SCHOOL OF APPLIED SCIENCES

Head of School
Lydia Rubiang-Yalambing, PhD (UNSW, Australia), MSc (King's College, London), BSc (PNGUoT)

Applied Chemistry Section

Program Head

David Timi, PhD, MPhil, BSc (UNITECH, PNG)

Academic Team

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Senior Lecturer
David Timi, PhD, MPhil, BSc (UNITECH, PNG)

Lecturers
Justin Narimbi, MPhil (UNSW, Australia), MSc (UNSW, Australia), BSc (UNITECH)
Jayson Wau, MPhil (UNITECH), BSc (UNITECH) – Study Leave
Kaupa Philip, M.Phil. (PNG Unitech, PNG) M.Sc. (Bharathiar University, India), B.Sc. (PNG Unitech, PNG)

Food Technology Section

Program Head
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Academic Team

Reilly Nigo, Postgraduate Certificate (University of Cambridge, UK), MSc (University of Reading, UK), BSc (UNITECH)
Lydia Rubiang-Yalambing, PhD (UNSW, Australia), MSc (King's College, UK), BSc (PNGUoT)
Sogoing Denano, MSc (University of Reading, UK), BSc (UNITECH)

Senior Technical Instructors
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Technical Team

Laboratory Manager
Jerry Sei, MSc (Massey, NZ), BSc (UNITECH)

Principal Technical Officers
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Jacqueline Ghamugh, BSc (UNITECH)

Senior Technical Officers
Sibron Bingmalu, BSc (Unitech)
Philip Badawol, Diploma (LTC)

Tagi George BSc (Unitech)

Technical Officer
Yvonne Pamao BSc (Unitech)

Senior Technical Officer and Boiler man
Donald Bangui, Diploma (PNG PTI)

Senior Storeman
Solomon Bulu, Pre-Employment Tech. Training (Chem.)

Administration Team

Executive Secretary
Yamu Elisha Mulung, Basic Secretary Certificate, Stenographer Certificate (LTC)

Support Staff

Janitor
Salome Kwambara
Robin Moliki

A BRIEF INTRODUCTION TO THE DEPARTMENT AND THE PROGRAMS

Degree Programs

The Department of Applied Sciences consists of two sections, Applied Chemistry and Food Technology. Apart from the service courses, the Department offers the following four-year academic programs leading to:
(a) Bachelor of Science in Food Technology
(b) Bachelor of Science in Applied Chemistry

These degree programs are designed to produce Applied Chemists and Food Technologists who will be able to pursue careers in industry, academia or government sectors. Applied chemists perform analysis, testing and investigations of a wide range of materials. Food technologists are concerned with production, processing, preservation, distribution and utilization of foods.

The first year of each course is designed to form a common foundation upon which years 2, 3 and 4 of the separate professional options are based.

Entry requirements (any one of the following:

i) **Food Technology:** Grade 12 School Leavers: SAT_P Test Score, Minimum of B grades in physics, Maths A plus B grades in either chemistry, or biology and B grades in either Language and Literature or Applied English.
ii) **Applied Chemistry**: Grade 12 School Leavers: STAT_P Test Score, Minimum of B grades in chemistry, Maths A plus B grades in either physics or biology and B grades in either Language and Literature or Applied English.
iii) All non-school leavers entering into Applied Sciences programs: as in school leaver requirements except that upon acceptance with the minimum requirement will do entry exams instead of STAT-P test.
iii) Diploma Certificate from Polytechnical Institute with Credit grades in science related subjects are required to do entry exams before entry.
iv) Diploma from other universities will be selected on case-by-case basis as per the PNGUoT admissions policy.

Chemistry is taught to students from the Schools of Agriculture, Forestry and Applied Physics.

Higher Degree Program

The School also offers postgraduate degrees in Master of Philosophy (MPhil) and Doctor of Philosophy (PhD) by research.

Entry requirement for a MPhil is Bachelor's Degree in Science with above average grades from a recognized university and for a PhD program Master of Science degree is required.

COURSE STRUCTURE

BACHELOR OF SCIENCE IN APPLIED CHEMISTRY

First Year First Semester

Code	Subject	Contact Hours	Credit
CH111	Foundation Chemistry	6	15
CD111	Development Practices & Sustainability	6	15
MA115	Mathematics 1 AS (Applied Sciences)	6	20
PH112	Physics for Applied Science I	6	17
		24	**67**
First Year	**Second Semester**		
CH112	Introduction to Applied Chemistry	6	15
FR123	Biology (Plant & Animal)	6	15
MA125	Applied Mathematics	6	20
PH121	Physics for Applied Science II	6	17
		24	**67**

Second Year First Semester

Code	Subject	Contact Hours	Credit
CH211	Applied Physical Chemistry	6	18
CH212	Applied Inorganic Chemistry	6	18
CH213	Applied Organic Chemistry	6	18
CS113	Introduction to ICT	6	18
		24	**72**
Second Year	**Second Semester**		
CH221	Advanced Physical Chemistry	6	18
CH222	Advanced Inorganic Chemistry	6	18
CH223	Advanced Organic Chemistry	6	18
CH224	Analytical Chemistry	6	18
		24	**72**

Third Year First Semester

Code	Subject	Contact Hours	Credit
CH312	Geochemistry/Mineral Technology	6	16
CH313	Instrumental Analysis	6	16
CH314	Advanced Analytical Chemistry	6	20
MP311	Hydrometallurgy	6	13
		24	**65**
Third Year	**Second Semester**		
CH321	Medicinal Chemistry & Natural Product	6	16
CH322	Industrial Inorganic Chemistry	6	16
CH323	Advanced Instrumental Analysis	6	16
CH324	Environmental Chemistry I	6	16
***CH400**	Industrial Training		
		24	**64**

Fourth Year First Semester

Code	Subject	Contact Hours	Credit
CH411	Research Project I	6	8
CH412	Industrial Organic Chemistry	6	16
CH413	Petroleum Chemistry	6	16
BM111	Introduction to Business Management	6	20
		24	**60**
Fourth Year	**Second Semester**		
CH421	Research Project II	6	8
CH422	Organometallic Compounds & Nano Technology	6	16
CH423	Food Chemistry & Analysis	6	16
CH424	Environmental Chemistry II	6	16
		24	**56**

***CH400: Industrial Training – Industrial work experience to be undertaken in Sem 2 of Year 3 Nov-Jan. This subject will not have any credit point and will be assessed with pass/fail.**

Graduate Statement (GS)

Our Unitech Applied Chemistry Graduates will research, trained to be problem-solvers in chemistry related issues in industries, through understanding of research and quality control methodologies. The graduates will be innovative in creating healthy environment using knowledge-based resources available in the country.

Course Learning Outcomes (CLOs)

On completion of the course the student will:

CLO1	Plan, select and demonstrate suitably related theoretical knowledge in science, mathematics, information technology and communication skills to solve chemistry related problems.
CLO2	Understand and comprehend concepts and principles in chemistry, applied chemistry and engineering chemistry.
CLO3	Select and use appropriate lab equipment/equipment, including digital technologies, to collect and record data systematically and accurately; prepare and present scientific reports, and effectively communicate to a variety of audience across all levels of society.
CLO4	Understand the approved standards of Occupational Health and Safety (OHS); select and apply safe working practices in laboratory and work environment, assess risk and ethical issues associated with the laboratory practices.
CLO5	Organize, plan and apply the knowledge and techniques to upgrade and compete according to the changes in day-to-day scientific development; understanding the strategies to effectively use those concept & skills in chemistry related industries.
CLO6	Demonstrate knowledge and understanding of different operational aspects of analytical instrumentation and differentiate it to meet the specific needs of mining, agriculture, petroleum, food industries. Plan and implement chemistry knowledge in environment related systems.

CLO7	Interact and collaborate effectively in a team, be a team player, demonstrate good leadership. Is responsible and accountable.
CLO8	Use entrepreneurial principles to generate novel ideas and products for wealth creation and empowerment of society and engage in life-long learning through higher education and science-based research activities.
CLO9	Demonstrate the knowledge and skills in chemistry - plan, design and execute small scientific projects related to multidisciplinary branches of chemistry.

SUBJECT DETAILS: APPLIED CHEMISTRY

FIRST YEAR SUBJECTS – SEMESTER 1

CH111 FOUNDATION CHEMISTRY

Course(s): Applied Chemistry (NQF Level 7)

Subject Name: Foundation Chemistry

Subject Code: CH111

Duration: 13 Teaching weeks

Contact Hours: 6 Hours per week

Credit Points: 16 **(**3 Lectures + 3 Practical sessions)

Delivery Mode On campus

Prerequisites: Grade 12

Co-requisites: None

Subject Coordinator: TBA

Synopsis

Chemistry for Natural Sciences is an introduction to fundamentals of chemistry. It introduces First Year Food Technology and Forestry students to analytical, inorganic, organic, physical, and water chemistry. This provides the prerequisites to comprehend, understand and the application of chemistry when advancing into Food Technology and Forestry subjects. This is an examinable subject and will be delivered in different segments throughout the semester.

Subject Topics

1. Safety in the laboratory;
2. Naming of chemical compounds, its formulae and equations
3. The Atomic structure, electronic configuration, periodic trends and quantum numbers
4. Determination of concentration, empirical formula and limiting reagent.
5. Oxidation-Reduction reaction.
6. Chemical bonding, Lewis diagrams and shapes of molecules
7. Gas laws: Boyle's law, Charles 'law and ideal gas equation, the vander Waals equation

Subject Outline

Topic	Content
1. Safety and Chemicals	• Safety in the Laboratory • Chemical Foundations Naming of compounds, Formulae, Equations- chemical, ionic & net ionic
2. The atom and periodic arrangement of elements	• Atomic Structure, isotopes. Calculation of average atomic mass, • Electronic Configuration, Stoichiometry • Avogadro's number, moles, molarity,
3. Introduction to analytical chemistry	• Dilution, empirical formula, limiting reagent Oxidation –Reduction reaction; Oxidation number and electron transfer

	Half-reactions, balancing redox reactions
4. Chemical bond and Structure	• Orbital types, electronic configuration, • Classification of elements by property and electronic structure, Periodicity of atomic and ionic size, ionization energy, electron affinity, electronegativity, polarizability and polarizing ability, Different types of bonds: ionic, covalent, coordinate and metallic, properties of ionic and covalent compounds, Criteria for determining the nature of bonding, hybridization of orbitals, molecular shape and VSEPR theory.
5. Chemistry of materials	• Metals, non-metals, metalloids.
6. Gas Laws	• Gas Laws: Boyle's Law, Charles Law • Ideal Gas Equation, The van der Waals equation

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Apply the principles heat transfer in different heat exchangers in the process industry.
2. To do fluid flow calculations in food processing and to understand the various behaviour of food systems upon application of force (stirring, pumping, etc).
3. Explain the principles behind thermal processing, canning operations and UHT operating principles.
4. Discuss the importance of packaging in food processing.
5. Discuss fully the water treatment process and understand water quality standards
6. Discuss fully the different sources of wastes, there treatments and transformation of waste into useful bi products.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	**(25 %)**
Laboratory and field work	**(10%)**
Assignments	**(10%)**
Quiz	**(5%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 5 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Laboratory and field work** The Laboratory and field work will contribute 10% towards the final grade for the subject. The case studies will have some problems which will assess the student's ability to think outside the box to consider real design and quality tests.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 4 - **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 **Final written examination:** A 3 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Singh. P.R, and Heldman. D.R (2013). *Introduction to Food Engineering* Academic Press, London. 5 th Ed.

References

1. Fryer, P.J., Pyle, D.L. and Reilly, C.D (1997). Chemical Engineering for the Food Industry, Blackie Academic & Professional, London.
2. Levis. M.J (1990). *Physical Properties of Foods and Food Process Systems*. Ellis Horwood Limited, West Sussex, England.
3. Earle, R.L (1988).Unit Operations in Food Processing Pergamon Press, Oxford.3. Wardlaw & Smith. (2011). *Contemporary Nutrition*. McGraw Hill Companies, New York.
4. Brennan *etal* (1990). Food Engineering Operations, 3rd ed, Elsevier Applied Science, London.

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/

CD111 DEVELOPMENT PRACTICES & SUSTAINABI;ITY: Taught by the Department of Communication for Development studies.

MA115 MATHEMATICS I APPLIED SCIENCES: Taught by the Department of Mathematics and Computer Science

PH111 PHYSICS FOR APPLIED SCIENCE I : Taught by the Department of Applied Physics

CD111 DEVELOPMENT PRACTICES & SUSTAINABILITY: Taught by the Department of Communication for Development Studies.

MA115 MATHEMATICS 1 AS (APPLIED SCIENCES): Taught by the Department of Mathematics and Computer Science

PH112 PHYSICS FOR APPLIED SCIENCE I: Taught by the Department of Applied Physics

FIRST YEAR SUBJECTS – SEMESTER 2

CH112: INTRODUCTION TO APPLIED CHEMITRY:

Applied Chemistry (NQF Level 7)

Subject Name: Introduction to Applied Chemistry

Subject Code: CH112

Duration: 13 teaching weeks

Contact Hours: 6 hours per wee

Credit Points: 16 **(**3 lectures, 3 laboratory sessions)

Delivery Mode: On campus

Prerequisites: CH111

Co-requisites: None

Subject Coordinator: **TBA**

Synopsis

Chemistry II is an introductory course to fundamentals of chemistry. It introduces first year Applied Chemistry and Applied Physics students to analytical, inorganic, organic and physical chemistry. This provides the prerequisites to comprehend, understand and the application of chemistry when advancing into the chemistry and physics subjects in the subsequent years.

This is an examinable subject and will be delivered in three different segments throughout the semester.

Subject Topics

1. Periodic classification of element and periodic trends
2. Types of bonds, its properties and nature, VSEPR theory
3. Fundamentals of thermodynamics
4. Chemical equilibrium and equilibrium calculations
5. Fundamentals of chemical kinetics
6. Introduction to organic compounds and its properties
7. The functional groups and organic redox reactions mechanisms

Subject Outline

Topic	Content
1. Thermodynamics	Thermodynamic system, State and path functions, First law of thermodynamics, energies and enthalpies of chemical reactions, Hess's Law, Second Law of Thermodynamics, Spontaneity, Free energy of formation, ΔGf
2. Chemical Equilibrium	Le Châtelier's principle, equilibrium calculations including sparingly soluble salts,strong and weak acids, bases and buffers and chemical reactions, pH,

3. Chemical Kinetics	Measuring Reaction Rates, Kinetics and Chemical Equilibrium, Investigating Reaction Mechanism, Effect of Temperature on Reaction Rates, Kinetics of Catalysis
4. Organic Chemistry	Bonding, hybridization and structural features, including oxidation states of organic compounds, The functional group approach: structure, nomenclature, Preparation and properties of alkanes, alkenes, alkynes, benzenes, halogen compounds, aldehydes, ketones, amines, ethers, alcohols, phenols, carboxylic acids and their derivatives,Organic redox reactions, the use of pKa values in organic reactions, brief treatment of organic reaction mechanisms

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Understand the atom and the placement of elements in the periodic table and the periodic trends.
2. Understand the different types of bonds, their properties, nature and the geometry of bonds.
3. Identify the prerequisites and rates at which chemical reactions to occur, and the laws of thermodynamics governing chemical processes
4. Understand how to manipulate equilibrium reaction systems to create favourable industrial processes.
5. Appreciate the usefulness of organic compounds in nature, and preparation and properties of functional groups and organic reaction mechanism

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	**(20 %)**
Laboratory practice	**(15%)**
Assignments	**(10%)**
Quiz	**(5%)**
Final Examination	**(50%)**

Assessment 1 -	**Tests:** There will be 4 Tests contributing 20% towards the final grade for the subject.
Assessment 2 -	**Laboratory practice:** The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.
Assessment 3 -	**Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject
Assessment 4 -	**Quizzes:** These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.
Assessment 5	**Final written examination:** A 3 hour written examination weighs 50%

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

Zumdahl, S.S and Zumdahl, S.A; Chemistry, 8th Ed., (Brooks Cole, California, USA, 2010).

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/

FR112 BIOLOGY (PLANT & ANIMALS): Taught by Agriculture and Forestry Departments.

MA125 APPLIED MATHEMATICS : Taught by the Department of Mathematics and Computer Science

PH121 PHYSICS FOR APPLIED SCIENCE II : Taught by the Department of Applied Physics

SECOND YEAR SUBJECTS – SEMESTER 1

CH211: APPLIED PHYSICAL CHEMISTRY

Course(s): Applied Chemistry (NQF Level 7)

Subject Name: Applied Physical Chemistry

Subject Code: CH211

Duration: 13 Teaching Weeks

Contact Hours: 6 Hours per week

Credit Points: **16 (**3 Lectures + 3 Laboratory Sessions)

Delivery Mode: On campus

Prerequisites: CH112

Co-requisites: None

Subject Coordinator: TBA

Synopsis

This subject focuses on general chemistry principles packaged into a cohesive foundational course in applied physical chemistry. The subject addresses the foundational understanding of chemical kinetics, chemical equilibria in gaseous and liquid states including acid-base theory, thermochemistry and chemical thermodynamics, and electrochemistry and allied phenomena.

Subject Topics

1. Chemical Kinetics
2. Thermochemistry and the First Law of Chemical Thermodynamics
3. Homogeneous and Heterogeneous Chemical Equilibria, and the Van't Hoff Equation
4. Spontaneity, Entropy, and the Second and Third Laws of Chemical Thermodynamics
5. Spontaneity and Gibbs Free Energy, and Ellingham Diagrams
6. Electrochemistry and Allied Phenomena

Subject Outline

Topics	**Contents**
1. Chemical Kinetics	Relate collision theory and chemical reactions, first and second order reaction rates, effect of concentration on reaction rates, establishing the order of reactions from initial rates and experimental measurements using integrated rate laws, half-lives of reactions based on integrated rate laws, effect of temperature on reaction rates including use of Arrhenius equation, reaction mechanism, and the use of steady-state approximation
2. Thermochemistry and the First Law of Chemical Thermodynamics	Introduce the concept of thermochemistry, open and closed systems and the surroundings, the concept of heat as a form of energy, specific heat, heat capacity and its relationship with the quantity of heat, illustrate a simple experiment to measure the specific heat of a substance, the conservation of energy, heats of reaction (ΔH and ΔU) and calorimetry, standard states and standard enthalpy changes, indirect determination of ΔH using Hess's Law, standard enthalpies of formation and standard enthalpies of reactions
3. Chemical Equilibrium	The concept of chemical equilibrium with reference to reversible reactions starting with gas phase reactions, the dynamic nature of equilibrium, the equilibrium constant and reaction rates, the

	magnitude of the equilibrium constant, the dimensionless nature of the equilibrium constant, manipulating equilibrium constants for multiple reactions to arrive at equilibrium constant for overall reaction, relationship between Kp and Kc, the Van't Hoff equation, applications of Le Chatelier's principle and position of equilibrium), use of ICE Tables; Concept of equilibrium extended to weak acids and weak bases in aqueous solution, Kw, Ka and Kb, relationship between Ka, Kb, and Kw and its importance in aqueous equilibria systems, pH and pOH and their relationship with pKw, buffers and the Henderson-Hasselbalch equation, buffer action; Equilibria extended to sparingly-soluble salts, Ksp and solubility, Ksp from solubility (molarity) and solubility from Ksp, using Ksp determine which salt is more soluble from a given list of salts, Le Chatelier's principle to systems in aqueous equilibria (example, effects of pH and common-ion effect);
4. Spontaneity, Entropy, and the Second and Third Laws of Chemical Thermodynamics	The meaning of spontaneous change, the concept of entropy, spontaneous change based on entropy, evaluating entropy and entropy changes, criteria for spontaneous change on the basis of the second law of thermodynamics
5. Spontaneity and Gibbs Free Energy	Standard Gibbs energy change (ΔG^o) as the best criterion for spontaneity, standard Gibbs energy change of a reaction from ΔG^o formation data, Gibbs energy change and equilibrium constant K, relationship of ΔG^o to ΔG for nonstandard conditions, use of coupled reactions, Ellingham diagrams
6. Electrochemistry and Allied Phenomena	Reference electrodes, standard electrode potentials and their measurements, standard electrode potentials and galvanic cells, cell diagrams and terminology, Nernst equation, relationships between Ecell, ΔG, and K under standard and non-standard conditions, Ecell as a function of concentration, concentration cells, principles of electrolysis illustrated with the refining of copper and aluminium production from Al_2O_3

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Understand the fundamental principles in chemical kinetics;
2. Understand the general principles of chemical equilibrium in gaseous and aqueous states;
3. Understand the general principles of Thermochemistry including the use of standard enthalpies of formation to calculate heat of reactions, and Hess's Law of constant heat summation;
4. Understand spontaneity, entropy, and Gibbs Free Energy; and relations between Gibbs free energy, equilibrium constant, and temperature;
5. Use standard thermodynamic data to perform thermodynamic calculations for a given chemical reaction;
6. Understand the fundamental principles in Electrochemistry as related to electrode potentials and their measurement, standard electrode potentials, and perform calculations involving E cell, ΔG, and equilibrium constant K
7. Distinguish between galvanic and electrolytic cells.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and.

Students must also refer to the Subject Assessment Details.

Tests	(20 %)
Laboratory practice	(15%)
Assignments	(10%)
Quiz	(5%)
Final Examination	(50%**)**

Assessment 1 - Tests: There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - Laboratory practice: The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - Assignment/Group work: The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 4 - Quizzes: These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 - Final written examination: A 2 hour written examination weighs 50%

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

Atkins, P. W., De Paula, Julio, Elements of physical chemistry, W.H. Freeman, New York, USA, 2005.

References

Zumdahl, S.S and Zumdahl, S.A; Chemistry, 8th Ed., (Brooks Cole, California, USA, 2010).

Relevant Unitech Policies

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CH212 APPLIED INORGANIC CHEMISTRY

Course(s):	Applied Chemistry (NQF Level 7)
Subject Name:	Applied Physical Chemistry
Subject Code:	CH212
Duration:	13 Teaching Weeks
Contact Hours:	6 Hours per week
Credit Points:	16 **(**3 Lectures + 3 Laboratory Sessions)
Delivery Mode	On campus
Prerequisites:	CH112
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

Applied Inorganic Chemistry is a starting point for the chemical principles related to inorganic chemistry. It covers the main group elements – s and p block elements and also the d-block elements. The general characteristics, chemical reactivity, bonding aspects of s, p and d block elements are discussed. Additionally, emphases are given to the extraction and applications of d-block elements.

Subject Topics

1. Preparation and properties of Group 1,2, 13-18 elements
2. Allotropes and diagonal relationships in the periodic table
3. Preparation, properties and structures of hydrides
4. Introduction to molecular, non-molecular and metallic structures
5. First row d-block elements and some of its selected compounds
6. Advanced VSEPR theory
7. Molecular Orbital Theory

Subject Outline

Topic	Content
7. Descriptive chemistry: s- and p- block elements	• General introduction, electronic configuration, physical properties • Molecular, non-molecular and metallic structures • Inert pair and relativistic effects • Allotropes; allotropes of non-metals; Allotropes of carbon; Graphene; Discussion on diagonal relationships in the periodic table
8. Hydrides of main group elements	• Hydrogen: position in the periodic table; resemblance with alkali metals and halogen group • Hydrides: different types (ionic, covalent, metallic and polymeric), preparation, properties and structure.

9. Extraction and applications of main group elements	• Extraction of selected elements in s- and p- block elements: Sodium, Beryllium, Aluminium; Applications: Applications of Group 1 and Group 2 metals and their compounds
10. Chemistry of selected compounds of main group elements	• Preparation, properties of Group I peroxides, superoxides, suboxides and ozonides; Crown ethers and Cryptands; hydrated ions. Preparation and properties of selected Group II compounds – Beryllium halides. Preparation and properties of Group 13 and 14 compounds: diboranes, silicates • Structure and bonding of selected compounds of Group 1, 2, 13 to 18
11. Structure and bonding in s- and p- block elements	• Advanced VSEPR theory - principle, procedure, examples and explanation • Molecular Orbital Theory – concept, advantages, limitation, seven rules, treatment to simple homo- and hetero- diatomic molecules.
12. Descriptive chemistry – d- block elements	• General properties: electronic configuration, physical properties, reactivity, colour, magnetic properties, oxidation states and ability to form complexes, catalysis
13. Selected compounds of d-block elements	• Ti, V, Cr, Mn – chemistry and compounds • Fe, Co, Ni, Cu – chemistry and compounds

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Predict the properties, stability and reactivity features of the compounds of s- and p- block elements
2. Discuss on the structures and bonding aspects of s- and p- block elements and their compounds
3. Explain the extraction, properties and oxidation states of first row d-block elements
4. Explain the applications of first row d-block elements
5. Discuss on the structures and bonding aspects of the compounds of first row d-block elements.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	**(15 %)**
Laboratory and field work	**(20%)**
Assignments	**(5%)**
Quiz	**(10%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 5 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Laboratory and field work:** The Laboratory and field work will contribute 20% towards the final grade for the subject. The case studies will have some problems which will assess the student's ability to think outside the box to consider real design and quality tests.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 5% towards the final grade for the subject

Assessment 4 -	**Quizzes:** These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 10%.
Assessment 5	**Final written examination:** A 2 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

1. Housecroft, C. and Sharpe, A.G., Inorganic Chemistry, 2nd Edn., Pearson - Prentice Hall, New Jersey, 2005.
2. Miessler, G.L., Fischer, P.J. and Torr, D.A., Inorganic Chemistry, 5th Ed., Pearson Edu. Ltd., New Jersey, 2013.

References

Greenwood, N.N. and Earnshaw, A., Chemistry of the Elements, 2nd Ed., Butterworth-Heinemann, Oxford, 2002.

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/

CH213: APPLIED ORGANIC CHEMISTRY

Course(s): **Applied Chemistry** (NQF Level 7)

Subject Name: Applied Organic Chemistry

Subject Code: CH213

Duration: 13 Teaching Weeks

Contact Hours: 6 hours per week

Credit Points: 16 **(**3 lectures, 3 laboratory Sessions)

Delivery Mode: On campus

Prerequisites: CH112

Co-requisites: None

Subject Coordinator: TBA

Synopsis

Applied Organic Chemistry is a subject to study the principles of mechanism. It covers aliphatic, aromatic, homocyclic and heterocyclic compounds. It also covers the various types of organic reactions and wide knowledge on various methods of preparation and chemical properties.

