



NATIONAL BOARD FOR TECHNICAL EDUCATION

PLOT B BIDA ROAD, P.M.B. 2239, KADUNA, NIGERIA

NATIONAL DIPLOMA

IN

POSTHARVEST PRODUCE TECHNOLOGY

CURRICULUM AND COURSE SPECIFICATION

JUNE, 2026

PREFACE

The transformation of Nigeria's agricultural sector remains central to the nation's aspirations for sustainable economic growth, food security, job creation, industrial development, and poverty reduction. As agriculture continues to evolve in response to technological advancements, climate change, emerging global market demands, and the need for increased productivity across agricultural value chains, it has become imperative to ensure that curricula in Nigerian tertiary institutions remain relevant, responsive, and aligned with contemporary industry requirements. It is against this backdrop that we embarked on the comprehensive review and modernization of Agricultural curricula for Nigerian tertiary institutions. The review process was designed to address identified skills gaps, integrate emerging technologies and innovations, strengthen entrepreneurship and employability competencies, promote climate-smart agriculture, and align training programmes with the industry expectations and global best practices. The successful execution of this important project was made possible through the invaluable support and commitment of key stakeholders. I wish to express profound appreciation to the Honourable Minister of Education for providing the policy direction and leadership that facilitated this initiative. I also extend sincere gratitude to the Honourable Minister of Agriculture and Food Security and the Honourable Minister of Livestock Development for their unwavering support, technical contributions, and commitment to strengthening agricultural education and workforce development in Nigeria. Special appreciation goes to the Tertiary Education Trust Fund (TETFund) for providing the special intervention grant that enabled the conduct of nationwide skills gap analyses and supported the series of national curriculum review and development workshops. The findings from the skills gap studies provided critical evidence and industry insights that guided the review process and ensured that the curricula reflect current and future workforce requirements within the agricultural sector.

I also acknowledge with gratitude the immense contributions of the Sector Skills Council for Agriculture, whose expertise and industry perspectives greatly enriched the curriculum development process. Equally commendable are the efforts of members of the Implementation Committee, resource persons, industry experts, professional bodies, French Embassy in Nigeria, regulatory agencies, academic institutions, employers, development partners, and other stakeholders who devoted their time, knowledge, and experience to the various workshops and technical sessions. The revised curricula represent a collective national effort to produce graduates equipped with relevant knowledge, practical skills, digital competencies, entrepreneurial capabilities, and professional attitudes required to drive innovation and productivity across Nigeria's agronomy, forestry, fisheries and livestock sectors. It is my expectation that Institutions offering these programmes will faithfully implement the curricula and continue to collaborate with industry to ensure sustained relevance and quality. I commend all stakeholders for their dedication and contributions to this landmark achievement and look forward to the successful implementation of these curricula for the benefit of our dear nation.

Professor Idris M. Bugaje, FNSE
Chairman, Implementation Committee

EXECUTIVE SECRETARY

National Board for Technical Education (NBTE), Kaduna

ACKNOWLEDGEMENT

The National Board for Technical Education (NBTE) expresses its profound appreciation to all individuals and organizations whose invaluable support, expertise, and commitment made the successful review and modernization of the Agricultural Education curricula for Nigerian tertiary institutions possible. Our sincere gratitude goes to the Honourable Minister of Education for providing the policy direction and leadership that made this national initiative possible. We also appreciate the Honourable Minister of Agriculture and Food Security and the Honourable Minister of Livestock Development for their technical guidance, collaboration, and unwavering commitment to strengthening agricultural education and workforce development in Nigeria. The Board is particularly grateful to the Tertiary Education Trust Fund (TETFund) for providing the special intervention grant that funded the nationwide skills gap analyses, stakeholder engagements, curriculum review exercises, validation meetings, and development workshops. The evidence generated through these studies provided a solid foundation for developing curricula that are relevant, industry-driven, and responsive to national and global agricultural priorities.

Special appreciation is extended to the members of the agriculture sector, curriculum specialists, resource persons, academic experts, professional bodies, regulatory agencies, employers, industry practitioners, development partners, and representatives of public and private sector organizations who participated actively in the skills gap studies, technical sessions, validation exercises, and curriculum development workshops. Their diverse expertise and practical insights greatly enriched the quality and relevance of the curricula. We further appreciate the support of the French Embassy in Nigeria and other development partners for their collaboration in promoting excellence and innovation in technical and vocational education within the agricultural sector. Finally, NBTE expresses its gratitude to all tertiary institutions, researchers, facilitators, rapporteurs, technical staff, and administrative personnel whose commitment and hard work contributed to the successful completion of this important national assignment. The Board acknowledges that this achievement is the result of a collective effort and remains confident that the effective implementation of these curricula will contribute significantly to producing competent, innovative, and entrepreneurial graduates capable of advancing sustainable agricultural development, food security, and economic prosperity in Nigeria.

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GENERAL INFORMATION

1.0 PROGRAMME NOMENCLATURE:

National Diploma (ND) in Postharvest Produce Technology

2.0 PROGRAMME GOAL

The programme aims to produce National Diploma graduates who are conversant with existing local practices, practically competent in modern practices, digitally enabled, and internationally compliant postharvest technicians, capable of managing all forms of agricultural produce (durables, perishables and semi-perishables) using modern postharvest handling techniques, smart technology, cold chain management, food safety systems, and value addition strategies to extend shelf life, minimise losses, ensure quality, and connect produce to domestic and international markets.

3.0 OBJECTIVES OF THE PROGRAMME

On completion of the programme, the diplomates should be able to:

- i. Appreciate the traditionally existing practices and be conversant with their pros and cons.
- ii. Apply modern postharvest handling techniques for perishables, semi-perishables and durables.
- iii. Design, operate and maintain cold chain systems from Zero Energy Cool Chambers to solar-powered cold rooms and commercial refrigeration units.
- iv. Use drone technology and IoT sensor networks for pre-harvest quality assessment, cold store environment monitoring and supply chain tracking.
- v. Implement Hazard Analysis and Critical Control Point (HACCP), GlobalGAP, ISO 22000 and Codex Alimentarius food safety systems in postharvest facilities.
- vi. Apply smart packaging technologies: active packaging, modified atmosphere, nanotechnology films and digital freshness indicators.
- vii. Assist in produce inspection
- viii. Prepare produce for pesticide residue testing
- ix. Assist in phytosanitary certification and export compliance documentation.
- x. Utilise blockchain traceability and AI-assisted quality grading systems for export-grade produce.
- xi. Design and manage postharvest enterprises including digital agri-marketing, e-commerce and agri-finance.
- xii. Operate solar-powered cold storage systems for off-grid postharvest operations.
- xiii. Measure food losses using the FAO FLW Protocol and APhLIS tool.

- xiv. Implement food loss reduction strategies.
- xv. Demonstrate the confidence at graduation to venture into self-employment.

4.0 ENTRY REQUIREMENTS

The entry requirements into National Diploma in Postharvest Produce Technology Programme are as follows: -

- a. Four (4) GCE, WASC, SSCE, SAISSCE, NECO or NABTEB subjects passed at not more than two sittings. The subjects must be passed at Credit level and should include English Language, Mathematics, Agricultural Science/Biology and any one (1) other subject from the list contained in the most current Directory of Accredited programmes of Polytechnics and similar tertiary technical institutions in Nigeria.
- b. Evidence of registration with Joint Admissions and Matriculation Board (JAMB)

5.0 PROGRAMME STRUCTURE AND DURATION

The programme is structured to last for two (2) years (4 semesters) of classroom, workshop, studio, and laboratory activities. The National Diploma is a two-year terminal academic programme.

The duration also incorporates 3-4 months Students' Industrial Work Experience (SIWES) which shall take place at the end of the second semester of the first year. Each semester shall be for 17 weeks, made up of:

- 15 contact weeks of teaching (i.e. lectures and practical sessions etc.) and
- 2 weeks for registration and examinations

6.0 CURRICULUM

6.1 The curriculum of the ND programme consists of four main components. These are

- a. General studies/education
- b. Foundation courses.
- c. Professional courses.
- d. Students' Industrial Work Experience Scheme (SIWES)

6.2 The General education component shall include courses in:

- Arts and Humanities – English Language and Communication. These are compulsory.
- Mathematics and Science (for non-Science based programmes)
- Social Studies – Citizenship (the Nigerian constitution) and
- Entrepreneurship Studies.

The courses in Citizenship Education and Entrepreneurship are compulsory. The General Education component shall account for not more than 15% of total contact hours for the programme.

6.3 Foundation Courses include Computer, Mathematics, English Language and Statistics, etc. The number of hours will vary and may account for about 10 – 15% of the total contact hours.

6.4 Professional Courses are courses, which give the student the theory and practical skills he/she needs to enable him/her practice professionally at skilled middle level.

6.5 Students' Industrial Work Experience Scheme (SIWES) shall be taken during vacation following the end of the second semester of the first year. See details of SIWES at paragraph 14.0

7.0 STAFFING REQUIREMENTS

7.1 Core Teaching Staff

A minimum of four (4) Core teaching staff who should possess at least HND, B.Sc. Agric, B.Agric, B.Tech Agric.(2nd Class or higher) or any related disciplines at good grade.

7.2 Technical Staff

There should be technical staff;

i) Technologist

A technologist is a highly skilled professional trained at the Higher National Diploma (HND) level. They possess advanced technical and practical knowledge in their field and are capable of supervising operations, managing projects, operating modern equipment, and applying technology to solve practical problems. In agriculture, technologists help in farm management, research support, and the application of improved technologies.

ii) Technician

A technician is a middle-level manpower trained at the National Diploma (ND) level. Technicians are responsible for carrying out technical tasks, operating tools and equipment, and assisting technologists and professionals in practical activities. In agriculture, they assist in crop production, livestock management, farm maintenance, and data collection.

iii) Farm Assistants

Farm assistants are support workers who help in daily farm operations under supervision. They perform basic practical activities such as planting, weeding, feeding animals, harvesting, cleaning farm tools, and maintaining farm records. They contribute to the smooth running of farm activities and help improve productivity.

7.3 Career prospects

Holders of the ND can work in:

- Schools

- Farms
- Commodity Boards
- Agricultural Finance Institutions
- Cold-chain logistics
- Produce Inspection
- Warehouses
- Border quarantine Services
- Customs/Port Inspection Services
- NGOs
- Private firm
- Higher Educational Institutions
- Food companies, etc.

7.5 Headship of the Department

The Head of Department shall have at least HND or First degree and Master's Degree in Agricultural programmes or related fields. He or she shall not be less than the rank of a Senior Lecturer and Must be registered with the relevant professional body and must have a minimum of (12 years) experience in both academic and industry.

7.6 Academic Prospects

Possibility of proceeding for further studies in HND, B.Agric /B.Tech /BSc programmes.

8.0 CERTIFICATION

A diplomate of this programme shall be awarded ND in Postharvest Produce Technology

9.0 CONDITIONS FOR THE AWARD OF ND

Institutions offering accredited programmes will award the National Diploma to candidates who successfully completed the programme after passing prescribed coursework, examinations, diploma project and the Students Industrial Work Experience Scheme (SIWES). Such candidates should have completed a minimum of between 138 and 145 semester credit units depending on the programme.

Grading of Courses: Courses shall be graded as follows:

MARKS RANGE	LETTER GRADE	WEIGHTING
75% and above	A	4.00

70% – 74%	AB	3.50
65% – 69%	B	3.25
60% – 64%	BC	3.00
55% – 59%	C	2.75
50% – 54%	CD	2.50
45% – 49%	D	2.25
40% – 44%	E	2.00
Below 40%	F	0.0

9.2 Classification of Diplomas:

Diploma Certificates shall be awarded based on the following classifications:

CGPA	CLASS OF DIPLOMA
CGPA 3.50 and above	Distinction
CGPA 3.00-3.49	Upper Credit
CGPA 2.50-2.99	Lower Credit
CGPA 2.00-2.49	Pass

10.0 ACCREDITATION

The National Diploma (ND) in Postharvest Produce Technology shall be accredited by NBTE before the diplomates can be awarded the diploma certificate. Details about the process of accrediting a programme for the award of the ND are available from the Executive Secretary, National Board for Technical Education (NBTE) Plot 'B', Bida Road, P.M.B. 2239, Kaduna, Nigeria.

11.0 LOGBOOK

A personal logbook for each course is to be kept by the students. It shall contain all the recordings of the day-to-day, weekly and semester practical works/activities from day one to the end of the programme. This is to be checked, marked appropriately and endorsed by all lecturers concerned at the end of every week.

12.0 FINAL YEAR PROJECTS

Final year students are expected to carry out project work, either on individual or group basis (not more than 2 per group). The project topics should as much as possible be related to the programme and serve as useful tools for further Research and /or Development.

Projects should be properly supervised, and their reports well presented. The Institution should develop formats for presenting and grading projects. The formats should be adopted as applied to each stakeholder.

13.0 GUIDANCE NOTES FOR TEACHERS OF THE PROGRAMME:

13.1 The new curriculum is drawn in unit courses. This is in keeping with the provisions of the National Policy on Education which stress the need to introduce the semester credit units which will enable a student, who so wishes, to transfer the units already completed in an institution of similar standard from which he/she is transferring.

13.2 In designing the units, the principle of the modular system by product has been adopted, thus making each of the professional modules, when completed provides the student with technician operative skills, which can be used for employment purposes.

13.3 As the success of the credit unit system depends on the articulation of programmes between the institution and industry, the Curriculum content has been written in behavioural objectives, so that the expected performance of the student is clear to all students who successfully completed some of the courses or the diplomates of the programme. There is a slight departure in the presentation of the performance-based curriculum which requires the conditions under which the performance is expected to be carried out and the criteria for the acceptable levels of performance. It is a deliberate attempt to further involve the staff of the department teaching the programme to write their own curriculum stating the conditions existing in their institution under which the performance can take place and follow that with the criteria for determining an acceptable level of performance. Departmental submission on the final curriculum may be vetted by the Academic Board of the institution. Our aim is to continue to see to it that a solid internal Evaluation system exists in each institution for ensuring minimum standard and quality of education in the programmes offered throughout the polytechnic system.

13.4 The teaching of theory and practical work should, as much as possible, be integrated. Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation from the theory. For each course, there should be a balance of theory to practice in the ratio of 50:50 or 60:40 or the reverse.

14.0 GUIDELINES ON SIWES PROGRAMME

For the smooth operation of the SIWES, the following guidelines shall apply:

14.1 Responsibility for placement of Students.

- a. Institution offering the ND programme shall arrange to place the students in relevant industries. By the end of second semester of the first academic session, six copies of the master list showing where each student has been placed shall be submitted to the Executive Secretary, NBTE, who shall, in turn authenticate the list and forward it to the Industrial Training Fund, Jos.
- b. The Placement Officer should discuss and agree with the various industries on the following:

- i. A task inventory of what the student is expected to experience during the period of attachment. It may be wise to adopt the one already approved for each field by the industry-based supervisor.
- ii. The evaluation of the student by the industry-based supervisor and the institution-based supervisor.
- iii. The final grading of the student during the period of attachment should be weighted more on the evaluation by industry-based supervisor.

