (s)	Bachelor of Science in Forestry (NQF Level 7)
Subject Name	Multipurpose forest inventory and assessment
Subject Code	FR412
Duration	13 Teaching weeks
Contact Hours	6 hours per week (3 Lecture + 1 tut + 3proj.)
Credit Points	15
Delivery Mode	On campus
Prerequisites	Forest surveying, Forest Mensuration, GIS for nat.res Forest Soils, Dendrology
Subject Coordinator	TBA

Synopsis
Students' teams will draw on accumulated technical knowledge and skills to undertake a comprehensive survey of a large forest area, involving using appropriate sampling techniques to assess trees, above ground vegetation and soil to evaluate timber volume and carbon content respectively. The project will incorporate field and lab work, synthesis and analysis and team presentation through a professional level report and seminar.

Subject Topics
1. Planning with Maps & GIS and remote sensing techniques are used in forest inventory
2. Sampling design strategies for Forest inventory
3. Multipurpose Forest Inventory in Papua New Guinea: field equipment, field measurements.
4. SOPs in timber volume estimation, above ground biomass and soil carbon estimation
5. Data processing and analysis techniques
6. Presentation and communicating the results

Subject Outline:

Topic	Content
Planning with Maps & GIS and remote sensing techniques used in forest inventory	• Course Introduction: What is forestry inventory • Sampling Theory • Inventory Planning • Field Survey and Measurement
Sampling design strategies for Forest inventory	• Inventory Techniques • Sampling Techniques
Multipurpose Forest Inventory in Papua New Guinea	• Inventory Planning • Field survey and Measurements • Field equipment • Field measurements.
SOPs in timber volume estimation	• above ground biomass • soil carbon estimation
Data processing and analysis techniques	• Inventory data processing • Data analyses approaches • Inventory Computations
Presentation and communicating of results	• Preparation of results from inventory • Summary results • Presentation and communication of results

Subject Learning Outcomes (SLOs)

After completing this unit students will possess the skills and knowledge to:

1. Plan and apply differentiate sampling strategies in multipurpose forest inventories, in situations they are best applied.
2. Participate within and contribute to a multidiscipline forest inventory team through application of team roles and communication.
3. Understanding of how forest inventory and geographical (spatially referenced) data are used in forest inventory.
4. Present the inventory result or outcomes via a detailed report and an audio visual presentation, which include application of result to PNG.

Assessment Tasks and Weightings

Continuous Assessment (CA):	100%
Final Examination:	No Examination

Students must also refer to the Subject Assessment Details.

Project Concept Report:	10%
Progress Report	20%
Final Report	50%
Team Presentation	20%

To obtain a pass grade in this Unit 50% overall must be achieved.

There is no final examination in this subject.
Unit Assessment consists of reports and a presentation as summarised below. Students must also refer to the Assignments and the Subject Assessment Guide for detailed information on each assignment.

Assessment 1. Project Concept Report: Team based report outlining team formation and roles, project selection, action plan and future schedule (10%).

Assessment 2. Progress Report: Team based report outlining team progress in achieving inventory and outcomes in line with schedule (20%).

Assessment 3. Final Report: Individual and team based report outlining inventory processes, rationale and outcomes (50%)

Assessment 4. Team Presentation: Audio visual presentation of the findings in the multiple purpose inventory outcomes (20%)

Note:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload
The total workload for the average student is a nominal 150 hours based on a 14 week semester with 13 weeks of teaching as per PNG National Qualifications Framework

Subject text book

PNGFA & FAO (2018) 1st National Forest Inventory Papua New Guinea Field Manual, NFI Technical Working Group, PNGFA and FAO.

References

1. Van Laar, A and Akca, A., [2007]: Forest Mensuration, Springer, Dordrecht, The Netherlands (e-book ISBN -13-978-1-4020-5991-9) 389 pp.
2. Wood, Turner and Brack (Eds), (1999), Code of Forest Mensuration Practice: A guide to good tree measurement practice in Australia and New Zealand. Research Working Group #2, URL: http://sres.anu.edu.au/associated/mensuration/rwg2/code ISBN 0-7315-3310-0
3. Zobrist, K.W, Hanely, D.P, Grotta, A.T and Schnepf.C. [2012]: Basic Forest Inventory Techniques for Family Forest Owners, a Pacific Northwest Extension Publication. PNW630, Washington State University, 76 pp
4. Vatasan, G.S., [1985]: Practical Forest Resource Inventories in Papua New Guinea, School of Forestry Report No. 1, Lae
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Relevant Unitech Policies:

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR413: FOREST ENGINEERING AND TIMBER HARVESTING

Course (s): Bachelor of Science in Forestry (NQF Level 7)
Subject Name: Forest Engineering & Timber Harvesting
Subject Code: FR413
Duration: 13 Teaching weeks
Contact hours: Hours per week 6 (4 lect+2 Prac)
Credit Points: 19
Delivery Mode: On campus
Prerequisites: MA186 Mathematics for Natural Resource (Forestry)
Subject Coordinator: TBA

Synopsis:
This course will provide students with the basic concepts of engineering principles that can be utilised in finding a workable solution to most forestry related problems and its relevance to forestry in terms of sound forest management practice, including the basic of road layout and design and harvesting in the tropical forest in Papua New Guinea.