This is an examinable subject and will be delivered in different segments throughout the semester.

Subject Topics

1. Preparation and properties of homocylic and heterocyclic compounds
2. Homolytic fission and heterolytic fission in organic reactions
3. Reaction intermediates and transition state in organic reactions
4. Electronic and electrical effects
5. Electrophilic and nucleophilic addition reactions
6. Electrophilic and nucleophilic substitution reactions
7. Electrophilic and nucleophilic elimination reactions
8. Preparation and chemical properties of Aromatic compounds

Subject Outline

Topic	Content
1. Preparation, and properties of homocyclic and heterocyclic compounds	Classification and nomenclature of homocyclic and heterocyclic compounds. Preparation and properties (aromaticity, chemical) of heterocyclic compounds.
2. Reaction intermediates and transition state in organic reactions	Homolytic fission, heterolytic fission. Structural features and properties of carbon free radicals, carbanion, carbonium ion and carbenes.
3. Electronic and electrical effects	Inductive effect, electromeric effect, no-bond resonance and mesomeric effects on stability of molecules.

4. Electrophilic and nucleophilic addition reactions	Electrophilic and nucleophilic reagents. Prediction of different types of products using Markovnikov's rule, peroxide effect.
5. Electrophilic and nucleophilic substitution reactions	Steric effect, unimolecular substitution reactions and bimolecular substitution reactions in aliphatic and aromatic compounds.
6. Electrophilic and nucleophilic elimination reactions	α – Elimination reaction, nucleophilic elimination reaction, electrophilic elimination reaction. Prediction of order of reactivity, stability of products using Hoffmann rule and Saytzeffrule.
7. Preparation and chemical properties of Aromatic compounds	Delocalisation in aliphatic and aromatic compounds. Prediction of stability using X – ray and electron diffraction techniques. Rules and applications of resonance. Resonance Description of benzeneand Molecular orbital description of benzene.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Draw and name the homocyclic and heterocyclic compounds
2. Describe the properties of reaction intermediates and transition state
3. Describe the types of electrical and electronic effects
3. Explain the types of organic reactions (nucleophilic and electrophilic) in the lab;
4. Apply the rules for the formation of compounds through mechanism;
5. Explain nature of reactions in aliphatic and aromatic compounds.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	**(20 %)**
Laboratory practice	**(15%)**
Assignments	**(10%)**
Quiz	**(5%)**
Final Examination	**(50%)**

Assessment 1 -	**Tests:** There will be 4 Tests contributing 20% towards the final grade for the subject.
Assessment 2 -	**Laboratory practice:** The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.
Assessment 3 -	**Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject
Assessment 4 -	**Quizzes:** These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.
Assessment 5	**Final written examination:** A 3 hour written examination weighs 50%

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
Brown, W. H., Poon, T., Introduction to organic chemistry, John Wiley & Sons, Hoboken, USA, 2004.

References
Solomons, T.W.G.,Fryhle, C.B., Organicchemistry, John Wiley, Hoboken, USA, 2011.

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/

CS113 INTRODUCTION TO ITC : Taught by the Department of Mathematics and Computer Science

SECOND YEAR SUBJECTS – SEMESTER 2

CH221: ADVANCED PHYSICAL CHEMISTRY

Course(s): Advanced Physical Chemistry (NQF level 7)

Subject Name: Advanced Physical Chemistry

Subject Code: CH224

Contact hours: 6 Hours per week

Duration: 13 Teaching Weeks

Credit Points: 16 (3 Lectures + 3 Laboratory Sessions)

Delivery Mode: On campus

Prerequisites: CH214

Co-requisites: None

Subject Coordinator: TBA

Synopsis

This subject focuses on advanced topics in chemical thermodynamics packaged into a broader understanding of the thermodynamics of mixtures, phase diagrams, and effects of temperature and pressure on thermodynamic quantities like enthalpy, entropy, and Gibb's free energy. The mathematical treatments are higher, to build a solid understanding in chemical thermodynamics.

Subject Topics (ST)

1. Introduction to mathematical concepts used in the treatment of thermodynamic relationships
2. Enthalpy
3. Entropy
4. The Gibbs Energy
5. Physical transformation of pure substances
6. Additional concepts on phase diagrams
7. The thermodynamic description of mixtures

Subject Outline

Topic	Content
Introduction to mathematical concepts in chemical thermodynamics	Introduce the mathematical concepts used in the treatment of thermodynamic quantities such as partial derivatives and basic integrations. Exact and inexact differentials
Enthalpy	The temperature dependence of the enthalpy; changes in the enthalpy at constant volume, the isothermal compressibility, the Joule-Thompson effect, the relation between Cp and Cv
Entropy	The thermodynamic definition of entropy, entropy as a state function. Entropy changes accompanying specific processes; the entropy of phase transitions at the transition temperature, the variation of entropy with temperature, the measurement of entropy, the standard reaction entropy (ΔrSo)
The Gibbs Energy	Properties of the Gibbs energy; general considerations, the variation of the Gibbs energy with temperature, the variation of the Gibbs energy with pressure

Physical Transformation of Pure Substances	Phase diagrams; the stabilities of phases, phase boundaries, Illustrate with phase diagrams for CO2, H2O, and He
Additional Concepts on Phase Diagrams	Phases, components, and degrees of freedom, and the phase rule. Two-component systems; vapour pressure diagrams, temperature-composition diagrams, liquid-liquid phase diagrams, liquid-solid phase diagrams
The Thermodynamic Description of Mixtures	Partial molar quantities, the thermodynamics of mixing, the chemical potentials of liquids. The properties of solutions; liquid mixtures, colligative properties

Subject Learning outcomes (SLOs)

On completion of this subject the student should be able to:

1. Understand the basic mathematical concepts used in the treatment of thermodynamic quantities;
2. Understand the temperature dependence of enthalpy as a thermodynamic quantity;
3. Understand the broader features of entropy as a thermodynamic quantity;
4. Understand the variation of the Gibbs energy with temperature and pressure
5. Understand the physical transformation of pure substances as illustrated by phase changes;
6. Understand a deeper aspect of Raoult's law in relation to vapour pressure composition diagrams, and liquid-liquid phase diagrams
7. Understand the thermodynamics of mixing, liquid mixtures, and colligative properties.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.
Students must also refer to the Subject Assessment Details.

Tests	(20 %)
Laboratory practice	(15%)
Assignments	(10%)
Quiz	(5%)
Final Examination	(50%)

Assessment 1 - Tests: There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - Laboratory practice: The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - Assignment/Group work: The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject.

Assessment 4 - Quizzes: These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 Final written examination: A 2 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text
Zumdahl, S.S and Zumdahl, S.A; Chemistry, 8th Ed., (Brooks Cole, California, USA, 2010).

References

Atkins, and and DePaula; Atkins' Physical Chemistry, 7th Ed., (Oxford University Press, 2002).
www.oup.com/pchem7

Relevant Unitech Policies

It is important that all students familiarize 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/

CH222: ADVANCED INORGANIC CHEMISTRY

Course(s): Applied Chemistry (NQF Level 7)

Subject Name: Advanced Inorganic Chemistry

Subject Code: CH222

Contact hours: 6 Hours per week

Duration: 13 Teaching Weeks

Credit Points: 16 (3 Lectures + 3 Laboratory Sessions)

Delivery Mode: On campus

Prerequisites: CH212

Co-requisites: Nil

Subject Coordinator: TBA

Synopsis

Advanced Inorganic Chemistry is the continuation of Applied Inorganic Chemistry [CH212] that students have taken in semester I. It covers the structural, bonding and application aspects of transition metal coordination compounds. The subject also covers the nuclear chemistry where the various nuclear reactions and types of nuclear reactions will be discussed. In addition, the subject will also deals with the constructive and destructive applications of nuclear chemistry.

Subject Topics (ST)

1. Coordination chemistry of compounds: coordination number, geometry, nomenclature and stability
2. Complexes: Isomerism and splitting of d-orbitals in various environments
3. Spectrochemical series, Magnetic properties and Electronic spectra of complexes
4. Nuclear chemistry and fundamental particles
5. Nuclear reactions – nuclear fission and fusion reactions
6. Applications of radio-isotopes: Carbon-14 datin

Subject Outline

Topics	Contents
Coordination chemistry and general characteristics	Coordination bond and its characteristics, coordination number, macrocylic ligands, bite angle, bite distance, geometry, Nomenclature, Stability of coordination compounds, Formation constants Factors determining the stability – kinetic and thermodynamic, Chelate effects
Coordination chemistry – bonding theories	Isomerism in complexes: introduction, types, examples and selected preparations, bonding theories of complexes – Werner's theory, Valence Bond Theory, Crystal field theory; Ligand Field theory Splitting of d-orbitals in Octahedral, Tetrahedral and Square planar geometry; High and Low spin complexes
Coordination chemistry – applications	Applications of theories to some selected complexes Spectrochemical series, Magnetic properties Electronic spectra of complexes - Orgel diagrams, Selection rules; Electronic spectral discussions of octahedral aqua complexes of first row transition metals; Jørgensen's equation - Theoretical calculation of crystal field splitting energy; Inter-electronic repulsion parameter (Racah parameter)
Nuclear Chemistry	General Introduction of nuclear chemistry; balancing nuclear equations; Different types of radiation Fundamental particles of nucleus and extending to meson theory of nucleus
Nuclear reactions	Chain reactions, Nuclear fission and fusion reactions Kinds of radioactivity transformations; Decay series, Half-life and Nuclear Binding Energy; Nuclear synthesis

Applications of nuclear chemistry	Effects of nuclear radiations; Destructive and constructive applications Q-value of nuclear reactions; Nuclear reactors

Subject Learning Outcomes (SLOs)

On completion of this subject the student should be able to:
1. Design simple synthesis of coordination compounds;
2. Discuss on the structure, bonding and application aspects of transition metal coordination compounds;
3. Interpret the electronic spectra of simple coordination compounds;
4. Discuss and predict the colour and magnetic properties of coordination compounds.
5. Discuss on the principles, involved in various nuclear reactions;
6. Classify the types of nuclear reactions and radio isotopes;
7. Explain on the constructive as well as destructive applications of nuclear chemistry and its reactions to the mankind.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	(20 %)
Laboratory practice	(15%)
Assignments	(10%)
Quiz	(5%)
Final Examination	(50%)

Assessment 1 - Tests: There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - Laboratory practice: The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - Assignment/Group work: The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject.

Assessment 4 - Quizzes: These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 Final written examination: A 2 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Textbook
Kettle, S.F.A, Coordination compounds, Springer, 1995.

References
Housecroft, C. and Sharpe, A.G., Inorganic Chemistry, 2nd Edn., Pearson - Prentice Hall, New Jersey, 2005.
Miessler, G.L., Fischer, P.J. and Torr, D.A., Inorganic Chemistry, 5th Ed., Pearson Edu. Ltd., New Jersey, 2013.

Relevant Unitech Policies

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CH223: ADVANCED ORGANIC CHEMISTRY

Course: Applied Chemistry (NQF level 7)

Subject Name: Advanced Organic Chemistry

Subject Code: CH223

Duration: 13 Teaching Weeks

Hours: 6 Hours per week

Credit Points: 16 (3 Lectures + 3 Laboratory Sessions)

Delivery Mode: On campus

Prerequisites: CH213

Co requisites: Nil

Subject Coordinator: TBA

Synopsis

Advanced Organic Chemistry is the higher level of Applied Organic Chemistry, CH213, that students' have taken in semester I. This subject focuses on advanced topics in chemistry like triglycerides, phospholipids, saccharides. This subject also includes stereochemistry, polymers and their different types - thermoplastics thermosetting plastics.

Subject Topics

1. Structure & Chemistry of Triglycerides
2. Chemistry of Phospholipids, Fats & Oils
3. Structure & Chemistry of saccharides
4. Structural isomerism and Optical isomerism
5. Geometrical isomerism and configurational systems
6. Chemistry of Polymers
7. Thermo and thermosetting plastics.

Subject Outline

Topic	Content
Chemistry of Glycerides	Occurrence, structure and chemical properties of mono, di and tri glycerides, Phospholipids, Sphingolipids.
Chemistry of fatty acids, soap, detergent	Iodine number, saponification number and numerical problems. Analysis of butter and oil. Properties of saturated and unsaturated fatty acids. Steroids, terpenes, isoprene rule and its applications. Cleansing action of soap and detergents.
Chemistry of amino acids, proteins and peptides	Classification, synthesis and properties of amino acids. Classification and physiological functions of proteins and peptides. Iso-electric point and related numerical problems.
Chemistry of saccharides	Synthesis, nomenclature, properties and structural features of mono, di, tri and polysaccharides (starch, glycogen, cellulose).
Structural isomerism	Nuclear isomerism, position isomerism, functional isomerism, metamerism and tautomerism with examples and medicinal properties.
Optical isomerism	Optical activity of carbon containing molecules, chirality, enantiomers, Van't Hoff and LeBel rule.
Geometrical isomerism	Cis - Trans nomenclature and its application to ene systems, and diene systems. C.I.P (R.S. Cahn, Ingold and Prelog) rules and E and Z nomenclature.

Configurational systems	D, L – System of Configurational Designation and its application to carbohydrates and amino acids. R and S configurational system, Sequence rules and its application to chiral molecules.
Polymers	Natural and synthetic polymers. Degree of polymerization and its determination. Chain growth polymerization, step growth polymerization, condensation polymerization, Ziegler-Natta polymerization, thermo plastics and thermosetting plastics. Effect of polymer structures on properties. Isotactic, syndiotactic, atactic.

Subject Learning outcomes (SLOs)

On completion of this subject the student should be able to:
1. Describe the building blocks of biological systems;
2. Describe the structure and properties of lipids;
3. Explain the types of stereochemically active organic compounds;
4. Explain the rules applicable for the structural isomers and mirror image isomers;
5. Explain various configurations
6. Ability to explain the structure of polymers

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.
Students must also refer to the Subject Assessment Details.

Tests	(20 %)
Laboratory practice	(15%)
Assignments	(10%)
Quiz	(5%)
Final Examination	(50%)

Assessment 1 - Tests: There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - Laboratory practice: The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - Assignment/Group work: The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject.

Assessment 4 - Quizzes: These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 Final written examination: A 2 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text
Brown, W. H.,Poon,T., Introduction to organic chemistry, John Wiley & Sons, Hoboken, USA, 2004.

Reference

Solomons, T. W. G., Fryhle, C. B., Organicchemistry, John Wiley, Hoboken, USA, 2011.

Relevant Unitech Policies

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CH 224: ANALYTICAL CHEMISTRY

Course(s): Applied Chemistry (NQF Level 7)

Subject Name: Analytical Chemistry

Subject Code: CH225

Contact hours: 6 Hours per week

Duration: 13 Teaching weeks

Credit Points: 16 (3 Lectures + 3 Laboratory sessions)

Delivery Mode: On campus

Prerequisites: CH112

Co-requisites: Nil

Subject Coordinator: TBA

Synopsis

Analytical Chemistry is a one of the core subject includes basic concepts, principles and techniques of modern analytical chemistry that would empower students with an analytical mind set and the abilities to solve diverse analytical problems in an efficient and quantitative way that conveys the importance of accuracy and precision of the analytical results. Analytical chemists assess the chemical structure and nature of substances. Their skills are needed for a variety of purposes including drug development, forensic analysis, toxicology, pharmaceuticals industries, manufacturing units and environmental analysis etc.

Subject Topics (ST)

1. Analytical Perspective
2. Basic Tools of Analytical Chemistry
3. Analytical Terms and sampling
4. Data Evaluation.
5. Calibrations, Standardizations and blank corrections

Subject Outline

Topic	Content
Analytical Perspective	Introduction. Role of analytical Chemistry. Applications of Analytical Chemistry.
Basic Tools of Analytical Chemistry	Fundamental Units of Measurement Selecting and handling reagents and other Chemicals Cleaning and marking laboratory ware Equipment for measuring mass, Equipment for measuring volumes Equipment for weighing, Equipment for drying Cooling apparatus Filtration apparatus Evaporating liquids Laboratory note book Safety in the laboratory
Analytical Terms and sampling	Some important units of measurement Calculations used in analytical chemistry ppm, ppb…etc Molar concentration of solutions, normality, milli-molar concentrations

	Techniques, Methods, Procedures, and Protocols Classifying Analytical Techniques Selecting an Analytical Method
Data Evaluation.	Characterizing Measurements and Results Errors in chemical analysis, evaluation Statistical Analysis of Data, Propagation of Uncertainty
Calibrations, Standardizations and blank corrections	Sampling, sample handling methods Volumetric analysis, Introduction Theory, Practice of volumetric analysis Standardizing Methods (Volumetry/Gravimetry) Linear Regression and Calibration Curves Blank Corrections

Subject Learning Outcomes (SLOs)

On completion of this subject the student should be able to:

1. Identify and explain the use of specific chemicals, basic apparatus and the unit of operation in analytical chemistry;
2. Carry out calculations commonly used in analytical chemistry;
3. Identify errors correctly in chemical analysis and understand the correct statistical technique used to treat and evaluate analytical data;
4. Understand the process of carrying out sampling and correct sample handling;
5. Carry out titrations based on acid-base and precipitation reactions.
6. To develop an understanding of the range and uses of analytical methods in chemistry.
7. To establish an appreciation of the role of chemistry in quantitative analysis
8. Develop an understanding of the broad role of the chemist in measurement and problem solving for analytical tasks.
9. To provide an understanding of chemical methods employed for elemental and compound analysis.
10. To provide experience in some scientific methods employed in analytical chemistry.
11. To develop some understanding of the professional and safety responsibilities residing in working on chemical analysis.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.
Students must also refer to the Subject Assessment Details.

Tests	(20 %)
Laboratory practice	(15%)
Assignments	(10%)
Quiz	(5%)
Final Examination	(50%)

Assessment 1 - Tests: There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - Laboratory practice: The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - Assignment/Group work: The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject.

Assessment 4 - Quizzes: These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5- Final written examination: A 2 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text

Skoog, D.A., West, D.M. and Holler, F.J. Crouch, S.R., Fundamentals of Analytical Chemistry, 8th Ed., (Brooks/Cole-
Thompson Learning Inc., California, USA,2004

Reference

1. Harris, D.C., Exploring Chemical Analysis, 4th Ed., (W. H. Freeman, New York, USA, 2008)
2. Harvey, D., Modern Analytical Chemistry, 1st Ed., (McGraw-Hill, USA, 2000)

Relevant Unitech Policies

It is important that all students familiarize themselves with the University of Technology Assessment Guidelines at www.unitech.ac.pg/Asses

THIRD YEAR SUBJECTS – SEMESTER 1

CH312: GEOCHEMICAL ANALYSIS

Course(s): Applied Chemistry (NQF Level 7)

Subject Name: Geochemical Analysis

Subject Code: CH312

Duration: 13 Teaching weeks

Contact Hours: 6 Hours per week

Credit Points: 16 **(**3 Lectures + 3 Practical sessions)

Delivery Mode On campus

Prerequisites: CH212 & CH222

Co-requisites: None

Subject Coordinator: TBA

Synopsis

Geochemical analysis is a subject that is introduced to third year students and it covers topics on analytical techniques in assaying geochemical samples like ores and concentrates for the determination of noble metals. Sampling and sample preparations, fire assay and quantitative analysis of the geochemical samples are discussed. Different instrumental methods employed in geochemical analysis, result interpretation and the significance of the results are also discussed.

Subject Topics

1. Fire-assay as a quantitative technique.
2. Fire-assay reagents.
3. Furnaces and furnace room supplies.
4. Theory of crucible fusion.
5. Discussion on different instrumental techniques.

Subject Outline

Topic	**Content**
1. Sampling & Sample preparation	Ore and concentrate sampling, sample commination and preparation, Describe steps taken to minimize sampling errors.
2. Fire-assay	Fire-assay as a quantitative technique, advantage of using fire-assay for the determination of the nobel metals, describe steps taken to minimize errors in fire-assay, discuss the significance of the analytical results.
3. Fire-assay Reagents	sodium carbonate, litharge, silica, borax glass, calcium fluoride, household flour as a reducing agent or potassium nitrate as an oxidizing agent, proper selection of flux components. Fusion products; lead button, slag, matte and speiss.
4. Furnace and Furnace Room Supplies	crucible or pot-furnaces, muffle furnaces, coal furnaces, wood furnaces, coke furnaces, gasoline furnaces, gas furnaces, muffles, crucibles, scorifiers and furnace tools.

5. Theory of Crucible Fusion	classification of ores, crucible slags, classification of silicates, action of borax in slags, fluidity of slags, acidic and basic slags, mixed silicates, the lead button, reduction and oxidation, reducing reactions, reducing power of minerals, oxidizing reactions, preliminary fusion, estimating reducing power. Bone ash, making cupels, description of process, practice in cupellation, influence of impurities on the loss of precious metals during cupellation, rule governing cupellation loses.
6. Parting Practices	Definitions, weights, sampling bullion, lead bullion, copper bullion, dore bullion, gold bullion, assay of lead bullion, assay of copper bullion, scorification method, crucible method, nitric acid combination method, mercury-sulphuric acid method, assay of dore bullion.
7. Different Instrumental Techniques	Discussion on different instrumental analytical techniques (XRD, XRF, FAAS, ICP-OES and ICP-MS) used in the quantitative analysis of geochemical samples.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Carry out sampling and sample preparation of ore/concentrate samples for analysis.
2. Understand the appropriate chemical reagents and flux components used in fire assay.
3. Describe the main equipment and materials used in a fire assay laboratory.
4. Carry out fire assay of geological samples using crucible fusion and related steps.
5. Understand and perform instrumental analysis of the precious metals.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved .

Students must also refer to the Subject Assessment Details.

Tests	**(15 %)**
Laboratory and field work	**(20%)**
Assignments	**(5%)**
Quiz	**(10%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 5 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Laboratory and field work:** The Laboratory and field work will contribute 20% towards the final grade for the subject. The case studies will have some problems which will assess the student's ability to think outside the box to consider real design and quality tests.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 5% towards the final grade for the subject

Assessment 4 - **Quizzes:** These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 10%.

Assessment 5 **Final written examination:** A 2 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Bugbee E. E., A textbook of fire assaying, Colorado School of Mines, Golden, USA, 1981.

References

Joseph H., Riley, L. B., and Goss, W. D. A manual on fire assaying and determination of the noble metals in geological materials, Geological Survey Bulletin 1445, Washington DC, USA, 1977.

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/

CH313: INSTRUMENTAL ANALYSIS

Course(s): Applied Chemistry (NQF Level 7)

Subject Name: Instrumental Analysis

Subject Code: CH313

Duration: 13 teaching weeks

Contact Hours: 6 hours per week

Credit Points: 16 **(**3 lectures, 3 laboratory sessions)

Delivery Mode: On campus

Prerequisites: CH223

Co-requisites: None

Subject Coordinator:

Synopsis

It is a subject in organic chemistry and in this subject, the science of separation and identification of organic molecules are discussed. The subject is focussed more on solvent extraction, both qualitative & quantitative chromatographic analysis applying both non-instrumental and instrumental chromatographic methods and subsequent identification of the organic molecules by chromatographic and spectroscopic techniques.

This is an examinable subject and will be delivered in different segments throughout the semester.

Subject Topics

1. Solvent extraction
2. Acid/Base extraction
3. Non-Instrumental chromatography
4. Qualitative Gas-Chromatography (GC).
5. Qualitative & quantitative high pressure liquid chromatography (HPLC)
6. Spectroscopy
7. Some spectroscopic techniques

Subject Outline

Topic	**Content**
Solvent Extraction	Solvent solvent extraction, partition coefficient (K) and acid/base extraction.
Non-Instrumental Chromatography Techniques.	Qualitative and preparative chromatography, paper and thin & thick layer chromatography, column chromatography, gel permeation chromatography, ion exchange chromatography theory and application of chromatotron.
Gas Chromatography (GC)	Theory of GC, GC instrumentation, Qualitative and quantitative GC (GC-MS) analysis, interpretation of results.
High Pressure Liquid Chromatography (HPLC)	Theory of HPLC, HPLC instrumentation, qualitative, quantitative & preparative HPLC (UPLC) analysis, interpretation of results, HPLC - MS
Spectroscopy	Electromagnetic radiation Theory, qualitative and quantitative application of Ultra-Violet and Visible spectroscopy and respective interpretation of the analytical results.

	Theory and application of Fourier Transform Infra-red Spectroscopy and interpretation of results.
Nuclear Magnetic Resonance Spectroscopy (NMR)	Theory, instrumentation and application of Proton (^{1}H) and carbon-13 (^{13}C) NMR and spectral interpretation.
Mas Spectrometry (MS)	Theory, instrumentation, application and interpretation of MS spectra.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Understand the science of chromatography.
2. Understand when and how to apply the techniques of gel permeation chromatography and chromatotron analysis.
3. Understand when and how to apply GC analysis and to be able to interpret results.
4. Have some understanding of the operating principle of HPLC, when to apply HPLC, and analysis of the results.
5. Understand the theory behind IR and UV-Vis. spectroscopy and the information gathered about organic molecules
   obtained from these techniques.
6. Understand the theory of NMR and how to interpret 1H and 13C NMR spectra and to be able to elucidate structures of
   small organic molecules including use of mass spectrometric data.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	**(20 %)**
Laboratory practice	**(15%)**
Assignments	**(10%)**
Quiz	**(5%)**
Final Examination	**(50%)**

Assessment 1 -	**Tests:** There will be 4 Tests contributing 20% towards the final grade for the subject.
Assessment 2 -	**Laboratory practice:** The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.
Assessment 3 -	**Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject
Assessment 4 -	**Quizzes:** These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.
Assessment 5	**Final written examination:** A 3 hour written examination weighs 50%

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
Williams, D.H. and Flemming, I., Spectroscopic Methods In Organic Chemistry, 6th edition (McGraw Hill, London, (2007).