14.2 Evaluation of Student during the SIWES

In the evaluation of the student, cognisance should be taken of the following items:

- i. Punctuality
- ii. Attendance
- iii. General attitude to work
- iv. Routine report of weekly activities in the logbook
- v. Respect for authority
- vi. Interest in the field/technical area
- vii. Technical competence as a potential technician in his field.

14.3 Grading of SIWES

To ensure uniformity of grading scales, the institution should ensure that the uniform grading of students work agreed to by all TVET Institutions is adopted.

14.4 The Institution based Supervisor

The institution-based supervisor should initial the log book during each visit. This will enable him to check and determine to what extent the objectives of the scheme are being met and to assist students having any problems regarding the specific tasks given to them by their industry-based supervisor.

14.5 Frequency of visit

Institutions should ensure that students placed on the attachment are visited within one month of their placement. Other visits shall be arranged so that:

- i. There is another visit six weeks after the first visit; and
- ii. A final visit in the last month of the attachment.

14.6 Stipend for Students in SIWES

The rate of stipend payable shall be determined from time to time by the Federal Government after due consultation with the Federal Ministry of Education, the Industrial Training fund and the NBTE.

14.7 SIWES as a component of the Curriculum

The completion of SIWES is important in the final determination of whether the student is successful in the programme or not. Failure in the SIWES is an indication that the student has not shown sufficient interest in the field or has no potential to become a skilled technician in his field. The SIWES should be graded on a **fail** or **pass** basis. Where a student has satisfied all other requirements but failed SIWES, she/he may only be allowed to repeat another four months SIWES at his own expense.

15.0 GUIDELINES ON MANDATORY SKILLS QUALIFICATIONS (MSQ)

Please, see the Guidelines for the Implementation of MSQ in Polytechnics in Nigeria, available on NBTE website (web.nbte.gov.ng/downloads).



CURRICULUM TABLE**Year I- Semester I**

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 101	Use of English I	2	0	0	2	2
2.	GNS 111	Citizenship Education I	2	0	0	2	2
3.	COM 111	Introduction to Computing	2	0	2	4	4
4.	MEC 113	Basic Workshop Technology and Practice	1	0	3	4	4
5.	MSQ 111	Mandatory Skills Qualification	1	0	1	2	2
6.	AGR 101	Introduction to Agriculture	1	0	2	3	3
7.	PPT 111	Introduction to Biology of Perishables and Semi-Perishables	1	0	3	4	4
8.	PPT 112	Introduction to Postharvest Equipment, Tools and Precision Instruments	1	0	2	3	3
9.	PPT 113	Introduction to Postharvest Science and Food Systems	1	0	2	3	3
10.	PPT 114	Introduction to Grain Storage and Hermetic Technology	1	0	3	4	4
11.	PPT 115	Introduction to Professional English for Postharvest Product Trade Documentation	1	0	1	2	2
12.	PPT 116	Introduction to Postharvest Microbiology	1	0	3	4	4
TOTAL			15	0	22	37	37

Year I- Semester II

S/N	COURSE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 102	Communication in English I	2	0	0	2	2
2.	GNS 121	Citizenship Education II	2	0	0	2	2
3.	ENT 126	Introduction to Entrepreneurship I	2	0	1	3	3
4.	PIE 121	Produce Inspection and Quality Assessment	1	0	3	4	4
5.	AGT 125	Agro-Climatology	1	0	2	3	3
6.	PPT 121	Introduction to Integrated Pest Management & Stored Grain Toxicology	1	0	3	4	4
7.	PPT 122	Introduction to Controlled & Modified Atmosphere Storage	1	0	2	3	3
8.	PPT 123	Introduction to Food Processing, Packaging and Quality Control	1	0	2	3	3
9.	PPT 124	Introduction to Stored Product Pest Identification & Bioassay	1	0	3	4	4
10.	PPT 125	Introduction to Drone, IoT Sensors & Precision Postharvest Produce Handling	1	0	3	4	4
11.	PPT 126	Introduction to Handling of Fruits and Vegetables	1	0	3	4	4
TOTAL			14	0	22	36	36

Year II- Semester I

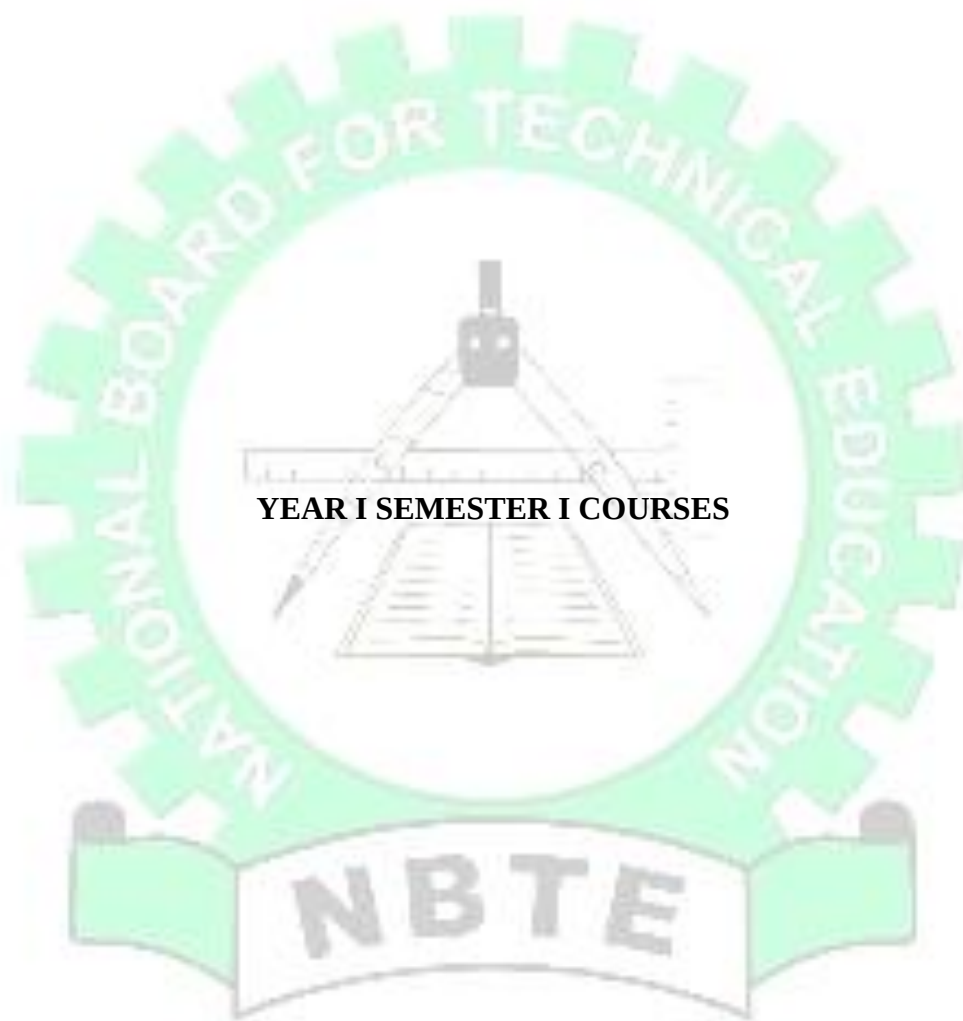
S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 201	Use of English II	2	0	0	2	2
2.	ENT 216	Introduction to Entrepreneurship II	2	0	1	3	3
3.	AGR 201	Research Methods and Experimental Design	1	0	1	2	2
4.	PPT 211	Principles of Renewable Energy for Cold Storage and Off-Grid	1	0	3	4	4
5.	PPT 212	Introduction to Postharvest Produce Transportation and Logistics	1	0	3	4	4
6.	PPT 213	Introduction to Digital Agri-Marketing	1	0	3	4	4
7.	PPT 214	Introduction to Food Safety Systems	1	0	3	4	4
8.	PPT 215	Introduction to Value Addition and Food Processing Technology	1	0	3	4	4
9.	PPT 217	Students Industrial Work Experience Scheme (SIWES)	0	0	4	4	4
TOTAL			10	0	23	33	33

Year II- Semester II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 202	Communication in English II	2	0	0	2	2
2.	AGT 226	Agricultural Extension, Digital Advisory Systems and Rural Development	1	0	1	2	2
3.	PPT 221	Introduction to Warehouse Management and Inventory Systems	1	0	3	4	4
4.	PPT 222	Introduction to Packaging Technology	1	0	3	4	4
5.	PPT 223	Storage Management of Perishables and Semi-Perishables	1	0	3	4	4
6.	PPT 225	Principles of Packing House Management and Automation	1	0	3	4	4
7.	PPT 226	Agri-Entrepreneurship, Business Planning and Enterprise	1	0	3	4	4
8.	PPT 227	Project	0	0	4	4	4
TOTAL			9	0	23	32	32

KEY:

L= Lecture (hours/week), T= Tutorial (hours/week), P= Practical (hours/week), CH=Contact Hours (hours/week), CU=Credit Unit



YEAR I SEMESTER I COURSES

INTRODUCTION TO BIOLOGY OF PERISHABLES AND SEMI-PERISHABLES

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO BIOLOGY OF PERISHABLES AND SEMI-PERISHABLES	COURSE CODE: PPT 111	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills of biological and physiological basis of postharvest behavior of perishables and semi-perishables agricultural produce		
GENERAL OBJECTIVES On completion of this course, the student should be able to: 1.0 Understand the structural composition and classification of perishables and semi-perishables agricultural produce; 2.0 Know the physiological processes that occur in fresh produce after harvest; 3.0 Understand the processes of ripening, senescence and quality deterioration; 4.0 Know the major biochemical changes during storage and handling perishables and semi-perishables agricultural produce; 5.0 Understand prediction and management of postharvest quality of agricultural produce; 6.0 Know natural defense compounds (phenolics, antioxidants) in perishables and semi-perishables of agricultural produce.		

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO BIOLOGY OF PERISHABLES AND SEMI-PERISHABLES			COURSE CODE: PPT 111		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowldge and skills of biological and physiological basis of postharvest behavior of perishables and semi-perishables agricultural produce						
GENERAL OBJECTIVE 1.0: Understand the structural composition and classification of perishables and semi-perishables agricultural produce						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Define horticultural produce. 1.2 Explain the classification of horicultural produce them into: Carbohydrates Proteins Oil Vitamins. 1.3 Describe their cellular structure and composition.	• Explain horticultural produce. • Explain the classification of horicultural produce them into: Carbohydrates Proteins Oil Vitamins. • Describe their cellular structure and composition.	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Identify 20 fresh produce samples. • Draw cellular structures under a microscope. • Prepare a produce classification reference chart. • Report findings	Guide students to: • Identify 20 fresh produce samples. • Draw cellular structures under a microscope. • Prepare a produce classification reference chart Report findings	Laptop, Laboratory equipment, instruments, specimens/sample s, writing materials, Worksheets Projector Reference chart
GENERAL OBJECTIVE 2.0: Know the physiological processes that occur in fresh produce after harvest						
3 – 5	2.1 Describe the role of plant hormones in ripening and senescence.	• Explain the role of plant hormones (ethylene, auxin, etc.) in ripening	Laptop computers, smart board, projector,	• Conduct ethylene production using simple chemical or sensor-based	• Guide students to: Conduct ethylene production using simple chemical or	- Ethylene sensor (handheld) or KMnO ₄ traps; ripening agents -

	2.2 Outline factors affecting quality of produce during postharvest handling operations. 2.3 Describe losses that occur during poor postharvest handling.	and senescence. • Explain factors affecting quality of produce during postharvest operations (water loss, wilting etc.) • Explain losses that occur during poor postharvest handling	writing materials, whiteboard, markers, internet Ethylene production graph; Plant Hormones Sample data tables	methods. • Identify factors affecting quality of produce during postharvest handling operations. • Measure water loss (transpiration) under different humidity and temperature • Report findings.	sensor-based methods. • Identify factors affecting quality of produce during postharvest handling operations • Measure water loss (transpiration) under different humidity and temperature • Report findings	Digital scale, - humidity chambers, Laptop computers, specimens/sample s, Projector
GENERAL OBJECTIVE 3.0: Understand the processes of ripening, senescence and quality deterioration						
6 – 7	3.1 Define the followings: - Ripening - Maturity - Senescence - Chlorophyll degradation - Anthocyanin development - Cell wall softening - Aroma development in fruits and vegetables. 3.2 Explain the role of ethylene syntheses in ripening. 3.3 Differentiate between Maturity	○ Explain the followings: - Ripening - Maturity - Senescence - Chlorophyll degradation, - Anthocyanin development, - Cell wall softening, - Aroma development in fruits and vegetables. ○ Explain the role of ethylene syntheses in ripening. • Differentiate	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Track ripening of 10 each of: banana, mango, pineapple, etc. samples over 7 days • Record colour score, firmness (penetrometer), and Brix. • Draw a ripening curve. • Interpret a ripening curve.	• Guide students to: Track ripening of 10 each of: banana, mango, pineapple, etc. samples over 7 days. • Record colour score, firmness (penetrometer), and Brix. • Draw a ripening curve. • Interpret a ripening curve.	Specimens/sample s, projector