Subject Topics:

1. Introduction
2. Timber Harvesting
3. Forest Road Network Planning
4. Road Geometric Design
5. Hydrology, Hydraulics and drainage design
6. Soil engineering and pavement design
7. Road construction, Maintenance and Costing
8. Planning, Monitoring, and Control Procedures in timber harvest operation.
9. Pre-harvest Preparation & Reduce Impact Logging field techniques
10. Assessment of machineries and manpower requirements
11. Logging Cost

Subject Outline:

Topic	Content
Introduction	• Course Review • Introduction • SI Units • Mechanics of Material • Ground Surveying
Timber Harvesting	• Pre-harvest Inventory • Pre-harvest Preparation of Plans • LCOP in the planning stages • LCOP in field application
Forest Road Network Planning	• Forest transportation systems • Forest road network • Factors in road network planning • Road Classification • Optimum road spacing • Road Standards • Road Location guideline
Road Geometric Design	• Forest road survey techniques • Design speed • Horizontal Alignment • Sight distance • Vertical alignment • Road cross-sections • Earth work computation • Bulking factor • Mass diagram

	• Optimum design considerations for forest roads
Hydrology, Hydraulics and drainage design	• Hydrology • Hydraulics • Drainage structures • Design principles • Subsurface drainage
Soil engineering and pavement design	• Introduction to soil engineering • Pavement surfaces • Erosion control structures • Soil and landscape analysis • Hydrology • Storm event return period
Road construction, Maintenance and Costing	• Road construction • Road maintenance • Road construction costing
Planning, Monitoring, and Control Procedures in timber harvest operation.	• Introduction to Timber Harvesting • Background, the terms and definitions • Learning outcome • The Planning, Monitoring, and • Control Procedures of PNG • Forestry Authority.
Pre-harvest Preparation & Reduce Impact Logging field techniques	• Roads and skid trails • Bridges, and culverts • Tree harvest practices • Reduce waste impact
Assessment of machineries and manpower requirements	• Road construction equipment and machinery requirements • Manpower requirements
Logging Cost	• Machineries • Transport • Manpower • Fuel and lubricant

Subject Learning Outcomes (SLOs):
After completing this subject, students will possess the knowledge and skills to:

1. Survey and measure land and forest resources so that the engineering tasks associated with forest operations can be effectively completed.
2. Be able to provide supervision for projects involving complex surveying and road building and harvest planning.
3. Provide designs and manage the forest transportation in a way that meets the needs of forest land management with societally acceptable environmental impact.
4. Plan and manage safe, economic and environmentally sound forest operations.
5. Incorporate long term forest land management and operational planning in an environmental and economic context into forest operation plans.
6. Comprehend Planning Monitoring and Control process in which logging plans are formulated, based on timber harvest strategies, and implemented.

Assessment Tasks and Weightings:
Continuous Assessment: **50%**
Final Exam: **50%**

Students must also refer to the Subject Assessment Details.

Assignment (x2):	10%
Test (x2)	20%
Major Project	20%
Final Examination	50%

To obtain a pass grade in this subject 50% overall must be achieved.
Subject Assessment consists of assignments, tests and a major project that is the construction of a horizontal curve in a road construction project. Students must also refer to the Assignments and the Subject Assessment Guide for detailed information on each assignment.

Assignment 1 – 5%
This assignment will be introduced after the students have covered units 1, 2 and 3.

Assignment 2 – Unit Test 1: 10%
This test will cover all the topics that have been covered so far and will include units 3, 4, 5 and 6.

Assignment 3 – 5%
Logging Cost Estimates to cover topic 10 – 11
In groups students will do a cost analysis of running a logging operation in cutting units based on an annual allowable harvest volume which are issued by PNGFA for each forest concession under Timber Permit. Cost projections will involve manpower, machineries, fuel consumption, maintenance cost, cost for road and skid trail construction (based on road density), extraction and etc. The final cost of operation will be drawn down to Kina/m3, which is easy to interpret and understand This is production against expenditure cost analysis, often referred by this question "What is your logging cost? (loggers)
This Assignment will be given after completing units 7, 8, & 9

Assignment 4 – Unit Test 2: 10%
This will include all topics from unit 7, 8, 9, and 10 covered in the course or subject.

Assignment 5 – Major Project (horizontal curve construction): 20%
This will be given to students in week 3.
This is a major project which will require the students to be grouped. Each group will then be given a road layout design and curve section which the student must create or establish in the field with a horizontal curve meeting the requirements of a fully loaded semi-trailer negotiating the horizontal curve.

Assessment 6- Final Exam (50%).

Relevant Unitech Policies:
It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism. (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

Student Workload:
The total workload for the average student is a nominal 150 hours based on a 14 weeks semester with 13 weeks of teaching as per PNG National Qualifications Framework.

Subject Textbook:
1. Kramer, B.W (1999). A Road Design Process for Low Volume Recreation and Resource Development Roads. Oregon State University, Corvallis, Oregon, USA.
2. PNGFA Logging Code of Practice.2nd Edition, June 2020

References:

3. Hossain, M., (2014). Forest Transportation Engineering: Roads, Culverts and Bridges. Lecture note, School of Forestry, Papua New Guinea University of Technology, Lae, Morobe Province, Papua New Guinea.
4. Kramer, B.W (1999). A Road Design Process for Low Volume Recreation and Resource Development Roads. Oregon State University, Corvallis, Oregon, USA.
5. Walbridge, TA. (1990). The Direct Location of Forest Roads. Virginia Polytechnique Institute and State University, Virginia.
6. PNGFA Logging Code of Practice.2nd Edition, June 2020
7. Art K. 2006, Planning, Location, survey, Construction and Maintenance for Low-impact Forest Roads, 4th Technical Procedural Manuel. Republic of Indonesia.

8. PNGFA Planning, Monitoring and Control Procedures.

Relevant Unitech Policies:

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR414: FOREST POLICY AND LEGISLATION

Course (s)	Bachelor of Science in Forestry (NQF Level 7)
Subject Name	Forest Policy & Legislation
Subject Code	FR414
Duration	13 Teaching weeks
Contact Hours	6 hours per week (3 Lecture + 2 tut + 1 Pract)
Credit Points	18
Delivery Mode	On campus
Prerequisites	FR123 Introduction to Forestry
Co requisites	
Subject Coordinator	TBA

Synopsis

This subject aims to provide students with an overview of natural resource and forest policies, the processes by which they are formulated, and their expression in the form of legislation and regulation.