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/

CH314: ADVANCED ANALYTICAL CHEMISTRY

Course(s):	Applied Chemistry (NQF Level 7)
Subject Name:	Advanced Analytical Chemistry
Subject Code:	CH314
Duration:	13 Teaching weeks
Contact Hours:	6 Hours per week
Credit Points:	**16 (**3 Lectures + 3 Laboratory sessions)
Delivery Mode:	On campus
Prerequisites:	CH222
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

This is a Third-Year subject in Analytical Chemistry in which the students are introduced to some topics in advanced analytical techniques in doing chemical analysis. Concepts in advanced volumetric and gravimetric analysis are delivered as well as the science of absorption and emission of electromagnetic radiation as applied in analytical chemistry. Some basic concepts of separation methods are also discussed in this subject.

Topics covered include:

Subject Topics

1. Redox Titration Curve
2. Complexometric titration curves
3. Gravimetric analysis
4. Electromagnetic Radiation
5. Nephelometry and fluorimetry
6. Basic concepts of separation methods

Subject Outline

Topics	Contents
Redox Titration Curve	auxiliary oxidizing and reducing reagents, applying standard reducing agents, applying standard oxidizing agents, indicators and potentiometric titrations.
Complexometric titration curves	masking phenomena, formation of complexes, titration with inorganic and organic complexing agents, EDTA complexes and their formation constants, conditional formation constants, indicators, scope and application of EDTA titrations.
Gravimetric analysis	precipitating agents and precipitates, mechanism and conditions for precipitate formation, co-precipitation, and calculation of results from gravimetric data application of gravimetric analysis.
Electromagnetic radiation	properties of electromagnetic radiation, interaction of radiation and matter, absorption and emission of electromagnetic radiation. Sources of energy, wavelength selectors, detectors, signal processors. Absorbance of electromagnetic radiation, transmittance and absorbance, absorbance and concentration, Beer's law and its limitations. Quantitative applications, qualitative applications, evaluation.

Nephelometry and fluorimetry	comparison of spectrophotometer, turbidimetry and nephelometry, instrumentation and applications.
Basic concepts of separation methods	basic concepts of separation methods, ion exchange, theories of chromatography, high resolution separation techniques and their applications.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Apply redox, complexometric and acid-base titrimetry in volumetric analysis
2. Utilize precipitation reactions in gravimetric analysis
3. Interpret development and function of electromagnetic radiation, detection and signal acquisition in spectrometric analysis.
4. Employ concepts of separation methods, theories of chromatography, resolution, and applications

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	(20 %)
Laboratory practice	(15%)
Assignments	(10%)
Quiz	(5%)
Final Examination	(50%**)**

Assessment 1 - Tests: There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - Laboratory practice: The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - Assignment/Group work: The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 4 - Quizzes: These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 - Final written examination: A 2 hour written examination weighs 50%

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

1. Skoog, D.A., West, D.M. and Holler, F.J. Crouch, S.R., Fundamentals of Analytical Chemistry, 8th Ed., (Brooks/Cole-Thompson Learning Inc., California, USA,2004

Reference

1. Harris, D.C., Exploring Chemical Analysis, 4th Ed., (W. H. Freeman, New York, USA, 2008)
2. Harvey, D., Modern Analytical Chemistry, 1st Ed., (McGraw-Hill, USA, 2000)

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.

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MP311 HYDROMETALOGY : Taught by the Department of Mining Engineering
THIRD YEAR SUBJECTS – SEMESTER 2

CH321: NATURAL PRODUCTS AND MEDICINAL CHEMISTRY

Course(s)	Applied Chemistry (NQF Level 7)
Subject Name	Natural Products and Medicinal Chemistry
Subject Code	CH321
Contact hours	6 hours per week
Duration	13 teaching weeks
Credit Points	16 (3 Lectures + 3 Laboratory sessions)
Delivery Mode	On campus
Prerequisites	CH213, CH223
Co-requisites	Nil

Synopsis

This is a third-year subject that is taught in the second semester and it captures two concepts in organic chemistry namely natural products (primary & secondary metabolites) and medicinal chemistry. Biosynthesis and classification of different chemical groups, naming, biological functions and industrial uses of the natural products are discussed. Additionally, in medicinal chemistry, synthesis, adsorption & distribution of some selected medicinal products as well as their mode of activity are discussed.

Subject Topics (ST)

1. Introduction and Primary & Secondary metabolites
2. Terpenes & Steroids
3. Polyphenolic compounds
4. Carbohydrates
5. Some miscellaneous molecules of significance.
6. Drug absorption and distribution
7. Natural agents
8. Anti-fungal agents
9. Antimalarial drugs
10. HIV inhititors

Subject Outline

Topics	**Contents**
Introduction, Primary & Secondary Metabolites	Introduction, metabolism, primary metabolites, secondary metabolites.
Terpenes & Steroids	Isoprene rule, applications to terpenes. classification and synthesis of isoprenes. Steroids and nomenclature. Sterols and nomenclature
Polyphenolic Compounds	Flavonoids, saponins, tannins and their properties.
Carbohydrates	Mono, di, polysaccharides, structural evidences, properties of monosaccharides. Polysaccharides, starch, amylase, amylopectin, glycogen, cellulose
Miscellaneous Compounds	Rotenones, prostaglandins, pyrethrins and their properties.
Drug absorption and distribution	Absorption & distribution of drugs, protein binding, metabolism and excretion, physical parameters - solubility, partition coefficient, ionization and Pka value, Hydrogen bonding. Mechanism of action, classification-I & classification-II, inhalation anaesthetics-hydrocarbons, cyclopropane, halogenated hydrocarbons, isoflurane, sevoflurane. Mechanism of action
Natural Medicinal Agents	Natural agents. Mechanism of action, natural agents- Cocaine, piperocaine Ester derivatives- p-Amino benzoic acid derivatives, Quinoline and isoquinoline derivatives- Dimethisoquin, carbamate- diperodon hydrochloride. Alcohols, aldehydes, phenols, preservatives. Topical Agents for dermatophytoses,
Anti-fungal agents	Antifungal antibiotics, Azole antifungal agents

Antimalarial Drugs	Sulphonamides, quinoline, first line agents, second line agents. cinchona alkaloids, 4-amino quinoline, 8-amino quinoline, polycyclic antimalarials.
HIV Inhibitors	Reverse Transcriptase Inhibitors, Non-Nucleoside RT inhibitors, HIV protease inhibitors.

Subject Learning Outcomes (SLOs)

On completion of this subject the student should be able to:

1. Predict the metabolites, types of metabolism in natural process producing alkaloids and their effects
2. Discuss the isoprene rules and applications on terpenes with classification
3. Explain the synthesis and properties of steroids and sterols
4. Explain the classification, structural evidences and properties of carbohydrates
5. Discuss principle, mechanism of drug delivery action
6. Explain the types of anaesthetics, anti-infective and anti-fungal agents, antitubercular agents, antimalarial and anti-HIV
   agents.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	(20 %)
Laboratory practice	(15%)
Assignments	(10%)
Quiz	(5%)
Final Examination	(50%)

Assessment 1 - Tests: There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - Laboratory practice: The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - Assignment/Group work: The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject.

Assessment 4 - Quizzes: These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 Final written examination: A 2 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Textbook

1. Bhat, S. V., Nagasampagi, B. A., Sivakumar, M., Chemistry of natural products, Springer, Berlin, Germany, 2005.

2. Graham L. Patrick, An Introduction to Medicinal Chemistry, 4th edition (Oxford University Press, 2009)
3. K. Ilango, P.Valentina. Text Book of Medicinal Chemistry, 1st edition (Keerthi Publishers, Chennai, India, 2012)

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/

CH322: INDUSTRIAL INORGANIC CHEMISTRY

Course: Applied Chemistry (NQF level 7)

Subject Name: Industrial Inorganic Chemistry

Subject Code: CH322

Duration: 13 weeks

Hours: 6 hours per week

Credit Points: 16 (3 Lectures + 3 Laboratory sessions)

Delivery Mode: On campus

Prerequisites: CH222

Co requisites: Nil

Subject Coordinator: TBA

Synopsis

A third-year subject introduced to students to understand and appreciate some various industrial inorganic materials. Their manufacture, composition, structure, chemistry, properties and industrial applications are discussed.

Subject Topics

Subject Outline

Topic	Content
Cement	Introduction, Importance, composition, manufacture, types and applications, properties.
Glass	Introduction, Importance, composition, manufacture, types and applications, properties.
Fertilizer	Introduction, Importance, composition, manufacture, types and applications.
Semiconductors and insulators	Introduction, composition, manufacture, types and applications, structure and properties.

Subject Learning outcomes (SLOs)

On completion of this subject the student should be able to:

1. Understand and explain the essential roles played by inorganic chemistry in specialized industries;
2. Explain the chemistry of some common inorganic materials like cement, glass, fertilizers, ceramics and semiconductors & insulators;
3. Identify the characteristics of common inorganic materials;
4. Discuss and understand the need of various types of inorganic materials available.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	(20 %)
Laboratory practice	(15%)
Assignments	(10%)
Quiz	(5%)
Final Examination	(50%)

Assessment 1 - Tests: There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - Laboratory practice: The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - Assignment/Group work: The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject.

Assessment 4 - Quizzes: These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 Final written examination: A 2 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text

1. Buchel, K H, Moretto, H H, Industrial Inorganic Chemistry-Wiley-VCH, 2003
2. Greenwood, N. N., Earnshaw, A., Chemistry of the Elements, Butterworth-Heinemann, Oxford, UK, 2002.

Relevant Unitech Policies

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CH323: ADVANCED INSTRUMENTAL ANALYSIS

Course(s): Advanced Physical Chemistry (NQF level 7)

Subject Name: Advanced Instrumental Analysis

Subject Code: **CH323**

Contact hours: 6 hours per week

Duration: 13 Teaching Weeks

Credit Points: 16 (3 Lectures + 3 Laboratory sessions)

Delivery Mode: On campus

Prerequisites: CH313, CH314

Co-requisites: None

Subject Coordinator: TBA

Synopsis

This subject focuses on introducing to third-year students different advanced instrumental techniques in the analysis of various inorganic materials. Instrumentations, accessories of different instruments, their applications, limitations, advantages & disadvantages as compared to each other are discussed.

Subject Topics (ST)

1. Flame and flameless atomic absorption spectrometers (AAS)
2. Design of the plasma atomizer
3. Modern designs of an ICP-MS instrumentation
4. X-ray fluorescence and X-ray diffraction spectroscopy

Subject Outline

Topic	Content
Flame and flameless atomic absorption spectrometers (AAS)	Schematic features of flame and flameless atomic absorption spectrometers (AAS): Types of lamps and flames, and discussion of their advantages and disadvantages. Flame chemistry, and discussions on types of interference and correction methods. Cold vapour, hydride generation and graphite furnace atomic absorption spectrometry, graphite furnace atomizer temperature programming and transverse and longitudinal Zeeman background corrections. Discuss the use of modulation in AAS.
Design of the plasma atomizer	Design of the plasma atomizer. Advantages and disadvantages of the argon plasma atomizer for elemental analysis. Compare and contrast flame and plasma optical emission spectrometry. Compare and contrast the Rowland circle detector design, and the use of charged couple devices (CCD) for simultaneous multi-element detection in plasma optical emission spectrometry.
Modern designs of an ICP-MS instrumentation	Discuss modern designs of an ICP-MS instrumentation including the use of a dynamic reaction cell for isobaric correction in the Triple Quadrupole design, pros and cons of axial and lateral detector positioning from the torch. Discuss the advantages and disadvantages of ICP-MS applications.
X-ray fluorescence and X-ray diffraction spectroscopy	Origins of fluorescence and diffraction of X-rays, instrumentation and applications. Anodic stripping voltammetry, cyclic voltammetry, and their

	applications. Merits and shortcomings of the selected voltammetric methods in analytical chemistry.

Subject Learning outcomes (SLOs)

On completion of this subject the student should be able to:

1. Gain experience in the theory and operational aspects of instrumentation used for the analyses of a variety of samples
2. Comprehensively describe the accessories used for flame and flameless atomic absorption spectrometry
3. Comprehend the principles of flame and flameless atomic absorption spectrometry;
4. Comprehend the instrumentation used for flame emission, and inductively coupled plasma optical emission Spectrometry, and their merits and limitations
5. Understand the various types of interferences in elemental analysis, and how they are corrected
6. Comprehensively describe the equipment required for X-ray fluorescence and X-ray diffraction, ICP-MS, Voltammetry, and discuss the applications, merits, and shortcomings of these techniques

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	(20 %)
Laboratory practice	(15%)
Assignments	(10%)
Quiz	(5%)
Final Examination	(50%)

Assessment 1 - Tests: There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - Laboratory practice: The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - Assignment/Group work: The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject.

Assessment 4 - Quizzes: These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 Final written examination: A 2 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text

1. Skoog, D. A., West, D. M., Holler, F. J., Crouch, S. R., Fundamentals of analytical chemistry, Brooks/Cole-Thompson

Learning, Belmont, USA, 2004.
2. Robinson, J.W., Skelly Frame, E.M., and Frame II, G.M. Undergraduate Instrumental Analysis, 6th Ed., CRC Press, Printed and Distributed by Marcel Dekker, New York, NY, USA, 2005. ISBN:0-8247-5359-3

Relevant Unitech Policies

It is important that all students familiarize 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/

CH 324: INVIRONMENTAL CHEMISTRY I

Course(s): Applied Chemistry (NQF Level 7)

Subject Name: Analytical Chemistry

Subject Code: CH324

Contact hours: 6 hours per week

Duration: 13 Teaching weeks

Credit Points: 16 (3 Lectures + 3 Laboratory sessions)

Delivery Mode: On campus

Prerequisites: CH313, CH314

Co-requisites: Nil

Subject Coordinator: TBA

Synopsis

This subject is offered at the third-year level of the degree program. It emphasizes on the comprehensive understanding of the negative environmental impact of human activities and natural causes. Discussion is centred on sources of regional and global air and water pollutants and the legal framework governing environmental protection. Students are also introduced to the applicable analytical techniques in the environment monitoring programs.

Subject Topics (ST)

1. Primary & Secondary Pollutants
2. Chemical pollution and their effects
3. Montreal Protocol and the Kigali Amendment
4. Environment Monitoring

Subject Outline

Topic	Content
Primary and secondary pollutants	Primary pollutants and their sources and sinks; Photochemistry, and secondary pollutants formation in the troposphere; Ozone formation and methods to control its formation; Smog formation and its impact on human health and visibility; Temperature inversion and pollution episodes in the troposphere. Ozone and its usefulness in the Stratosphere; Ozone destruction mechanisms in the Stratosphere; The role of polar stratospheric clouds (PSC) and the chemistry of ozone in the stratosphere; CFCs, international protocols and regulations, and the fate of stratospheric ozone
Chemical pollution and their effects	Agrochemicals such as pesticides and fertilizers, petrochemicals such as polycyclic aromatic hydrocarbons, gasoline (petrol) and its additives, spillage of crude oil and other fossil fuels; mining activities and mine-tailings; industrial effluents and sewage treatment and disposal; emerging pollutants such as pharmaceuticals and their metabolites; leachates from landfills
Montreal Protocol and the Kigali Amendment	the obligations, requirements, and restrictions of the Basel Convention, and the post-convention initiatives; international legislation and regulations/protocols on marine and riverine disposal of mine tailings;

Monitoring of environment	Why environmental monitoring? Carbon emissions and the commodity market; Greenhouse gases and climate change issues; CO2 capture and sequestration. Gas chromatography-mass spectrometry; Liquid chromatography-mass spectrometry; ion chromatography; elemental analyses.

Subject Learning Outcomes (SLOs)

On completion of this subject the student should be able to:

1. Develop comprehension on the effect of chemistry and related activities on the environment.
2. Discuss the sources, fate, and sinks of common air and water pollutants.
3. Understand global and regional issues on environmental impacts from air and water pollution.
4. Understand regulatory/legislative compliance issues and the need for environmental monitoring.
5. Familiarise themselves with selected instrumental techniques used for chemical analyses.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	(20 %)
Laboratory practice	(15%)
Assignments	(10%)
Quiz	(5%)
Final Examination	(50%)

Assessment 1 - Tests: There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - Laboratory practice: The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - Assignment/Group work: The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject.

Assessment 4 - Quizzes: These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5- Final written examination: A 2 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Textbooks

1. Manahan, S.E., Environmental Chemistry, CRC Press, Boca Raton, USA, 2010
2. De, A.K. Environmental Chemistry, New Age International, New Delhi, India, 2010

3. Baird, C, and Cann, M. Environmental Chemistry, 5th Ed., W.H. Freeman and Company, New York, NY, USA, 2012.

Relevant Unitech Policies

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

CH400 INDUSTRIAL TRAINING: Work integrated Learning will be in Sem 2, Year 3 Nov-Jan. This subject will not have any credit point and will be assessed with pass/fail.

Fourth YEAR SUBJECT – SEMESTER 1

CH411 RESEARCH PROJECT I

Course(s)	**Applied Chemistry** (NQF Level 7)
Subject Name	Research Project I
Subject Code	CH411
Duration	13 Teaching weeks
Contact Hours	6 Hours per week
Credit Points	8 **(**Project)
Delivery Mode	On campus
Prerequisites	None
Co-requisites	None
Subject Coordinator	TBA

Synopsis

Students are to undertake a substantial project relevant to Chemistry. The topic should be so chosen that it draws together the different facets of the course and provides experiences in research procedures, data handling and processing. Students select a topic under any areas of chemistry as chosen by a lecturer who will provide the supervision and guidance throughout the duration of the project. Students will conduct a literature search, write a proposal, plan the programme of work and give a research seminar on their selected projects and/or as directed by the supervisor. At the end of the semester, the students are required to do an oral presentation and present a written report in the form of a thesis.

Subject Topics

The research will cover topics in any main areas of chemistry such as physical, inorganic, organic environmental, analytical and material chemistry.

Subject Outline

Topic	Content
14. Literature Review	• Do thorough literature review on the relating to the related research topic.
15. Experimental Planning	• Design experimental procedures. • Planning their actual experimentation on weekly basis using Gantt Charts.
3. Presentation	• Compile literature review and the methodology into thesis format and oral presentation.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Do extensive literature review surrounding the chosen research projects.
2. Do experimental planning using the latest information on the chosen project.
3. Write preliminary thesis from the gathered information on the topic.

Assessment Tasks and Weightings

The assessment is continuous and comprises of 50% seminar presentation and 50% individual thesis report. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Seminar presentation;	**(50 %)**
Thesis report	**(50%)**

Assessment 1 - **Seminar presentation:** The areas to be assessed includes; scientific content, presentation style, presentation clarity, answers to questions, audio-visual clarity and timing. All of these contributes to 50% of the assessment.

Assessment 2 - **Written report:** Written report in the form of a thesis will be assessed by two lecturers one of which will be the supervisor. This contributes to 50% of the assessment.

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Relevant Unitech Policies

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CH412: Industrial Organic Chemistry

Course(s):	Applied Chemistry (NQF Level 7)
Subject Name:	Applied Physical Chemistry
Subject Code:	CH412
Duration:	13 Teaching weeks
Contact Hours:	6 Hours per week
Credit Points:	16 **(**3 Lectures + 3 Practical sessions)
Delivery Mode	On campus
Prerequisites:	CH212
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

Industrial organic chemistry is a Fourth-Year degree subject that covers topics based on the use of organic chemicals in industrial process applications in the country. The subject discusses sources of the industrial organic molecules, the production processes involved in their applications, and their uses as intermediates in the production of other organic molecules.

1. Sources of Organic Chemicals.
2. Industrial use of Some Organic Chemicals
3. Soaps and Detergents
4. Paints
5. Agrochemicals
6. Brewing technology and chemistry of fermentation processes Subject Topics

Subject Outline

Topic	**Content**
1. Sources of Organic Compounds	Organic chemicals from oil and natural gas, from coal, carbohydrates, starch, cellulose animal and vegetable oils and fats.
2. Industrial use of Some Organic Chemicals	Production and use of organic chemicals including ethylene, propylene, benzene, toluene, xylene, acetylene, naphthalene and C4 petrochemicals.
3. Soaps and Detergents	Detergency and types of soaps and detergents; raw materials for soap and detergent manufacture, soap processing, quality control. Cationic, anionic and non-ionic detergents, detergent formulation, identification of detergent bases, biodegradability.
4. Paints	Paint constituents and properties; the nature, manufacture and applications of alkyds, polyurethanes and acrylics, solvents, inorganic and organic pigments.
5. Agrochemicals	Pesticides, herbicides and veterinary products; methods of manufacture and use, hazards, environmental issues.
6. Brewing Technology and Chemistry of Fermentation processes	Raw Materials: Water, malt, hops and other important materials, Chemistry and its impact on processing. Malting and Mashing: Chemical composition of barley, nitrogen/protein, enzymes, starch, Polysaccharides & impact on brewing.

	Chemistry and Biochemistry of Malting, Brew house procedures: Milling, mashing, boiling, filtration, equipment and machinery in brewing, Chemistry and Biochemistry of Fermentation: Yeast characteristics, yeast biochemistry, metabolism of sugars, nitrogen metabolism, post fermentation techniques. Other industrial fermentation processes other than beer fermentation (eg., antibiotics production from microorganisms)..

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Understand primary sources of organic chemicals for industrial chemistry applications.
2. Understand the manufacture, chemistry and uses of soaps and detergents.
3. Have some understanding of the chemistry and types of paints in the coating industry.
4. Have some understanding of the chemistry of agrochemicals, their applications and environmental impacts
5. Understand brewing technology and the chemistry of fermentation in beer production.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	**(15 %)**
Laboratory and field work	**(20%)**
Assignments	**(5%)**
Quiz	**(10%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Laboratory and field work:** The Laboratory and field work will contribute 20% towards the final grade for the subject. The case studies will have some problems which will assess the student's ability to think outside the box to consider real design and quality tests.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 5% towards the final grade for the subject

Assessment 4 - **Quizzes:** These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 10%.

Assessment 5 **Final written examination:** A 2 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Heaton, A., (Ed.) An introduction to industrial chemistry, 3rd Ed., (Blackie Academic & Professional, Melbourne, Australia, 1996).

References

R Selinger, B., Chemistry in the market place, 5th Ed., (Allen & Unwin Academic Publisher, Sydney, Australia, 1998).elevant Unitech Policies

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/

CH400: INDUSTRIAL TRAINING: Students after the second semester of third year are to take up at least 13 weeks of industrial training (work experience).

CH413: Petroleum Chemistry

Course(s): **Applied Chemistry** (NQF Level 7)

Subject Name: Quality Assurance

Subject Code: CH413

Duration: 13 teaching weeks

Contact Hours: 6 hours per week

Credit Points: 16 **(**3 lectures, 3 laboratory sessions)

Delivery Mode: On campus

Prerequisites: CH223

Co-requisites: None

Subject Coordinator: TBA

Synopsis

Petroleum Chemistry is a basic requirement for the analysis, principles and products related to industrial chemistry. It covers the important techniques involved to improve quality of petroleum. The general characteristics, chemical reactivity, quality aspects of compounds are discussed. Additionally, emphases are given to the methods of improving the quality and applications in industries.

This is an examinable subject and will be delivered in different segments throughout the semester.

Subject Topics

1. Introduction to fuels and its classification
2. Calorific value and related calculations
3. Coal and importance
4. Coke and importance
5. Techniques to prepare coke
6. Crude oil and its classification
7. Crude oil refining techniques
8. Gaseous fuels and its composition
9. Fixed bed and moving bed Catalytic cracking
10. Aliphatic petroleum compounds and properties
11. Aromatic petroleum compounds and properties

Subject Outline

Topic	**Content**
Introduction to fuels and its classification	Fuels, Classification of Fuels, Comparison between solid, liquid and gaseous fuels, Calorific Value.
Calorific value and related calculations	Higher calorific value, Bomb calorimeter .Lower calorific value, ,Dulong's formula & problems on calorific value.
Coal and importance	COAL, Classification of coal by rank, Analysis of Coal, Proximate analysis & Ultimate analysis.
Coke and importance	Metallurgical Coke, Manufacture of Metallurgical coke, Beehive oven method.

Techniques to prepare coke	Otto Hoffman's by-product oven, Recovery of by-products
Crude oil and its classification	Crude oil ,Classification of crude oils, Types of Compounds in crude oil, Saturated hydrocarbons, Aromatic hydrocarbons, Resins and Asphaltenes,
Crude oil Refining techniques	Refining of Crude oil. Liquid petroleum fuels, Vacuum distillation, Comparison between diesel fuel and gasoline fuel, Petroleum Products and their structural activities.
Gaseous fuel and its composition	Gaseous Petroleum fuels, Natural gas. Liquefied Petroleum Gas, Coal Gas, Oil Gas, Knocking, Octane number, Cracking, Thermal cracking, Catalytic cracking.,.
Fixed bed and moving bed Catalytic cracking	Fixed bed catalytic cracking, Moving - bed catalytic cracking, Flash point & Fire point, Cloud point and pour point, Aniline point, Iodine Value
Aliphatic petroleum compounds and properties	Petrochemicals, Production& properties of Methanol, Acetic acid & Acetone Production & properties of 1, 3, Butadiene & isoprene,
Aromatic petroleum compounds and properties	Aromatic compounds- Benzene Petroleum Oils, Purification & properties of lubric- oil.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

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

1. Understand and discuss on the classification and characterization and calculation of HCV & LCV of fuels by Bomb
   calorimeter .
2. Explain the composition and structure of components of petroleum.
3. Have the ability to explain and relate various parameters used for grading petroleum.
4. Understand and predict the types of additives required to be added to petroleum products for a specific application.
5. Discuss on the chemistry of coal.
6. Discuss on the industrial production, properties and uses of selected petrochemicals.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	**(20 %)**
Laboratory practice	**(15%)**
Assignments	**(10%)**
Quiz	**(5%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Laboratory practice:** The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the

	students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.
Assessment 3 -	**Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject
Assessment 4 -	**Quizzes:** These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.
Assessment 5	**Final written examination:** A 3 hour written examination weighs 50%

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
Brown, W. H., Poon, T., Introduction to organic chemistry, John Wiley & Sons, Hoboken, USA, 2004.

References
Solomons, T.W.G.,Fryhle, C.B., Organicchemistry, John Wiley, Hoboken, USA, 2011.