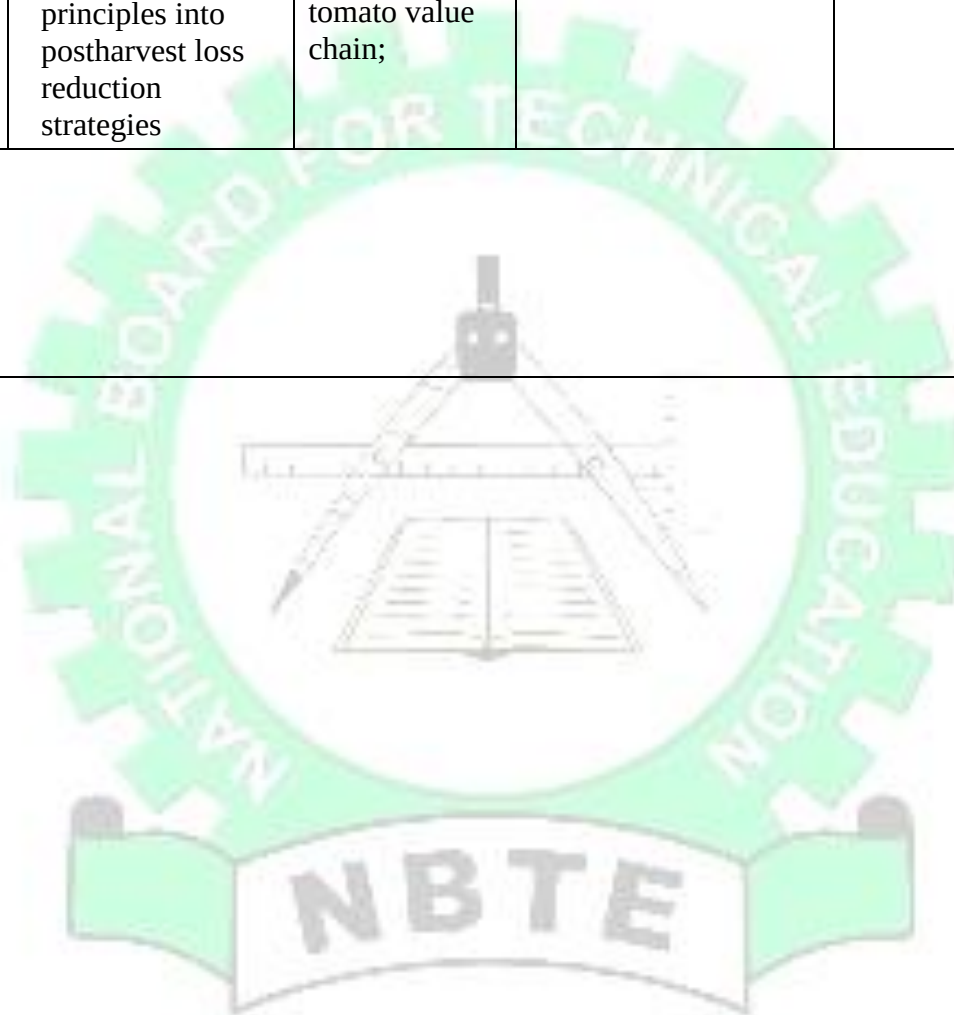
	Ripening Senescence.	between Maturity Ripening Senescence				
GENERAL OBJECTIVE 4.0: Know the major biochemical changes during storage and handling perishables and semi-perishables agricultural produce.						
8 – 9	4.1 Describe biochemical changes in storage. 4.2 Explain the effects of temperature, Relative Humidity, and gas composition on produce shelf-life. 4.3 Discuss the disadvantages of these biochemical changes in postharvest storage.	• Explain biochemical changes in storage: Starch-sugar conversion ii Lipid oxidation, Iii Protein degradation Iv Vitamin loss. • Explain effects of temperature, RH, and gas composition on produce shelf life Explain the disadvantages of these biochemical changes in postharvest storage	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Compare Brix, firmness, and colour of produce stored at 3 different temperatures over 7 days. • Show biochemical pathway diagrams • Demonstrate Brix measurement Show storage condition charts for major produce types. • Present findings in a class report with tables and graphs.	Guide students to: • Compare Brix, firmness, and colour of produce stored at 3 different temperatures over 7 days. • Show biochemical pathway diagrams • Demonstrate Brix measurement Show storage condition charts for major produce types. • Present findings in a class report with tables and graphs.	specimens/sample s, worksheets, projector Temperature logger RH meter Gas analyzer
GENERAL OBJECTIVE 5.0: Understand prediction and management postharvest quality of agricultural produce						
10 – 11	5.1 List biological disorders. 5.2 Mention problems associated with biological disorders.	• Explain the followings: Biological disorders Chilling injury Freezing injury, Internal	Laptop computers, smart board, projector, writing materials,	• Identify 10 disorder symptoms from provided images and specimens. • Propose specific prevention measures	Guide students to: - Identify 10 disorder symptoms from provided images and specimens. - Propose specific	Specimens/sample s, worksheets, projector Calorimeter Microscope

	5.3 Explain their causes and prevention strategies for major Nigerian horticultural crops.	browning, Physiological breakdown. • Justify problems associated with biological disorders • Explain their causes and prevention strategies for major Nigerian horticultural crops.	whiteboard, markers, internet	for each disorder identified. • Show images and specimens of biological disorders • Profile prevention strategies; • Facilitate case study discussion with real produce samples.	prevention measures for each disorder identified. • Show images and specimens of biological disorders; Profile prevention strategies; Facilitate case study discussion with real produce samples.	
GENERAL OBJECTIVE 6.0: Know natural defense compounds (phenolics, antioxidants) in perishables and semi-perishables of agricultural produce.						
12 – 15	6.1 Define natural defense compounds (phenolics, antioxidants) in perishables 6.2 Explain the role of natural defense compounds (phenolics, antioxidants) in perishables. 6.3 Describe pre-harvest factors (nutrients, water, field heat) effects on postharvest	• Define natural defense compounds (phenolics, antioxidants) in perishables • Discuss the role of natural defense compounds (phenolics, antioxidants) in perishables. • Explain pre-harvest factors (nutrients, water, field heat) effects on postharvest	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet, Enzyme reaction diagram; Phenolic biosynthesis poster; Harvest video (pre-cooling	• Test enzymatic browning inhibition • Use citric acid, ascorbic acid, and blanching. • Conduct a simple shelf life experiment with 3 storage conditions (ambient, fridge, zero-energy cool chamber) • Perform a postharvest handling protocol based on produce biology for a given perishable. • Reports findings	Guide students to: • Test enzymatic browning inhibition • Use citric acid, ascorbic acid, and blanching. • Conduct a simple shelf life experiment with 3 storage conditions (ambient, fridge, zero-energy cool chamber) • Perform a postharvest handling protocol based on produce biology for a given perishable.	-Apple slices, citric acid, ascorbic acid, hot water bath, timer, color scorecard. Evaporative cooler (clay pot), fridge, ambient rack, tomatoes/leafy veg.

	shelf life of perishables. 6.4 Explain biological principles into postharvest loss reduction strategies.	shelf life of perishables • Explain biological principles into postharvest loss reduction strategies	need FAO loss data; Case study: Kenya tomato value chain;		• Reports findings	
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COURSE ASSESSMENT:

Course work:	10%
Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%



INTRODUCTION TO POSTHARVEST EQUIPMENT, TOOLS AND PRECISION INSTRUMENTS

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO POSTHARVEST EQUIPMENT, TOOLS AND PRECISION INSTRUMENTS	COURSE CODE: PPT 112	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNITS: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills in modern postharvest equipment, precision instruments, digital sensors, calibration procedures and maintenance practices used in postharvest operations.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Know standard postharvest quality-testing instruments; 2.0 Understand electronic measurement and digital sensor equipment for postharvest monitoring; 3.0 Know precision instruments for gas, ethylene and quality assessment; 4.0 Know IoT-enabled environmental monitoring equipment. 5.0 Know routine maintenance and calibration of postharvest instruments		

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO POSTHARVEST EQUIPMENT, TOOLS & PRECISION INSTRUMENTS			COURSE CODE: PPT 112		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNITS: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with hands-on competency in modern postharvest equipment, precision instruments, digital sensors, calibration procedures and maintenance practices used in postharvest operations.						
GENERAL OBJECTIVE 1.0: Know standard postharvest quality-testing instruments.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 List quality-testing instruments:(refractometer, penetrometer, colour charts, and moisture meters). 1.2 Describe their measurement principles. 1.3 Explain their application for each produce type.	• Explain quality-testing instruments: (refractometer, penetrometer, colour charts, and moisture meters). • Explain their measurement principles • Explain their application for each produce type.	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Measure Brix using a refractometer • Use penetrometer Measure Firmness on 5 fruit types. • Record results • Compare results • Tabulate results with appropriate units. • Compare manual vs. digital models • Show care and storage procedures. • Record findings an • Present in class	Guide students to: • Measure Brix using a refractometer • Use penetrometer Measure Firmness on 5 fruit types. • Record results • Compare results • Tabulate results with appropriate units. • Compare manual vs. digital models • Show care and storage procedures. • Record findings an • Present in class	Specimens/samples, writing materials, worksheets, projector, Penetrometer, refractometer
GENERAL OBJECTIVE 2.0: Understand electronic measurement and digital sensor equipment for postharvest monitoring.						
3 – 5	2.1 Describe electronic moisture meters, digital weighing	• Explain electronic moisture meters, digital weighing	Laptop computers, smart	• Operate a digital moisture meter • Record readings	Guide students to: • Operate a digital moisture meter	Specimens/samples, , worksheets, projector electronic moisture

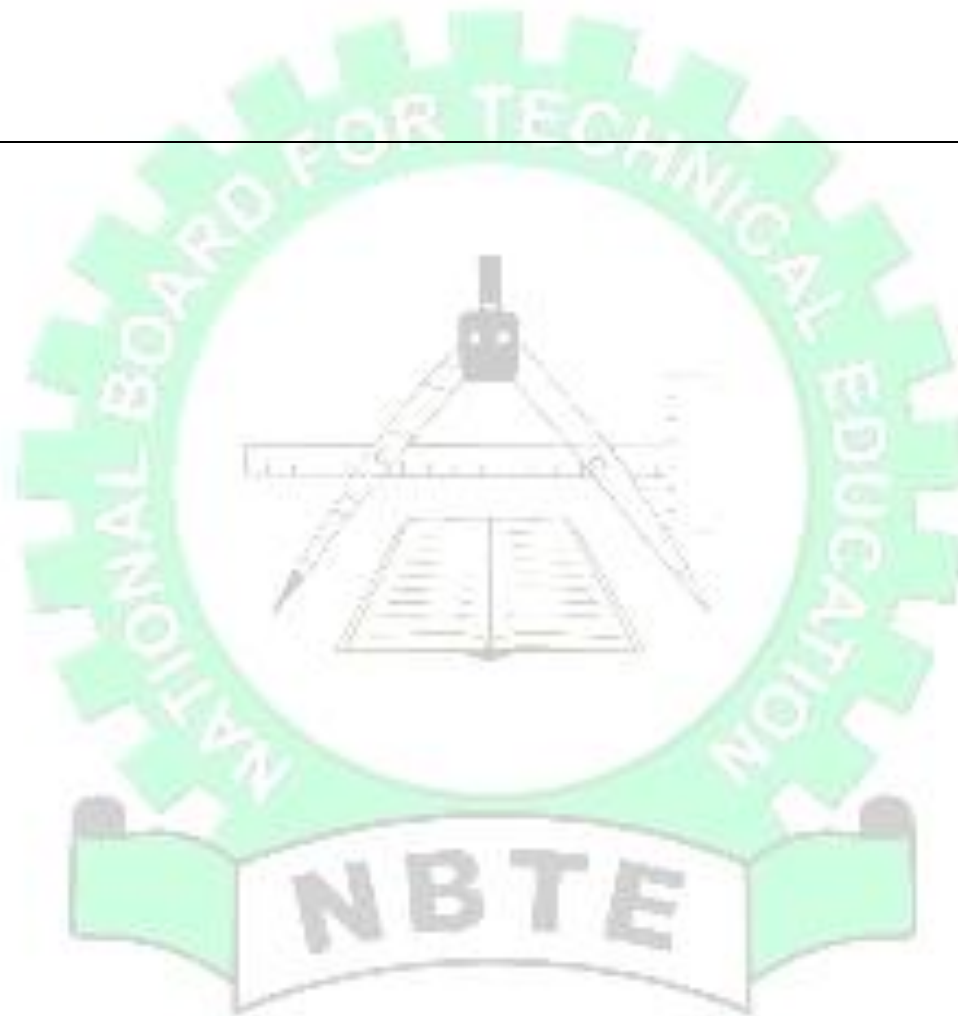
	systems, and automated sorting/grading equipment. 2.2 Describe their role in quality assurance and commercial produce grading. 2.3 Outline maintenance requirement of each of the tools mentioned above.	systems, manual and automated sorting/grading equipment. • Explain their role in quality assurance and commercial produce grading. • Explain maintenance requirement of each of the tools mentioned above	board, projector, writing materials, whiteboard, markers, internet	across 4 produce types. • Use grading rings • Record produce size grades. • Demonstrate electronic measurement principles; • Demonstrate moisture meter calibration; • Show automated grading line videos • Carry out calibration frequency requirements • Report findings	• Record readings across 4 produce types. • Use grading rings • Record produce size grades. • Demonstrate electronic measurement principles; • Demonstrate moisture meter calibration; • Show automated grading line videos • Carry out calibration frequency requirements Report findings	meters, digital weighing systems, automated sorting/grading equipment.
GENERAL OBJECTIVE 3.0: Know precision instruments for gas, ethylene, and quality assessment.						
6 – 7	3.1 Describe precision postharvest instruments. 3.2 Discuss their role in atmosphere management and ripening control 3.3 Outline maintenance requirement of each of the tools mentioned above	• Explain precision postharvest instruments: (portable ethylene analysers, CO₂/O₂ sensors, and gas chromatographs) Explain their role in atmosphere management and ripening control. • Explain maintenance	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Measure ethylene and CO₂ from 5 produce samples using portable analysers. • Record data • Interpret results relative to storage requirements. • Carry out gas analysis instrumentation • Demonstrate	Guide students to: • Measure ethylene and CO₂ from 5 produce samples using portable analysers. • Record data • Interpret results relative to storage requirements. • Carry out gas analysis instrumentation	Specimens/samples, writing materials, worksheets, projector portable ethylene analysers, CO₂/O₂ sensors, and gas chromatographs

		requirement of each of the tools mentioned above		ethylene analyser operation • Show GC output interpretation • Demonstrate instrument procurement and maintenance. • Documents findings	• Demonstrate ethylene analyser operation • Show GC output interpretation • Demonstrate instrument procurement and maintenance. Documents findings	
GENERAL OBJECTIVE 4.0: Know IoT-enabled environmental monitoring equipment						
8 – 11	4.1 Define IoT in relation to produce tracking and monitoring of perishables. 4.2 Describe IoT-enabled environmental monitoring. 4.3 Discuss the following IoT equipment: Temperature/humidity data loggers, Ethylene sensors Cloud transmission systems, Alert mechanisms for cold store management.	• Explain IoT in relation to produce tracking and monitoring of perishables • Explain IoT-enabled environmental monitoring • Explain the following IoT equipment's: Temperature/humidity data loggers, Ethylene sensors Cloud transmission systems, Alert mechanisms for cold store management.	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Set up an IoT temperature/humidity data logger in a simulated storage environment. • Configure an IoT temperature/humidity data logger in a simulated storage environment. • Download 48-hour data and interpret temperature/humidity trends. • Demonstrate IoT sensor technology • Show data logger setup and configuration • Demonstrate cloud dashboard interface and alert threshold	Guide students to: • Set up an IoT temperature/humidity data logger in a simulated storage environment. • Configure an IoT temperature/humidity data logger in a simulated storage environment. • Download 48-hour data and interpret temperature/humidity trends. • Demonstrate IoT sensor technology • Show data logger setup and configuration • Demonstrate cloud dashboard interface	Specimens/samples, writing materials, worksheets, projector Temperature/humidity data loggers, Ethylene sensors Cloud transmission systems, Alert mechanisms.

				setting.	and alert threshold setting.	
GENERAL OBJECTIVE 5.0: Know routine maintenance and calibration of postharvest instruments.						
12 – 15	5.1 Describe routine and quarterly maintenance of postharvest equipment. 5.2 Outline cleaning procedures, calibration verification, safe storage of postharvest equipment. 5.3 Explain maintenance record-keeping of postharvest equipment.	• Explain routine and quarterly maintenance of postharvest equipment: • Explain cleaning procedures, calibration verification, safe storage of postharvest equipment: • Discuss maintenance record-keeping of postharvest equipment	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Conduct a maintenance exercise. • Demonstrate a standard maintenance record log with date, instrument, and actions taken. • Carry out pre and post operation maintenance procedures • Demonstrate calibration and verification • Show maintenance log templates; Demonstrate consequences of poor equipment maintenance • Record findings	Guide students to: • Conduct a maintenance exercise: clean, calibrate, and store. • Demonstrate a standard maintenance record log with date, instrument, and actions taken. • Carry out pre and post operation maintenance procedures • Demonstrate calibration and verification • Show maintenance log templates • Demonstrate consequences of poor equipment maintenance • Record findings	Laptop computers, laboratory equipment, instruments, specimens/samples, writing materials, worksheets, projector