Subject Topics

1 Natural resource and forest policy in PNG.
2 Forest management and policy.
3 Role of forest policy and law in PNG.
4 Major issues influencing policy development.
5 Roles of Governments and stakeholders in forest policy development in PNG.
6 Forest policy document and relevant legislation.
7 The PNG Logging Code of Practice.
8 Forest law enforcement and governance.
9 Legislations and Acts.
10 Log pricing and royalty systems.

Subject Outline:

Topic	Content
Natural resource and forest policy in PNG.	• Overview of forest resources • PNG's National Forest Policy - background • Forest Management and Policy – historical developments • Major issues influencing policy • development at national, regional and international level.
Forest management and policy.	• Introduction and background • PNG's forest resources and timber production • Timber production and trade
Role of forest policy and law in PNG.	• Forest Policy Document • Relevant Legislations associated with forest management in PNG
Major issues influencing policy development.	• Background and introduction • What influences the development of policies? • Challenges in implementing policies • What are the policy factors • The six (6) steps of policy making
Roles of Governments and stakeholders in forest policy development in PNG.	• Government's role in policy development • Stakeholders influence forest policy formation • Role of other interested parties in policy development
Forest policy document and relevant legislation.	• Structure, form and content of PNG forest policy • Other relevant legislation
The PNG Logging Code of Practice.	• PNG Logging Code of Practice background and introduction • Objectives of the Forestry Act • The PNG Logging Code of Practice 1996 rev. 2014 • The legal basis of the code

Forest law enforcement and governance.	• Background and Introduction • The World Bank definition of Governance • Implementation of the Forest Policy and the Forestry Act • Prevention and Detection • Investigation and prosecution
Legislations and Acts.	• Drafting legislation and acts • How legislation and acts are enacted to become law
Log pricing and royalty systems.	• Log pricing • PNGFA's royalty system • Log pricing and royalty systems role in forest policy implementation

Subject Learning Outcomes (SLOs)

On completion of this subject, students will be able to:

1. Provide an overview of natural resources and forest policies in PNG, describing principal issues that influences these policies at a national, regional and international level;
2. Demonstrate an understanding of the roles of governments and other interested parties, including foresters, in natural resource and forest policy formation processes;
3. Explain the structure, form and content of forest policy documents, and relevant legislation, in Papua New Guinea;
4. Describe how PNG legislation and acts are drafted, passed and enacted;
5. Describe the log pricing and royalty system used in Papua New Guinea, and their role as instruments of forest policy.

Assessment Tasks and Weightings

Assessment of this subject constitutes a 50% Continuous Assessment and 50% Final Examination.

Continuous assessments:	50%
Final Examination:	50%

The details of the Assessment are given below;

Assignment (x 2)	14%
Tests (x 2)	24 %
Project (x 1)	12%
Final Examination	50%

To obtain a pass grade in this Subject, 50% overall must be achieved.

Subject Assessment consists of two assignments; two tests; one Project; and the final examination as detailed below;

Assessment 1. Assignment # 1: Individualised assignment report based on the PNG National Forest Policy 1991.
The aim of this Assignment is to understand some specific requirements of the PNG National Forest Policy 1991. The specific objective of the Assignment is for the student to do some policy research on a specific Policy Requirement and report the findings (7%).

Assessment 2. Assignment # 2: Individualised assignment report based on the PNG Logging Code of Practice.
The overall aim of this assignment is to understand the different processes involved in the implementation, monitoring and enforcement of the PNG Logging Code of Practice 2014. The specific objective of the assignment is for the student to understand the basic requirements of *Section C. Timber Harvesting, [C.2] Exclusion Zones and Special Management Zones, (c.2.1) Exclusion Zones, (c.2.2) Trees adjoining Exclusion Zones or trees marked for retention* and *Section K Monitoring* and *Section L Enforcement* of the implementation of the PNG Logging Code of Practice (7%).

Assessment 3. Test # 1: Individualised testing of a student's ability to understand natural resources and policy at global level and PNG context in relation to sustainable forest management.
This test will also evaluate the individual student's ability to understand the definition of policy; law; green paper; white paper; and a bill in the context of policy development and implementation (12%).

Assessment 4. Test # 2: Individualised testing of student's ability to understand the procedures associated with forest law enforcement in PNG in relation to the implementation of the Forestry Act 1991.
In this test, the individual student will be presented with a real scenario in which the student will be required to describe the step-by-step procedures that the PFMC will follow in accordance with the various Sections of the Forestry Act 1991 in order

to evaluate the project proposals and submit the evaluation report to the Board in the context of the application of the 33 steps in the acquisition and allocation of timber concession areas in PNG (12%).

Assessment 5. Project # 1: Group work for students to interact with each other; do research; and present the outcome of their findings with reference to the different processes involved from formulating a policy to drafting of Legislations or Acts. The overall aim of this assessment is for students to understand the different processes involved from formulating a policy to drafting of Legislations or Acts. The specific objectives are for the students to understand how Policies are formulated into Bills by legislators and are enacted to become law at the floor of Parliament (16%).

Assessment 6. Final Examination: Individualised testing in the form of a final examination to assess and evaluate the ability of the student to understand; apply; and demonstrate the FR414 course undertaken in the final year in semester II of the BSc in Forestry Degree Program (50%).

Note:
It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload
The total workload for the average student is a nominal 150 hours based on a 14-week semester with 13 weeks of teaching as per PNG National Qualifications Framework

Subject text book
1. Ellefson, P.V., (1991). Forest Resources Policy: processes, participants and programs,
2. McGraw Hill.
3. Ministry of Forests. 1991. National Forest Policy. Independent State of PNG. Hohola, September 1991.
4. PNG Forest Authority. 1991. Forestry Act 1991. Independent State of PNG. No. 30 of 1991. Certified on 16 October 1991, Port Moresby.