Relevant Unitech Policies

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BM111 INTRODUCTION TO BUSINESS MANAGEMENT : Taught by the Department of Business Studies/

FOURTH YEAR SUBJECTS – SEMESTER 2

CH421 RESEARCH PROJECT II

Course(s):	**Applied Chemistry** (NQF Level 7)
Subject Name:	Research Project II
Subject Code:	CH421
Duration:	13 Teaching weeks
Contact Hours:	6 Hours per week
Credit Points:	**8 (**Project)
Delivery Mode:	On campus
Prerequisites:	None
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

Students will conduct research on the project proposed in Semester I, report their findings to fellow students and staff in the form of a seminar presentation, and finally a full written report on the project shall be submitted for assessment.

Subject Topics

The research will cover topics in any main areas of chemistry such as physical, inorganic, organic environmental, analytical and material chemistry.

Subject Outline

Topic	Content
1. Experimental studies both in the laboratory and in the field	• Laboratory and field studies. • Data collections
2. Data collection and evaluation of results	• Further data collection. • Evaluation of data
3. Thesis writeup	• Further evaluation of data. • Thesis writeup

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Confidently do independent scientific research.
2. Collect data and analyse data.
3. Write full undergraduate thesis.

Assessment Tasks and Weightings

The assessment is continuous and comprises of 50% seminar presentation and 50% individual thesis report. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Seminar presentation;	**(50 %)**
Thesis report:	**(50%)**

Assessment 1 - **Seminar presentation:** The areas to be assessed includes; scientific content, presentation style, presentation clarity, answers to questions, audio-visual clarity and timing. All of these contributes to 50% of the assessment.

Assessment 2 - **Written report:** Written report in the form of a thesis will be assessed by two lecturers one of which will be the supervisor. This contributes to 50% of the assessment.

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Relevant Unitech Policies

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CH422: ORGANOMETALLIC COMPOUNDS AND NANOTECHNOLOGY

Course(s): Applied Chemistry (NQF Level 7)

Subject Name: Organometallic Compounds and Nanotechnology

Subject Code: CH422

Duration: 13 Teaching weeks

Contact Hours: 6 Hours per week

Credit Points: **16 (**3 Lectures + 3 Laboratory sessions)

Delivery Mode: On campus

Prerequisites: CH222, CH223

Co-requisites: None

Subject Coordinator: TBA

Synopsis

Organometallic compounds and Nanotechnology, is a fourth-year subject for the final year BACH students. The subject introduces the basic concepts of organometallic chemistry with special emphasis on the importance of organometallic compounds in catalysis. The subjects also deal with the applications of the metals in the biological systems. The emerging area of nanotechnology is introduced in the second part of the subject. The topic will enable the learners to understand the basic principles behind nanomaterials formation and some of the applications of nanomaterials in the current era. Further, the subject explores the risk associated with the use of nanomaterials, and outlines the safety procedures when using them.

Subject Topics

1. Organometallic Chemistry
2. Metals in biological systems.
3. Introduction to nanotechnology
4. Nanomaterials
5. Nanotechnology, Society and Environment

Subject Outline

Topics	**Contents**
Organometallic Chemistry	Introduction to organometallic chemistry, properties, classification of ligands, stability, synthesis, structure and bonding of selected organometallic compounds, their importance in catalysis; EAN and 18 electron rules, Stability of organometallic compounds, Metal carbonyls. Compounds with unsaturated hydrocarbons (alkenes, alkynes) and cyanide, Structure of organometallic compounds, Bonding in ferrocene, alkene complexes and carbonyls, Importance of organometallic compounds in catalysis.
Role of applications of Metals in biological systems.	Comprehend and appreciate the role played by alkali, alkaline earth and transition metals in biological systems
Introduction to Nanotechnology	Defining nanotechnology, Basic concepts and introduction to nanotechnology; Nanoparticles, Core-shell nanostructures and Bulk materials Metal and magnetic nanoparticles (semiconductor quantum dots)
Nanomaterial synthesis and characterisation	Synthesis of nanomaterials: carbon nanotubes, porous silicon, nanofibers

	Different methods of nanomaterial synthesis – CVD (Chemical Vapour Deposition), hydrothermal, solvothermal, precipitation, and electrodeposition methods. Characterisation tools for nanomaterials: brief introduction on how techniques like FTIR spectroscopy, Raman spectroscopy, UV-Vis spectroscopy, XRD (X-ray diffraction), SEM (Scanning Electron Microscopy), TEM (Transmission Electron Microscopy) can be useful in the characterisation of nanomaterials. Applications of Nanomaterials in Science and technology
Impact of Nanotechnology, Society and Environment	Scientific and technical impacts; Societal implications of nanoscience and nanotechnology: Society and the scientific and technological innovation process; nano-economy; safety and risk associated with the use of nanotechnology. Environmental aspects of nanotechnology; concern about nano-sized objects and its toxicity

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Comment on the synthesis, general properties, stability, structure, bonding and industrial applications of common organometallic compounds;
2. Comprehend and appreciate the role played by alkali, alkaline earth and transition metals in biological systems
3. Understand the basic concepts on nanotechnology
4. Explain and discuss on what nanomaterials are and how to characterise them
5. Discuss and explain on the environmental implications of nanotechnology

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	(20 %)
Laboratory practice	(15%)
Assignments	(10%)
Quiz	(5%)
Final Examination	(50%**)**

Assessment 1 - Tests: There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - Laboratory practice: The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - Assignment/Group work: The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 4 - Quizzes: These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 - Final written examination: A 2 hour written examination weighs 50%

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

1. Pradeep, T., Nano: The essentials, Understanding nanoscience and nanotechnology, Tata McGraw-Hill Publishing Company Ltd (India) 2007.
2. Ramsden, J.J., Nanotechnology: An Introduction - A volume in Micro and Nano Technologies, Second edition, Elsevier Publications, 2016.
3. Cotton, F.A., Wilkinson, G., Murillo, C.A. and Bochmann, M, Advanced Inorganic Chemistry, 6th Edition, Wiley Publications, 1999.

References

1. Shatkin, J.A. and Shatkin, J.A., Nanotechnology: Health and Environmental Risks, Second Edition, Taylor & Francis Group, 2012.
2. Shah, M.A. and Shah, K.A., Science of Small, First Edition, Wiley India Pvt, Ltd, New Delhi, India, 2013.
3. Miessler, G.L., Fischer, P.J. and Torr, D.A., Inorganic chemistry, 5th Ed., Prentice Hall, New Jersey, 2013.
4. Housecroft, C. and Sharpe, A.G., Inorganic chemistry, 2nd Ed., Pearson Edn. Ltd., New Jersey, 2005.

Relevant Unitech Policies

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CH423: FOOD CHEMISTRY AND ANALYSIS

Course(s):	Applied Chemistry (NQF Level 7)
Subject Name:	Food Chemistry and Analysis
Subject Code:	CH423
Contact hours:	6 hours per week
Duration:	13 teaching weeks
Credit Points:	16 (3 lectures, 3 laboratory sessions)
Delivery Mode:	On campus
Prerequisites:	CH223, CH224
Co-requisites:	Nil
Subject Coordinator:	TBA

Synopsis

Food chemistry and analysis is a fourth-year subject for the final year BACH students. It outlines the fundamental concepts and analytical methods, used in food chemistry, to the students. The subject will enable the students to understand the chemistry of foods - composition of food, its constituents and role played by each component including its interaction. As this subject comes in the fourth-year of the BACH course, it aims to teach students the basic food chemistry, role of enzymes and various processing treatments in food industry and also help to understand the concept of new product development. The subject also gives importance to the functional aspects of food components and to study their role in food processing.

Subject Topics (STs)

1. Constituents of food - I
2. Constituents of food - II
3. Enzymes
4. Food processing
5. Food additives and food colours
6. Food safety
7. Food product development

Subject Outline

Topics	Contents
Naturally occurring constituents of foods – I (focusing mainly on: proteins, lipids, carbohydrates)	Protein classification and structure; nature of food proteins; properties of proteins (e.g., electrophoresis, denaturation); Functional properties of proteins (e.g., gelation, emulsification etc) Classification of lipids; chemical (e.g., saponification value, peroxide value, iodine value) and physical (softening point, fire point, turbidity point), properties; Effect of frying on fats, Auto-oxidation and its prevention. Classification of carbohydrates; structure and chemical reactions of important carbohydrates
Naturally occurring constituents of foods – II (focusing mainly on: vitamins, minerals and the role of water in the food context)	Structure, importance and stability of vitamins; water- and fat- soluble vitamins; structure and properties of selective vitamins (e.g., vitamin D and vitamin C). major and minor minerals; metal uptake in canned food physical properties of water and ice; water activity and food spoilage; water binding of meat; water activity and packaging
Role of enzymes and Browning reactions in food	Introduction and classification of enzymes; general characteristics; enzymes in food processing; industrial uses of enzymes Enzymatic browning; non-enzymatic browning; maillard reaction; caramelisation reaction

Food additives and food colours	Definition and basic tastes, chemical structure and taste; description of food flavours; food enhancers Properties and uses of selective food additives: pectins, alginates, carrageenans, gums and hydrocolloids. Introduction and classification of food colourants
Food processing	physio-chemical and nutritional changes during food processing treatments: drying and dehydration; freezing; canning. Nutritional enhancement and marketability
Food safety	Introduction to food safety; definition, types of hazards, biological, chemical, physical hazards; factors affecting food safety; chemical contaminants in food; management of hazards; importance of safe foods, newer approaches to food safety
New food product development	definition; importance; need of new food product development; steps of product development; product development tools

Subject Learning Outcomes (SLOs)

On completion of this subject the student should be able to:

1. Discuss and explain the chemistry of food constituents, their functions and uses
2. Understand the functional aspects of food components, role of each component and their interactions
3. Explain the role of enzymes and various chemical reactions mediated by the enzymes
4. Explain certain role of certain food additives and their properties
5. Discuss on the properties and uses of colouring agents and chemical contaminants in food
6. Understand the concept of new food product development.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	(20 %)
Laboratory practice	(15%)
Assignments	(10%)
Quiz	(5%)
Final Examination	(50%)

Assessment 1 - Tests: There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - Laboratory practice: The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - Assignment/Group work: The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject.

Assessment 4 - Quizzes: These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 Final written examination: A 2 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Textbook

Fennema, O. R., Food chemistry, Mercell Dekker, New York, 1996.

References

1. Nelson, D. L & Cox, M. M., Principles of Biochemistry, sixth edition, 2013.
2. Lee, F. A., Basic Food chemistry, AVI Publications, Westport, USA, 2013.
3. Joslyn, M., Methods in food analysis, Academic Press, New York, USA, 1970.
4. Ihekoronye, A.I. and Ngoddy, P.O., Integrated Food Science and Technology for the Tropics, Macmillan, London and Basingstoke, UK, 1985.
5.DeMan, J. M., Principles of Food Chemistry, Aspen Publication, Maryland, 1999.
6. Desrosier, N.W and Desrosier, J.N., The technology of food preservation. AVI Publishing, Westport, Connecticut, USA, 1977.

Relevant Unitech Policies

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CH424: ENVIRONMENTAL CHEMISTRY II

Course: Applied Chemistry (NQF level 7)

Subject Name: Environmentally Chemistry II

Subject Code: CH424

Duration: 13 weeks

Hours: 6 hours per week

Credit Points: 16 (3 lectures, 3 laboratory sessions)

Delivery Mode: On campus

Prerequisites: CH324

Co requisites: CH221, CH224

Synopsis

Environmental Chemistry II is an introduction to marine chemistry, and topics in solid waste management strategies. Solid waste minimization, disposal, recycling, and treatment are discussed. Other discussions include hazardous waste minimization, segregation, and treatment.

Subject Topics

1. Stable isotopes and their applications in marine radiochemistry
2. Selected instrumental methods for stable isotope applications
3. Marine nitrogen cycle
4. Mine tailings and the global environmental debates
5. Hazardous waste minimization, segregation, and treatment
6. Solid waste minimization, disposal, treatment, and recycling

Subject Outline

Topic	Content
Stable isotopes and their applications in marine radiochemistry	Sources and sinks of materials to the ocean. Introduction to stable isotopes; definitions, measurement, theories and models. Applications of stable isotopes in marine chemistry; physical and chemical processes, biological processes, and introduction to paleoceanography le
Selected instrumental methods for stable isotope applications	Principle of isotope ratio mass spectrometry (IRMS), and its use in the measurement of stable isotopes. Sample preparation techniques, and ratio measurements.
Marine nitrogen cycle	Why study the nitrogen cycle? Marine nitrogen pools, fluxes, and distributions. Biogeochemical transformations. Human impacts on the nitrogen cycle.
Mine tailings and the global environmental debates	Disposal and management, Case Studies in Papua New Guinea and other global locations, pros and cons of tailing disposal methods.
Hazardous waste minimization, segregation, and treatment	Introduction to Chemical Hygiene Plans. Management of hazardous wastes in a laboratory. Segregation of wastes and Satellite Accumulation Sites. Recycling of waste oil.
Solid waste minimization, disposal, treatment, and recycling	Solid waste minimization and segregation. The FOUR R's in waste management. Sanitary landfills and considerations for their design. Incinerators and considerations for their design. Compare and contrast between sanitary landfills and incinerators. Recycling of solid wastes.

Subject Learning outcomes (SLOs)

On completion of this subject the student should be able to:

1. Understand the nature of stable isotopes and their applications in marine chemistry;
2. Understand the operations of instruments used for the quantitative measurement of stable isotopes;
3. Distinguish between marine and freshwater nitrogen cycles;
4. Partake in the global debates on mine tailings;
5. Objectively discuss waste management practices.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.
Students must also refer to the Subject Assessment Details.

Tests	(20 %)
Laboratory practice	(15%)
Assignments	(10%)
Quiz	(5%)
Final Examination	(50%)

Assessment 1 - Tests: There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - Laboratory practice: The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - Assignment/Group work: The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject.

Assessment 4 - Quizzes: These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 Final written examination: A 2 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text

1. Manahan, S.E., Environmental Chemistry, CRC Press, Boca Raton, USA, 2010
2. De, A.K. Environmental Chemistry, New Age International, New Delhi, India, 2010
3. Baird, C, and Cann, M. Environmental Chemistry, 5th Ed., W.H. Freeman and Company, New York, NY, USA, 2012.

Relevant Unitech Policies

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

COURSE STRUCTURE

BACHELOR OF SCIENCE IN FOOD TECHNOLOGY

First Year First Semester

Code	Subject	Contact Hours	Credit
MA115	Mathematics For Applied Sciences I	6	20
CD 111	Development Practices & Sustainability	6	15
PH113	Physics for Food Technologists	6	18
AS113	Chemistry for Natural Sciences	6	15
		24	**68**

First Year Second Semester

MA125	Mathematics For applied Sciences II	6	20
FR123	Biology (Plant & Animal)	6	18
FT121	Introduction to Food Engineering	6	22
FT122	Introduction to Food Science	6	20
		24	**80**

Second Year First Semester

Code	Subject	Contact Hours	Credit
FT211	Food Engineering I	6	18
FT212	Food Chemistry I	6	18
FT213	Food Microbiology I	6	16
FT214	Nutrition I	6	18
		24	**70**

Second Year Second Semester

FT221	Food Processing Practical I	6	8
FT222	Unit Operations I	6	21
FT223	Chemical Analysis for Food &Water	6	16
FT224	Advanced Food Chemistry	6	16
		24	**61**

Third Year First Semester

Code	Subject	Contact Hours	Credit
FT311	Food Engineering II	6	18
FT312	Quality Assurance	6	16
FT313	Food Microbiology and Biotechnology	6	16
BM111	Introduction To Business Management	6	21
		24	**71**

Third Year Second Semester

FT321	Food Safety & HACCP	6	16
FT322	Commodity Science I: Tropical Agricultural Crops	6	16
FT323	Food Processing Practical II	6	8
FF324	Science Communication & Research Methodology	6	18
***FT400**	Industrial Training		
		24	**58**

Fourth Year First Semester

Code	Subject	Contact Hours	Credit
FT412	Advance Nutrition	6	16
FT413	Food Processing Practical III	6	8
FT414	Innovation & Entrepreneurship	6	18
FT411	Research Project I	6	8
		24	**50**

Fourth Year	**Second Semester**		
FT422	Food Processing Practical IV	6	8
FT423	Unit Operations II	6	21
FT424	Commodity Science II: Meat & Seafood Technology	6	16
FT421	Research Project II	6	8
		24	**53**

***FT400: Industrial Training -Work integrated Learning will be in Sem 2, Year 3 Nov-Jan. This subject will not have any credit point and will be assessed with pass/fail.**

Graduate Statement (GS)

The Unitech Food Technology Graduate will research, produce and preserve food and agro- commodities in a sustainable manner. They will be innovative and entrepreneurial in creating wealth using locally available resources. The Unitech Food Technology Graduate will easily integrate into any working environment.

Course Learning Outcomes (CLOs)

On completion of the course the student will:

CLO1	Demonstrate effective and appropriate communication skills to present a clear and coherent exposition of food technology knowledge and ideas to a variety of audience across all levels of society.
CLO2	Understand and comprehend concepts and principles in food sciences, food engineering and food processing.
CLO3	Apply approved standards and regulations to analyze, evaluate and develop food and food products that are free from risks of public health significance. These food and food products are nutritious, of assured quality, free of fraudulent products and are readily available in sufficient quantities for all consumers.
CLO4	Use adaptable technology to design engineering processes to produce and preserve marketable food, food products and food by-products that are sustainable.
CLO5	Research and design adaptable technologies that are affordable and accessible to reduce post-harvest losses and promote downstream processing.
CLO6	Apply the fundamental knowledge and skills in food sciences, food microbiology, food engineering, and food processing to research, critique, and contribute to the scientific body of knowledge in food and allied industries, government and non-government organizations and research institutions.
CLO7	Interact and collaborate effectively in a team, be a team player, demonstrate good leadership. Is responsible and accountable.
CLO8	Use entrepreneurial principles to generate novel ideas and products for wealth creation and empowerment of society.
CLO9	Demonstrate the knowledge and skills in human nutrition and food microbiology to analyze, evaluate and address issues of public health significance.

SUBJECT DETAILS: FOOD TECHNOLOGY

FIRST YEAR SUBJECTS – SEMESTER 1

AS111 CHEMISTRY FOR NATURAL SCIENCES

Course(s): Food Technology and Forestry (NQF Level 7)

Subject Name: Chemistry for Natural Sciences

Subject Code: AS113

Duration: 13 Teaching weeks

Contact Hours: 6 Hours per week

Credit Points: 16 **(**3 Lectures + 3 Practical sessions)

Delivery Mode On campus

Prerequisites: Grade 12

Co-requisites: None

Subject Coordinator:

Synopsis

Chemistry for Natural Sciences is an introduction to fundamentals of chemistry. It introduces First Year Food Technology and Forestry students to analytical, inorganic, organic, physical, and water chemistry. This provides the prerequisites to comprehend, understand and the application of chemistry when advancing into Food Technology and Forestry subjects. This is an examinable subject and will be delivered in different segments throughout the semester.

Subject Topics

1. Safety in the laboratory, naming of chemical compounds, its formulae and equations
2. Atomic structure ,Periodic arrangement of elements, electronic configuration, and quantum numbers
3. Physical Chemistry: Fundamentals of thermodynamics, Chemical equilibrium and chemical kinetics
4. Organic chemistry: organic compounds and its properties, biological chemistry, functional groups and organic reactions mechanisms
5. Analytical chemistry; Acids and bases, determination of concentration, empirical formula, limiting reagents
6. Water chemistry: COD, BOD, organic and inorganic pollutants

Subject Outline

Topic	Content
16. Safety and chemicals	• Safety in the Laboratory, Chemical Foundations Naming of compounds, Formulae, Equations-chemical, ionic & net ionic
17. The atom and Periodic Arrangement of Elements	• Atomic Structure, isotopes. Calculation of average atomic mass, Electronic Configuration, Stoichiometry, Avogadro's number, moles, molarity, Dilution, empirical formula, limiting reagent Oxidation –Reduction

	reaction; Oxidation number and electron transfer, Half-reactions ,balancing redox reactions
18. Chemical Bonds and Structures	• Orbital types, electronic configuration, Classification of elements by property and electronic structure, Periodicity of atomic and ionic size, ionization energy, electron affinity, electronegativity, polarizability and polarizing ability, Different types of bonds: ionic, covalent, coordinate and metallic, properties of ionic and covalent compounds, Criteria for determining the nature of bonding, hybridization of orbitals, molecular shape and VSEPR theory.
19. Thermodynamics	• Thermodynamic system, State and path functions, First law of thermodynamics, energies and enthalpies of chemical reactions, Hess's Law, Second Law of Thermodynamics, Spontaneity, Free energy of formation, ΔG_f
20. Chemical Equilibrium	• Le Châtelier's principle, equilibrium calculations including sparingly soluble salts, strong and weak acids, bases, buffers, chemical reactions and pH,
21. Chemical Kinetics	• Measuring Reaction Rates, Kinetics and Chemical Equilibrium, Investigating Reaction Mechanism, Effect of Temperature on Reaction Rates and Kinetics of Catalysis
22. Organic Chemistry	• Bonding, hybridization and structural features, including oxidation states of organic compounds, The functional group approach: structure, nomenclature, Preparation and properties of alkanes, alkenes, alkynes, benzenes, halogen compounds, aldehydes, ketones, amines, ethers, alcohols, phenols, carboxylic acids and their derivatives, Organic redox reactions, the use of pKa values in organic reactions
23. Water Chemistry	• BOD, COD, organic and inorganic pollutants

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Provide information on application of safe working practices in the laboratory;
2. Name and write the formulae of elements and compounds, write balanced chemical, ionic and net ionic equations for chemical reactions, including redox reactions;
3. Discuss the properties of elements and compounds in terms of their position in the periodic table;
4. Discuss chemical bonding and draw Lewis diagrams for different types of bonding;
5. Calculate moles, molarity, normality, density, specific gravity, concentration, dilution, limiting reagent and empirical formulae;
6. Apply the gas laws including the ideal gas equation and van der Waals equation.
   Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests : (25 %)
Laboratory and field work: (10%)

Assignments:	**(10%)**
Quiz:	**(5%)**
Final Examination:	**(50%)**

Assessment 1 - **Tests:** There will be 5 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Laboratory and field work** The Laboratory and field work will contribute 10% towards the final grade for the subject. The case studies will have some problems which will assess the student's ability to think outside the box to consider real design and quality tests.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 4 - **Quizzes:** These are very short, short answer, or multiple-choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 **Final written examination:** A 3 hour written examination weighs 50%

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 weeks semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text book

Zumdahl, S.S and Zumdahl, S.A; Chemistry, 8th Ed., (Brooks Cole, California, USA, 2010).

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/

CD111 DEVELOPMENT PRACTICES & SUSTAINABI;ITY: Taught by the Department of Communication for Development studies.

MA115 MATHEMATICS I APPLIED SCIENCES I: Taught by the Department of Mathematics and Computer Science

PH113 PHYSICS FOR FOOD TECHNOLOGISTS : Taught by the Department of Applied Physics

FIRST YEAR SUBJECTS – SEMESTER 2

FT121 INTRODUCTION TO FOOD ENGINEERING

Programs:	**Engineering (NQF Level 7)**
Subject Name:	**Introduction to Food Engineering**
Subject Code:	**FT121**
Duration:	**13 weeks**
Credit Points:	**4 Lectures and 2 Tutorials (21 Credit Points)**
Delivery Mode:	**On campus**
Prerequisites:	**PH113**
Co requisites:	**MA 115**
Subject Coordinator:	**TBA**

Synopsis

Introduction to Food Engineering enables student to attain the fundamental concepts to be later used in food engineering and processing subjects in Food Technology course. It will impart cognitive skills to think critically about the topics relevant for food engineering and processing applications.

SUBJECT TOPICS

1. Topic 1: Units and Dimensions
2. Topic 2: Basic Thermodynamics.
3. Topic 3: Energy Balance and Steam Production.
4. Topic 4: Mass Balance
5. Topic 5: Introduction to process flow systems and engineering drawing
6. Topic 6: Fluid Statics

SUBJECT OUTLINE

Topic	Contents
1. UNITS AND DIMENSIONS	**Introduction** Introduces the importance of uses of units and dimensions and their conversions from one system to another. **Unit and dimensional consistency** Covers the importance of dimensional and unit consistencies in different equations. Conversions between different measurement systems. **Significant figures, precision measurements and concentrations** Covers the importance of precision of measurements , uncertainties, significant figures , simple concentration calculations involving moisture and density calculations.
2. BASIC THEROMODYNAMICS	Introduction to thermodynamics – definition of thermodynamics and its importance in engineering. Law of thermodynamics, heat , work and energy. Gas laws and concept of free energy. Understanding and use of thermodynamic charts.
3. ENERGY BALANCE AND STEAM PRODUCTION	Importance of the energy and concept of conservation of energy. Tyes of energies Concept of sensible and latent heat balances. Factors influencing heat that affect specific heat capacity. Phase diagram and heating curves of water. Thermodynamics of steam production Use of steam tables in engineering calculations
4. MASS BALANCE	Importance of the concept of conservation of mass. System boundaries. Total and component balances. Calculations involving concentration and dilution processes. Choosing basis for mas balance calculations. Calculations involving recycles. Multistage calculations.
5. BASIC ENGINEERING DRAWING AND INTRODUCTION TO PROCESS FLOW SYSTEMS	Unit operations and unit process – definition and examples. Food process system concept. Batch and continuous operation systems. Costing systems in engineering operations. Basic engineering drawing and flow charts in engineering operations
6. FLUID STATICS	States of matter and definition of fluid dynamics and fluids statics. Pressure and depth. Static head and its relationship thermal processing. Pressure measuring systems.

SUBJECT LEARNING OUTCOMES (SLOs)

After completing this Subject, students will be able to:

1. Demonstrate how to covert units from one system from one to another.
2. Attain fundamental knowledge of the basic thermodynamic principles relevant to food engineering applications.
3. Understand how steam is produced and able to demonstrate the use of steam table to solve thermal process calculations.
4. Solve food engineering problems using mass balance principles.
5. Demonstrate the use of simple engineering drawing and process flow systems to relate to food engineering applications.
6. Understand the importance of static fluids in food processing systems.