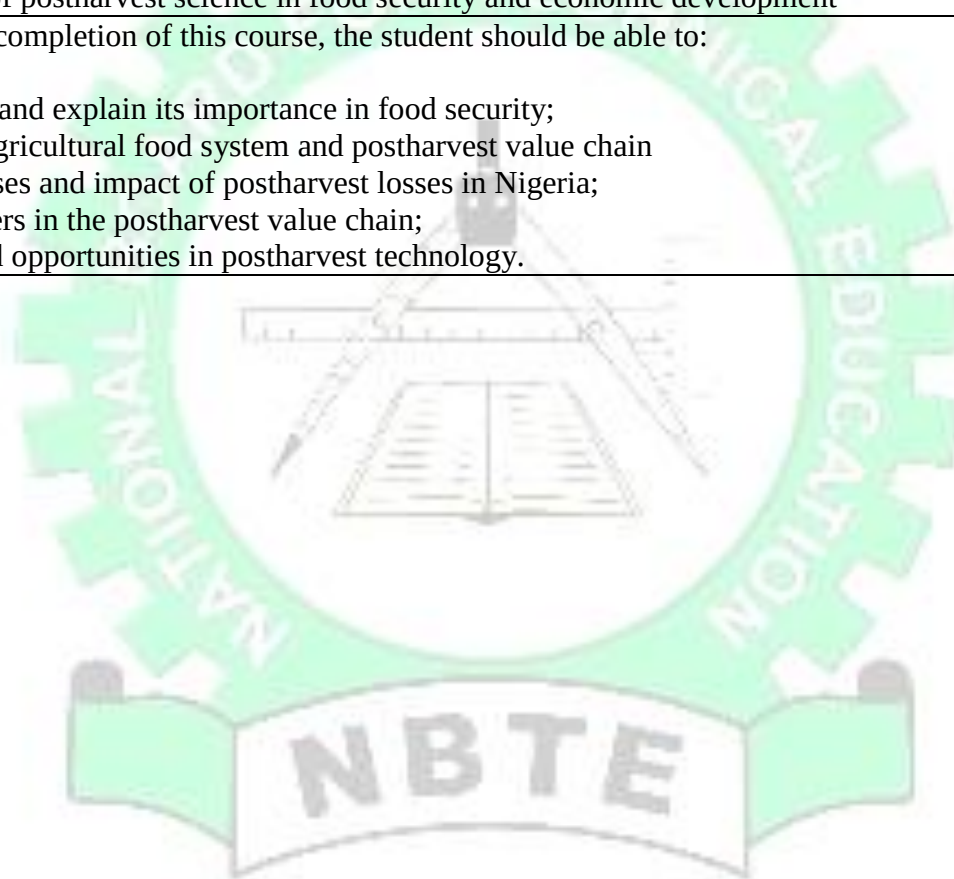
COURSE ASSESSMENT:

Course work:	10%
Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%



INTRODUCTION TO POSTHARVEST SCIENCE AND FOOD SYSTEMS

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO POSTHARVEST SCIENCE AND FOOD SYSTEMS	COURSE CODE: PPT 113	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNITS: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills of postharvest science, food systems, Nigeria's postharvest losses and the global importance of postharvest science in food security and economic development		
GENERAL OBJECTIVES: On completion of this course, the student should be able to:		
1.0 Know postharvest science and explain its importance in food security; 2.0 Understand the Nigerian agricultural food system and postharvest value chain 3.0 Understand the scope, causes and impact of postharvest losses in Nigeria; 4.0 Understand key stakeholders in the postharvest value chain; 5.0 Know career pathways and opportunities in postharvest technology.		



PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO POSTHARVEST SCIENCE AND FOOD SYSTEMS			COURSE CODE: PPT 113		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNITS: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills of postharvest science, food systems, Nigeria's postharvest losses and the global importance of postharvest science in food security and economic development						
GENERAL OBJECTIVE 1.0: Know postharvest science and explain its importance in food security.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Define postharvest science 1.2 Describe the scope of postharvest from harvest to consumption. 1.3 Explain the relationship between postharvest management and food security, 1.2 Outline Sustainable Development Goal No. 2 (SDG 2) (Zero Hunger)	• Explain postharvest science Explain postharvest scope from harvest to consumption. • Discuss the relationship between postharvest management, food security • Explain Sustainable Development Goals 2 (SDG 2) (Zero Hunger) with supporting FAO statistics.	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Conduct a market survey • Visit a local market, • Conduct a postharvest assessment • Observe types of produce loss • Write a report on findings including photographs or sketches.	Guide students to: • Conduct a market survey • Visit a local market, • Conduct a postharvest assessment • Observe types of produce loss • Write a report on findings including photographs or sketches.	Laptop Computers, Laboratory equipment, instruments, Specimens/samples, writing materials, worksheets, projector Internet
GENERAL OBJECTIVE 2.0: Understand the Nigerian agricultural food system and postharvest value chain.						
3 – 5	2.1 Describe Nigeria's agricultural food system 2.2 Explain production zones of crops, market structures and value chain actors.	• Explain Nigeria's agricultural food system • Discuss production zones, Key crops Market structures Value chain actors.	Laptop computers, smart board, projector, writing materials,	• Map the value chain for one Nigerian crop (tomato, Maize, Yam etc) • Profile all	Guide students to: • Map the value chain for one Nigerian crop (tomato, Maize, Yam etc) • Profile all actors	Computers Laboratory equipment Specimen/sample s, writing materials,

	2.3 Describe the contribution of agriculture to Nigeria's GDP and export earnings.	• Explain the contribution of agriculture to Nigeria's GDP and export earnings.	whiteboard, markers, internet	actors from farm to consumer. • Draw the value chain diagram with loss points marked.	from farm to consumer. • Draw the value chain diagram with loss points marked. • Report findings	Worksheets projector Card board Cash specimen Food produce samples
GENERAL OBJECTIVE 3.0: Understand the scope, causes, and impact of postharvest losses in Nigeria						
6 – 8	3.1 Describe causes of postharvest losses: biological, mechanical, physiological, chemical, and socioeconomic factors 3.2 Explain impact of postharvest losses in Nigeria 3.3 Describe APHLIS (African Postharvest Losses Information System) estimates for major Nigerian crops.	• Explain causes of postharvest losses: biological, mechanical, physiological, chemical and socioeconomic factors • Discuss the impact of postharvest losses in Nigeria • Explain APHLIS (African Postharvest Losses Information System) estimates for major Nigerian crops.	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Access APHLIS (aphlis.net) to extract loss data for 3 Nigerian crops. • Calculate the economic cost of losses for a typical 1-tonne batch at current market prices of known Nigerian crops. • Record findings	Guide students to : • Access APHLIS (aphlis.net) to extract loss data for 3 Nigerian crops. • Calculate the economic cost of losses for a typical 1-tonne batch at current market prices of known Nigerian crops. • Record findings	cComputers, laboratory equipment writing materials, worksheets, projector Internet
GENERAL OBJECTIVE 4.0: Understand key stakeholders in the postharvest value chain.						
9- 11	4.1 List key postharvest value chain stakeholders: Farmers Aggregators Processors Transporters Retailers Regulators (NAFDAC, SON, NAQS). 4.2 Describe their roles and interactions in a specific	• Explain key postharvest value chain stakeholders: Farmers Aggregators Processors Transporters Retailers Regulators (NAFDAC, SON, NAQS). • Explain their interactions in handling	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Conduct a stakeholder mapping • Conduct a stakeholder interview • Role-play as Farmer, Aggregator, and	• Guide students to: Conduct a stakeholder mapping • Conduct a stakeholder interview • Role-play as Farmer, Aggregator, and Retailer in a supply chain scenario.	Computers, laboratory equipment, writing materials, worksheets, projector Specimens of money

	crop. 4.3 Explain their roles in handling of a named agricultural produce.	of a named agricultural produce • Discuss their roles in handling of a named agricultural produce		Retailer in a supply chain scenario. • Document challenges and opportunities identified. • Present findings	• Document challenges and opportunities identified. • Present findings	
GENERAL OBJECTIVE 5.0: Know career pathways and opportunities in postharvest technology.						
12 – 15	5.1 Describe career pathways in postharvest technology Cold chain management, Export compliance, Food safety, Enterprise development Research and Innovations in food handling. 5.2 Describe professional associations/bodies/institutions in postharvest technology 5.3 Explain certification bodies associated with postharvest handling and management	• Explain career pathways in; Postharvest technology Cold chain management, Export compliance, Food safety, Enterprise development Research and Innovations in food handling. • Discuss professional associations/bodies/institutions in postharvest technology • Explain certification bodies/institutions associated with postharvest handling and management	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Prepare a personal career development plan • Identify 3 career goals that required skills in postharvest handling/management with an action steps. • Present brief overview to class.	• • Guide students to Prepare a personal career development plan • Identify 3 career goals that required skills in postharvest handling/management with an action steps. • Present brief overview to class..	computers, laboratory equipment, Writing materials, worksheets, projector Career planning Canvas Template
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

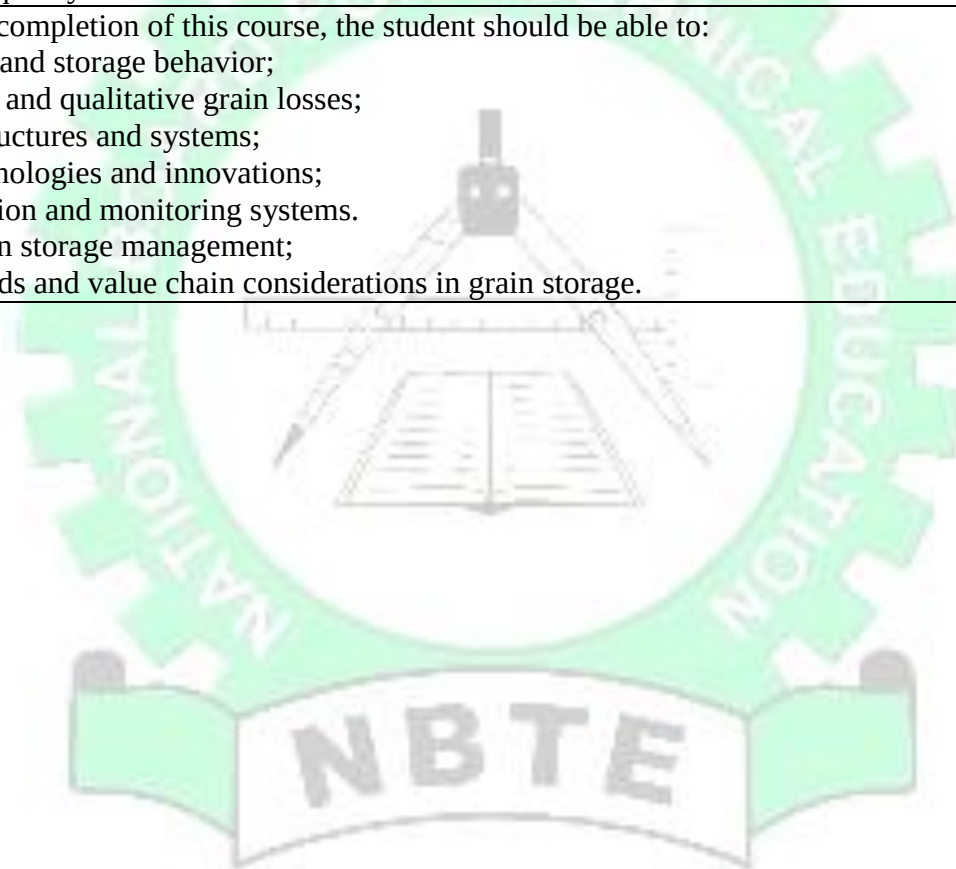
INTRODUCTION TO GRAIN STORAGE AND HERMETIC TECHNOLOGY**PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY**

COURSE TITLE: INTRODUCTION TO GRAIN STORAGE AND HERMETIC TECHNOLOGY	COURSE CODE: PPT 114	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK

GOAL: This course is designed to equip students with the Knowledge and skills in grain storage principles, storage structures and hermetic technologies for preserving grain quality.

GENERAL OBJECTIVES: On completion of this course, the student should be able to:

- 1.0 Understand grain properties and storage behavior;
- 2.0 Know causes of quantitative and qualitative grain losses;
- 3.0 Understand grain storage structures and systems;
- 4.0 Know hermetic storage technologies and innovations;
- 5.0 Know storage safety, sanitation and monitoring systems.
- 6.0 Know practical skills in grain storage management;
- 7.0 Understand policies, standards and value chain considerations in grain storage.



PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO GRAIN STORAGE AND HERMETIC TECHNOLOGY			COURSE CODE: PPT 114		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the Knowledge and skills in grain storage principles, storage structures and hermetic technologies for preserving grain quality.						
GENERAL OBJECTIVE 1.0: Understand grain properties and storage behavior						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Describe physical and chemical properties of grains. 1.2 Describe the relationship between grain moisture, temperature, and storability. 1.3 Define equilibrium moisture content (EMC). 1.4 Outline the significance of EMC.	• Explain physical and chemical properties of grains (moisture content, bulk density, porosity and proximate properties) • Explain the relationship between grain moisture, temperature, and storability • Explain equilibrium moisture content (EMC) Explain the significance of EMC	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentari es Journals Grain samples, moisture meter, EMC tables, Multi-media Boards, textbooks	• Determine moisture content of grain samples using a grain moisture meter • Compare bulk density of different grain types • Record findings • Conduct a simple grain moisture determination using salt/sugar and a tin or bottle	Guide students to: • Determine moisture content of grain samples using a grain moisture meter • Compare bulk density of different grain types • Record findings • Conduct a simple grain moisture determination using salt/sugar and a tin or bottle	Grain samples (maize, sorghum, beans) Moisture meter Measuring cylinders Weighing balance Salt Sugar Tin Glass bottle
GENERAL OBJECTIVE 2.0: Know causes of quantitative and qualitative grain losses						
3 – 5	2.1 Explain grain losses: quantitative	• Explain grain losses: quantitative (weight	Textbooks Articles	• Inspect grain samples for pest damage, mould	• Guide students to: Inspect grain samples	Grain samples Magnifying