References

1. Lamb, D., (1990). Exploiting the Tropical Rainforest: an account of Pulpwood Logging in Papua New Guinea. Man and Biosphere Series. Vol. 3.
2. PNG Forest Authority. 2001. Forestry (Amendment) Act 1993; 1996; 2000; 2005. Independent State of PNG. Certified on 29th January 2001, Port Moresby.
3. Poore, D., (1989). No Timber Without Trees: sustainability in the Tropical Forest. Earthscan Publications Ltd.
4. Sharma, N.P., (Ed.) (1992). Managing the World's Forests: looking for the balance between conservation and development. World Bank, Washington D.C.
5. Westoby, J., (1987). The Purpose of Forests. Basil Blackwell Ltd, London.
6. Yosi, C.K., (2011). Scenarios for Community-based Management of Cutover Native Forest in Papua New Guinea. PhD Thesis. Department of Forest and Ecosystem Science University of Melbourne. Australia.
7. Yosi, C.K., R.J. Keenan., and J.C. Fox. 2011. Forest management in Papua New Guinea: historical development and future directions. Pages 17-31 in J. C. Fox., R. J. Keenan., C. L. Brack., and S. Saulei eds. Native forest management in Papua New Guinea: advances in assessment, modelling, and decision-making. ACIAR Proceeding No. 135. Australian Center for International Agricultural Research, Canberra.

Relevant Unitech Policies:
It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination).

FR421: RESEARCH PROJECT AND PUBLICATION

Course (s)	Forestry (NQF Level 7)
Subject Name	Research Project and Publication
Subject Code	FR 421
Duration	14 Teaching weeks
Contact Hours	6 Hours per week (2hrs tutorials, 4 hrs. project)
Credit Points	9
Delivery Mode	On campus
Prerequisites	FR 411 and FR 312
Subject Coordinator	TBA

Synopsis

This subject will assist students with practical application of scientific knowledge and skills gained from FR411 to collect and collate data, analyse and present findings in both oral and written forms.

Subject Topics

1. Techniques of data analysis, extrapolation and interpretations
2. Introduction to types of relevant scientific journals for scientific research publications
   Scientific publishing standards and requirements
3. Steps and techniques in writing a scientific publication

Subject Outline:

Topic	Content
Techniques of data analysis, extrapolation and interpretations	• Data analyses approaches • Results extrapolation and interpretation • Research supervision • Researcher-supervisor collaboration in research
Introduction to types of relevant scientific journals for scientific research publications	• Scientific Journals • Impact Factors for Journals • Authors 'guide to publication • Techniques and skills in research • Presentation of oral and written scientific data • Skills and knowledge of research data presentation
Scientific publishing standards and requirements	• Standard Procedures for scientific publication • Developing publication skills • Submission of scientific papers for publication • Reviewer's role in publication

Subject Learning Outcomes (SLOs)

After completing this unit students will possess the skills and knowledge to:

1. Comprehensively analyse the data obtained from the study, and apply the appropriate statistical inference tools to determine whether the stated hypothesis was supported.
2. Synthesise the results into a coherent, comprehensive discussion.
3. Create a comprehensible final report that incorporates style and formatting conventions of written scientific reports.
4. Prepare a basic scientific research paper for publication.

Assessment Tasks (AT) and Weightings

Continues Assessment (CA): 100%
Final Examination: No Examination

The details of the Assessment are given below;

Draft Manuscript	10%
Conference Standard Poster	10 %
Oral Proposal Presentation	20%
Final Manuscript	60%

To obtain a pass grade in this Unit 50% overall must be achieved.
Unit Assessment consists of draft manuscript (10%), project abstract poster (10%), project oral presentation (20%) and final report in a scientific manuscript format (60%).

Assessment Task 1 – Draft written manuscript: Students are required to submit a draft of their research manuscript for supervisors to assess and provide commentary. The draft manuscript will account for 10% of the CA.

Assessment Task 2 – Conference poster – Students will submit a scientific conference standard poster for assessment (10%).

Assessment Task 3 – Oral proposal presentation: After the assessment of the draft manuscript, students are required to give a 15 minutes oral defence of their projects in the presence of the faculty. The final project presentation accounts for 20% CA

Assessment Task 4 – Submission of final manuscript for assessment with weighted CA of 60%

Note:
It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:

The total workload for the average student is a nominal 150 hours based on a 14 week semester with 13 weeks of teaching as per PNG National Qualifications Framework.

Subject Textbook:

1. Bright Wilson Jnr (2003). An Introduction to Scientific Research. Dover Publications, Inc. New York
2. Snooks and Co. (2002). Style manual. John Willey and Sons Australia Ltd.

References:

3. Bright Wilson Jnr (2003). **An Introduction to Scientific Research**. Dover Publications, Inc. New York
4. Graham Basten (2010**). Introduction to scientific research projects**. Ventus Publishing ApS. Download at: http://web.ftvs.cuni.cz/hendl/metodologie/introduction-to-scientific-research-projects.pdf
5. John Crewel (2914). **Research Design: Qualitative, Quantitative and Mixed Method Approaches**. Sage Publication Inc, California, USA. Download at: http://www.drbrambedkarcollege.ac.in/sites/default/files/Research-Design_Qualitative-Quantitative-and-Mixed-Methods-Approaches.pdf
6. Karts Michael (2009). **From Research to Manuscript: A guide to scientific writing**. Springer, Netherlands.
7. Snooks and Co. (2002). **Style manual**. John Willey and Sons Australia Ltd.