ASSESSMENT TASKS AND WEIGHTINGS

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	**(25 %)**
Laboratory and field work	**(10%)**
Assignments	**(10%)**
Quiz	**(5%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 5 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Laboratory and field work :** The Laboratory and field work will contribute 10% towards the final grade for the subject. The case studies will have some problems which will assess the student's ability to think outside the box to consider real design and quality tests.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 4 - **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 **Final written examination:** A 3 hour written examination weighs 50%

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

References

1. Singh. P.R, and Heldman. D.R (2001). **Introduction to Food Engineering** . Academic Press, London. 3rd Ed.
2. Fellows.J.P (2009). **Food Processing Technology: Principles and Practice**, Woodhead Pub, Cambridge, 3rd Ed.

3. Earle. L.R. (1983). **Unit Operations in Food Processing**. Pergamon Press, Oxford, England. 2nd Edition.

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 atwww.unitech.ac.pg/AssessmentGuide/ **and** www.unitech.ac.pg/Plagiarism/

FT121 INTRODUCTION TO FOOD SCIENCE

Course(s):	Food Technology (NQF Level 7)
Subject Name	Introduction to Food Science
Subject Code	FT122
Duration	14 teaching weeks
Contact Hours	6 hours per week
Credit Points	20 **(**3 x lectures & 3 x tutorial)
Delivery Mode	On campus
Prerequisites	None
Co-requisites	None
Subject Coordinator	TBA

Synopsis

The subject provides the first year food technology students with the introduction into the sciences of food chemistry, food microbiology and human nutrition. This subject provides the prerequisite to advance understanding, comprehension and application of the sciences which will be covered in the subsequent years. This is an examinable subject and will be delivered in three different segments throughout the semester.

Subject Topics

1. History of Microbiology and Binomial nomenclature of microorganisms. Major characteristics of prokaryotic and eukaryotic cells.
2. General characteristics, morphology and classification of bacteria, fungi, algae, protozoa and virus and the importance of microorganisms.
3. Introduction to macromolecules, their nomenclatures and classifications, structures, compositions and conformations.
4. Important chemical reactions of macromolecules.
5. Introduction to the science of nutrition, nutrients and nourishment. The classes and sources of nutrients; food groups; the factors that affect eating and food choices. Diet planning guides.
6. Human body- in nutrition perspective.

Subject Outline

Topic	Content
History of Microbiology	Major events in the development of Microbiology: Construction of Leeuwenhoek microscope and observation of *animalcules*, the theory of spontaneous generation or a biogenesis, disapproval of the theory by Louis Pasteur. Germ theory of disease, development of laboratory techniques to study microorganisms and binomial nomenclature

Classification of microorganisms	The general characteristics of procaryotic and eukaryotic cells. The major groups of prokaryotic microorganisms: The Eubacteria and Archaeobacteria, gross morphology of bacteria. The major groups of eukaryotic microorganisms: The gross morphology and classification of fungi, algae and protozoa.
Macromolecules and Structure and conformations and nomenclature	Basic introduction to cells and elemental compositions in biological systems in relation to food, bonding of atoms and molecules within biological structures in relation to food. Bonding of carbon atoms and the tetrahedral shape of its nucleus. Classes of macromolecules and their building blocks, types of covalent bonds in macromolecules. Functionally active groups in macromolecules in relation to physical and chemical reactions. Chemical structures of carbohydrate, protein and lipid and their monomers. Nomenclature of carbohydrate in relation to their number of carbon atoms. Stereochemistry of carbohydrate, protein and lipids in relation to their structures and how these affect their physical and chemical properties and reactions. Fischer and Haworth projections and the boat and chair conformations of hexoses. Basic structures of food colloids/non-starch polysaccharides .Primary, secondary and tertiary structures of proteins and their bonds. General structure of fatty acid, glycerol and phospholipids.
Classification and Important chemical reactions in food	Monosaccharides, oligosaccharides and polysaccharides and their structures, basic, acidic, neutral and non-polar amino acids and their structures, basic introduction to simple, conjugated and derived proteins and compositions including globular and rod-shape proteins in various sources. Simple, compound and derived lipids and their compositions. Isomerization and mutarotation and of carbohydrates and their solutions. Reaction of functional groups to useful compounds such as sugar acids, sugar alcohols, sugar esters, amino sugars (Maillard browning , food caramels (caramelization). Protein denaturation and the denaturing agents. Oxidative and hydrolytic rancidity of lipids. Reactions of antioxidants in controlling the process of lipid rancidity.
Introduction to the science of nutrition, nutrients and nourishment.	Introduction to the classes and sources of nutrients; Major nutrient classes, the different food groups and their composition. The factors that affect eating and food choices. Diet planning principles, guidelines.
Human body- in nutrition perspective.	Human Physiology; the cell; organisation of the body; Cardiovascular system & lymphatic system; nervous system, endocrine system, immune system, digestive system; Urinary system; storage capabilities; common problems with digestion.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Understand the history of Microbiology and binomial nomenclature of microorganisms.
2. Identify and characterize different groups of microorganisms based on major characteristics and cell morphology and appreciate the importance of microorganisms.
3. Understand the three important macromolecules, their nomenclatures, classification and identify their composition, conformations and structures.
4. Describe the important chemical reactions of macromolecules.
5. Discuss the importance of the different classes of nutrients and food groups and the factors that affect food choices and eating and the diet planning principles.

6. Understand the chemical, biological and physiological aspects of nutrition.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	**(20 %)**
Case studies or lab reports	**(10%)**
Assignments	**(10%)**
Quiz	**(10%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 6 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Case studies:** The case studies will contribute 10% towards the final grade for the subject. The case studies will have some real life problems which will assess the student's ability to think outside the box to consider factors that influence food, nutrition and health.

Laboratory practice: The laboratory practice will contribute 10% towards the final grade for the subject. The hands-on practices in the lab will assess students' confidence in doing lab work and projects as well as a check to see if the students have understood the theory component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 4 - **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 10%.

Assessment 5 **Final written examination:** A 3 hour written examination weighs 50%

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 14 weeks of teaching as per the PNG National Qualification Framework.

References

1. Whitney, E.N., Sharon, R., *Understanding nutrition*, Wadsworth Publishing, Belmont, USA, 2011. McGuire M. & Beerman, K. A., *Nutritional Sciences*. Wadsworth Cengage Learning, USA. 2011
2. Fennema, O. R., Damodaran, S., Parkin, K., *Fennema's food chemistry*, Taylor & Francis, Boca Raton, USA, 2007.
3. Pelczar, M.J., Krieg, N.R., Chan, E.C.S., *Microbiology: an application based approach*, Tata McGraw-Hill Education, New Delhi, India, 2010.

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/

FR123 BIOLOGY (PLANT & ANIMALS): Taught by Agriculture and Forestry Departments.

MA125 NATHENATICS FOR APPLIED SCIENCES II : Taught by the Department of Mathematics and Computer Science

SECOND YEAR SUBJECTS – SEMESTER 1

FT211 FOOD ENGINBEERING I

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Food Engineering I
Subject Code:	FT211
Duration:	13 teaching weeks
Contact Hours:	6 hours per week
Credit Points:	21 (4 x Lect + 2x Lab)
Delivery Mode:	On campus
Prerequisites:	FT 121
Co-requisites	PH113
Subject Coordinator	TBA

Synopsis

The subject provides the second year food technology students with in-depth knowledge in heat transfer and mass transfer mechanisms. This subject also provides understanding and comprehension of dehydration a unit operation involving both heat and mass transfer. This subject also provides in-dept knowledge in how vapour compression cycle works and its application in freezing technology. This is an examinable subject and the summative examination will carry 50%.

Subject Topics

1. Heat transfer principles and applications.
2. Mass Transfer Theory and Application
3. Pschrometery and Sorption Studies
4. Food Dehydration
5. Theory of refrigeration systems
6. Freezing Technology

Subject Outline

Topic	Content
Heat transfer principles and applications.	• Introduce the basic principles of conduction, convection and radiation. • Convection theory, estimating film heat transfer coefficients in different flow conditions. • Log mean temperature, co and counter current flow patterns. • Unsteady state heat transfer and their applications in food processing. Application of radiation principle in food process calculations.
Mass Transfer Theory and Application	• Introduction to mass transfer and its usefulness in food and allied industries • Definition and concept of steady and unsteady state mass transfer. • Molecular Diffusion of gasses. • Diffusion of gases and liquids through solids. • Analysis and estimation of film convective mass transfer coefficients in different flow conditions. • Analysis and application of unsteady state mass transfer. • Mass transfer in packaging materials. Mass transfer in membrane systems.

Pschrometery and Sorption Studies	• Introduction to pyschrometry • Properties of air • Properties of water vapor • Properties of Air-vapor mixtures • Construction of Pyschrometric charts • Applications using pyschrometric charts – heating and cooling of air, heating and humidification, cooling and dehumidification, mixing of air and drying of foods. • Water activity • Sorption isotherms
Food Dehydration	• Classification of different drying systems. • Hot air or convective drying. • Factors affecting convective drying. • Convective drying curves. • Convective drying equipments. • Estimating conductive drying times and efficiencies • Direct or conductive drying principle and estimating of drying times. • .Conductive drying equipments. • Radiative drying. • Freeze drying – concept, drying time and equipments. • Drying and quality analysis.
Theory of refrigeration systems	• Introduction to theory of refrigeration, selection of refrigerants, ozone depletion and global warming potential, types of refrigerants. • Vapour compression system – route of refrigerant flow ,components and functions of the vapour compression system. Mathematical analysis of vapour compression cycle, cooling load, condenser, evaporator, compressor, refrigerant flow rate. Multi cycle vapour compression system .
Freezing Technology	• Introduction and importance of cooling to food preservation, difference between chilling and freezing, principle of chilling, effects of chilling on foods and chilling equipment. • Introduction to freezing technology, principle of freezing and stages in a freezing of water and foods, estimation of freezing times. • Effects of freezing on food quality – ice crystal formation, storage and thawing, classification of freezing equipments.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Relate the principle of heat transfer to food processing and engineering.
2. Relate the principle of mass transfer to food processing and engineering.
3. Apply the principles of sorption and psychrometry to food processing and engineering.
4. Apply the principle of dehydration to food processing and engineering.
5. Understand the principles of refrigeration system.
6. Understand freezing technology as an important preservation operation in food industry.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the formative Subject Assessment Details.

Tests **(30%)**

Assignments **(10 %)**

Quiz **(10%)**

Final Examination **(50%)**

Assessment 1:	**Tests:** There will be 6 Tests contributing 30% towards the final grade for the subject.
Assessment 2:	**Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject
Assessment 3:	**Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 10%.
Assessment 4:	**Final written examination:** A 3 hour written examination weighs 50%

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 13 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text Book

Singh. P.R, and Heldman. D.R (2013). *Introduction to Food Engineering* . Academic Press, London. 5 th Ed.

References .

Levis. M.J (1990). *Physical Properties of Foods and Food Process Systems*. Ellis Horwood Limited, West Sussex, England.

Brennan *etal* (1990). Food Engineering Operations, 3rd ed, Elsevier Applied Science, London.

Readings

Study notes (ppt or pdf) will be provided through the Learning Management System in use.

Online materials (web addresses to be given during lectures).

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/

FT212 FOOD CHEMISTRY I

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Food Chemistry I
Subject Code:	FT212
Duration:	14 teaching weeks
Contact Hours:	6 hours per week
Credit Points:	16 (3 x Le + 3 x Lab)
Delivery Mode:	On campus
Prerequisites:	FT 122
Co-requisite:	AS 113
Subject Coordinator:	TBA

Synopsis

The subject consists of a mixture of lectures and practicals classes. It provides the second year food technology students with in-depth knowledge of food chemistry, majoring in macromolecules including water and nucleic acids which form major compositions of food. The subject provides understanding and comprehension of the structure and composition of macromolecules and various reactions and processing conditions which modify these structures and compositions to produce some useful functional outcomes and other undesirable outcomes. The subject also provides hands-on practice where students develop skills in carrying out chemical analysis in identifying and quantifying these chemicals in foods. This is an examinable subject and the summative examination will carry 50%.

Subject Topics

1. Introduction to water and ice, their structures and physical properties and water solute interactions.
2. Polysaccharide conformations and interactions (with water and other polysaccharides), polysaccharide solution behaviour
3. Non-starch polysaccharide structure and interactions with water and other processing conditions
4. Protein conformations and interactions (with water and other proteins), protein denaturation and denaturing agents
5. Lipids polymorphism, extraction and processing and use of antioxidants
6. Nucleic acid structure and composition:DNA and RNA sequencing and synthesis and protein biosynthesis, other functions of nucleotides in the cells.

Subject Outline

Topic	Content
Water and Ice	Structure of water, structure of pure ice and structure of ice in the presence of solutes. Water binding, hydration and water holding capacity at macroscopic level. At molecular level: bound water, interaction of water with ions and ionic groups, neutral groups (hydrophilic solutes, non-polar substances, with protein.
Polysaccharides and non-starch polysaccharides	Native starch structure and interaction with water and temperature: gelatinization and retrogradation and modification of starch to derive functional uses. Starch and non-starch polysaccharides conformations, bonding patterns and behaviour in solution (water): viscosity, dilatant, plastic, pseudoplastic, gelling properties.

Proteins	Protein shapes and conformations and effects of processing conditions including other denaturing agents on protein Water protein interation: hydration Solubility, wettability, water sorption, swelling, adhesion, gelation,viscosity Surface properties: emulsification, film formation, foaming Protein-protein interaction: Aggregation, network formation, elasticity, dough formation, extrudability
Lipids	Native crystalline structures of triacylglycerol (polymorphs) and effect of processing/storage conditions on them. Natural sources of oil, their extraction and refining processes: degumming, bleaching and deodorisation of crude oil Processing of crude oil: blending, fractionation, inter-esterification, winterization, partial hydrogenation of oil and its functional uses in various food systems Types of oxidation, oxidation curve, stages of lipid oxidation, factors affecting lipid oxidation, types and classes of antioxidant, mode of action
Nucleic acids	Nucleotides structure and composition and other use of nucleotides in the cells. DNA structures and arrangement in the cells, base pairing in DNA replication and transcription of DNA, translation of RNA and protein biosynthesis, DNA sequencing and synthesis, polymerase chain reaction.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

3. Explain the structures of water and ice and their water binding and water holding capacities.
4. Discuss water-solutes interactions with ionic, neutral and non-polar substances.
3. Explain starch-water interactions and modification of its structure to improve stability and its functional properties.
4. Describe various conformational structures of starch and non-starch polysaccharides and their viscosity and gelling properties.
5. Explain the effects of processing and denaturing agents on protein structures and on proteinacious foods.
6. Discuss the functional properties of proteins in terms of protein-water interactions, surface interactions and protein-protein interactions
7. Explain the native structure of triacylglycerol and effects of processing on it.
8. Discuss the natural sources of lipids, their extraction, refining and processing processes to improve their functional properties.
9. Describe the stages of lipid oxidation and the function of anti-oxidants in controlling it.
10. Explain structure and composition of nucleic acids and other functions of nucleotides, gene coding using DNA and RNA and subsequent protein biosynthesis.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the formative Subject Assessment Details.

Tests: **(20 %)**
Lab reports: **(15%)**
Assignments: **(5 %)**
Quiz: **(10%)**
Final Examination: **(50%)**

Assessment 1 - **Tests:** There will be 5 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Laboratory practice:** There will about 7 laboratory practicals contributing 15% towards the final grade for the subject. The hands-on practices in the lab will assess students' confidence in doing lab work and projects as well as a check to see if the students have understood the theory component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 5% towards the final grade for the subject

Assessment 4 - **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 10%.

Assessment 5 **Final written examination:** A 3 hour written examination weighs 50%

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

Assessment Rubrics

Laboratory Reports

Criteria	**Description**	**Mark**
Cover page	Title of the experiment or series of experiments with person's full name, ID number and date of experiment	
Introduction	Brief background of the experiment which include information on species analysed, it's significance to food science and food industries and the principle of the method used to analyse this analyte	**1.5**
Aim	Clear, concise and a short statement to indicate what you will achieve in the experiment	**0.5**
Materials & Methods	Refer materials & method to the manual stating the reference method. State clearly any modifications to the method as this can have a bearing on the result(s) obtained.	**0.5**
Results	Must contain a full account of the results obtained. Must be expressed in a clear and logical way. Do not refer to what was expected Use tables and well-labelled graphs to present your results, unit of measurements must be correct and calculations must be clearly shown, both for quantitative and qualitative results	**2**

Discussion	Must present a logical argument based on the results in comparison with the information obtained from the literature Should focus on sticking points of the results such as any variation in the result(s), deviation from the mean value or from the literature value Discussion should include information on results obtained and on expected results and should provide possible reasons for any differences which might have occurred between actual and expected. It must not be a repeat of the results .	**4**
Conclusion	Should draw together the aim and the discussion. Must include what was set out to be obtained and what was the actual result and whether the values were acceptable It must be clear, concise and to the point	**1**
Reference	All references used must be listed in alphabetical order rather than numbered using the correct format the annotated form or generic form	**0.5**

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 14 weeks of teaching as per the PNG National Qualification Framework.

Subject Textbook

Fenemma, O. R., Damodaran, S. and Parkin, K. (2007). Fenema's Food Chemistry, 4th Edition. CRC Press, Boca Raton, Florida

References .

Coultate, T. (2009). FOOD. The Chemistry of its Components, 5th Edition. RSC Publishing, Cambridge, UK.

Gunstone, F. D. (2004). The Chemistry of Fats and Oils, 1st Edition. CRC Press, Boca Raton, Florida.

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/

FT213 FOOD MICROBIOLOGY I

Course: Food Technology (NQF level 7)

Subject Name: Food Microbiology 1

Subject Code: FT213

Contact Hours: 6 hours per week

Credit Points: 16 (3Lect +3 pract)

Delivery Mode: On campus

Prerequisites: FT122

Co-requisites: Nil

Subject Coordinator: TBA

Synopsis

This subject deals with growth of microorganisms, factors which influence their growth and modes of actions of physical and chemical methods used in controlling their growth. It also covers common genera, species or groups of bacteria, yeasts, moulds, viruses, animal parasites and other biohazards encountered in foods. This subject will provide the foundation for Food Microbiology and Biotechnology and Food Safety subjects offered in the third and final year of the degree course.

Subject Topics

1. Bacterial cell structures and their functions.
2. Factors that influence growth of microorganisms.
3. Control of growth of microorganisms by physical and chemical antimicrobial agents.
4. Introduction to foodborne microorganisms.
5. Major sources of contamination of foods and good hygienic practices.
6. Principles and basic microbiological techniques used in isolation and classification of bacteria.

Subject Outline

Topic	**Content**
1. Bacterial cell structure, composition and their functions	Flagella, pili, glycocalyx, cell wall, cytoplasmic membrane, outer layer of gram negative bacteria, ribosomes, nuclear material, inclusion bodies, endospore, plasmid.
2. Factors that influence growth of microorganisms.	Growth of bacteria, bacterial growth curve (batch culture), continuous culture system. Factors that influence growth of microorganisms: Nutrients, pH, oxygen, pH, water activity temperature.
3. Control of growth of microorganisms by physical and chemical antimicrobial agents.	General mode of actions of antimicrobial agents, conditions influencing the effectiveness of antimicrobial agents, microbial death rate. Mode of actions and application of moist and dry heat, low temperature, filtration, radiation and chemical compounds used in as cleaning agents, sanitizers, disinfectants and antibiotics.
4. Introduction to foodborne microorganisms.	Primary sources of microorganisms found in foods. Common foodborne bacteria, common genera of foodborne moulds, common genera of foodborne yeasts. General characteristics of desirable microorganisms in

	foods and indicator microorganisms. Foodborne viruses, animal parasites and other food foodborne biological hazards.
5. Major sources of contamination of foods and good hygienic practices	Sources of contamination of foods include soil, water, plant and plant products, food equipments and utensils, food handlers, animal feeds, animal hides, air and dust. Major causes of foodborne illness. Good hygienic practices such as personal health status and cleanliness, hand washing, personal behaviour,
6. Principles and basic microbiological techniques used in isolation and classification of bacteria.	Principles and basic techniques such as gram staining, endospore staining, aseptic techniques, streaking, anaerobic growth of microorganisms, biochemical tests for identification of gram negative rods, effect of temperature on growth of bacteria, antibiotic sensitivity test.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Identify bacterial cell structures and explain their composition and functions.
2. Describe bacterial growth in a batch and continuous culture systems and factors that influence microbial growth.
3. Describe the modes of actions of antimicrobial agents and the factors that influence their effectiveness.
4. Explain primary sources of microorganisms found in foods and characteristics of common foodborne moulds, yeasts, bacteria, viruses, animal parasites and other foodborne biological hazards.
5. Identify major sources of contamination of foods and explain measures or procedures to prevent or reduce contamination, such as by application of good hygienic practices.
6. Perform basic microbiological techniques.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the formative Subject Assessment Details.

Tests:	**(20 %)**
Lab reports:	**(15%)**
Assignments:	**(5 %)**
Quiz:	**(10%)**
Final Examination:	**(50%)**

Assessment 1 - **Tests:** There will be 5 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Laboratory practice:** There will about 7 laboratory practicals contributing 15% towards the final grade for the subject. The hands-on practices in the lab will assess students' confidence in doing lab work and projects as well as a check to see if the students have understood the theory component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 5% towards the final grade for the subject

Assessment 4 - **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 10%.

Assessment 5 **Final written examination:** A 3 hour written examination weighs 50%

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 13 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

References

Jay, M.J. Modern Food Microbiology. APA Publishers Service, Singapore, 2000.

Pelcaz.M.J., Chan E.C.S., Krieg N.R. Microbiology, Concepts and Application. McGraw Hill, New York, 1993.

Other References

Frazier, W.C., Westhoff, D.C. Food Microbiology. Tata Mcgraw Hill Education Ltd., 2008

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/

FT214 NUTRITION I

Subject Name: Nutrition 1

Subject Code: FT214

Duration: 13 teaching weeks

Contact Hours: 6 hours per week

Credit Points: **21 (**4 x lectures & 2 x tutorial)

Delivery Mode: On campus

Prerequisites: FT122

Co-requisites: None

Subject Coordinator: TBA

Synopsis

This subject builds on the introductory principles established in FT122. It teaches the fundamental principles in human nutrition focusing on the main classes of nutrients, the functions of these nutrients, the sources of these nutrients and the associated deficiency diseases. It highlights the importance of balanced diet with the concept of recommended dietary allowance, food composition, food labels, food groups and dietary guidelines. Anatomy, physiology and processes of digestion, absorption and metabolism of macronutrients are discussed. Relationship between diet and disease is an important component of this subject. This is an examinable subject.

Subject Topics

1. Macronutrients
2. Micronutrients
3. Digestion and absorption of nutrients
4. Metabolism of nutrients
5. Food composition, Food groups, Dietary Guidelines, RDA, Food labels
6. Diet and Health

Subject Outline

Topic	Content
Macronutrients	Carbohydrates, Proteins and Lipids. Occurrence of nutrients in foods and their role in human physiology, health and disease. Structure, properties and sources of nutrients; role of nutrients in human structure and function. Occurrence of these nutrients in foods and their role in human physiology, health and disease.
Micronutrients	Water soluble and fat soluble vitamins essential for human health and trace and major minerals important in human nutrition. Occurrence of these nutrients in foods and their role in human physiology, health and disease. Structure, properties and sources of nutrients; role of nutrients in human structure and function.
Digestion & Absorption	Anatomy, physiology and regulation of the processes of digestion, absorption of the macronutrients including circulatory and lymphatic system.
Metabolism	Metabolism of the macronutrients. The metabolism of carbohydrates, lipids, and proteins, explaining how food is converted into useful energy for the body.
Food Composition, Food Groups, Dietary Guidelines	Principles, importance and use of food composition data, dietary guides, food groups, guidelines, recommended dietary intake. Food labels; nutritional information panel; importance in planning healthy or healthful diets
Diet and Health	Relationship between diet and health. Food intolerances & allergies, malnutrition, micronutrient deficiencies and non- communicable or lifestyle diseases

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Describe how nutrients are obtained from foods, sources of these nutrients, their functions in the body and the specific deficiency diseases related to these nutrients.
2. Appreciate the anatomy, physiology and regulation of the processes of digestion, absorption and circulation of nutrients in the body. Understand and relate to the occurrence and effect of some specific gastrointestinal problems.
3. Understand how food consumed is converted to useful energy for the body.
4. Recognize the importance of a balanced diet in the maintenance of good health and how the application of the knowledge and understanding of the Food composition, food groups and guidelines as well as food labels help you achieve good health.
5. Understand the relationship between diet and health; especially malnutrition, micronutrient deficiencies and lifestyle diseases

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests:	**(20 %)**
Case studies:	**(10%)**
Assignments:	**(10%)**
Quiz:	**(10%)**
Final Examination:	**(50%)**

Assessment 1 - **Tests:** There will be 3 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Case studies:** The case studies will contribute 10% towards the final grade for the subject. The case studies will have some real life problems which will assess the student's ability to think outside the box to consider factors that influence food, nutrition and health.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 4 - **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 10%.

Assessment 5 **Final written examination:** A 3 hour written examination weighs 50%

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 13 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

References

1. Whitney, E.N., Sharon, R., (2011). *Understanding Nutrition*, Wadsworth Publishing, Belmont, USA.
2. McGuire M. & Beerman, K. A., (2011). *Nutritional Sciences*. Wadsworth Cengage Learning, USA.
3. Wardlaw & Smith. (2011). *Contemporary Nutrition*. McGraw Hill Companies, New York.

Relevant Unitech Policies

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SECOND YEAR SUBJECTS – SEMESTER 2

FT221 FOODPROCESSING PRACTICAL I

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Food Processing Practical I
Subject Code:	FT221
Duration:	13 teaching weeks
Contact Hours:	6 hours per week
Credit Points:	**8 (**6 x Lab)
Delivery Mode:	On campus
Prerequisites:	FT121
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

This subject builds on the introductory principles established in FT112 Introduction to Food Engineering. The subject introduces the practical aspects of food engineering and processing applying the principles of heat and mass balances. Temperature effects on food keeping quality is investigated. Good manufacturing practice is encouraged.