	(weight loss) vs qualitative (nutritional, sensory) 2.2 Describe biotic loss agents: insects, rodents, birds, moulds 2.3 Describe abiotic losses: improper drying, high temperature, mechanical damage, etc.	loss) vs qualitative (nutritional, sensory) • Describe biotic loss agents: insects, rodents, birds, moulds • Describe abiotic losses: improper drying, high temperature, mechanical damage, etc.	Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Damaged grain samples, Multi-media Boards, video resources,	growth, and foreign matter • Calculate weight loss percentage from infested vs healthy grain samples • Carry out cost benefit analysis between the infested grains and non-infested grains • Record findings	for pest damage, mould growth, and foreign matter • Calculate weight loss percentage from infested vs healthy grain samples • Carry out cost benefit analysis between the infested grains and non-infested grains • Record findings	lens Weighing balance Worksheets Sieves
GENERAL OBJECTIVE 3.0: Understand grain storage structures and systems						
6 – 7	3.1 Describe traditional storage structures (cribs, pits, clay pots, jute bags etc.) 3.2 Describe improved and modern structures (metal silos, concrete silos, warehouses etc.) 3.3 Compare capacities, costs, and performance of different storage structures.	• Explain traditional storage structures (cribs, pits, clay pots, jute bags etc.) • Explain improved and modern structures (metal silos, concrete silos, warehouses etc.) • Explain capacities, costs, and performance of different storage structures	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Boards, video resources	• Construct a model of a traditional and an improved grain storage structure • Evaluate the model for ventilation, pest resistance, and moisture control	• Guide students to: • Construct a model of a traditional and an improved grain storage structure • Evaluate the model for ventilation, pest resistance, and moisture control	Cardboard Clay or craft materials Construction tools Evaluation rubric Prototype of Traditional and Modern Storage structures
GENERAL OBJECTIVE 4.0: Know hermetic storage technologies and innovations						
8 – 9	4.1 Define hermetic	• Explain hermetic	Textbooks	• Carryout the following:	• Guide students to:	PICS bags/

	storage 4.2 Describe the principle of modified atmosphere through O₂ depletion 4.3 Describe hermetic technologies: PICS bags, SuperGrain bags, metal silos, GrainPro cocoons, etc. 4.4 Describe selection criteria and proper use of hermetic storage systems	storage Explain the principle of modified atmosphere through O₂ depletion Explain hermetic technologies: PICS bags, SuperGrain bags, metal silos, GrainPro cocoons, etc. • Explain selection criteria and proper use of hermetic storage systems	Articles Computer Multi-media Boards White board Marker Educational Videos or Documentari es Journals PICS/hermeti c bags, grain samples, Multi-media Boards, technology brochures	Fill, seal, and store grain in hermetic bags following proper procedure • Monitor O₂ and CO₂ levels inside hermetic bags over 2 weeks using indicator strips	• Fill, seal, and store grain in hermetic bags following proper procedure • Monitor O₂ and CO₂ levels inside hermetic bags over 2 weeks using indicator strips	Zero fly or equivalent Grain samples Gas indicator strips Sealing ropes Data sheets CO₂ monitor GrainPro cocoons samples
GENERAL OBJECTIVE 5.0: Know storage safety, sanitation and monitoring systems						
10 – 11	5.1 Explain pre-storage sanitation procedures (cleaning, disinfection, structural treatment, etc.) 5.2 Describe grain store monitoring: temperature, moisture, pest inspection schedules, etc. 5.3 Outline safety practices in grain stores (fumigation	• Explain pre-storage sanitation procedures (cleaning, disinfection, structural treatment, etc.) • Describe grain store monitoring: temperature, moisture, pest inspection schedules, etc. • Outline safety practices in grain stores (fumigation	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentari es Journals Sanitation checklists, monitoring schedule templates,	• Conduct a simulated grain store sanitation exercise (sweep, spray, record) • Develop a 2-week monitoring schedule for a sample grain store • Visit to warehouse	Guide students to: • Conduct a simulated grain store sanitation exercise (sweep, spray, record) • Develop and implement a 2-week monitoring schedule for a sample grain store • • Visit to warehouse	Cleaning equipment Disinfectant spray, Monitoring forms PPE Grain store model Pallets Fume Extractor Charts

	hazards, structural safety, etc.)	hazards, structural safety, etc.)	Multi-media Boards, PPE samples			
GENERAL OBJECTIVE 6.0: Know practical skills in grain storage management.						
12 – 13	6.1 Describe grain drying methods and target moisture content before storage and need for periodic aeration after storage. 6.2 Explain record-keeping systems for grain inventories and storage logs. 6.3 Outline grain storage management plan for a smallholder farmer.	• Explain grain drying methods and target moisture content before storage • Discuss record-keeping systems for grain inventories and storage logs • Explain grain storage management plan for a smallholder farmer	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Grain drying data, inventory record templates, Multi-media Boards, sample management plans	• Sun-dry grain samples to target moisture content • Verify with moisture meter • Maintain a grain storage inventory log for a 2-week management simulation • Document a grain storage management plan including cost for small holder farmer	Guide students to: • Sun-dry grain samples to target moisture content • Verify with moisture meter • Maintain a grain storage inventory log for a 2-week management simulation • Document a grain storage management plan including cost for small holder farmer	Grain samples Drying surfaces Moisture meter Inventory log templates Weighing balance
GENERAL OBJECTIVE 7.0: Understand policies, standards, and value chain considerations in grain storage						
14 – 15	7.1 Outline Nigerian grain quality standards (SON, NAFDAC, NBMA) and international standards (Codex). 7.2 Describe the role of grain storage in	• Explain Nigerian grain quality standards (SON, NAFDAC, NBMA) and international standards (Codex) Explain the role of grain storage in	Textbooks Articles Computer Multi-media Boards White board Marker Educational	• Review a Nigerian grain standard document. • Identify key quality parameters • Map the grain value chain from production	Guide students to: • Review a Nigerian grain standard document. • Identify key quality parameters • Map the grain value	SON grain standards NAFDAC grain standards NBMA Standards Value chain mapping

	agricultural value chains and food security. 7.3 Discuss government policies and support programmes for grain storage in Nigeria.	agricultural value chains and food security • Explain government policies and support programmes for grain storage in Nigeria	Videos or Documentaries Journals Printed SON standards, value chain diagrams, Multi-media Boards, policy documents	to consumer, highlighting storage nodes • Record findings	chain from production to consumer, highlighting storage nodes • Record findings	templates Multi-media Board
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

INTRODUCTION TO PROFESSIONAL ENGLISH FOR POSTHARVEST PRODUCT TRADE DOCUMENTATION

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO PROFESSIONAL ENGLISH FOR POSTHARVEST PRODUCT TRADE DOCUMENTATION	COURSE CODE: PPT 115	CONTACT HOURS: 2 HOURS/WEEK
	CREDIT UNITS: 2	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 1 HOUR/WEEK
GOAL: This course is designed to equip students with the knowlledge and skills on english writing required for postharvest trade and export documentation.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand accurately in technical agricultural english for professional postharvest documents; 2.0 Know phytosanitary certificates language; 3.0 Understand Hazard Analysis and Critical Control Point (HACCP) audit reports and non-conformance records in formal english; 4.0 Know professional correspondence for export compliance and quality management; 5.0 Understand log frame output reports and executive summaries for donor and government audiences.		



PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO PROFESSIONAL ENGLISH FOR POSTHARVEST PRODUCT TRADE DOCUMENTATION			COURSE CODE: PPT 115		CONTACT HOURS: 2 HOURS/WEEK	
			CREDIT UNITS: 2		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE: NIL		PRACTICAL: 1 HOUR/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowlwdge and skills on english writing required for postharvest trade and export documentation.						
GENERAL OBJECTIVE 1.0: Understand accurately in technical agricultural English for professional postharvest documents						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Explain professional writing principles: formal vs. informal register, accuracy in technical documents. 1.2 Explain common errors in postharvest documentation. 1.3 Outline cost of documentation errors in export.	• Discuss professional writing principles: formal vs. informal register, accuracy in technical documents, etc • Explain common errors in postharvest documentation • Explain cost of documentation errors in export.	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Identify 15 errors in a badly written produce export email. • Rewrite the email in correct professional English. • Display good and bad document examples • Show real NAQS rejection notices caused by documentation errors • Presents reports finding in class	• Guide students to: • Identify 15 errors in a badly written produce export email. • Rewrite the email in correct professional English. • Display good and bad document examples • Show real NAQS rejection notices caused by documentation errors. • Presents reports finding in class	computers, laboratory equipment, instruments, specimens/samples, writing materials, worksheets, projector
GENERAL OBJECTIVE 2.0: Know phytosanitary certificates language						

3 – 5	2.1 Describe International Plants Protection Convention (IPPC) model phytosanitary certificate structure. 2.2 Outline all the mandatory fields, declaration language and probable common errors. 2.3 Explain NAQS electronic issuance procedures in Nigeria.	• Explain International Plants Protection Convention (IPPC) model phytosanitary certificate structure: • Discuss all the mandatory fields, declaration language and probable common errors • Discuss NAQS electronic issuance procedures in Nigeria.	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Complete a mock phytosanitary certificate for a 5-tonne pepper export to the UK using a NAQS template. • Peer-check partner's certificate for language and field errors. • Presents reports finding in class	Guide students to: • Complete a mock phytosanitary certificate for a 5-tonne pepper export to the UK using a NAQS template. • Peer-check partner's certificate for language and field errors. • Presents reports finding in class	Laptop computers, laboratory equipment, instruments, specimens/samples, writing materials, worksheets, projector NAQS Certificates FPIS Certificates NAFDAC Certificate
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GENERAL OBJECTIVE 3.0: Understand Hazard Analysis and Critical Control Point (HACCP) audit reports and non-conformance records in formal english.

6– 8	3.1 Explain HACCP non-conformance report language. 3.2 Explain the non-conformance, corrective action statement and verification language. 3.3 Describe quality certificate structure.	• Discuss HACCP non-conformance report language • Discuss the non-conformance, corrective action statement and verification language • Explain quality certificate structure.	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Write a HACCP non-conformance report for a failed CCP (temperature exceedance in transit). • Complete a SON quality certificate for a batch of dried ginger. • Guide report writing review Return with feedback.	Guide students to: • Write a HACCP non-conformance report for a failed CCP (temperature exceedance in transit). • Complete a SON quality certificate for a batch of dried ginger. • Guide report writing review Return with feedback.	computers, laboratory equipment, instruments, specimens/samples, writing materials, worksheets, projector
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GENERAL OBJECTIVE 4.0: Know professional correspondence for export compliance and quality management.

9 – 11	4.1 Describe formal professional correspondence for export compliance. 4.2 Explain a response to buyer MRL queries. 4.3 Explain a reason for appealing to NAQS rejection notices. 4.4 Describe a written compliance assurance letters.	• Explain formal professional correspondence for export compliance • Explain a response to buyer MRL queries • Discuss a reason for appealing to NAQS rejection notices • Justify a written compliance assurance letters	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Write a formal response to a Dutch importer's MRL compliance query. • Draft a formal appeal letter responding to a provided NAQS export rejection notice. • Show annotated examples of buyer queries and compliant responses • Demonstrate an appeal letter format Guide report writing	Guide students to: • Write a formal response to a Dutch importer's MRL compliance query. • Draft a formal appeal letter responding to a provided NAQS export rejection notice. • Show annotated examples of buyer queries and compliant responses • Demonstrate an appeal letter format Guide report writing	computers, laboratory equipment, specimens/samples, writing materials, worksheets, projector
GENERAL OBJECTIVE 5.0: Understand log frame output reports and executive summaries for donor and government audiences						
12 – 15	5.1 Describe log frame output reporting format for donor and project reports. 5.2 Define executive summary writing. 5.3 Explain food loss reports structure, length, key findings, and recommendations.	• Explain log frame output reporting format for donor and project reports. • Explain executive summary writing • Explain food loss reports structure, length, key findings, and recommendations	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Show a 1-page executive summary • Write a food loss assessment from a provided data summary. • Write 2 log frame output paragraphs for a postharvest development project scenario for a donor agency • Report findings	Guide students to: • Show a 1-page executive summary • Write a food loss assessment from a provided data summary. • Write 2 log frame output paragraphs for a postharvest development project scenario for a donor agency Report findings	computers, laboratory equipment specimens/samples, writing materials, worksheets, projector

COURSE ASSESSMENT:

Course work:	10%
Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%



INTRODUCTION TO POSTHARVEST MICROBIOLOGY

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO POSTHARVEST MICROBIOLOGY	COURSE CODE: PPT 116	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in identifying, controlling, managing microorganisms associated with postharvest deterioration, food spoilage and safety of agricultural produce.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand the fundamentals of microbiology in postharvest systems; 2.0 Know major microorganisms associated with postharvest spoilage; 3.0 Understand microbial contamination pathways in agricultural produce; 4.0 Know methods for prevention and control of postharvest microbial spoilage; 5.0 Understand laboratory skills for microbial detection and analysis; 6.0 Understand food safety principles and public health implications; 7.0 Understand awareness of emerging microbial threats and biotechnology applications in postharvest management.		

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO POSTHARVEST MICROBIOLOGY			COURSE CODE: PPT 116		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in identifying, controlling, managing microorganisms associated with postharvest deterioration, food spoilage and safety of agricultural produce.						
GENERAL OBJECTIVE 1.0: Understand the fundamentals of microbiology in postharvest systems						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Define microbiology and its scope in postharvest technology. 1.2 Describe the major groups of microorganisms (bacteria, fungi, viruses, etc.) 1.3 Explain microbial growth environmental factors.	• Explain microbiology • Discuss its scope in postharvest technology • Describe the major groups of microorganisms (bacteria, fungi, viruses, etc.) • Explain microbial growth environmental factors (temperature, pH, water activity, etc.)	Whiteboard, charts, Multi-media Boards, textbooks on food microbiology Computer	• Prepare wet mount and stained slides of common microorganisms • Examine wet mount • Staine slides of common microorganisms • Sketch microscopic observations of bacterial and fungal cells • Record microscopic observations of bacterial and fungal cells	•Guide students to: Prepare wet mount and stained slides of common microorganisms •Examine wet mount •Stained slides of common microorganisms •Sketch microscopic observations of bacterial and fungal cells •Record microscopic observations of bacterial and fungal cells	Microscopes Slides Staining kits Culture specimens lab manuals