Relevant Unitech Policies:
It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR422: WILDLIFE HABITAT AND MANAGEMENT

Course (s): Bachelor of Science in Forestry (NQF Level 7)
Subject Name: Wildlife Habitat and Management
Subject Code: FR422
Duration: 13 teaching weeks
Contact Hours: hours per week 6 (2lectures +2lab+2tutorial)
Credit Points: 15
Delivery Mode: On campus
Prerequisites: FR211 Forest Ecology; FR223 Forest Biodiversity
Subject Coordinator: TBA

Synopsis:
This subject tries to clarify the historical biogeography of New Guinea and its impact to the forest wildlife and its habitat. It includes understanding the natural impacts towards the ecology of our forests as well as the wildlife habitat and the social changes. This subject also deals with the application of the principles of ecology and forest biodiversity to the management of our wildlife and its habitat in Papua New Guinea, and to educate forestry students to understand the importance of protecting the different type of habitat needed by our unique wildlife species. Similarly, it will educate them in appropriate protection measures for the habitats that will save many other associated plant and animal species. To enable the students to understand the indicator and significant species of wildlife in PNG, the conservation methods, its processes, its strategies and plans to protect wildlife in PNG. Students should understand all the ecological relationships involved regarding population dynamics, ecological niches, and population census and habitat assessments). Thus, this subject focuses strongly on ecology and biodiversity.

Subject Topics:

1. Overview and Introduction of Wildlife Management (What is wildlife and what is wildlife management; Introduction to New Guinea's rich wildlife; Prehistoric wildlife and New Guineas Biogeographical history).
2. Principles of Ecology to Management of Wildlife and Habitat Management (Wildlife population structure and dynamics; Factors determining population growth rate; Environment carrying capacity; Effects of overpopulation and controlled hunting; Effective population size; genetic and demographic; Concept of population density and variability; Demographic problems and risks of species extinction).
3. Habitat Management (Biodiversity and ecosystem management; Wildlife habitat and managing wildlife hunting; Human impacts on wildlife and its habitat; Habitat Loss; invasive species; forest fragmentation and edge effects; Management of Wildlife Corridors; Application of GIS and wildlife population / habitat recovery and modelling).
4. PNG's Wildlife Species of Management Concern (Overview of PNG's Wildlife species lost and needing management; Survey of Major Wildlife Groups in Papua New Guinea).
5. Wildlife Conservation and Habitat Management Options in PNG (Wildlife management policies and Laws governing wildlife management in PNG; International Conventions and management of rare and endangered species (CITES, IUCN REDLIST, etc.); Wildlife Conservation Areas in PNG (Wildlife Management Areas, National Parks, Conservational Areas, etc.); World Heritage Sites & Others; Commercially exploited species and its breeding efforts in PNG).
6. Wildlife Management in Developing Countries (Traditional Wildlife Management Practices in Papua New Guinea; Wildlife Conservation efforts by PNG Government; Integrating Protected Areas with Local Aspirations)

Subject Outline:

Topic	Content
Overview and Introduction to Wildlife Management	• What is wildlife and what is wildlife management? • Introduction to New Guinea's rich wildlife • Prehistoric wildlife
Principles of Ecology to Management of Wildlife and Habitat Management	• Basic ecological concepts • Population structure and dynamics • Wildlife habitat • Managing wildlife hunting • Human impacts on wildlife • Biodiversity and ecosystem management

Habitat Management	• The greatest threat to species diversity is Habitat Loss • Purpose of wildlife habitat management. • Controlling invasive plants. • Managing vegetation cover • Forest edge improvement. • Creating refugia for wildlife
PNG's Wildlife Species of Management Concern	• Traditional Wildlife Management Practices in Papua New Guinea • Wildlife Conservation efforts by PNG Government • Survey of Major Wildlife Groups in Papua New Guinea
Wildlife Conservation and Habitat Management Options in PNG	• Legislations governing Wildlife Conservation in PNG • PNG's Wildlife Conservation areas
Wildlife Management in Developing Countries	• International Conventions • Management of rare and endangered species (CITES, IUCN Redlist, etc) • Commercially exploited species

Subject Learning Outcomes (SLOs):

On completion of this subject, students should be able to:

1) Identify and differentiate the unique forest wildlife of Papua New Guinea and their preferable forest habitat.
2) Understand the ecological, cultural and economic value of wildlife to Papua New Guinea;
3) Describe the wildlife conservation management methods relevant to Papua New Guinea;
4) Understand and describe the basic principles of population dynamics, ecological niches and habitat modelling;
5) Develop a conservation management plan for a threatened species.

Assessment Tasks and Weightings:

Continuous Assessment (CA): 50%
Examination: 50%

Students must also refer to the Subject Assessment Details.

Tests: 10%
Assignments: 30%
Quiz: 10%
Final Exam: 50%

To obtain a pass grade in this Unit, 50% overall must be achieved.

Unit Assessment consists of tests, quizzes, assignment and final exam. Students must also refer to the Assignments and the Subject Assessment Guide for detailed information on each assignment.

Assessment 1. Major Assignment: One major written assignment on topics to judge the individual student's understanding through descriptive writing on the topics provided by the lecturer (20%).

Assessment 2. Quiz 1: Classroom quiz to judge the individual students understanding on subject topics covered as suggested by the lecturer (5%).

Assessment 3. Quiz 2: Classroom quiz to judge the individual students understanding on subject topics covered as suggested by the lecturer (5%).

Assessment 4. Test 1: Classroom test to judge the individual students understanding on subject topics covered as suggested by the lecturer (5%).

Assessment 5. Test 2: Classroom test to judge the individual students understanding on subject topics covered as suggested by the lecturer (5%).

Assessment 6. Assignment: Group fieldwork and presentation of report through a professional level report and seminar on a subject related topic related to an excursion as suggested by the lecturer (10%).

Assessment 7. Final Exam: Final exam at the end of the semester to judge individual students' understanding through both short/quiz and descriptive questions on the subject matters (50%).

It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:
The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 14-week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Textbook:
Bookhout T.A., (ed.) (1987). Research and Management Techniques for Wildlife and Habitats. The Wildlife Society, Bethesda, Maryland.