This is a 100% continuous subject.
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Practical Classes

1. Specific Volume and Filtration System
2. Mass Balance Calculations and Physical Properties of Foods
3. Peanut Milk Processing and Jam Manufacturing Principles
4. Chips Manufacture From Starchy Staples and Water Absorption Behaviour of Food Systems
5. Pilot Plant Maintenance

Subject Outline

Topic	Content
Specific Volume and Filtration System	• Use of Vernier calipers and micro meters to do simple measurements. • Calculating standard deviations of measurements taken. • Unit conversions. • Irregular volume estimations. • Mass balance calculations of starches used. • Operation filter presses. • Do efficiency calculations.
Mass Balance Calculations and Physical Properties of Foods	• Use of Vernier calipers and micro meters to do simple measurements. • Calculating standard deviations of measurements taken. • Unit conversions. • Irregular volume estimations. • Mass balance calculations of starches used. • Operation filter presses. • Do efficiency calculations.

Peanut Milk Processing and Jam Making Principles	• Using mass balance and heat balance calculations to formulate recipes. • Introducing the concept of production planning to produce simple food products. • Do simple food production. • Apply HACCP principles to produce foods • To do simple downstream processing
Chips Manufacture From Starchy Staples and Water Absorption Behaviour of Food Systems	• Doing simple downstream processing • Use concept of production planning • Applying HACCP in food production. • Study post production behavior of food products
Pilot Plant Maintenance	• Do machine operations. • Cleaning and sanitation. • Greasing and servicing of machines.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Use simple processing tools.
2. Explain the principles behind food formulations.
3. Understand the effects of certain food operations and processes on shelf lives of food products.
4. Able to use appropriate tools to do pilot plant maintenance.

Assessment Tasks and Weightings

To obtain a pass grade in this Subject, 50% overall must be achieved from 100% scientific laboratory report writing. This is a non examinable subject.

Students must also refer to the Subject Assessment Details.

Assessment Rubrics for the laboratory Reports.

For each of the laboratory reports submitted:

Abstract: **(10%)**

Introduction and Background: **(20%)**

Materials and Methods: **(20%)**

Interpretation and Discussion: **(30%)**

Conclusion and Recommendation: **(10%)**

References and Appendixes; **(10%)**

Assessment - **Individual** Scientific Reports are to be submitted in four parts. Each reports carry 25%.

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 13 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

References

1.Singh. P.R, and Heldman. D.R (2013). *Introduction to Food Engineering*. Academic Press, London. 5 th Ed.
2. Fellows.J.P (1996). **Food Processing Technology: Principles and Practice**, Woodhead Pub, Cambridge.

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/

FT222 UNIT OPERATIONS I

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Unit Operations I
Subject Code:	FT222
Duration:	13 teaching weeks
Contact Hours:	6 hours per week
Credit Points:	21 (4 x Lect + 2x Lab)
Delivery Mode:	On campus
Prerequisites:	FT 211
Co-requisites:	PH113, FT121
Subject Coordinator:	TBA

Synopsis

The subject provides the second year food technology students with in-depth knowledge in important separation processes in food and chemical engineering namely sedimentation, crystallization, extraction and expression. This subject also provides understanding and comprehension of mixing, emulsification, milling as size reduction operation. This subject also provides in-dept knowledge cleaning and sanitation which is vital in any food processing operation. This is an examinable subject and the summative examination will carry 50%.

Subject Topics

1. Mixing and Emulsification.
2. Milling and Screening
3. Crystallization.
4. Sedimentation
5. Extraction and Expression.
6. Cleaning and Sanitation.

Subject Outline

Topic	Content
Mixing and Emulsification.	• Introduction to mixing, principles of mixing – mixing of solids. • Mixing of liquids and pastes, mixing equipment – low to medium viscosity high viscosity and pastes and dry powder. • Mixing of pastes and powders • Introduction and theory - colloidal system, internal and continuous phases. • Hydrophilic and hydrophobic and hydrophilic materials, factors affecting emulsion formation, emulsifying agents, emulsification methods. Equipment and design of emulsifying equipment.
Milling and Screening	• Introduction to size reduction, advantages of size reduction in food processing, Theory of size reduction operation. • Theory of size reduction operation – continue, hard and soft materials, energy requirements of milling. • Milling equipment classification, – roller mill and hammer mills, • Effects of milling on quality, • screening efficiency, factors affecting efficiency of screening.

Crystallization.	• Introduction to crystallization operation, crystallization in food industries, saturation and super saturation, solubility curves. • Nucleation – homogenous and heterogenous nucleation, crystal growth theory. • Crystallization operations in food industries involving separation and non separation of crystals.
Sedimentation	• Definition and principle. Stoke's equation. • Mass balance and continuity equation. • Calculations in sedimentation, clarification and thickening.
Extraction and Expression.	• Introduction to extraction, theory and operating principle of extraction process, definitions used in extraction operations. • Mass transfer in extraction process, factors affecting extraction, stage extraction process, mass balance involving extraction stages. Graphical process of extraction calculations using lever arm rule. • Equipment used in different extraction operations. • Application of expression. • Classification of the equipment.
Cleaning and Sanitation.	• Introduction to cleaning and sanitation, terms used in cleaning and sanitation, • Wet and dry cleaning methods. • Mechanisms of cleaning and factors affecting cleaning. • Steps in cleaning operations and cleaning methods. • Cleaning compounds, disinfections and sterilization, sanitizing compounds..

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Understand the principle of mixing and emulsification.
2. Understand the principle of milling and size reduction as a unit operation.
3. Understand the principle of crystallization as an important separation operation in food industries.
4. Understand the principle and application of sedimentation in food processing.
5. Understand extraction and expression as important unit operations in food and allied industries.
6. Discuss fully principles of cleaning and sanitation and their applications in the food industry.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the formative Subject Assessment Details.

Tests : **(30%)**

Assignments: **(10 %)**

Quiz: **(10%)**

Final Examination: **(50%)**

Assessment 1: **Tests:** There will be 6 Tests contributing 30% towards the final grade for the subject.

Assessment 2: **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 3: **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 10%.

Assessment 4: **Final written examination:** A 3 hour written examination weighs 50%

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 13 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text Book

Singh. P.R, and Heldman. D.R (2013). *Introduction to Food Engineering* . Academic Press, London. 5 th Ed.

References .

Levis. M.J (1990). *Physical Properties of Foods and Food Process Systems*. Ellis Horwood Limited, West Sussex, England.

Brennan *etal* (1990). Food Engineering Operations, 3rd ed, Elsevier Applied Science, London.

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/

FT223 CHEMICAL ANALYSIS FOR FOOD & WATER

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Chemical Analysis for Food and Water
Subject Code:	FT223
Duration:	14 teaching weeks
Contact Hours:	6 hours per week
Credit Points:	14 (2 x Le + 4 x lab)
Delivery Mode:	On campus
Prerequisites:	FT 214
Co-requisites:	FT 122, FT 213
Subject Coordinator:	TBA

Synopsis

The subject consists of a mixture of lectures and practicals classes. It provides the second year food technology students with basic understanding of theory and practice of selected instrumental methods and of the component of foods contributing to food functionality. The subject also provides hands-on practice where students develop skills in carrying out chemical analysis of food and water.

Subject Topics

1. The theory and practice of instrumental analysis of foods both by "traditional wet chemistry" and advanced instrumental identification techniques
2. Principles and application of spectrophotometric methods including UV-visible, fluorescence, atomic absorption, inductive coupled plasma.
3. Principles and application of chromatographic methods including gas and liquid chromatography
4. Principles and application of Enzyme Assay techniques including ELISA
5. Analysis of components of food including protein, fats, water, ascorbic acid, beta carotene, sucrose content, antioxidants, heavy metals, histamine etc.
6. Analysis of physical and chemical properties of water
7. Critical evaluation of analytical techniques and data

Subject Outline

Topic	Content
Theory and practice of instrumental analysis	Atomic and molecular spectroscopy and the theory of electromagnetic radiation and it properties, energy states of particles (analytes) in relation to quantum theory, how particles interact with electromagnetic radiation: particles emit, absorb or scatter electromagnetic radiation. Origin of chromatography, science of separation, plate and rate theories of chromatography and how they apply to types chromatography: normal phase, reversed phase, ion exchange, HILIC, size exclusion, affinity binding etc.

	Measurement of uncertainty: methods, limit of reporting, limit of quantification. Regression correlation analysis , proficiency testing Theory and practice of gravimetric and volumetric method of analysis and other related bench chemistry
Principle and application of spectrophotometric method of analysis	Principles and applications of UVVIS, ICP-MS, AAS their components and how they function to analyse food samples
Principles and application of chromatographic methods including gas and liquid chromatography	Principles of GC and HPLC and their applications, components and how they function to analyse food samples
Principles and application of Enzyme Linked Immunosorbent Assay (ELISA)	Antigen-antibody interaction, types of ELISA: Indirect, Competitive and Sandwich. Principles and application of ELISA and how the method is used to analyse food samples Preparation of samples for analysis
Analysis of components of foods	Extraction and preparation (clean-up) of analytes for analysis using various instruments and their methods of analysis Important food components and their functional uses Significance of the analysis in relation to quality and safety of food products and human health Important bench chemical test methods and their principles
Water Analysis	Selected physico-chemical properties of water: hardness, turbidity, total dissolved solids, pH, residual chlorine etc. Significance of analysis in relation to water quality and safety Important bench chemical test methods and their principles
Critical evaluation of analytical techniques and data	Lab work carried out with standards, blanks and controls. Lab results and reports containing measurement of uncertainty, mean and spread of data to demonstrate accuracy and reproducibility, standard curve and graphs with correlation to determine relationship between variables (independent and dependent)

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

3. Understand the theory and practice of selected instrumental methods used in food analysis.
4. Understand the principles and application of selected bench chemical methods (wet chemistry) used in food analysis.
5. Understand the components of foods contributing to food functionality
6. Develop skills to undertake chemical and instrumental analyses of foods.
7. Produce and interpret accurate and reliable analytical results.

Assessment Tasks and Weightings

The assessment and formative (continuous assessment). To obtain a pass grade in this subject, 50% overall must be achieved.

Formative Subject Assessment Details.

Tests : **(20 %)**

Lab reports: **(70)**

Quiz" **(10%)**

Assessment 1 - **Tests:** There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Laboratory practice:** There will about 10 laboratory practicals (5 instrumental analyses and 5 bench chemical analyses) contributing 70% towards the final grade for the subject. The hands-on practices in the lab will assess students' confidence in doing lab work and projects as well as a check to see if the students have understood the theory component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 10%.

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

Assessment Rubrics

Laboratory Reports

Criteria	**Description**	**Mark**
Cover page	Title of the experiment or series of experiments with person's full name, ID number and date of experiment	
Introduction	Brief background of the experiment which include information on species analysed, it's significance to food science and food industries and the principle of the method used to analyse this analyte	**1.5**
Aim	Clear, concise and a short statement to indicate what you will achieve in the experiment	**0.5**
Materials & Methods	Refer materials & method to the manual stating the reference method. State clearly any modifications to the method as this can have a bearing on the result(s) obtained.	**0.5**
Results	Must contain a full account of the results obtained. Must be expressed in a clear and logical way. Do not refer to what was expected Use tables and well-labelled graphs to present your results, unit of measurements must be correct and calculations must be clearly shown, both for quantitative and qualitative results	**2**
Discussion	Must present a logical argument based on the results in comparison with the information obtained from the literature Should focus on sticking points of the results such as any variation in the result(s), deviation from the mean value or from the literature value	**4**

	Discussion should include information on results obtained and on expected results and should provide possible reasons for any differences which might have occurred between actual and expected. It must not be a repeat of the results	
Conclusion	Should draw together the aim and the discussion. Must include what was set out to be obtained and what was the actual result and whether the values were acceptable It must be clear, concise and to the point	**1**
Reference	All references used must be listed in alphabetical order rather than numbered using the correct format the annotated form or generic form	**0.5**

Student Workload

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

Subject TextBook

Pomeranz, Y. and Meloan, C. E. (2004). Food Analysis: Theory and Practice, 3rd Edition. Chapman & Hall Inc., New York, USA

Fenemma, O. R., Damodaran, S. and Parkin, K. (2007). Fenema's Food Chemistry, 4th Edition. CRC Press, Boca Raton, Florida

References .

Skoog, DA; Holler, EJ; Crouch, SR. (2007). Principles of Instrumental Analysis. 6th Edition. Thomson Brookes/Cole. Canada.

Robert, S. M., Clayton, B. G. And Terrence, M. C. (1981). Spectrometric identification of organic compounds, 4th edition. John Wiley & Sons, New York, USA.

Kirk, R. S. And Sawyer, R. (1991). Pearson's Composition and Analysis of Foods, 9th Edition. Longman Scientific & Technical, England.

The AOAC International (2000). The Official Method of Analysis, 17th Edition. Gaithersburg, MD, USA.

Relevant Unitech Policies

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FT224 ADVAMCED FOOD CHEMSITRY

Course(s): Food Technology (NQF Level 7)

Subject Name: Advanced Food Chemistry

Subject Code: FT224

Duration: 13 teaching weeks

Contact Hours: 6 hours per week

Credit Point: **21 (**4 x lectures & 2 x tutorial)

Delivery Mode: On campus

Prerequisites: FT212

Co-requisites: FT122

Subject Coordinator: TBA

Synopsis

This subject provides students with the knowledge, and understanding of the functions and applications of food additives, enzyme systems, hydrocolloids, and phytochemicals in foods and in product formulations or development. Undesirable components of food in the form of different food toxins and allergens found in foods will be discussed.

Subject Topics

1. Food Additives
2. Enzymes and enzyme technology
3. Phytochemicals and functional foods
4. Hydrocolloids
5. Undesirable components of foods (toxins and allergens)

Subject Outline

Topic	Content
Food Additives	Definitions, Regulatory provisions Food additives including: preservatives, Food colours, Antioxidants, Sweeteners, Modifying agents, Anti-caking agents, Clarifying agents, Chelating agents, Bleaching agents. Uses, functionality and regulatory provisions. Application in the food industries
Enzymes	Nomenclature, mechanism of catalysis, Chemical nature of enzymes. Enzyme reaction kinetics. Factors affecting enzyme reaction in food systems (tempt, pH, Aw), Enzyme activation and inhibition. Applications in food industry Types of enzymes, sources and roles in baking, dairy, meat, beverage industries. Browning reactions, Enzymatic browning reactions – types, control, Caramelization stages. Maillard reactions. Nutritional significance. Effects on food quality.
Hydrocolloids	Types or Sources of hydrocolloids Hydrocolloids in food systems. Functional Uses of hydrocolloids. Application in the food industries.
Phytochemical	Main phytochemicals, sources and their functions Uses in the food and pharmaceutical industries.
Undesirables	Endogenous toxins in foods; Microbial toxins; toxic residues; toxic contaminants; Allergens.

Subject Learning Outcomes (SLOs)

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

8. Explain the role, functionality of the different food additives discussed; their synthesis, modification and extraction. Discuss the uses of food additives in different food systems
2. Explain the role and functionality of enzyme systems in foods and their uses.
3. Understand the major chemical reactions between food components and enzymes.
4. Identify the sources of hydrocolloids and describe the functional properties and uses of hydrocolloids in the food industry.
5. Identify the sources of phytochemicals and functional foods and describe their uses and health benefits in food and pharmaceutical product developments.
6. Identify the groups of toxins and allergens in foods and their implications on human health.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests :	**(30%)**
Assignments/Group work:	**(10%)**
Quiz:	**(10%)**
Final Examination:	**(50%)**

Assessment 1 -	**Tests:** There will be 4 Tests contributing 30% towards the final grade for the subject.
Assessment 2 -	**Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject
Assessment 3 -	**Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 10%.
Assessment 4	**Final written examination:** A 3 hour written examination weighs 50%

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 14 weeks of teaching as per the PNG National Qualification Framework.

References

1. Fennema. O. R, Dumoduran, S and Parkin, K. (2007) Fenemma's Food Chemistry, 4th Edition, CRC Press, Boca Raton, Florida.

2. Coultate, T. (2009) Food: The Chemistry of its Components, 5th Edition, RSC Publishing, Cambridge, UK.

3. Gunstone, F. D. (2004) The Chemistry of Fats and Oils, 1st Edition, CRC Press Boca Raton, Florida.

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/

THIRD YEAR SUBJECTS – SEMESTER 1

FT311 FOOD ENGINEERING] I

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Food Engineering II
Subject Code:	FT311
Duration:	13 Teaching weeks
Contact Hours:	6 Hours per week
Credit Points:	**18 (**3 Lect + 3Tut)
Delivery Mode:	On campus
Prerequisites:	FT211
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

This subject builds on the introductory principles established in FT121 and FT211. It teaches the applied aspects of heat and mass transfer. It also covers fluid dynamics and rheology which is important in food process engineering. Thermal processing, food canning and packaging, being important food processing aspects of the food technology program are covered in details. Water and waste management covers both the design and the operations principals. This course in general forms and important link between basic engineering concepts to applied process engineering applications This is an examinable subject.

Subject Topics

1. Heat transfer Application
2. Fluid Dynamics
3. Food Rheology
4. Thermal Processing , Canning and UHT Processing
5. Food Packaging
6. Water and waste water design and management

Subject Outline

Topic	Content
24. Heat Transfer Application	• Review of heat transfer modes • Principles of energy conservation, sensible and latent heat • Overall heat transfer coefficient, natural and forced convections. • Log mean temperature difference , co and counter current heat exchangers. • Fouling in heat exchangers • Calculation in heat transfers. • Classification of heat exchangers.
25. Fluid Dynamics	• Important terms used in fluid dynamics • Reynolds number, streamline and turbulent flow. • Residence time, continuity and Bernouilli's equations • Friction factor, Fanning friction chart, frictional loss in pipes and fittings and pump equation. • Flow measurements using venture, orifice and pitot tubes

	• Pumping in food industries, factors affecting pump selection and types of pumps used in the food industry.
26. Food Rheology	• Introduction to food rheology • Properties affecting rheological behavior of fluids: Viscosity, temperature, shear rate, time and composition. • Classification of non-Newtonian fluids • Calculation models of apparent viscosities. • Calculations in non_Newtonian fluids.
4. Thermal Processing , Canning	• Heat as source of processing • Ambient temperature processing, heating and removal of heat to process foods. • Heating as an important processing tool. • Severity of heat treatment with pH. • Types of heats used in processing. • Micribial survival during heating- thermal death curves • Graphical and formula method used in estimation of D and Z values. • Estimation of lethality values using formula and interpolation from tables. • Evaluating commercial sterility valued of processing using both improved graphical and formula methods. • Factors influencing length of time to reach sterilization.
27. Canning	• Sorting and grading, washing, cutting and filling. • Pulping /blending and concentrating. • Blanching, milling, Exhausting and Seaming. • Retorting and Labelling • Metals as a packing materials • Can manufacturing process • Can defects identification. • Retort Operating principles • Classification of retorts

28. Ultra High Temperature Processing (UHT)	• Introduction to UHT process
	• Link between thermal processing and UHT process
	• Estimating the sterility of UHT process.
	• Process characterization: Quality verses Safety/Killing.
	  • Controlling the process: HAACP approach.
	  • Equipment and heat exchangers used in UHT process.

29. Food Packaging	• Introduction to Packaging Food packaging definitions • Functions of packaging. • Permeability of packaging materials. • Microbial and biological issues of packaging • Types of packaging materials • Modified atmosphere packaging
30. Water Treatment and Quality Tests	• Introduce importance of water supply system. • Discuss Discuss the source of water- runoff and ground water.. • Water treatment process – screening, dilution, coagulation and flocculation. Settling and filtration process . • Operations and designs. Disinfection of water – application of chlorine and chlorine break point. • Removal of other impurities such as bad colour, gases odour, taste and mineral matter, common test for water quality in food industry
31. Waste Water Treatment	• Introduction to waste management and water waste treatment. Importance of pollution prevention . Factory waste management. BOD and COD levels associated to food wastes. • Waste treatment process: primary waste treatment process involving physical separation and chemical treatment.

	• Waste treatment process: secondary waste treatment (Biological waste treatment process), waste disposal methods, common test in methods in waste treatment plants process involving physical separation and chemical treatment. • Project work and case studies of biogas from methane.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Apply the principles heat transfer in different heat exchangers in the process industry.
2. To do fluid flow calculations in food processing and to understand the various behaviour of food systems upon application of force (stirring, pumping, etc).
3. Explain the principles behind thermal processing, canning operations and UHT operating principles.
4. Discuss the importance of packaging in food processing.
5. Discuss fully the water treatment process and understand water quality standards
6. Discuss fully the different sources of wastes, there treatments and transformation of waste into useful bi products.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved and at least 25% achieved in the final examination.

Students must also refer to the Subject Assessment Details.

Tests	**(25 %)**
Laboratory and field work	**(10%)**
Assignments	**(10%)**
Quiz	**(5%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 5 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Laboratory and field work** The Laboratory and field work will contribute 10% towards the final grade for the subject. The case studies will have some problems which will assess the student's ability to think outside the box to consider real design and quality tests.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 4 - **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 **Final written examination:** A 3 hour written examination weighs 50%

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

Singh. P.R, and Heldman. D.R (2013). *Introduction to Food Engineering* . Academic Press, London. 5 th Ed.

References

1. Fryer, P.J., Pyle, D.L. and Reilly, C.D (1997). Chemical Engineering for the Food Industry ,Blackie Academic & Professional, London.

2. Levis. M.J (1990). *Physical Properties of Foods and Food Process Systems*. Ellis Horwood Limited, West Sussex, England.
3. Earle, R.L (1988).Unit Operations in Food Processing Pergamon Press, Oxford.3. Wardlaw & Smith. (2011). *Contemporary Nutrition*. McGraw Hill Companies, New York.
4. Brennan *etal* (1990). Food Engineering Operations, 3rd ed, Elsevier Applied Science, London.

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/

FT312 QUALITY ASSUSRANCE

Course(s): Food Technology (NQF Level 7)

Subject Name: Quality Assurance

Subject Code: FT312

Duration: 13 teaching weeks

Contact Hours: 6 hours per week

Credit Points: 16 **(**3 lect, 3 lab)

Delivery Mode: On campus

Prerequisites: FT212, FT224

Co-requisites: None

Subject Coordinator: TBA

Synopsis

This subject deals with food quality assurance which include monitoring, control and evaluation of foods using statistical process control (SPC) and sensory evaluation.

The subject provides the third year food technology students with the knowledge and understanding of the concept of quality, its history and evolution and its management using management systems with an ultimate to meet customers' requirements. The subject also provides students practical skills on monitoring and controlling of quality using statistics and sensory evolution.

This is an examinable subject and will be delivered in two different segments throughout the semester.

Subject Topics

1. Microbial ecology of foods.
2. Microbial food sampling and analysis.
3. Conventional and rapid methods used in microbial analysis of foods.
4. Foodborne pathogenic microorganisms.
5. The microbiology of meat, poultry, egg, fish and canned foods.
6. Enzyme biosynthesis and immobilization and fermentation of alcoholic beverages, foods and food crops.

Subject Outline

Topic	Content
1.Quality Assurance	Definition of quality, aspects of quality (quality of design and quality of conformance. History and evolution of quality with plethora of terms and definitions including concepts or approaches to managing and assuring quality, significant development and contribution by various quality guru
2.Statistical Process Control (SPC)	Concepts and definitions, sources of variations, common and special causes of variation associated with defects and non-conformities, theory and relationship between precision and accuracy, and mean and spread of data and stability and capability of the process. The concept of central limit theorem in relation to sampling to minimize outliers, flattened and skewed distribution curves
3.Statistical tools and techniques used to assure quality	Use of variable and attribute data to construct shewhart' s control charts, determine trends, runs and cycles and establish if the process is stable and in control, construct histogram and distribution curves to establish if process is within specification or target and is in control, calculate process capability index to determine if the process is centred, in control and capable of meeting customers' requirements, construct

	fish-borne diagram and pareto chart to identify and defects/variations and improve process stability and capability to meet customers' requirements.
4.Acceptance Sampling	Concepts and Definitions, sampling plan, sampling risks, OC curves. Sampling by variables, sampling by attributes. Use of Dodge and Romig Sampling table and statistics to determine sample size (n), acceptance number of samples (c), Average outgoing quality limit (AOQL), use of ISO 2859-1 standard to determine sampling with 'n', 'c' and AQL
5.Sensory Science:	Process of human perception using sense organs, classes of sense, human sense organs respond to, structure of sense organs (tongue and nose) and respective cranial nerves that convey sensory signals to the brain for recognition and interpretation of specific sensory stimulus. Sensory properties of foods: volatile aromatic chemical compounds perceived through sense of smell, their sources and detectable thresholds, non-volatile flavouring chemical compounds perceived through sense of taste, their sources and detectable threshold
6.Sensory Evaluation:	Definitions and methods used to carry out sensory evaluation. Factors affecting sensory test (physiological and psychological). Requirements, planning and conducting of sensory tests. Computation of sensory data using inferential statistics, interpretation of results and decision making

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Understand the concepts and approaches to managing and assuring quality in the food industry.
2. Use statistical process control (SPC) tools and techniques to monitor the stability and capability of the processing operations, evaluate and improve their performances
3. Explain the process of human perception and effects involved in evaluating sensory properties of foods using human senses.
4. Discuss the sensory properties of foods, how these chemical compounds are formed in food sources and how they interact with human senses so as to be detected
5. Discuss the requirements for conducting sensory evaluation, the various available methods used to conduct sensory evaluation.
6. Conduct sensory analysis of foods, collect data, analyze and interpret results using statistic so as to establish realistic, lawful and specific relationships between product characteristics and human responses about the quality of foods

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	**(20 %)**
Laboratory practice	**(15%)**
Assignments	**(10%)**
Quiz	**(5%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Laboratory practice:** The laboratory practice will contribute 15% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 4 - **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 **Final written examination:** A 3 hour written examination weighs 50%

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

Lawless H. T. and Heymann H. (2010). Sensory Evaluation of Foods, 2nd Edition, Springer, New York.