GENERAL OBJECTIVE 2.0: Know major microorganisms associated with postharvest spoilage						
3 – 5	2.1 List principal bacteria, Fungi, etc, causing spoilage of fruits, vegetables, grains etc. 2.2 Describe spoilage symptoms caused by specific pathogens (e.g. Botrytis, Rhizopus, Aspergillus) 2.3 Differentiate spoilage organisms from pathogenic organisms.	• Explain principal bacteria, Fungi, etc, causing spoilage of fruits, vegetables, grains etc. • Explain spoilage symptoms caused by specific pathogens • Differentiate spoilage organisms from pathogenic organisms	Multi-media Boards, spoilage specimen photos, textbooks, printed case studies	• Isolate pathogens from spoiled produce • Sample Culture pathogens from spoiled produce samples • Use colony morphology and microscopy to identify common microorganisms	• Guide students to: Isolate pathogens from spoiled produce samples Culture pathogens from spoiled produce samples • Use colony morphology and microscopy to identify common microorganisms	PDA and NA media Petri dishes Inoculation loops incubator Spoiled produce samples
GENERAL OBJECTIVE 3.0: Understand microbial contamination pathways in agricultural produce						
6 – 7	3.1 Explain pre-harvest, harvest, and post-harvest contamination sources 3.2 Describe cross-contamination mechanisms during handling, packaging, and storage 3.3 State environmental, human, and equipment-related contamination routes	• Explain pre-harvest, harvest, and post-harvest contamination sources • Explain cross-contamination mechanisms during handling, packaging, and storage • Explain environmental, human, and equipment-related contamination	Multi-media Boards, contamination pathway charts, video resources, textbooks	• Conduct swab tests on produce surfaces, packaging materials, • Store equipment Culture swab • Identify microbial load sources	Guide students to: • Conduct swab tests on produce surfaces, packaging materials, • Store equipment Culture swab - Identify microbial load sources	Sterile swabs Nutrient broth Petri dishes Incubator Produce samples Packaging materials

		routes				
GENERAL OBJECTIVE 4.0: Know methods for prevention and control of postharvest microbial spoilage						
8 – 9	4.1 Describe physical control methods (heat treatment, irradiation, UV light, cold storage). 4.2 Explain chemical control methods (fungicides, sanitisers, preservatives). 4.3 Describe biological control approaches (antagonistic yeasts, bacteriophages, essential oils). 4.4 Explain integrated postharvest disease management strategies.	• Explain physical control methods (heat treatment, irradiation, UV light, cold storage) • Discuss chemical control methods (fungicides, sanitisers, preservatives) • Explain biological control approaches (antagonistic yeasts, bacteriophages, essential oils) • Discuss integrated postharvest disease management strategies	Textbooks, journals, printed case studies, Multi-media Boards, whiteboard	• Test efficacy of selected sanitisers and fungicides against common spoilage micro-organisms in vitro • Apply biological agents to inoculate produce • Monitor inhibition	Guide students to: • Test efficacy of selected sanitisers and fungicides against common spoilage micro-organisms in vitro • Apply biological agents to inoculate produce • Monitor inhibition	Agar plates Fungicide solutions Essential oils Disk diffusion Ruler Incubator
GENERAL OBJECTIVE 5.0: Understand laboratory skills for microbial detection and analysis						
10 – 11	5.1 Explain standard microbial enumeration methods (total plate count, Most Probable Number technique (MPN)). 5.2 Describe rapid detection technologies	• Explain standard microbial enumeration methods (total plate count, Most Probable Number technique (MPN)) • Describe rapid detection technologies	Lab manual, whiteboard, Multi-media Boards, journal articles on rapid detection	• Perform total plate count (TPC) on fruit and vegetable samples • Calculate microbial counts using appropriate units • Report microbial counts using appropriate units	Guide students to: • Perform total plate count (TPC) on fruit and vegetable samples • Calculate microbial counts using appropriate units • Report microbial counts using appropriate units	Nutrient agar Pipettes Colony counter Incubator laboratory balance worksheets

	(Polymerase Chain Reaction (PCR), immunoassay, biosensors). 5.3 Explain microbial count results against food safety limits.	(Polymerase Chain Reaction (PCR)), immunoassay, biosensors) • Explain microbial count results against food safety limits			appropriate units	
GENERAL OBJECTIVE 6.0: Understand food safety principles and public health implications						
12 – 13	6.1 Explain Hazard Analysis and Critical Control Point (HACCP) principles as applied to postharvest produce. 6.2 Describe mycotoxins (aflatoxins, fumonisins) and their health significance. 6.3 Outline national and international food safety regulations (SON, Codex Alimentarius).	• Explain Hazard Analysis and Critical Control Point (HACCP) principles as applied to postharvest produce • Describe mycotoxins (aflatoxins, fumonisins) and their health significance • Explain national and international food safety regulations (SON, Codex Alimentarius)	HACCP charts, printed Codex standards, Multi-media Boards, textbooks	• Selected postharvest operation • Develop a simple HACCP plan • Perform a thin-layer chromatography (TLC) • Demonstrate aflatoxin detection	Guide students to: • Selected postharvest operation • Develop a simple HACCP plan • Perform a thin-layer chromatography (TLC) Demonstrate aflatoxin detection	TLC plates Aflatoxin standards UV lamp HACCP templates Printed guidelines
GENERAL OBJECTIVE 7.0: Understand awareness of emerging microbial threats and biotechnology applications in postharvest management						
14 – 15	7.1 List emerging postharvest	• Explain emerging postharvest	Multi-media Boards,	• Carry out a review on a current postharvest	Guide students to: • Carry out a review	Library/internet access

	pathogens and antimicrobial resistance trends. 7.2 Describe applications of probiotics, biocontrol agents, and the genetics in postharvest microbiology. 7.3 State the advantages and disadvantages of biotechnology application in PPT.	pathogens and antimicrobial resistance trends • Explain applications of probiotics, biocontrol agents, and the genetics in postharvest microbiology • Explain the advantages and disadvantages of biotechnology application in PPT	current journal articles, internet resources	microbial threat or biotechnology solution from journals or proceedings • Present report findings	on a current postharvest microbial threat or biotechnology solution from journals or proceedings • Present report findings	Presentation materials Marking rubric
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



YEAR I SEMESTER II COURSES

INTRODUCTION TO INTEGRATED PEST MANAGEMENT AND STORED GRAIN TOXICOLOGY

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO INTEGRATED PEST MANAGEMENT AND STORED GRAIN TOXICOLOGY	COURSE CODE: PPT 121	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills on managing storage pests using integrated approaches while understanding toxicological implications of pest control chemicals.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Know common pests of stored grains and their biology; 2.0 Understand economic and qualitative losses caused by storage pests; 3.0 Know cultural, physical, biological and chemical pest control methods; 4.0 Understand toxicology and safe use of pesticides in grain storage; 5.0 Know skills in pest surveillance, monitoring, and evaluation 6.0 Understand regulatory frameworks and occupational safety in pest management; 7.0 Understand principles of integrated pest management in stored products		

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO INTEGRATED PEST MANAGEMENT AND STORED GRAIN TOXICOLOGY			COURSE CODE: PPT 121		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in managing storage pests using integrated approaches while understanding toxicological implications of pest control chemicals.						
GENERAL OBJECTIVE 1.0: Know common pests of stored grains and their biology						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Name major insect pests of stored grains. 1.2 Explain the classification of major insect pests of stored grains (weevils, beetles, moths,etc.) 1.3 Describe the life cycle and feeding habits of key storage pests. 1.4 Discuss rodents and their roles in grain deterioration. 1.5 Explain mites and their roles in grain deterioration.	• State major insect pests of stored grains. • Explain the classification of major insect pests of stored grains (weevils, beetles, moths,etc.) • Describe the life cycle and feeding habits of key storage pests. • Discuss rodents and their roles in grain deterioration. • Explain mites and their roles in grain deterioration.	Multi-media Boards, current journal articles, internet resources	• Identify five stored-grain insect pests using identification keys • Dissect major body parts of collected specimens • Sketch major body parts of collected specimens	Guide students to: • Identify five stored-grain insect pests using identification keys • Dissect major body parts of collected specimens Sketch major body parts of collected specimens	Specimen jars Dissection kits Identification keys Microscopes Drawing materials Grains

	1.6 Explain methods of control for rodents and mites in storage.	deterioration. • 1.6 Explain methods of control for rodents and mites in storage.				
GENERAL OBJECTIVE 2.0: Understand economic and qualitative losses caused by storage pests						
3 – 5	2.1 Explain grain weight loss caused by pests infestations. 2.2 Describe qualitative losses: nutritional degradation, contamination, mycotoxin development. 2.3 Explain economic impacts of storage losses on farmers and national food security.	• Discuss grain weight loss caused by pests infestations • Explain qualitative losses: nutritional degradation, contamination, mycotoxin development • Discuss economic impacts of storage losses on farmers and national food security	Multi-media Boards, current journal articles, internet resources	• Calculate percentage weight loss in infested grain samples • Conduct sensory and visual quality assessment of pest-damaged grain • Quantify grain weight loss caused by insect and rodent infestations	Guide students to: • Calculate percentage weight loss in infested grain samples • Conduct sensory and visual quality assessment of pest-damaged grain • Quantify grain weight loss caused by insect and rodent infestations	Grain samples (infested and healthy) Weighing balance Worksheets Sensory assessment forms
GENERAL OBJECTIVE 3.0: Know cultural, physical, biological and chemical pest control methods						
6 – 7	3.1 Describe cultural control (hygiene, rotation, proper drying, etc.) 3.2 Explain physical methods (heat treatment, cold storage, hermetic sealing,	• Explain cultural control (hygiene, rotation, proper drying, etc.) • Describe physical methods (heat treatment, cold storage, hermetic sealing,	Multi-media Boards, current journal articles, internet resources	• Demonstrate application of diatomaceous earth on grain samples • Conduct a fumigation simulation exercise using safe analogues • Apply a biopesticide • Record pest mortality	Guide students to: • Demonstrate application of diatomaceous earth on grain samples • Conduct a fumigation simulation exercise using safe	Diatomaceous earth Grain samples Personal Protective Equipment (PPE) Biopesticide samples Fumigation simulation kit

	diatomaceous earth). 3.3 Describe biological control agents (predators, parasitoids, bio-pesticides, etc.) 3.4 Explain chemical control (fumigants, pesticides) and their safe application.	diatomaceous earth) • Explain biological control agents (predators, parasitoids, biopesticides, etc.) • Describe chemical control (fumigants, pesticides) and their safe application		over 48 hours	analogues • Apply a biopesticide • Record pest mortality over 48 hours	Pesticides samples Sprayers
GENERAL OBJECTIVE 4.0: Understand toxicology and safe use of pesticides in grain storage						
8 – 9	4.1 Define toxicology and explain key terms (LD50, ADI, MRL). 4.2 Describe routes of pesticide exposure and health effects. 4.3 Explain pesticide residue regulations and pre-harvest intervals. 4.4 Outline first aid procedures for pesticide poisoning.	• Explain toxicology and explain key terms (LD50, ADI, MRL) Outline routes of pesticide exposure and health effects • Discuss pesticide residue regulations and pre-harvest intervals • Explain first aid procedures for pesticide poisoning	Multi-media Boards, current journal articles, internet resources	• Interpret pesticide label and safety data sheets • Practice correct donning and doffing of PPE for pesticide handling	Guide students to: • Interpret pesticide label and safety data sheets • Practice correct donning and doffing of PPE for pesticide handling	Pesticide label samples, PPE sets Safety data sheets
GENERAL OBJECTIVE 5.0: Know skills in pest surveillance, monitoring and evaluation						
10 – 11	5.1 Describe pest monitoring tools (pheromone traps, probe traps, grain	• Explain pest monitoring tools (pheromone traps, probe traps, grain probes, etc.)	Multi-media Boards, current journal articles, internet	• Set up pheromone traps in a simulated store environment • Record catch data	Guide students to: • Set up pheromone traps in a simulated store environment	Pheromone traps Graph paper Data recording sheets Simulated store area

	probes, etc.) 5.2 Describe sampling plans and record-keeping for surveillance. 5.3 Explain IPM programme effectiveness using monitoring data.	• Outline sampling plans and record-keeping for surveillance • Discuss IPM programme effectiveness using monitoring data	resources	• Plot pest population trends • Prepare a monitoring report with recommendations	• Record catch data • Plot pest population trends • Prepare a monitoring report with recommendations	
GENERAL OBJECTIVE 6.0: Understand regulatory frameworks and occupational safety in pest management						
12 – 13	6.1 Outline NAFDAC, NESREA and SON regulations on pesticide registration and use. 6.2 Outline International regulations on pesticide registration and use. 6.3 Describe occupational health and safety requirements for pest control operators.	• Explain NAFDAC, NESREA and SON regulations on pesticide registration and use • Discuss International regulations on pesticide registration and use • Explain occupational health and safety requirements for pest control operators	NAFDAC, NESREA and SON guidelines International pesticide regulations Multi-media Boards, current journal articles, internet resources	• Review the National pesticide registration regulation • Review the International pesticide registration regulation • Present key safety requirements	Guide students to: • Review the National pesticide registration regulation • Review the International pesticide registration regulation • Present key safety requirements	Printed regulatory documents by NAFDAC, NESREA and SON Multi-media Boards presentation materials
GENERAL OBJECTIVE 7.0: Understand principles of integrated pest management (IPM) in stored products						
14 – 15	7.1 Define IPM 7.2 Explain components of	• Define IPM • Explain its components	Multi-media Boards, current journal	• Examine stored grain samples for pest infestation levels	Guide students to: • Examine stored grain samples for	Grain samples Sieves Magnifying

	IPM. 7.3 Describe the role of IPM in reducing postharvest grain losses. 7.4 Explain economic threshold and action threshold concepts.	• Describe the role of IPM in reducing postharvest grain losses • Explain economic threshold and action threshold concepts	articles, internet resources, IPM charts, FAO IPM guidelines	• Use decision matrices to recommend IPM action based on sample data	pest infestation levels • Use decision matrices to recommend IPM action based on sample data	lenses IPM guidelines Insect Chart/ Calender
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

INTRODUCTION TO CONTROLLED AND MODIFIED ATMOSPHERE STORAGE

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO CONTROLLED AND MODIFIED ATMOSPHERE STORAGE	COURSE CODE: PPT 122	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNITS: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills of atmospheric manipulation technologies for extending shelf life and preserving quality of fresh and processed produce.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand simple definitions and concepts in weather and climate; 2.0 Know principles of respiration and atmospheric composition in storage; 3.0 Know the difference between controlled, modified and passive atmosphere systems; 4.0 Know equipment and technologies used in CA/MA systems; 5.0 Know atmospheric storage principles of fruits, vegetables and grains; 6.0 Know advantages and limitations of atmospheric storage technologies; 7.0 Understand practical skills in atmosphere packaging and storage management. 8.0 Understand safety, economic and environmental considerations of CA/MA technology.		