References:
1. Bookhout T.A., (ed.) (1987). Research and Management Techniques for Wildlife and Habitats. The Wildlife Society, Bethesda, Maryland.
2. Bonaccorso, F.J. (1998). *Bats of Papua New Guinea*. Conservation International Tropical Field Guide Series, Conservation International, Washington DC, USA.
3. Pratt, T.K. & Beehler, B.M. (2014). Birds of New Guinea, 2nd Edition. Princeton University Press.
4. Flannery, T.F. (1990). Mammals of New Guinea. Cornell University Press.
5. Menzies, J.I. (2006). The Frogs of New Guinea and the Solomon Islands. Pensoft. Moscow.

Relevant Unitech Policies:
It is important that all students familiarise themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR423: FOREST PRODUCTS AND INDUSTRIES

Course (s)	Bachelor of Science in Forestry (NQF Level 7)
Subject Name	Forest Products & Industries
Subject Code	FR 423
Duration	14 Teaching weeks
Contact Hours	6 hours per week (2 Lecture + 1 tut + 0 lab + 3 field)
Credit Points	15
Delivery Mode	On campus
Prerequisites	Introduction to Forestry, Wood Science & Technology
Subject Coordinator	TBA

Synopsis

This subject deals with traditional wood products and utilization, application of simple and advance technologies/processes in converting logs into primary and secondary products including engineered products. Also, this subject emphasizes value-adding technologies (machining) for improving product quality to meet domestic and international market specifications, industrial waste management and utilization, safety standards in timber processing industries, role of wood products for carbon mitigation as well as wood biomass for renewable energy.

Subject Topics

1. Background/Introduction of forest products & industries
2. Timber products Vs non-renewable materials for engineering constructions
3. PNG forest industry & world timber product trade
4. Traditional timber products & end uses
5. Solid timber products & end uses
6. Primary processing: sawmilling industry & sawn timber product
7. Secondary processing: wood products & industries
8. Engineered timber products: wood panels/composites
9. Industrial wood waste management & utilization
10. Industrial safety standards
11. Timber products for carbon mitigation & wood biomass for bio-energy

Subject Outline:

Topic	Content
Background/Introduction of forest products & industries	• Background and introduction • Forest products • Timber industries
Timber products Vs non-renewable materials for engineering constructions	• Timber products • Non-renewable materials • Engineering construction
PNG forest industry & world timber product trade	• The Forest Industry in PNG • The role of Industry and trade of timber products • World timber trade
Traditional timber products & end uses	• Types of timber products in PNG • End uses of traditional timber products
Solid timber products & end uses	• Introduction to Solid Timber products • End uses of solid timber products
Primary processing: sawmilling industry & sawn timber product	• Wood processing • Sawmilling • Sawn timber products
Secondary processing: wood products & industries	• Major wood products • Minor wood products

Engineered timber products: wood panels/composites	• Introduction to Engineered timber products • Wood panels and composites
Industrial wood waste management & utilization	• Wood wastage in sawmilling • Waste management in sawmilling facilities • Recovery rate of sawmilling
Industrial safety standards	• Safety standards and requirements in the timber industry • Occupational Health and Safety in the timber industry
Timber products for carbon mitigation & wood biomass for bio-energy	• Carbon mitigation in the timber industry • Wood biomass • Bio-energy and bio-fuel

Subject Learning Outcomes (SLOs)

After completing this unit students will possess the skills and knowledge to:

1. Understand wood as an eco-friendly material for engineering constructions
2. Know PNG's forest industry & world timber product trade and markets
3. Understand traditional & solid timber products and their end uses
4. Learn primary, secondary timber processing and manufacture of various engineered products
5. Know industrial wastes management, utilization and safety standards
6. Understand the role of timber products for carbon mitigation and wood biomass for bio-energy

Assessment Tasks (AT) and Weightings

Continuous Assessment (CA): 50%
Final Examination: 50%

Students must also refer to the Subject Assessment Details.

Tests (x2): 20%
Assignments: 20%
Fieldwork Report: 10%
Final Exam: 50%

To obtain a pass grade in this Unit 50% overall must be achieved.

Unit Assessment consists of tests, quizzes, assignment, project and final exam. Students must also refer to the Assignments and the Subject Assessment Guide for detailed information on each assignment.

Assessment 1. Tests: Two class room tests to judge individual student's understanding through descriptive questions on the topics covered and suggested by the lecturer (20%).

Assessment 2. Assignment: A review report on group work: each group of students will work on designing a simple technology to process and add-value to develop a finish product that will have market value. The students will do short oral presentation and submit the report (20%).

Assessment 3. Fieldwork: Two field practicals and presentation of individual professional level reports based on field tours organized by the lecturer (10%).

Assessment 4. Final Exam: Final exam at the end of the semester to judge individual student's understanding through both short/quiz and descriptive questions on the subject matters (50%).

Note:

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:

The total workload for the average student is a nominal 150 hours based on a 14 week semester with 13 weeks of teaching as per PNG National Qualifications Framework

Subject Text book:

1. Walker, J.F.C. Primary Wood Processing. Principles & Technology. Chapman & Hall, 1993.
2. Shmulsky, R., Forest Products & Wood Science: an introduction (Sixth edition). Willey-Blackwell,
3. Desch H., Timber: Its structure, Properties and Utilization. CRC Press; 7 Sub edition, 1996.
4. Bowyer, J.L., Shmulsky, R. & Haygreen, J.G. Forest Products & Wood Science: an introduction (Fifth edition). Blackwell Publishing, 2007
5. Tsoumis, G. Science & Technology of Wood. Structure, Properties & Utilization. Chapman & Hall, 1991
6. Forest Products Laboratory. Wood handbook – Wood as an Engineering Material Agric. Handb. 72. Washington, DC: USDA rev. 1987.