References

1.Oakland, J. S. (2008). Statistical Process Control. Elsevier, Oxford, UK.
2.Lawless H. T. and Heymann H. (2010). Sensory Evaluation of Foods, 2nd Edition, Springer, New York.
3.Lawless H. T. and Heymann H. (1999). Sensory Evaluation of Foods. Springer, New York.

Relevant Unitech Policies

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FT313 FOOD MICROBIOLOGY & BIOTECHNOLOGY

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Food Microbiology and Biotechnology
Subject Code:	FT313
Duration:	13 Teaching weeks
Contact Hours:	6 Hours per week
Credit Points:	**16 (**3 Lect + 3 Lab)
Delivery Mode:	On campus
Prerequisites:	FT213
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

This subject deals with the microbial ecology of foods, food sampling and analysis, foodborne pathogenic microorganisms, and microbiology of food commodities. It also covers enzyme biosynthesis and fermentation of certain foods, alcoholic beverages and food crops. applications This is an examinable subject.

Subject Topics

1. Microbial ecology of foods.
2. Microbial food sampling and analysis.
3. Conventional and rapid methods used in microbial analysis of foods.
4. Foodborne pathogenic microorganisms.
5. The microbiology of meat, poultry, egg, fish and canned foods.
6. Enzyme biosynthesis and immobilization and fermentation of alcoholic beverages, foods and food crops.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Explain intrinsic and extrinsic parameters of foods that influence survival and growth of microorganisms and manipulate these conditions to prevent or reduce microbial growth.
2. Discuss major characteristics, growth parameters and diseases caused by common foodborne pathogenic microorganisms and measures to prevent or reduce contamination and subsequent growth by these organisms.
3. Describe microbial food sampling plans and procedures used in sampling, and analysis of foods and water.
4. Discuss microbiology of fresh meat, poultry, egg, fish and canned foods.
5. Describe conventional and rapid methods used in characterization and identification of foodborne bacteria and fungi.
6. Discuss enzyme biosynthesis and immobilization techniques and processes, growth conditions, key metabolic end products and microorganisms involved in production of certain fermented foods, beverages and food crops.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	**(24 %)**
Laboratory practice	**(16%)**

Assignments	**(10%)**
Final Examination	**(50%)**

Assessment 1 -	**Tests:** There will be 4 Tests contributing 6% towards the final grade for the subject.
Assessment 2 -	**Laboratory practice:** The laboratory practice will contribute 16% towards the final grade for the subject. The hands-on practices in the laboratory will assess students' confidence in carrying laboratory analysis and projects as well as a check to see if the students have understood the theoretical component of lectures. The laboratory practice will also encourage students to work as a team to experiment and communicate their findings.
Assessment 3 -	**Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject
Assessment 4-	**Final written examination:** A 3 hour written examination weighs 50%

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

Jay, M.J. Modern Food Microbiology. APA Publishers, Service. Singapore, 2000.

References

1. Jay, M.J. Modern Food Microbiology. APA Publishers, Service. Singapore, 2000.
2. Frazier, W.C., and Weshof D.C. Food Microbiology. Tata McGraw Hill Education Ltd. New Delhi, 2008.
3. Mittal, G.S, Food Biotechnology. Technomic, Lancaster, 1992.

Relevant Unitech Policies

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BM111 INTRODUCTION TO BUSINESS MANAGEMENT: Taught by the Department of Business Studies.

THIRD YEAR SUBJECTS – SEMESTER 1I

FT321 FOOD SAFETY & HACCP

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Food Safety and HACCP
Subject Code:	FT321
Duration:	13 teaching weeks
Contact Hours:	6 hours per week
Credit Points:	16 **(**3 lect, 3 filed visits)
Delivery Mode:	On campus
Prerequisites:	FT312
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

This subject deals with food safety which include monitoring and control of food safety hazards and threats in the food manufacturing industry and in the global food trade between countries using systems that are based on the principles of hazard analysis critical control point (HACCP).

The subject provides the third year food technology students with the knowledge and understanding of the concept of food safety and its significance to public health within and across the globe including food safety systems, legislations and treaties in place to protect public health from these hazards. The subject also provides students practical skills on the development of a HACCP system in the food manufacturing industry to monitor and control potential and significant food safety hazards.

This is an examinable subject and will be delivered in two different segments throughout the semester.

Subject Topics

1. **Food Safety**: National and global trend and statistics, its significance to public health and global food trade.
2. **Risk Analysis**: A scientific-based tool used to mitigate food safety risks by a national government of any sovereign state
3. **HACCP and its application**: A scientific-based tool used to evaluate and control significant food safety hazards in the food industry
4. **Auditing of HACCP systems**: Introduction to ethnics, procedures and protocols of auditing HACCP systems
5. **Foods standards and regulations:** National, regional and international standards, regulations and treaties including bodies and organizations responsible for administering these documents to ensure public health and safety
6. **National food safety (control) systems**: System, procedures and protocols government of any sovereign state put in place to manage significant food safety hazards and threats within and from global food trade

Subject Outline

Topic	Content
1. Food safety	Definition of terms: food safety, hazard and risk. Global and national' statistics and trends of food and water borne diseases and mortality rates. Sources and factors contributing to the increase in the number of food safety hazards and threats including those emerging and scares. Three groups of hazards: physical, chemical and biological including their control measures
2. Risk Analysis	Definitions: What is risk analysis? Three component of risk analysis: risk assessment, risk management and risk communication. General process and procedures for risk assessors (scientific community) in research and investigation into and identifying significant hazards; procedures and protocols for risk managers to commission and provide resources for risk assessment, implementation of measures, review and improvement to control hazards that are significant to food safety
3. HACCP and its application	Definition, history and evolution. Seven principles and five pre-steps and how they apply in development and implementation of a HACCP system. Foundation pre-requisite programs: GMPs, GAPs and SSOP.and how they support HACCP system Preview into ISO 22000:2005 food safety management system and its content including ISO 9001:2008
4. Auditing of HACCP systems:	Definitions of terms: audit, auditee, auditor. Audit versus inspection, quality audit versus safety audit, major versus minor non-conformity; scope, type and depth of audit; stages of audit, techniques, competency of auditors, principles and ethics. Management of audit program: Preparation, implementation, monitoring, review and improvement. Actual audit activities: initiating audit, conducting on-site audit, completing audit report and conducting follow-up.
5.Foods standards and regulations	Definition of terms: food law, standard, regulation, food. Mandatory standards versus voluntary standards, private standards versus public national standards. Objectives of food law, legislation versus quality; structure of food law: international treaties such as SPS agreement, regional and national food laws, how PNG food legislations are developed. A closer look at FSR 2007. National, regional and global standard setting bodies, their scopes, goals and functions
6.National food safety (control) systems	Definitions: What is a national food control system? Its, features, its 5 components and how they function: Food legislations, management control, food laboratories and inspections, information, education and communication, a closer look at government agencies responsible for the management of the system, how they collaborate and function including laws and bi-laws that govern their activities within PNG, around the borders and ports of entry including international arrivals and exits. Traceability and recall strategies and protocols for non-conforming and hazardous food products. Current status of PNG food control system

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Explain the principles and concepts of food safety, its risks and hazards that are significant to food safety including HACCP systems of control

2. Identify the hierarchy of documents that go into making up ISO 22000 and ISO 9001 management systems and be able to quote specific clauses that are mandatory and directly relating to principles of HACCP including its pre-steps

3. Apply the principles and pre-steps of HACCP to develop a generic HACCP system including its supporting pre-requisite programs

4. Discuss the procedures and protocols of audit, ethics, techniques and competencies

5. Discuss differences between mandatory standards and technical standards from voluntary standards. Discuss national, regional and international laws and bi-laws which govern public health without providing unnecessary barriers to trade including those organizations that administer them

6. Explain the national food safety systems, its components and evaluate the state of the current national food control system of the state of Papua New Guinea. Discuss procedures and protocols of establishing and monitoring traceability and re-call schemes both at national and industrial levels to handle defects and non-conformities.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests	**(20 %)**
Laboratory practice	**(15%)**
Assignments	**(10%)**
Quiz	**(5%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 4 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Field visits:** The field visits will contribute 15% towards the final grade for the subject. The practical observation, survey and data collection will expose students to real and existing conditions of food safety systems in food manufacturing industry and the roles of government agencies in administering the national food control system. The visits will also assess students' confidence in carrying out projects under limited supervision, and communicating information and findings. It will further encourage students to work as a team to experiment, critically analyse and communicate their findings.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 4 - **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 **Final written examination:** A 3 hour written examination weighs 50%

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

Wallace C.A. (2009). Intermediate HACCP, a text for level 3 HACCP Courses and reference for the implementation of HACCP, 3rd Edition. Highfields Co. Limited, UK.

References

1. Wallace C.A. (2009). Intermediate HACCP, a text for level 3 HACCP Courses and reference for the implementation of HACCP, 3rd Edition. Highfields Co. Limited, UK.

2. FAO/WHO food and nutrition paper 87(2006). Food safety risk analysis: A guide for national food safety authorities, Rome Italy

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/

FT322 COMMODITY SVIENCE I: TROPICAL AGRICULTURAL CROPS

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Commodity Science I Tropical Agriculture Crops
Subject Code:	FT322
Duration:	13 teaching weeks
Contact Hours:	6 hours per week
Credit Points:	16 **(**3 lect, 3 lab)
Delivery Mode:	On campus
Prerequisites:	FT122, FT121, FT224
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

The subject encompasses three main subject areas in commodity science and tropical agricultural crops**.** It provides students with the knowledge and understanding of the pre- and post- harvest physiology of horticultural commodities and the changes leading to losses after harvest and relevant control measures. The subject then provides students with the knowledge and understanding of the significance of local food crops, fruits and vegetables; the root and tuber crops as well as the agro-commodities like coffee, cocoa, coconut, sugar and oil palm. The students also learn the processing technologies available to enhance preservation; maintain quality and generate entrepreneurship opportunities using these food and agro-commodities. Grain science covers discussions on cereal and legume crops; related postharvest handling; storage; and processing operations such as milling, parboiling and bakery technology.

Subject Topics

1. Structure and composition of fresh produce including physiological development and its effects; biochemistry and maturity indices.
2. Postharvest losses, handling and storage technology. Includes; types of losses, factors causing the losses, packaging and transportation considerations; cooling technology and storage atmosphere technology.
3 Food crops including root and tubers crops, sago, banana/plantain; fruits and vegetables. Their chemical composition, anti-nutritive factors; processing; value added products and potential for commercialization or entrepreneurship opportunities.
4. Agro-commodities including coffee, cocoa, coconut, oil palm, vanilla, tea and sugar. Includes: their composition, processing techniques; importance to PNG economy and the potential for entrepreneurship opportunities.
5. Cereal and legume grain crops, their chemical and nutritional composition and importance to human nutrition.
6. Milling practices used in the processing and preservation of cereal and legume grains. Utilization of cereal and legume flours processing of various products and the byproducts of milling.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Explain the cell structure, chemical composition, physiological growth and development of horticultural commodities including description of commercial and physiological maturity indices.
2. Demonstrate understanding of pre- and post-harvest physiology and biochemical reactions including other external factors and their effects on quality and shelf-life of horticultural commodities. Also describe various storage technologies available for controlling postharvest losses.
3. Understand the various techniques available to upgrade traditional handling of fruits, vegetables, roots and tubers and commodity crops in PNG;
4. Recognise the potential commercial viability of these crops and to apply the processing technologies available to enhance preservation; maintain quality and generate entrepreneurship opportunities using these crops.
5. Appreciate the important contribution of cereal and legume crops to human nutrition.
6. Understand the different milling practices that are used in the processing and preservation of cereal and legume grains. Analyze and describe the various uses of cereal and legume flours and the byproducts of milling.

Assessment Tasks and Weightings

The summative assessment (continuous assessment weighs 50%. To obtain a pass grade in this Subject, 50% overall must be achieved.

Students must also refer to the formative Subject Assessment Details.

Tests	**(30 %)**
Assignments	**(10%)**
Quiz	**(10%)**
Final Examination	**(50%)**

Assessment 1 - **Tests:** There will be 5 Tests contributing 30% towards the final grade for the subject.

Assessment 2 - **Assignment/Group work/excursion reports:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 3 - **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 10%.

Assessment 4 **Final written examination:** A 3 hour written examination weighs 50%

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

Eissa, Ayman Amer (Ed)(2012). Trends in Vital Food and Control Engineering, (Woodhead Publishing Ltd, Cambridge).

References

1.Ihekoronye, A.I. and Ngoddy, P.O., (1985) Integrated Food Science and Technology for the Tropics (Macmillan, London and Basingstoke).

2.Salunke, D.K, Chanvan, J.K and Kadam, S.S. (1985). Postharvest Biotechnology of Cereals (CRC Press Boca Raton, Florida)

3. Marshall, R. I. And Arbuckle, W. S. (1986) Ice Cream, 5th Ed, Chapman and Hall, London

4. Henderson, J.L., (1984) The Fluid Milk Industry, AVI, Westport, Conn

5. Harper and Hall, C. W., (1984) Dairy Technology and Engineering, AVI Westport, Conn

6.Scott, R., (1988) Cheese making Practice, Applied Science, Essex, UK.

7.Sudheer, K. P.,Indira, V.,*Postharvest technology of horticultural crops,* New India Publishing Agency, New Delhi, India, 2007.

8.Lebot, V.,*Tropical root and tuber crops: cassava, sweet potato, yams and aroids,* CABI Publishing, Wallingford, UK, 2009.

9.Hui, Y.H., (2006). Handbook of Fruits and Fruit Processing. Blackwell Publishing, UK.

Wills, R., McGlasson, B., Graham, D. and Joyce, D. (1998). Postharvest: An Introduction to the Physiology and Handling of Fruit and Vegetables, 4th Edition. UNSW Press, Sydney.

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/

FT323 FOOD PROCESSING PRACTICAL II

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Food Processing Practical II
Subject Code:	FT323
Duration:	13 teaching weeks
Contact Hours:	6 hours per week
Credit Points:	8 **(**6 laboratory practicals)
Delivery Mode:	On campus
Prerequisites:	FT221
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

This subject builds on the introductory principles established in FT121 Introduction to Food Engineering and in FT221 Food Processing Practical I. The subject introduces the practical aspects of food engineering and processing applying the principles of heat and mass balances. Thermal processing, canning processing of agro and fisheries commodities. Temperature effects on food keeping quality is investigated. Good manufacturing practice is encouraged.

Subject Topics

1. Performance Characteristics of Hammer Mill
2. Construction and setting of thermocouples.
3. Tinplate formation and examination of double seams.
4. Thermal Processing principles and Canning.
5. Juice Production.
6. Production of Smoked and Spiced Meat.
7. Animal Feed Development
8. Production Development from Coffee and Cocoa.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:
1. Use Processing Tools.
2. Understand the practical aspects of thermal processing principles.
3. Understand how meat and fisheries products are canned.
4. Understand the effects of certain food operations and processes on shelf lives of food products.
5. Understand how animal feeds are produced using mass balance and dehydration theories.

Assessment Tasks and Weightings

This a 100% continuous assessment. To obtain a pass grade in this Subject, 50% overall must be achieved .

Students must also refer to the formative Subject Assessment Details.

1. Laboratory practical writing: 80%
2. Pre Laboratory Assignment: 20%

Assessment 1: Laboratory reports are to be submitted for each session. This makes up 80% of the total assessment.

Assessment 2: This comprises of several pre-laboratory assignments. This makes up 20% of the total assessment.

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

Singh. P.R, and Heldman. D.R (2013). *Introduction to Food Engineering* . Academic Press, London. 5th Ed.

References

1. Singh. P.R, and Heldman. D.R (2013). *Introduction to Food Engineering* . Academic Press, London. 5th Ed.
2. Fellows.J.P (1996). **Food Processing Technology: Principles and Practice**, Woodhead Pub, Cambridge.

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/

FT324 SCIENCE COMMUNICATION AND RESEARCH METHODOLOGY

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Science Communication and Research Methodology
Subject Code:	FT324
Duration:	13 teaching weeks
Contact Hours:	6 hours per week
Credit Points:	18 **(**3 lect , 2 tut , 1 Proj)
Delivery Mode:	On campus
Prerequisites:	CD111, MA115, MA125
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

The subject provides the students with an understanding of the different research methods and methodologies and research techniques with the main focus on those commonly used in the science background. Data analysis including qualitative and quantitative data analysis, relevant statistics and statistical analysis will be discussed including analysis of error. Scientific writing and communication of science will equip the students with necessary knowledge and skills to communicate their science effectively to relevant audiences in both, written and oral presentations or forms. This subject prepares students for their final year research projects.

Subject Topics

1. Approaches to research and research ethics, research proposal literature review and research methodology
2. Research methods, hypothesis, sampling, different methods including, case study, survey method, experimental method
3. Research techniques; ways of collecting research data.
4. Scientific Methods
5. Data Analysis; qualitative, quantitative and relevant statistics including analysis of error
6. Effective Communication of science; both written and oral forms. Writing styles; Critical analysis and paraphrasing, drawing conclusions, language used.

Subject Outline

Topic	Content
1. Approaches to research and research ethics	Models and stages of research; codes of ethics, responsibilities, confidentiality; research proposal, plagiarism
2. Research methods and methodologies	Research methodology; subjective, objective, mixed methods Research methods: measurement principles, sampling, case study method, survey method, experimental methods (types of experimental designs, validity of experiments, etc.)
3. Research techniques	Introduce different techniques; Available data, observations, interview, questionnaire, tests. Concentrate on Research techniques appropriate for food scientists/food technologists.
4. Scientific Method	Steps involved in the scientific method; observation, hypothesis making sense of observations; (causative and correlative hypothesis) Scientific experimental designs. Data collected to test the hypothesis
5. Data Analysis and relevant statistics including analysis of error	Qualitative and quantitative data. Types of statistics-descriptive and inferential tests. Presenting quantitative data (description of results, analysis with inferential statistics in the data and interpretation.
6. Communication of science; written and oral presentations Writing styles; Critical analysis and paraphrasing	Presentation of data, scientific writing, conventions, presentations, visual aids and other presentation aids.

Subject Learning Outcomes (SLOs)

1. Understand the models of research, stages of research, codes of ethics, confidentiality issues.
2. Appreciate methods of data collection in research.
3. Understand and apply the steps involved in scientific method
4. Analyse and discuss experimental or laboratory data with confidence. Critically analyse scientific literature and paraphrase. Format and parts of a research paper: title page, acknowledgement, summary, table of contents, introduction, layout of chapters (numbered sections and subsections, etc.).
5. Make an effective oral and written presentation using visual aids and principles learnt.

Assessment Tasks and Weightings

The summative (final examination) will carry 50% and formative assessment (continuous assessment weighs 50%. To obtain a pass grade in this Subject, 50% overall must be achieved.

Students must also refer to the formative Subject Assessment Details.

Tests: **(25 %)**
Assignments: **(10 %)**
Project: **(15 %)**
Final Examination: **(50 %)**

Assessment 1 - **Tests:** There will be 5 Tests contributing 25 % towards the final grade for the subject.

Assessment 2 - **Assignment/Group work/excursion reports:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 3 - **Mini project:** In this project the students will individually choose a topic of research which they may be interested in and using the principles learnt in class write a proposal, literature review and methods and methodology sections of that write-up. This mini project will contribute 15%.towards the final grade for this subject.

Assessment 4 **Final written examination:** A 3 hour written examination weighs 50%

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 Textbook

Guthrie, G.,*Basic research techniques*, University of Papua New Guinea, Port Moresby, 1987.

References

Stephens Carey. A Beginner's Guide to Scientific Method, Third Edition. Wadsworth Cengage Learning. US, 2004.

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/

FT400 INDUSTRIAL TRAINING: Work integrated Learning will be in Sem 2, Year 3 Nov-Jan. This subject will not have any credit point and will be assessed with pass/fail.

FOURTH YEAR SUBJECTS – SEMESTER 1

FT411 RESEARCH PROJECT I

Course(s): Food Technology (NQF Level 7)

Subject Name: Research Project I

Subject Code: FT411

Duration: 13 Teaching weeks

Contact Hours: 6 Hours per week

Credit Points: **8 (** Project)

Delivery Mode: On campus

Prerequisites: FT324

Co-requisites: None

Subject Coordinator: TBA

Synopsis

This subject builds on the introductory principles established all subjects from first year up to final year. This is a fulltime research project work based on the main areas of food technology program, namely food engineering, downstream food processing, food product development, postharvest, food quality control, food safety, general food microbiology, industrial food microbiology and human nutrition. Students work on chosen topics and are supervised by individual lecturers, starting with literature review and preliminary laboratory work. Towards the end of the course the students are expected to do oral presentation and written report as a form of thesis. This course in general forms and important link between basic concepts learnt in class to applied field studies.

Subject Topics

The research is multidisciplinary, covering all areas of food technology program.

Subject Outline

Topic	Content
32. Literature Review	• Do thorough literature search relating to chosen projects. • Draw clear conclusions on what is to be done in their projects.
33. Experimental Planning	• Write experimental protocols and the research methodology. • Planning their actual experimentation on weekly basis using Gantt Charts.
34. Preliminary Investigation	• Do preliminary on the field survey or laboratory investigation. • Do preliminary analysis of the data collect and make way for detailed field or experimental work.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Do extensive literature review surrounding the chosen projects.
2. Do experimental planning using the latest information on the chosen project.
3. Collect data and analyse data.
4. Write scientific preliminary thesis from the information collected.

Assessment Tasks and Weightings

The assessment is continuous and comprises of 30% seminar presentation and 70% individual thesis report. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Seminar presentation;	**(30 %)**
Thesis report	**(70%)**

Assessment 1 - **Seminar presentation:** The areas to be assessed includes; content of work, quality of presentation such as clarity, layout and legibility, communication of ideas such as voice, eye contact, reaction to audience, the timeliness of the presentation and handling of questions by the audience. This contributes to 30% of the assessment.

Assessment 2 - **Laboratory and field work report as thesis:** This involves thorough report evaluation by lecturers for each of the thesis report. The areas of assessment includes; quality of literature review collected, understanding evaluation and conclusions from the review of literature, understanding of principles behind the actual research to be carried out. Also level of preparedness for the study through writing of laboratory procedures to be used both in the field and laboratory studies. Data collection and interpretation of the collected data from of the preliminary work will be assessed. This contributes to 70% of the assessment.

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

Stephens Carey. A Beginner's Guide to Scientific Method, Third Edition. Wadsworth Cengage Learning. US, 2004.

References

1. Lawless H. T. and Heymann H. (2010). Sensory Evaluation of Foods, 2nd Edition, Springer, New York.
2. Frazier, W.C., and Weshof D.C. Food Microbiology. Tata McGraw Hill Education Ltd. New Delhi, 2008.
3. FAO/WHO food and nutrition paper 87(2006). Food safety risk analysis: A guide for national food safety authorities, Rome Italy.
4. Singh. P.R, and Heldman. D.R (2013). *Introduction to Food Engineering* . Academic Press, London. 5 th Ed.

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/

FT412 ADVANCE NUTRITION

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Advanced Nutrition
Subject Code:	FT412
Duration:	13 teaching weeks
Contact Hours:	6 x hours per week (3 x lectures, 3 x practical)
Credit Points:	16
Delivery Mode:	On campus
Prerequisites:	FT122, FT213, FT214
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

This subject builds on from the introductory subject which is taught in second year FT214. Four main areas are the focus of this subject; (i) Life cycle nutrition – nutritional needs from infancy through to old age, special considerations on women and children. (ii) Nutritional problems in PNG – forms of malnutrition, non-communicable diseases, the causes and effects of these nutritional problems including strategies to address these problems. Includes discussions on food losses and PNG food habits. (iii) Intervention techniques – nutrition education, nutrition policy development, food product labelling laws (nutrition labelling). (iv) Nutrition research – methods used in nutrition studies or surveys, types of nutritional assessments, assessments of growth and good health in children. The subject equips a student who is interested in pursuing further studies or career in a nutrition and health related field.

Subject Topics

Topic	Content
Nutritional requirements through the life cycle. Nutrition and sports	Physiological changes and impact on nutritional requirements throughout the life cycle starting from pregnancy, lactation, infancy, childhood, adolescence, adulthood, and elderly Nutritional requirements during sports.
Malnutrition Micronutrient deficiencies of importance in PNG. Strategies in addressing micronutrient deficiencies	Basic, Underlying and immediate causes of malnutrition. UNICEF framework of causes of malnutrition.PNG perspective – highest stunting rate in the world. Indicators for assessment of malnutrition in a community, implications for using specific indicators. Iron, Vitamin A, Iodine and other micronutrients. Enrichment/fortification of foods, supplementation, public health; Food based approaches, bio-fortification approaches.
Over-nutrition – obesity and other related health problems Non communicable diseases (most common in PNG)	Cause for the incidence of these diseases. Importance. Global and PNG perspective Cause for the incidence of these diseases. Risk factors, lifestyle related and others Multi-sectorial approach to dealing with these problems.
Assessment of nutritional status	Dietary assessment Biochemical assessment Anthropometric assessments Clinical assessment Epidemiological studies

Nutrition intervention Food and Nutrition Policy	MDGs and SDGs and other policies/Acts in relation to food and nutrition Outline intervention techniques operating at different levels (National, Provincial and Community) within PNG. Introduction to nutritional intervention, role of PNG Food and Nutrition policies. Human Rights approach to dealing with nutritional problems. 2016 National Nutrition Policy and its objectives
Nutrition research Nutrition Survey and Nutrition Education/awareness	Methods in nutritional research Nutrition Surveys National nutrition surveys; 1978, 1983 and most recent 2005 survey Nutrition interventions studies Nutrition survey design and implementation Survey to be carried out at the Unitech Clinic/ outside or community nutrition awareness
Trends in Human Nutrition	Introduction to latest topics in human nutrition so that students are kept abreast of developments in nutrition.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

5. Explain the particular nutritional requirements at the different physiological stages in a human's life.
2. Understand the main nutritional (both malnutrition and non-communicable diseases) problems in PNG and the multi-factorial causes of these nutritional problems. And consider the strategies used in addressing these nutritional problems.
3. Appreciate the Understand the methods used in nutritional research and assessments. Design and participate in a useful nutrition survey.
4. Understand the intervention techniques operating at different levels (National, Provincial and Community) within PNG and the contribution of policy and education on nutrition intervention. Apply the multi-sectoral approach in nutrition intervention programs.
5. Keep up-to-date with global trends in human nutrition.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved .