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO CONTROLLED AND MODIFIED ATMOSPHERE STORAGE			COURSE CODE: PPT 122		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNITS: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills of atmospheric manipulation technologies for extending shelf life and preserving quality of fresh and processed produce.						
GENERAL OBJECTIVE 1.0: Understand simple definitions and concepts in weather and climate						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Define the following terms: i. Weather ii. Climate iii. Humidity iv. Evaporation v. Transpiration vi. Evapo-transpiration vii. Pressure and pressure pattern viii. Insolation ix. Aridity x. Precipitation xi. Sunshine xii. Wind. 1.2 Explain the relationship between weather and climate.	• Explain the following terms: - Weather - Climate - Humidity - Evaporation - Transpiration - Evapo-Transpiration - Pressure and pressure pattern - Insolation - Aridity - Precipitation - Sunshine - Wind. • Explain the relationship between weather	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals	• Make visual weather Observe over a 2 week period • Keep weather diary Make concurrent visual observation of some fresh fruits and vegetables samples over the two week period • Keep diary of effect of weather on the fresh fruits and vegetable.	Guide student to: • Make visual weather Observe over a 2 week period • Keep weather diary Make concurrent visual observation of some fresh fruits and vegetables samples over the two week period • Keep diary of effect of weather on the fresh fruits and vegetable	Diary for each student Samples of Basic fruits and vegetables in season

	1.3 Explain the concept of climate as a natural resource.	and climate • Explain the concept of climate as a natural resource				
GENERAL OBJECTIVE 2.0: Know principles of respiration and atmospheric composition in storage						
3 – 5	2.1 Define respiration. 2.2 Explain aerobic vs anaerobic pathways in stored produce. 2.3 Describe the role of CO ₂ , O ₂ , and ethylene in ripening and senescence. 2.4 Explain how atmospheric modification slows metabolic processes.	• Explain respiration • Explain aerobic vs anaerobic pathways in stored produce • Outline the role of CO ₂ , O ₂ , and ethylene in ripening and senescence • Describe how atmospheric modification slows metabolic processes	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Multi-media Boards Respiration charts Textbooks on postharvest physiology	• Measure respiration rate of selected fruits using a simple closed-jar CO ₂ method • Record respiration rates under different temperature conditions	Guide students to: • Measure respiration rate of selected fruits using a simple closed-jar CO ₂ method • Record respiration rates under different temperature conditions	Closed jars, CO ₂ indicator solution Thermometer Fresh produce samples Worksheets Potable CO ₂ and O ₂ Analyzer Penetrometer Refractometer Refrigerator Data recording worksheet Pressure test chamber MAP packaging materials Glass flushing apparatus
GENERAL OBJECTIVE 3.0: Know the difference between controlled, modified, and passive atmosphere systems						
6 – 7	3.1 Define Controlled Atmosphere (CA), Modified Atmosphere (MA), and Passive Atmosphere (equilibrium MA).	• Explain CA, MA, and passive atmosphere (equilibrium MA) Compare CA, MA, and passive atmosphere	Textbooks Articles Computer Multi-media Boards White board Marker Educational	• Set up simple modified atmosphere packaging using polyethylene bags with sachets. • Monitor O ₂ and	Guide students to: • Set up simple modified atmosphere packaging using polyethylene bags with	Polyethylene bags O ₂ and CO ₂ absorber sachets Gas analyser/indicator strips, Fresh produce

	3.2 Compare CA, MA, and passive atmosphere (equilibrium MA). 3.3 Explain how gas composition is maintained in each system. 3.4 Describe typical CA/MA conditions for common commodities (pineapples, tomatoes, grains, etc.)	(equilibrium MA) Explain how gas composition is maintained in each system • Explain typical CA/MA conditions for common commodities (pineapples, tomatoes, grains, etc.)	Videos or Documentaries Journals Comparison charts, Multi-media Boards, commodity-specific CA recommendation tables	CO₂ levels over 5 days using gas analyser or indicator strips	sachets. • Monitor O₂ and CO₂ levels over 5 days using gas analyser or indicator strips	
GENERAL OBJECTIVE 4.0: Understand equipment and technologies used in CA/MAP systems						
8 – 9	4.1 Describe CA room construction features (gas-tight sealing, scrubbers, sensors, etc.) 4.2 Explain MAP machinery (vacuum sealers, gas flushing equipment, modified atmosphere packaging lines). 4.3 List sensors and monitoring instruments used in atmosphere management.	• Explain CA room construction features (gas-tight sealing, scrubbers, sensors, etc.) • Explain MAP machinery (vacuum sealers, gas flushing equipment, modified atmosphere packaging lines) • Explain sensors and monitoring instruments used in atmosphere	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Equipment diagrams, Multi-media Boards, CA facility video, component samples	• Operate a vacuum/gas flush sealer • Produce MAP samples • Calibrate a handheld gas analyser to measure headspace composition	Guide students to: • Operate a vacuum/gas flush sealer • Produce MAP samples Calibrate a handheld gas analyser to measure headspace composition	Vacuum sealer Gas flush kit Gas analyser Packaging films Fresh produce

		management				
GENERAL OBJECTIVE 5.0: Know atmospheric storage principles to fruits, vegetables, and grains						
10 – 11	5.1 Discuss CA/MA conditions for selected fruits (mango, banana, citrus, etc.) 5.2 Describe MA storage for vegetables (leafy greens, tomatoes, peppers, etc.) 5.3 Explain hermetic/CO₂-enriched storage for grains.	• Explain CA/MA conditions for selected fruits (mango, banana, citrus, etc.) • Explain MA storage for vegetables (leafy greens, tomatoes, peppers, etc.) • Explain hermetic/CO₂-enriched storage for grains	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Commodity CA/MA recommendation tables, Multi-media Boards, case study handouts	• Package selected produce under different atmospheric conditions • Monitor quality attributes over time • Compare weight loss, colour, and firmness between MAP • Open-air control samples	Guide students to: • Package selected produce under different atmospheric conditions • Monitor quality attributes over time • Compare weight loss, colour, and firmness between MAP • Open-air control samples	MAP bags, Gas sachets, vacuum sealer, Colour chart, Firmness tester, Weighing balance Closed jars, CO₂ indicator solution Thermometer Fresh produce samples Worksheets Potable CO₂ and O₂ Analyzer Refrigerator Data recording worksheet Pressure test chamber MAP packaging materials Glass flushing apparatus
GENERAL OBJECTIVE 6.0: Know advantages and limitations of atmospheric storage technologies						
12 – 13	6.1 List advantages of CA/MA: extended shelf life, reduced chemical use, quality preservation. 6.2 Describe limitations: high	• Explain advantages of CA/MA: extended shelf life, reduced chemical use, quality preservation	Textbooks Articles Computer Multi-media Boards White board Marker Educational	• Conduct a comparative shelf-life trial between MAP and non-MAP produce • Compile findings on quality retention	• Guide students to: • Conduct a comparative shelf-life trial between MAP and non-MAP produce • Compile findings	MAP and control samples Quality assessment forms, presentation materials Closed jars, CO₂ indicator solution

	capital cost, technical expertise, risk of anaerobic injury. 6.3 Compare CA/MA with conventional cold storage for cost-effectiveness.	• Explain limitations: high capital cost, technical expertise, risk of anaerobic injury • Compare CA/MA with conventional cold storage for cost-effectiveness	Videos or Documentaries Journals Cost data sheets, Multi-media Boards, textbooks, journal articles on CA adoption	differences	on quality retention differences	Thermometer Fresh produce samples Worksheets Potable CO ₂ and O ₂ Analyzer Penetrometer Refractometer Refrigerator Data recording worksheet Pressure test chamber MAP packaging materials Glass flushing apparatus
GENERAL OBJECTIVE 7.0: Know practical skills in atmosphere packaging and storage management						
14	7.1 Explain packaging film selection criteria (permeability, thickness, material type). 7.2 Describe quality management procedures for CA/MA stores. 7.3 Explain record-keeping and troubleshooting in atmosphere storage.	• Explain packaging film selection criteria (permeability, thickness, material type) • Explain quality management procedures for CA/MA stores • Explain record-keeping and troubleshooting in atmosphere storage	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Packaging film samples, CA management logbooks, Multi-media	• Select appropriate packaging films • Produce MAP packages for two different commodities • Maintain a storage log for a 2-week produce • Monitoring exercise	• Guide students to: Select appropriate packaging films • Produce MAP packages for two different commodities • Maintain a storage log for a 2-week produce monitoring exercise	Packaging films Gas sachets Produce samples Storage log templates, labelling materials Gas permeability tester Water vapor tester Micrometer

GENERAL OBJECTIVE 8.0: Understand safety, economic, and environmental considerations of CA/MA technology

15	8.1 Explain O2-deficiency hazards in CA rooms and safety precautions. 8.2 Describe the environmental impact of packaging waste and emerging sustainable alternatives. 8.3 Explain economic feasibility of CA/MA for smallholder farmers.	• Discuss O2-deficiency hazards in CA rooms and safety precautions • Explain the environmental impact of packaging waste and emerging sustainable alternatives • Explain economic feasibility of CA/MA for smallholder farmers	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Safety guidelines, Multi-media Boards, cost- feasibility worksheets	• Participate in a CA room safety drill simulation • Prepare a brief economic feasibility summary for a selected CA/MA system • Select a sustainable packaging alternative for MAP • Document the excersice	Guide students to: • Participate in a CA room safety drill simulation • Prepare a brief economic feasibility summary for a selected CA/MA system • Select a sustainable packaging alternative for MAP • Document the excersice	Safety drill materials, feasibility calculation templates, Multi-media Boards Biodegradable materials Prototype chamber for CA and MA
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COURSE ASSESSMENT:

Course work:	10%
Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%

INTRODUCTION TO FOOD PROCESSING, PACKAGING AND QUALITY CONTROL

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO FOOD PROCESSING, PACKAGING AND QUALITY CONTROL	COURSE CODE: PPT 123	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNITS: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills of food processing, the science of modern packaging materials and the rigorous application of Quality Control (QC) tools in a food production environment.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand food processing technologies and unit operations; 2.0 Understand the chemical and physical properties of modern packaging materials; 3.0 Understand the principles of "Active" and "Intelligent" packaging; 4.0 Know the tools of Statistical Quality Control (SQC); 5.0 Know sensory evaluation techniques for quality assessment; 6.0 Understand laboratory techniques for chemical and microbial quality testing; 7.0 Understand the integration of Quality Assurance (QA) in industrial production.		

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO FOOD PROCESSING, PACKAGING AND QUALITY CONTROL			COURSE CODE: PPT 123		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNITS: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills of food processing, the science of modern packaging materials and the rigorous application of Quality Control (QC) tools in a food production environment.						
GENERAL OBJECTIVE 1.0: Understand food processing technologies and unit operations.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Define unit operations. 1.2 Define food processing. 1.3 Explain methods of processing food. 1.4 Outline food processing technologies. 1.5 Explain extrusion, aseptic processing, and membrane filtration. 1.6 Define process mapping.	• Explain unit operations • Explain food processing • Explain methods of processing food • Explain food processing technologies • Explain extrusion, aseptic processing, and membrane filtration. • Explain process mapping	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Flow diagrams, Projector.	• Design a flow process chart for a multi-stage food product. • Record findings	Guide students to: • Design a flow process chart for a multi-stage food product. • Record findings	Process templates, Flipcharts.
GENERAL OBJECTIVE 2.0: Understand the chemical and physical properties of modern packaging materials.						
3 – 5	2.1 Define packaging material science. 2.2 List different modern packaging	• Explain packaging material science • Explain different modern packaging materials • Explain	Textbooks Articles Computer Projector White board	• Compare glass, metal, plastics, and laminates. • Perform "Water	• Guide students to: • Compare glass, metal, plastics, and laminates.	Micrometers, Heat sealers, Testing weights

	materials. 2.3 State chemical and physical properties of packaging materials. 2.4 Define Material Testing	chemical and physical properties of packaging materials. • Explain Material Testing	Marker Educational Videos or Documentaries Journals Samples of various packaging polymers.	Vapor Transmission Rate" (WVTR) tests on films. • Record findings	• Perform "Water Vapor Transmission Rate" (WVTR) tests on films. • Record findings	
GENERAL OBJECTIVE 3.0: Understand the principles of "Active" and "Intelligent" packaging.						
6 – 7	3.1 Describe "Active" and "Intelligent" packaging. 3.2 Explain the principles of Smart Packaging Systems. 3.3 Explain Oxygen scavengers and Time-Temperature Indicators (TTI). 3.4 Define modified atmosphere setup.	• Explain "Active" and "Intelligent" packaging. • Discuss the principles of Smart Packaging Systems • Discuss Oxygen scavengers and Time-Temperature Indicators (TTI). • Explain modified atmosphere setup	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals TTI stickers, Scavenger sachets.	• Measure the gas composition inside a sealed package. • Record findings	Guide students to: • Measure the gas composition inside a sealed package. • Record findings	Gas analyzer, produce samples, Poly-bags Packaging materials TTI indicators
GENERAL OBJECTIVE 4.0: Understand the tools of Statistical Quality Control (SQC).						
8 – 9	4.1 Define statistical quality control. 4.2 List tools of statistical quality control (SQC). 4.3 Explain Mean () and Range (R) control charts.	• Explain statistical quality control • Explain tools of statistical quality control (SQC). • Explain Mean () and Range (R) control charts.	Textbooks Articles Computer Projector White board Marker Educational Videos or	• Plot a control chart for a batch filling process (e.g., juice volume).	Guide students to: • Plot a control chart for a batch filling process (e.g., juice volume).	Graduated cylinders, Data sets, Graph paper.

	4.4 Define chart construction.	• Explain chart construction	Documentaries Journals SQC software, Statistical tables.			
GENERAL OBJECTIVE 5.0: Understand sensory evaluation techniques for quality assessment.						
10 – 11	5.1 Define Sensory Evaluation. 5.2 Outline sensory evaluation techniques for quality assessment. 5.3 Explain hedonic scales and discriminative testing (Duo-Trio/Triangle). 5.4 Describe taste panel simulation.	• Explain Sensory Evaluation Explain sensory evaluation techniques for quality assessment. • Explain hedonic scales and discriminative testing (Duo-Trio/Triangle). • Explain taste panel simulation	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Sensory booths (simulated), Scorecards.	• Conduct a Triangle Test to detect variations in juice blends • Report findings	Guide students to: • Conduct a Triangle Test to detect variations in juice blends • Report findings	Sample cups, crackers, various juice brands Electronic nose Electronic tongue Texture analyser Colorimeter Moisture analyzer pH meter
GENERAL OBJECTIVE 6.0: Understand laboratory techniques for chemical and microbial quality testing						
12 – 13	6.1 Define laboratory quality testing 6.2 Outline techniques for chemical and microbial quality testing. 6.3 Describe proximate analysis and microbial load limits. 6.4 Explain chemical quality assay	• Explain laboratory quality testing Explain techniques for chemical and microbial quality testing. • Discuss proximate analysis and microbial load limits. • Explain chemical quality assay	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Lab chemicals, Refractometers.	• Determine the Vitamin C or acidity content of a processed fruit. • Report findings	• Guide students to: Determine the Vitamin C or acidity content of a processed fruit. • Report findings	Burettes, Indicators, processed samples pH meters Refractometer Laboratory apparatus

GENERAL OBJECTIVE 7.0: Understand the integration of Quality Assurance (QA) in industrial production.

14 – 15	7.1 Define Quality Assurance (QA). 7.2 Define quality assurance systems integration. 7.3 Explain the application of Quality Assurance (QA) in industrial production. 7.4 State the difference between quality control and quality assurance. 7.5 Describe final quality audit.	• Explain Quality Assurance (QA) Explain quality assurance systems integration Discuss the application of Quality Assurance (QA) in industrial production. • Explain the difference between quality control and quality assurance. • Explain final quality audit	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals QA Manuals, Case studies	• Perform a "Final Product Inspection" including labeling and seal integrity. • Visit to NAFDAC, SON And any other relevant food processing industries	Guide students to: • Perform a "Final Product Inspection" including labeling and seal integrity. • Visit to NAFDAC, SON And any other relevant food processing industries	Vacuum leak testers, weighing scales
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COURSE ASSESSMENT:

Course work:	10%
Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%

INTRODUCTION TO STORED PRODUCT PEST IDENTIFICATION AND BIOASSAY

PROGRAMME: NATIONAL DIPLOMA POSTHARVEST TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO STORED PRODUCT PEST IDENTIFICATION AND BIOASSAY	COURSE CODE: PPT 124	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills to identify major pests of stored agricultural products and conduct bioassays to determine the efficacy of various control agents		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know major insect pests of stored grains and tubers based on morphological characteristics; 2.0 Understand the biology and life cycles of primary and secondary storage pests; 3.0 Understand the nature of damage caused by different stored product pests; 4.0 Understand the principles and techniques of insect culture and maintenance; 5.0 Understand the procedures for conducting toxicity and repellency bioassays; 6.0 Understand the efficacy of botanical and chemical pesticides using standardized methods; 7.0 Understand resistance monitoring and data interpretation in pest management.		