References:

1. Eddowes, P.J., Commercial timbers of Papua New Guinea, 1977.
2. Oteng-Amoako, A.A., Macroscopic Wood Identification Manual for Papua New Guinean Timbers, Forest Research Institute Publication No. 1, 1990.
3. Bootle K.P., Wood in Australia, properties and uses, McGraw-Hill Book Co., 1993.
4. Tisseverasinghe, A.E.K., A Manual of Timber Utilization for Ceylon, 1971.
5. Kollmann F.F.P., & Cote W.A., "Principles of Wood Science & Technology I Solid Wood" Springer-Verlag New York Inc. 1968.
6. Panshin, A.J.; Harrar, E.S.; Bethel, J.S. & Baker, W.J. Forest Products: their sources, Production & Utilization.
7. NISIT, PNGS 1293:2012, Preservation specification for sawn and round timber, 2012
8. Sosef, M.S.M.; Hong, L.T. & Prawirohatmodjo, S (editors) Plant Resources of South-East Asia No. 5 (3). Timber trees: Lesser-known timbers. Backhuys Publishers, 1998.

Relevant Unitech Policies:

It is important that all students familiarize themselves with the PNG University of Technology Assessment Guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR424: PROJECT AND HUMAN RESOURCE MANAGEMENT

Course (s)	Bachelor of Science in Forestry (NQF Level 7)
Subject Name	Project and Human Resource Management
Subject Code	FR424
Duration	13 Teaching weeks
Contact Hours	6 Hours per week (2hrs lecture + 3hrs practical + 1hr tutorial)
Credit Points	15
Delivery Mode	On campus
Prerequisites	FR 314, FR 325, FR326 & FR 414
Subject Coordinator	TBA

Synopsis

The course Human Resource Management (HRM) deals with people-related activities in an organization. The course develops an understanding of the role and functions of the various human resource activities in an organization, providing students with a comprehensive view of key HRM concepts, techniques and issues. Topics include mission statements, strategic plans, performance indicators, organization structure, role and responsibilities of supervisors, scope of authority, occupational health and safety, characteristics of an effective leader/manager, maintaining effective work groups, motivation, and delegation. Personnel management, recruitment and selection, performance appraisal, separation processes, career development, assertion and negotiation skills, conflict resolution, meeting processes, industrial relations. Assignments will involve individual extensive literature review and submission of a professional level report. The project will incorporate an extensive literature review and group presentation through a professional level report and seminar.

Subject Topics

1. Philosophies of an organization
2. Role and responsibilities of supervisors.
3. Occupational health and safety.
4. Personnel Management.
5. Negotiation skills
6. Conflict and dispute resolution.
7. Meeting processes
8. Industrial relations.

Subject Outline:

Topic	Content
Philosophies of an organization	• Philosophy of an Organization. • Concepts of Philosophy • Organizational structures • Institutional Thinking • Administration and Human Resource Management
Role and responsibilities of supervisors.	• Introduction to Supervision • Role of a Supervisor • Transition from Team Members to First-line Supervisor • Qualities of a Supervisor • Developing Leadership Skills • Positive Attitude
Occupational health and safety.	• Ethics of workplace safety • Occupational Safety and Health Administration • Codes of ethics in the workplace • Harassment in the workplace
Personnel Management.	• Personnel Management • The Role of Human Resource Management • Theory Models in Human Resource Management • Employment Policies and Laws in PNG.
Negotiation skills	• Introduction to Negotiation • What is Negotiation

	• Industrial Relations
Conflict and dispute resolution.	• Opposing interests – the core of most conflicts • Potential causes of conflicts • What are the major causes of Conflict? • Competition over scarce resources, time • Ambiguity over responsibility and authority • differences in perceptions, work styles, attitudes, communication problems
Meeting processes	• Types of Meetings • Preparing for a Meeting and Setting up a Meeting place • Starting a Meeting and Conducting a Meeting • Keeping records of a Meeting (Meeting minutes)
Industrial relations.	• Introduction to Industrial Relations • What is Industrial Relation

Subject Learning Outcomes (SLOs)
On completion of this subject, students should be able to:

1. Demonstrate an understanding of the basic philosophies of an organization indicator;
2. Discuss and define supervision styles and strategies, the characteristics of a good leader/manager and the role of supervision in maintaining effective work groups;
3. Define expectations and responsibilities of supervisors, employers, and employees, including occupational health and safety considerations;
4. Know the elements of the HR function (e.g. – recruitment, selection, training and development, etc.) and be familiar with each element's key concepts & terminology;
5. Apply proper procedures for the conduct of meetings, and act as chairperson;
6. Deal with conflict resolution; and
7. Describe the role, processes and requirements of industrial relations.

Assessment Tasks and Weightings

Continuous	50%
Examination	50%

Students must also refer to the Subject Assessment Details.

Tests (x2):	20%
Quizzes (x2)	10%
Assignments:	10%
Project:	10%
Final Exam:	50%

To obtain a pass grade in this subject a 50% overall must be achieved.
Continuous assessment consists of assignments, tests and reports as summarised below. Students must also refer to the assignments and the subject assessment guide for detailed information on each assignment.

To obtain a pass grade in this Unit 50% overall must be achieved.
Unit Assessment consists of tests, quizzes, assignment, project and final exam. Students must also refer to the Assignments and the Subject Assessment Guide for detailed information on each assignment.

Assessment 1. Tests: Two class room tests to judge individual student's understanding through descriptive questions on the topics covered and suggested by the lecturer (20%).

Assessment 2. Quizzes: Two class room quizzes to judge individual student's understanding through short/quiz type questions on the topics covered and suggested by the lecturer (10%).

Assessment 3. Assignment: Individual review report by the students on a subject related topic as suggested by the lecturer (10%).

Assessment 4. Project: Group review work and presentation through a professional level report and seminar on a subject related topic as suggested by the lecturer (10%).