Students must also refer to the Subject Assessment Details.

Tests:	**(25 %)**
Nutrition Research mini project:	**(15%)**
Assignments:	**(10%)**
Final Examination:	**(50%)**

Assessment 1 - **Tests:** There will be 5 Tests contributing 25% towards the final grade for the subject.

Assessment 2 - **Nutrition research project:** The students will use the theory leanrt in class and the research methods covered in class to design and carry out a nutrition survey or project and writeup on it. This will assess the student's ability to think outside the box to consider real problems.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 4 **Final written examination:** A 3 hour written examination weighs 50%

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 14 weeks of teaching as per the PNG National Qualification Framework.

Subject Text

Whitney, E.N. and Sharon, R. (2011). Understanding Nutrition, 12th edition. Wardsworth Publishing Company. Belmont, CA.

References

Mahan, L.K., Escott-Stump, S. (2000). Krause's Food, Nutrition and Diet Therapy. 10th Edition. WB Saunders Company, USA.

Garrow, JS; James, WPT; Ralph, A. (2000). Human Nutrition and Dietetics. Churchill Livingstone, UK.

McGuire M. & Beerman, K. A., *Nutritional Sciences*. Wadsworth Cengage Learning, USA. 2011.

Paul Insel, R. Elaine Turner & Don Ross (2004). *Nutrition*. (2nd Edition). Jones & Bartlett Publishers Inc., US.

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/

FT413: FOOD PROCESSING PRACTICAL III

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Food Processing Practical III
Subject Code:	FT413
Duration:	13 teaching weeks
Contact Hours:	6 hours per week
Credit Points:	8 **(L**aboratory Practicals)
Delivery Mode:	On campus
Prerequisites:	FT323
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

This subject builds on the introductory principles established in FT121 Introduction to Food Engineering, FT221 Food Processing Practical I and FT323 Food Processing Practical III. The subject introduces the practical aspects of food engineering and processing applying the principles of heat and mass balances. Downstream processing of agriculture and fisheries commodities are investigated in details. Good manufacturing practice is encouraged.

Subject Topics

1. Textural characteristics of different food materials.
2. Application of different peeling methods in food processing.
3. Performance characteristics of drying systems.
4. Production of sweet potato flour.
5. Osmotic dehydration of banana and plantain.
6. Packaging studies of fruits and vegetables
7. Smoking as a means of fish preservation studies.
8. Drying studies of ginger.
9. Use of sweet potato flour in bread manufacture.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

6. Use Processing Tools.
7. Understand the practical aspects of drying to produce products.
8. Understand how to make bread using sweet potato as a local starch.
9. Understand the effects of packaging on postharvest behaviour certain fruits and vegetables.
10. Understand how smoking can affect storage life of fish and meat.

Assessment Tasks and Weightings

This a 100% continuous assessment. To obtain a pass grade in this Subject, 50% overall must be achieved.

Students must also refer to the formative Subject Assessment Details.

1. Laboratory practical writing: 80%
2. Pre Laboratory Assignment: 20%

Assessment 1: Laboratory reports are to be submitted for each session. This makes up 80% of the total assessment.

Assessment 2: This comprises of several pre-laboratory assignments. This makes up 20% of the total assessment.

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

Singh. P.R, and Heldman. D.R (2013). *Introduction to Food Engineering* . Academic Press, London. 5th Ed.

References

1. Singh. P.R, and Heldman. D.R (2013). *Introduction to Food Engineering* . Academic Press, London. 5th Ed.
2. Fellows.J.P (1996). **Food Processing Technology: Principles and Practice**, Woodhead Pub, Cambridge.

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/

FT414 INNOVATION AND ENTREPRENUERSHIP

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Innovation and Entrepreneurship
Subject Code:	FT414
Duration:	13 teaching weeks
Contact Hours:	6 hours per week
Credit Points:	18 **(**3 Lectures , 2 Tutorial , 1 Project)
Delivery Mode:	On campus
Prerequisites:	BM111
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

This subject builds on the introductory principles established in BM11. It teaches concept of scientific approach to process and product development processes, idea creation, innovation, entrepreneurial mindset, business models, marketing and strategic planning, financial management and business development. This course in general forms and important link between basic science innovation and business, hence changing scientific ideas into business. This is an examinable subject.

Subject Topics

1. Concept of product development and entrepreneurship.
2. Process and product development processes.
3. Entrepreneurship , innovation and design thinking.
4. Characteristics of business and business models
5. Marketing strategy and planning
6. Management and operational strategy
7. Financial management and investment analysis.
7. Business plan and project development.

Subject Outline

Topic	Content
1. Concept of Product Development and Entrepreneurship in PNG	• Need for entrepreneurship and product development in PNG • Product and process development of food and agricultural resources.
2. Systematic Process and Product Development	• Importance of inclusion of scientific ideas with market research. • Idea screening and systematic product formulation process. • Systematic experimental design and action plans
3. Entrepreneurship, innovation and design thinking.	• Why taking up entrepreneurial challenge and its benefits to the society. • Approaches to becoming a successful entrepreneur. • Testimonies of world's leading entrepreneurs. • Mechanics of design thinking and how to apply it solve complex problems and making them into business.

	• Systematic approach to design thinking based on University of Stanford Model – understand, create and deliver.
4. Introduction to business and economic systems	• Introducing the idea the functions and existence of businesses. • The economic system of other countries and PNG. • Theory of supply and demand. • Government's role in the free market system.
5. Business management or operational strategy	• Human resource management and operations. • Economic influences – business cycle, interest rates, exchange rates. • Government influences – government policies and legal environment. • Social influences – social issues, environmental issues, ethics and technology.
11. Marketing strategy	• Role of marketing in business. • Market concept. • Market research. • Marketing strategy and marketing mix. • Product development and product life cycle. • Product portfolio analysis. • Elasticity of demand.
12. Financial Management Strategy	• Budgets and variance. • Understanding cash flows. • Costs. • Break even analysis. • Company accounts and investment analysis.
13. Business Plan and Project Development	• Components of a business plan. • Writing a business from ideas and products developed from the course.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Understand and discuss importance of entrepreneurship in PNG's development.
2. Discuss the principles of product development process.
3. Apply design think and idea creation principles enter into business.
4. Discuss the reasons as to why business exist and their core values.
5. Understand the importance of human or management aspects of businesses.
6. Understand the importance of marketing strategy for a successful business operation.
7. Understand the importance of financial literacy and financial management for a successful business operation.
8. Apply business ideas into developing a business plan.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests : (25 %)
Product development project and business
Projects: (10%)
Assignments: (10%)
Quiz: (5%)
Final Examination: (50%)

Assessment 1 - **Tests:** There will be 5 Tests contributing 20% towards the final grade for the subject.

Assessment 2 - **Product development and field project:** The Laboratory and field work will contribute 10% towards the final grade for the subject. The case studies will have some problems which will assess the student's ability to think outside the box to consider real design and quality tests.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 4 - **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 **Final written examination:** A 3 hour written examination weighs 50%

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

Madura, J (2007). Introduction to Business, 4th Edition. South Western, Gengage Learning, Canada.

References

Earle, D. M., and Anderson.A.M (1985). Product and Process Development in the Food Industry. Harwood Academic Publishers, London, UK.

IFST (1998). Food and Drink: GMP – A Guide to its Responsible Management. 4th Edition, Institute of Food Science and Technology, London, UK.

Kotler, P. and Armstrong, G. (2005). Principles of Marketing. 11th Edition, Prentice Hall.

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/

FOURTH YEAR SUBJECTS – SEMESTER 2

FT421 RESEARCH PROJECT II

Course(s): Food Technology (NQF Level 7)

Subject Name: Research Project I

Subject Code: FT421

Duration: 13 Teaching weeks

Contact Hours: 6 Hours per week

Credit Points: **8 (** Project)

Delivery Mode: On campus

Prerequisites: None

Co-requisites: None

Subject Coordinator: TBA

Synopsis

This subject builds on the introductory principles established all subjects from first year up to final year. This is a fulltime research project work based on the main areas of food technology program, namely food engineering, downstream food processing, food product development, postharvest, food quality control, food safety, general food microbiology, industrial food microbiology and human nutrition. Students work on chosen topics and are supervised by individual lecturers, to do filed and laboratory investigations. Towards the end of the course the students are expected to do oral presentation and written report as a form of thesis. This course in general forms and important link between basic concepts learnt in class to applied field studies.

Subject Topics

The research is multidisciplinary, covering all areas of food technology program.

Subject Outline

Topic	Content
1, Experimental studies both in the laboratory and in the field	• Laboratory and field studies. • Data collections
2. Data collection and evaluation of results	• Further data collection. • Evaluation of data
3. Thesis writeup	• Further evaluation of data. • Thesis writeup

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Confidently do independent scientific research.
2. Collect data and analyse data.
3. Write full undergraduate thesis.

Assessment Tasks and Weightings

The assessment is continuous and comprises of 30% seminar presentation and 70% individual thesis report. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Seminar presentation;	**(30 %)**
Thesis report	**(70%)**

Assessment 1 - **Seminar presentation:** The areas to be assessed includes; content of work, quality of presentation such as clarity, layout and legibility, communication of ideas such as voice, eye contact, reaction to audience, the timeliness of the presentation and handling of questions by the audience. This contributes to 30% of the assessment.

Assessment 2 - **Laboratory and field work report as thesis:** This involves thorough report evaluation by lecturers for each of the thesis report. The areas of assessment includes; quality of literature review collected, understanding evaluation and conclusions from the review of literature, understanding of principles behind the actual research to be carried out. Also level of preparedness for the study through writing of laboratory procedures to be used both in the field and laboratory studies. Data collection and interpretation of the collected data from of the preliminary work will be assessed. This contributes to 70% of the assessment.

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

Stephens Carey. A Beginner's Guide to Scientific Method, Third Edition. Wadsworth Cengage Learning. US, 2004.

References

1. Lawless H. T. and Heymann H. (2010). Sensory Evaluation of Foods, 2nd Edition, Springer, New York.
2. Frazier, W.C., and Weshof D.C. Food Microbiology. Tata McGraw Hill Education Ltd. New Delhi, 2008.
5. FAO/WHO food and nutrition paper 87(2006). Food safety risk analysis: A guide for national food safety authorities, Rome Italy.
6. Singh. P.R, and Heldman. D.R (2013). *Introduction to Food Engineering* . Academic Press, London. 5 th Ed.

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/

FT422 FOOD PROCESSING PRACTICAL IV

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Food Processing Practical IV
Subject Code:	FT422
Duration:	13 teaching weeks
Contact Hours:	6 hours per week
Credit Points:	8 **(L**aboratory Practicals)
Delivery Mode:	On campus
Prerequisites:	FT413
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

This subject builds on the introductory principles established in FT121 Introduction to Food Engineering ,FT221 Food Processing Practical I, FT323 Food Processing Practical II and FT413 Food Processing Practical III. The subject introduces the practical aspects of food engineering and processing applying the principles of heat and mass balances. Downstream processing of agro and fisheries commodities are investigated in details. The subject involves detailed studies into three different product forms. Good manufacturing practice is encouraged.

Subject Topics

1. Detail research investigation into processing starchy foods using different processing variables.
2. Detail research investigation into processing fruit juices of different concentrations using different processing variables.
3. Detail research investigation production of peanut butter using different processing variables.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Use Processing Tools.
2. Understand how to produce safe and marketable starchy products using common local staples.
3. Understand how to produce safe and marketable fruit juice products using local fruits.
4. Understand how to produce safe and marketable peanut butter using peanuts.

Assessment Tasks and Weightings

This a 100% continuous assessment. To obtain a pass grade in this Subject, 50% overall must be achieved.

Students must also refer to the formative Subject Assessment Details.

1. Laboratory practical writing: 80%
2. Pre Laboratory Assignment: 20%

Assessment 1: Laboratory reports are to be submitted for each session. This makes up 80% of the total assessment.

Assessment 2: This comprises of several pre-laboratory assignments. This makes up 20% of the total assessment.

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

Singh. P.R, and Heldman. D.R (2013). *Introduction to Food Engineering* . Academic Press, London. 5th Ed.

References

1. Singh. P.R, and Heldman. D.R (2013). *Introduction to Food Engineering* . Academic Press, London. 5th Ed.
2. Fellows.J.P (1996). **Food Processing Technology: Principles and Practice**, Woodhead Pub, Cambridge.

Relevant Unitech Policies

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FT423 UNIT OPERATIONS II

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Innovation and Entrepreneurship
Subject Code:	FT423
Duration:	13 teaching weeks
Contact Hours:	6 hours per week
Credit Points:	21 **(**4 Lectures , 2 Tutorial)
Delivery Mode:	On campus
Prerequisitesl	FT222
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

This subject builds on the introductory principles established FT211 and FT222. It teaches the applied unit operations such as filtration, milling and size reduction, evaporation, centrifugation and irradiation. It also covers process control which is important in food process engineering. This course in general forms and important link between basic engineering concepts to applied process engineering applications This is an examinable subject.

Subject Topics

1. Filtration
2. Evaporation
3. Process control
4. Irradiation
5. Extrusion technology
6. Centrifugation
7. Milling and size reduction.

Subject Outline

Topic	Content
1. Filtration	• Principle of filtration process. • Constant rate and constant pressure filtration. • Classification filtration equipment.
2. Milling and size reduction	• Introduction to size reduction, advantages of size reduction in food processing. • Theory of size reduction operations. • Energy requirements of milling • Milling equipment classification, – roller mill and hammer mills, effects of milling on quality. • Equipment classification. • Screening efficiency and factors affecting efficiency of screening.
3. Centrifugation	• Introduction to centrifugation. • Separation of immiscible liquids and insoluble solids from liquids. • Scale up operations. • Centrifugal filtration and their uses, “g” factor, classification of centrifuges. • Classification of centrifugation equipment.

4. Evaporation	• Introduction to evaporation. • Principle of evaporation. • Factors affecting heat transfer, heat conservation in evaporation systems. • Multi effect evaporation, arraignment of heat exchangers in MEE systems. • Effects of evaporation on food quality. • Natural circulation and forced circulation evaporators • Classification of evaporation equipment.
5. Extrusion	• Introduction to extrusion technology. • cold and hot extrusion. • Principle of extrusion cooking. • Advantages of extrusion cooking. • Factors influencing extrusion cooking. • Design and operating conditions of an extruder- influence of process variables on the extrusion process. • Equipment, effects on quality and safety.
6. Irradiation	• Introduction to irradiation. • Units of irradiation. • Advantages and disadvantages of irradiation. • Principle of irradiation in food processing. • Dose distribution. • Application of irradiation in food processing and effects on food quality.
7. Process control	• Introduction to process control. • Natural and artificial process control, dynamic variable and regulation. • Principle of process control in industries. • Types of process control loops, components of process control loop, measuring element, measurements of different variables using signals.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Understand the principle of filtration system.
2. Discuss the principles of milling and size reduction operations.
3. Discuss the principles of centrifugation operations.
4. Discuss the principles of evaporation operations.
5. Understand the operating principle extrusion technology.
6. Appreciate Irradiation as a unit operation in food processing.
7. Appreciate process control as an important operation tool in food processing.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests:	**(35 %)**
Assignments:	**(10%)**
Quiz:	**(5%)**
Final Examination:	**(50%)**

Assessment 1 - **Tests:** There will be 5 Tests contributing 35% towards the final grade for the subject.

Assessment 2 - **Assignment:** Assignment will contribute 10% towards the final grade for the subject. The case studies will have some problems which will assess the student's ability to think outside the box to consider real problem in the industries

Assessment 3 - **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 4 **Final written examination:** A 3 hour written examination weighs 50%

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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

Brennan *etal* (1990). **Food Engineering Operations**, 3rd ed, Elsevier Applied Science, London

References

E.A.Parr (1986), **Industrial Control Handbook, Vol 1**, Collins, London.

C.D.Johnson(1977),**Process Control Instrumentation Technology**, 2nd Ed

Singh. P.R, and Heldman. D.R (2013). *Introduction to Food Engineering* . Academic Press, London. 5 th Ed.

Relevant Unitech Policies
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FT424 COMMODITY SCIENCE II: MEAT AND SEAFOOD TECHNOLOGY

Course(s):	Food Technology (NQF Level 7)
Subject Name:	Commodity Science II – Meat and Seafood Technology
Subject Code:	FT424
Duration:	13 teaching weeks
Contact Hours :	6 hours per week
Credit Points	16 **(**3 x lectures & 3 x Field visits)
Delivery Mode	On campus
Prerequisites:	FT121, FT122, FT211, FT212 & FT222
Co-requisites:	None
Subject Coordinator:	TBA

Synopsis

This subject provides students with the knowledge and understanding of the structure and composition of animal meat, poultry meat, egg, fish and seafoods, the post-mortem biochemical processes that affect their quality, and the technologies applied in processing, preservation and distribution of these commodities. The subject also provides an overview into sustainable management and regulatory requirements of managing fisheries resources.

Subject Topics

1. **Domestication, breed, species and classification**: History and domestication of wild and free range cattle, pig, sheep and poultry through settled agriculture, animal breeds and classification, commercial and scientific classification of aquatic animals: fish, molluscs and crustaceans and their commercial species, benthic, bethopelagic and pelagic species.

2. **World Fisheries and Market Trend**: category, production, trade, consumption and utilisation, global fishery fleets.

3. **Habit of Aquatic Animals**: Marine and freshwater, tropical climate, weather and wind patterns, ocean current and their effects, Neritic and oceanic zones, Lakes, ponds and river basins light, depth, stratification and effects on aquatic life.

4. **Anatomy**: Internal and external anatomy of domesticated animals and aquatic animals and their functions, market names of cuts and portions for trade.

5. **Structure and Composition**: Muscle and egg structures and their chemical compositions, muscle structure and composition of various aquatic animal classes.

6. **Post-mortem physiology, biochemical and physico-chemical reactions and effects and methods of control**: Process of converting muscle to meat and its effects on quality of meat, fish, crustaceans and molluscs and methods of control

7. **Methods of processing and preservation:** Ante-mortem and post-mortem care, abattoir operations and best practices, various secondary methods of processing and preservation of beef, pork lamb/mutton, poultry meats, and processing and preservation of eggs, methods of fishing, harvesting, processing and preservation of fish, crustaceans and molluscs.

8. **Management of Fisheries resources:** National Fisheries Authority and its functions, laws and regulations and bodies relating to management

Subject Outline

Topic	Content
Domestication, breed, species and classification	Brief background of animal domestication associated with human evolution, from gatherers of wild and loose species to settled agriculture, producing special breeds that are versatile, robust early maturing to meet increasing demands for meat, egg and milk with settled agriculture. Different classification of fish and seafoods and those species that are of commercial value to PNG according to commercial and scientific classification. Discuss the classes of chordata, malacostraca and mollusca (cephalopoda & bivalvia) and their sub-classes. Identify benthic and bethno-pelagic species: those species that are bottom dwellers (sedentary species), on the seafloor, along continental shelves and slopes, on the river and lake floors from those pelagic species that inhabit water columns
World Fisheries and trend	Explain the classification of World Fisheries: Inland Fishery versus Marine Fishery, Aquaculture Fishery versus Capture Fishery. Total global production of fish and shellfish: capture and aquaculture fisheries, both in tonnage and top producing countries including main species produced. Trends and issues in production associated with climate change, global wind patterns and ocean currents, growth rate. Total global fishing fleets both is marine capture and inland capture fisheries and leading the countries which own these vessels. Export and import trades with top trading countries both developed and developing countries and total monetary value in trade. Global utilization of fishery products in terms of direct consumption versus other purpose usage. Overview of employment by the world fishery sector
Habitat of aquatic animals	Tropical Environment and the factors which affect this environment and aquatic animals that live and thrive in this environment, both marine and freshwater. Tropic humid climate, wind patterns, geomorphology, vegetation patterns, proportion of land to water masses, general topography, both natural and man-made: hydrological changes, euthrophication, climate change which affect the eco-system balance and the nutrients, physico-chemical properties, habitat and spawning grounds. Neritic and oceanic zones, lakes, ponds, reservoirs, river basins, their depths and the amount of light penetration and food availability.
Anatomy	Identify various internal and external body parts of domesticated animals, fish, cartilaginous fish, molluscs and crustaceans and explain their functions. Identify cut portions for trade and their trade names. Describe abattoir operations, converting carcass (muscle) to meat, filleting process, converting fish to fillets, loins and stakes.
Structure and composition	Skeletal muscle structures and connective tissue structures of domesticated animals versus fish, molluscs and crustaceans; muscle types, fiber types, amount and location; types of protein associated with these muscles; uses of muscles for physiological activities: contraction, relaxation, feeding, swimming, mating; vascular system of tuna in relation to its dark muscle and effects. Chemical composition of muscles and their effects from starvation, stress, spawning and moulting. Internal and external structure of egg and its functions; life cycle of a hen, egg formation and maturity process; chemical composition of egg, its quality and uses
Post-mortem physiology, biochemical reactions and physico-chemical reactions and their effects and control	Post-mortem glycolysis and its effects on muscles of both domesticated animals, fish and seafoods: pH effects: DFM and PSE meats; rigor mortis, gaping, protein denaturation, autolysis, burnt tuna syndrome, enzymic browning, oxidation, nucleotide breakdown, amine and histidine breakdown, trimethylamineoxide breakdown, bacterial degradation, rough handling, cold-shortening, thaw rigor. Methods of control: good ante-mortem and post-mortem care of animals, careful handling of fish/seafoods to minimize stress and reduce cross-contamination, instant stunning, killing and bleeding, rapid chilling, rapid freezing, maintaining cold-chain
Methods of processing and preservation	Canning, pasteurization, curing by brine, drying: conventional (sun-drying, hot-air drying) and freeze-drying, chilling, freeing; processing of sausages and other table-ready meat, unit operations of processing table-ready meat products, fish/seafood surimi and minced product processing; poultry processing: scalding and defeathering; egg processing and preservation: whole egg, egg-white, egg-yolk; methods of fishing: passive fishing and active fishing: trawling, gillnetting, trolling, seining, long-lining; fresh fish supply chain, frozen fish supply chain, conventional freezing (blast freezing, plate freezing, cryogenic freesing) versus new freezing methods: pressure shift freezing, impingement freezing, cell alive system freezing,

	glazing; chilling: RSW, RFW, using ice, chilled-air; shellfish growing and harvesting environment and control, depuration, heat shucking, high pressure processing
Management of Fisheries resources	National Fisheries Authority, structure and functions; different fisheries: aquaculture/Inland fishery, tuna fishery, prawn/lobster fishery etc. sedentary/beche-demer etc, sustainable management of fish stock, Other regional and international bodies: WCPFC, FFA etc, their roles and functions EEZ, International laws, treaties, governing fisheries activities: United Nation's convention on the Law of the Sea of 10 December, 1982, Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, 08 September, 1995, Agreement on IUU Fishing 2010; types of vessels and flags., Exports: EU quota-free and duty-free special arrangement

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Discuss the classification and anatomy of aquatic animals (marine and freshwater animals) and their habitats including those commercial species in Papua New Guinea.

2. Discuss brief history of animal domestication, breed, classification and anatomy of domesticated animals : cattle, pig, sheep, poultry

3. Explain the structure and chemical composition of aquatic animals and the effects of seasonal changes on them and the structures and chemical compositions of meat and egg.

4. Discuss the ante-mortem practices, process of slaughter, abattoir operations and best practices.

5. Discuss the post-mortem biochemical reactions and their effects on quality and safety of meat and eggs.

6. Discuss the post-mortem physiology, biochemical and physic-chemical reactions and their effects on quality and safety of aquatic animals.

7. Describe methods of processing and preservation of meat including table ready meats: sausages, bacons and hams, and processing and preservation of eggs.

8. Describe methods of fishing, processing and preservation of aquatic animals including their table-ready products.

9. Discuss the management and regulatory and functions and laws relating to sustainable management of aquatic animals.

Assessment Tasks and Weightings

The summative exam (final examination) will carry 50% and formative assessment (continuous assessment) 50%. To obtain a pass grade in this subject, 50% overall must be achieved.

Students must also refer to the Subject Assessment Details.

Tests:	**(25 %)**
Field visits:	**(10%)**
Assignments:	**(10%)**
Quiz:	**(5%)**
Final Examination:	**(50%)**

Assessment 1 - **Tests:** There will be 5 Tests contributing 25% towards the final grade for the subject.

Assessment 2 - **Field visits:** The field visits will contribute 10% towards the final grade for the subject. The practical observations will expose students to real handling, processing and preservation processes. The visits will also assess students' confidence in carrying out projects under limited supervision, and communicating information and findings. It will further encourage students to work as a team to critically analyse and communicate their findings.

Assessment 3 - **Assignment/Group work:** The assignments and group work encourage students to work as a team, to research and to communicate the research appropriately and effectively in both written and oral forms. Contributes 10% towards the final grade for the subject

Assessment 4 - **Quizzes:** These are very short, short answer, or multiple choice questions which are to check if students did understand some of the important components of lectures and collectively weigh 5%.

Assessment 5 Final written examination: A 3 hour written examination weighs 50%

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Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 14 weeks of teaching as per the PNG National Qualification Framework.

References

1. Lawrie, L.A (1998). Meat Science, 6th ed, Woodhead, England
2. Fennema Owen R (1996). Food Chemistry, NY, USA
3. Ihekoronye, A.I. and Ngoddy P.O (1985). Intergrated Food Science and Technology for the tropics, Macmillan, UK
4. Granata, L. A, Flick G. J, Martin R.E. (2012). The Seafood Industry: Species, Products, Processing, and Safety, 2nd ed. Wiley Blackwell. Australia.
5. Hall, G (2010). Fish Processing: Sustainability and New Opportunities. Wiley-Blackwell, Australia.
6. Bratt, L. (2010). Fish Canning Handbook. Wiley-Blackwell, Australia.
7. Alasalvar, C., Miyashita, K., Shahidi, F. and Wanasundara, U. (2010). Wiley-Blackwell. Australia.

Relevant Unitech Policies

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