Assessment 5. Final Exam: Final exam at the end of the semester to judge individual student's understanding through both short/quiz and descriptive questions on the subject matters (50%).

Note:

It is important that all students familiarize themselves with the PNG University of Technology Assessment guidelines including those on plagiarism at www.unitech.ac.pg

Student Workload:
The total workload for the average student is a nominal 150 hours based on a 14-week semester with 13 weeks of teaching as per PNG National Qualifications Framework

Subject Textbook:

Stine, R.J. 2014. Human Resource Management, John Willey, Australia.

References:

1. Flippo, E.B., (1984). Personnel Management. (6th ed.). McGraw-Hill International eds, New York.
2. George C.G., and Cole K., (1992).Supervision in Action: the art of managing. (3rd ed.). Prentice Hall.
3. Haiman, T., & Hiegert, R., (1987).Supervision: Concepts and Practices for Management (4th edition). Southwestern Publ. Co., Ohio
4. Luis, R., Gomez-Meija, 2012. Principles of Management, Azonia State University.
5. Rao, P. Subba, Management: Theory and Practice, Himalaya Publishing House, Mambia, India.
6. Stine, R.J. 2014. Human Resource Management, John Willey, Australia.
7. Noel, Raymond, A. 2016. Employee Training and Development, McGraw-Hill, New York.

Relevant Unitech Policies:
It is important that all students familiarize themselves with the PNG University of Technology Assessment guidelines including those on plagiarism at www.unitech.ac.pg (http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules (http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)

FR425: PROFESSIONAL WORK EXPERIENCE

Course (s)	Bachelor of Science in Forestry (NQF Level 7)
Subject Name	Professional Work Experience
Subject Code	FR425
Duration	60 days in the workplace
Contact Hours	Not Applicable
Credits:	0
Delivery Mode	Workplace
Prerequisites	Completion of Year 2
Subject Coordinator	TBA

Synopsis

Students must complete a minimum of 60 days in total of professional practice in their discipline area to meet professional requirements and be eligible to graduate from their Bachelor's degree course. The 60 days will normally consist of not more than 3 periods of employment with each period normally being of 20 days minimum duration. The subject requires students to document details of the practical work and professional practice skills they acquire within the workplace. Since students may obtain work experience over their full course, experience may take numerous forms ranging from roles as junior members of teams to leading parts of projects. Students maintain a dairy and prepare a portfolio that describe the work undertaken and how the work experience has contributed to the development of Unitech Graduate Capabilities and their professional discipline course learning outcomes. A diary with regular entries must be maintained as a true and faithful record of the days/hours the student has completed and each work experience period must be certified by the employer.

Subject Topics

1. Review the Unitech Graduate Capability statements and Course Learning Outcomes for their Discipline;
2. Arrange and prepare for Professional Work Experience;
3. Undertake the required amount of Professional Work Experience;
4. Document periods of Professional Work Experience in a Diary;
5. Prepare a single Professional Work Experience portfolio that outlines key professional aspects of the work experience and reflects on work experience participation.

Subject Outline:

Topic	Content
Review the Unitech Graduate Capability statements and Course Learning Outcomes for their Discipline;	• Graduate statement • Course learning outcomes
Arrange and prepare for Professional Work Experience;	• Liaison with the National Forest Service • Liaison with the timber industry • Liaison with other relevant stakeholders
Undertake the required amount of Professional Work Experience;	• Undertake required fieldwork • Hands-on fieldwork with stakeholders
Document periods of Professional Work Experience in a Diary;	• Keep diary in a template provided • Submit required report after completion of Professional Work Experience Training
Prepare a single Professional Work Experience portfolio that outlines key professional aspects of the work experience and reflects on work experience participation.	• Prepare and submit detailed report of the 60 days Professional Work Experience Training in a required format • Grading of the report and the entire training program as Satisfactory or Unsatisfactory

Subject Learning Outcomes (SLOs)
On completion of this subject students will be able to:

1. Demonstrate practical skills in a selected discipline;
2. Undertake and complete assigned tasks in the workplace and maintain a professional level record of those tasks;
3. Critically reflect on achievements within the workplace within the context of the course learning outcomes of their discipline;
4. Communicate workplace experiences and achievements through a professional portfolio;
5. Understand and apply basic workplace health and safety principles in their discipline setting.

Assessment Tasks and Weightings
Continuous Assessment: 100%
Final Examination: No Examination

Students must also refer to the Subject Assessment Details.
Diary Report: 40%
Professional Work Experience Portfolio: 60%

This subject has a Satisfactory or Unsatisfactory Assessment.
There is no final examination in this subject. Both assessment tasks should be submitted during the student's final year of study to enable eligibility for graduation.

Assessment 1 – Professional Work Experience Diary. The diary will provide details of 60 days minimum of workplace employment within the student's discipline. The diary may consist of up to 3 separate employment periods, each of 20 days minimum duration. Each period of employment must be accompanied by a statement from the employer. **The combined diary contributes 40% towards the final grade for the subject.**
Assessment 2 - Professional Work Experience Portfolio: The single portfolio will provide descriptions of the work experience undertaken including salient aspects of major projects undertaken and the student's role within those projects. While being a single portfolio it may consist of under to 3 episodes of workplace experience. The student will also reflect on each period with the workplace within the context of the learning outcomes of their course. **The single portfolio contributes 60% towards the final grade for the subject.**

It is important that all students familiarize themselves with the PNGUOT Assessment Guidelines including those on plagiarism and other relevant policies.

These policies can be viewed by visiting the PNGUOT website:
http://asix.unitech.ac.pg/apps/pnguot/?q=unitech/policies
(http://www.unitech.ac.pg/unitech/policies/academic-integrity) and also examination rules
(http://www.unitech.ac.pg/unitech/policies/procedures-university-examination)