PROGRAMME: NATIONAL DIPLOMA POSTHARVEST TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO STORED PRODUCT PEST IDENTIFICATION AND BIOASSAY				COURSE CODE: PPT 124		CONTACT HOURS: 4 HOURS/WEEK
				CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II				PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills to identify major pests of stored agricultural products and conduct bioassays to determine the efficacy of various control agents						
GENERAL OBJECTIVE 1.0: Know major insect pests of stored grains and tubers based on morphological characteristics.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Describe morphological identification of pests. 1.2 Describe pest collection and sorting. 1.3 Describe Coleoptera (beetles) and Lepidoptera (moths) pests. 1.4 Discuss the following pests: <i>Sitophilus zeamais</i> , <i>Tribolium castenum</i> , <i>Callosobruchus maculatus</i> , <i>Agrotis ipsilon</i> .	• Explain morphological identification of pests • Explain pest collection and sorting • Explain Coleoptera (beetles) and Lepidoptera (moths) pests • Explain the following pests: <i>Sitophilus zeamais</i>, <i>Tribolium castenum</i>, <i>Callosobruchus maculatus</i>, <i>Agrotis ipsilon</i>	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Insect boxes, Stereomicroscopes.	• Collect pests from local stores and classify them into Orders. • Preserve them in an insect box	Guide students to: • Collect pests from local stores and classify them into Orders. • Preserve them in an insect box	Specimen bottles, Hand lenses, Infested grain samples. insect box
General Objective 2.0: Understand the biology and life cycles of primary and secondary storage pests.						
3-4	2.1 Define pest. 2.2 Describe the biology and life cycles of pest.	• Explain pest • Explain the biology	Textbooks Articles Computer	• Set up observation jars for different developmental	Guide students to: • Set up observation jars	Petri dishes, Transparent jars, Muslin

	2.3 Distinguish between primary and secondary pests. 2.4 Discuss the life cycle of observed pests.	and life cycles of pest • Distinguish between primary and secondary pests. • Explain the life cycle of observed pests •	Projector White board Marker Educational Videos or Documentaries Journals Life cycle charts, Projector.	stages. • Record observations and findings.	for different developmental stages. • Record observations and findings.	cloth
General Objective 3.0: Know the nature of damage caused by different stored product pests.						
5-6	3.1 Define damage assessment 3.2 Describe internal vs. external feeding damage. 3.3 Define damage quantification.	• Explain damage assessment • Explain internal vs. external feeding damage. • Explain damage quantification	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals	• Calculate the percentage of bored grains and weight loss. • Record findings	Guide students to: • Calculate the percentage of bored grains and weight loss. • Record findings	Electronic balance, Sieve set, Counting trays.
General Objective 4.0: Understand the principles and techniques of insect culture and maintenance.						
7-8	4.1 Define insect culture techniques. 4.2 Explain environmental requirements for pest breeding. 4.3 Describe culture establishment.	• Explain insect culture techniques • Discuss environmental requirements for pest breeding. • Explain culture establishment	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries	• Start a fresh culture of <i>Callosobruchus maculatus</i> or other insect pest • Record findings	Guide students to: • Start a fresh culture of <i>Callosobruchus maculatus</i> or other insect pest • Record	Autoclave/ Oven, Culture jars, Healthy grain.

			Journals Incubators, RH meters		findings	
General Objective 5.0: Understand the procedures for conducting toxicity and repellency bioassays.						
9-10	5.1 Discuss the principles of bioassay. 5.2 Define LC _{50} and LT _{50} in pest mortality studies. 5.3 Describe the toxicity and repellency bioassays. 5.4 Discuss toxicity testing.	• Explain the principles of bioassay • Explain LC_{50} and LT_{50} in pest mortality studies. • Explain the toxicity and repellency bioassays. • Explain toxicity testing	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Bioassay diagrams, Probit analysis charts.	• Conduct a contact toxicity test using filter paper. • Record findings	Guide students to: • Conduct a contact toxicity test using filter paper. • Record findings	Micropipette s, Filter paper, Test insects.
General Objective 6.0: Understand the efficacy of botanical and chemical pesticides using standardized methods.						
11-12	6.1 Discuss the botanical and chemical efficacy of pesticides. 6.2 Describe standardized methods of using pesticides. 6.3 Describe the effectiveness of synthetic vs. natural pesticides. 6.4 Discuss the repellency assays.	• Explain the botanical and chemical efficacy of pesticides • Explain standardized methods of using pesticides • Explain the effectiveness of synthetic vs. natural pesticides. • Explain the repellency assays	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Neem oil, Actellic dust samples.	• Measure the repellency of plant extracts (e.g., orange peel, neem, etc.) • Record and report findings	Guide students to: • Measure the repellency of plant extracts (e.g., orange peel, neem, etc.) • Record and report findings	Choice chambers, Essential oils, Stopwatches

General Objective 7.0: Understand resistance monitoring and data interpretation in pest management.						
13-15	7.1 Define pest resistance. 7.2 Discuss pest monitoring. 7.3 Define data analysis and interpretation. 7.4 Explain reporting and evaluation.	• Explain pest resistance • Explain pest monitoring • Explain data analysis and interpretation • Discuss reporting and evaluation	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Statistical software, Sample data sets	• Compile bioassay results into a technical report.	Guide students to: • Compile bioassay results into a technical report.	Graph paper, Calculators, Notebooks.
COURSE ASSESSMENT: Coursework: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

INTRODUCTION TO DRONE, IoT SENSORS AND PRECISION POSTHARVEST PRODUCE HANDLING

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO DRONE, IoT SENSORS AND PRECISION POSTHARVEST PRODUCE HANDLING	COURSE CODE: PPT 125	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills to drone technology for farm-to-store monitoring, IoT sensor networks for real-time postharvest environment management and AI-assisted quality prediction tools.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Know Unmanned Aerial Vehicle (UAV) /Drone classifications, regulations and agricultural postharvest applications; 2.0 Understand Internet of Things sensor networks and their use in postharvest environment monitoring; 3.0 Understand how drone imagery is used to assess crop condition and storage environments; 4.0 Understand Artificial Intelligence assisted quality inspection and grading applications; 5.0 Understand QR-code traceability systems for postharvest produce.		



PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO DRONE, IoT SENSORS & PRECISION POSTHARVEST PRODUCE HANDLING			COURSE CODE: PPT 125		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to introduce students to drone technology for farm-to-store monitoring, IoT sensor networks for real-time postharvest environment management and AI-assisted quality prediction tools applicable to Nigerian postharvest operations.						
GENERAL OBJECTIVE 1.0: Know Unmanned Aerial Vehicle (UAV) /Drone classifications, regulations and agricultural postharvest applications.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1– 3	1.1 Explain classification of drones by type. 1.2 Explain Nigeria Civil Aviation Authority (NCAA) and (NSIA) roles in Nigeria for Drone regulations, Registration requirements, No-fly zones, Flight safety protocols for postharvest operations. 1.3 Outline uses of drone in postharvest operations.	• Explain classification of drones by type. • Explain Nigeria Civil Aviation Authority (NCAA) and (NSIA) roles in Nigeria for Drone regulations, Registration requirements, No-fly zones, Flight safety protocols for postharvest operations. • Outline uses of drone in postharvest operations.	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Assemble components of an agricultural drone Frame, Motors, Electronic Speed Controller (ESC) Camera, Battery • Carry out a pre-flight safety checklist. • Perform a take-off, hover, and landing • Conduct debrief on safety points. • Visit to NCAA Visit NSA Reports findings	Guide students to: • Assemble components of an agricultural drone Frame, Motors, Electronic Speed Controller (ESC) Camera, Battery • Carry out a pre-flight safety checklist. • Perform a take-off, hover, and landing • Conduct debrief on safety points. Visit to NCAA Visit NSA Reports findings	Laptop computers, specimens/samples, writing materials, worksheets, projector Different types of drones
GENERAL OBJECTIVE 2.0: Understand Internet of Things sensor networks and their use in postharvest environment monitoring.						

4– 6	2.1 Describe IoT sensor networks for storage monitoring of: Temperature Humidity CO₂ Ethylene Pest activity sensors. 2.2 Explain sensor types Communication protocols (Wi-Fi, LoRa), and cloud data platforms. 2.3 Explain data interpretation and alert threshold setting.	• Explain IoT sensor networks for storage monitoring of: Temperature Humidity CO₂ Ethylene Pest activity sensors • Explain sensor types Communication protocols (Wi-Fi, LoRa), and cloud data platforms • Explain data interpretation and alert threshold setting	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Install IoT sensors in a cold store. • Configure IoT sensors in a cold store. • Monitor 72-hour temperature/humidity data. • Observe data set trends • Record anomalies in the data set • Report findings	Guide students to: Install • Install IoT sensors in a cold store. • Configure IoT sensors in a cold store. • Monitor 72-hour temperature/humidity data. • Observe data set trends • Record anomalies in the data set • Report findings.	computers, laboratory equipment, instruments, specimens/samples, writing materials, worksheets, projector IoT sensor kits
GENERAL OBJECTIVE 3.0: Understand how drone imagery is used to assess crop condition and storage environments.						
7– 9	3.1 Describe drone imagery Normalise Difference Vegetation index (NDVI), Red Green Blue (RGB). 3.2 Explain the roles of drone in predicting storage suitability. 3.3 Describe multi spectral imaging applications in	• Explain drone imagery Normalise Difference Vegetation Index (NDVI) Red Green Blue use to assess pre-harvest crop condition • Explain roles of drone in predicting storage suitability. • Explain multi	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Process a drone image using Open Drone Map to generate a produce field condition map. • Interpret NDVI colour scale • Assess stressed vs. healthy crop zones using drone imagery • Provide pre-captured drone images and OpenDroneMap for interpretations • Report findings	Guide students to: • Process a drone image using Open Drone Map to generate a produce field condition map. • Interpret NDVI colour scale • Assess stressed vs. healthy crop zones using drone imagery • Provide pre-captured drone images and OpenDroneMap for interpretations	computers, laboratory equipment, instruments, specimens/samples, writing materials, worksheets, projector Drones imagery samples

	postharvest handling 3.4 Explain remote sensing with drone imagery 3.5 Describe image processing using free software (Open Drone Map) 3.6 Describe NDVI colour interpretation scale.	spectral imaging applications in postharvest handling • Explain remote sensing with drone imagery • Discuss image processing using free software (Open Drone Map) • Explain NDVI colour interpretation scale.			• Report findings	
GENERAL OBJECTIVE 4.0: Understand Artificial Intelligence assisted quality inspection and grading applications						
10– 12	4.1 Define AI/ML (Artificial Intelligence Mark up Language). 4.2 Explain Artificial Intelligence food quality inspection systems using: - i. Computer vision ii. Image classification iii. Defect detection algorithm. 4.3 Describe these to reduce labour costs and improve	• Explain AIML (Artificial Intelligence Mark up Language)- Explain Artificial Intelligence food quality inspection systems using: - Computer vision - Image classification - Defect detection algorithms • Explain these to reduce labour	Laptop computers, smart board, projector, writing materials, whiteboard tablets	• Demonstrate using a mobile AI quality inspection app to grade a batch of 20 tomatoes and 20 mangoes. • Compare AI grades with manual grades • Record accuracy to the nearest percentage. • Demonstrate mobile grading application on fresh produce • Compare AI grading systems with commercial grading	Guide students to: • Demonstrate using a mobile AI quality inspection app to grade a batch of 20 tomatoes and 20 mangoes. • Compare AI grades with manual grades • Record accuracy to the nearest percentage. • Demonstrate mobile grading application on fresh produce • Compare AI grading systems with commercial grading	computers; laboratory equipment; specimens/samples; writing materials; worksheets; Projector; Tablets; Tomatoe and Mango Produce samples; Whiteboard.

	consistency in grading applications.	costs and improve consistency in grading applications		machine • Carry out accuracy in calculation and simulations • Record findings.	machine • Carry out accuracy in calculation and simulations • Record findings.	
GENERAL OBJECTIVE 5.0: Understand QR-code traceability systems for postharvest produce						
13 – 15	5.1 Discuss blockchain-enabled for: - Digital traceability - Recording original produce handling events 5.2 Describe quality data on an immutable ledger 5.3 Describe quick response code (QR-Code) labelling and Global, Open System Standards (GS1) standards.	• Explain blockchain-enabled for: - Digital traceability - Recording original produce handling events • Explain quality data on an immutable ledger • Explain quick response code (QR-Code) labelling and Global, Open System Standards (GS1) standards.	Laptop computers, smart board, projector, writing materials, whiteboard, markers, internet	• Create a QR-code traceability label for a produce batch (origin, harvest date, quality grade). • Verify supply chain data on a traceability platform • Demonstrate QR code generation online tool • Show traceability platform interface.	Guide students to: • Create a QR-code traceability label for a produce batch (origin, harvest date, quality grade). • Verify supply chain data on a traceability platform • Demonstrate QR code generation online tool • Show traceability platform interface	computers, laboratory equipment, , specimens/samples, writing material markers, internet worksheets, projector
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

INTRODUCTION TO HANDLING OF FRUITS AND VEGETABLES

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO HANDLING OF FRUITS AND VEGETABLES	COURSE CODE: PPT 126	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills in managing the physiological processes and specialized handling techniques required for horticultural produce		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand respiratory and transpiration dynamics in harvested produce; 2.0 Understand ethylene management and commercial ripening/inhibition protocols; 3.0 Know Modified Atmosphere Packaging (MAP) and Controlled Atmosphere (CA) technologies; 4.0 Know physiological disorders and chilling injuries; 5.0 Understand Agro-chemicals and biological preservatives; 6.0 Know specialised postharvest handling for exotic crops; 7.0 Understand sustainable waste management and byproduct utilisation.		

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO HANDLING OF FRUITS & VEGETABLES			COURSE CODE: PPT 126		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills in managing the physiological processes and specialized handling techniques required for horticultural produce						
GENERAL OBJECTIVE 1.0: Understand respiratory and transpiration dynamics in harvested produce.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-2	1.1 Describe respiration dynamics. 1.2 Describe transpiration dynamics. 1.3 Describe the biochemistry of the climacteric rise and respiration pathways.	• Explain respiration dynamics • Explain transpiration dynamics • Explain the biochemistry of the climacteric rise and respiration pathways.	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Respiration charts, Projector.	• Measure CO₂ production and O₂ consumption. • Record findings	Guide students to: • Measure CO₂ production and O₂ consumption. • Record findings	Titration kit NaOH Airtight jars.
GENERAL OBJECTIVE 2.0: Understand ethylene management and commercial ripening/inhibition protocols						
3-4	2.1 Describe ethylene management. 2.2 Describe commercial ripening protocol. 2.3 Explain ethylene	• Explain ethylene management • Explain commercial ripening protocol • Explain ethylene	Textbooks Articles Computer Projector White board Marker	• Induce ethylene for ripening in Bananas, mangoes, pineapples, citrus.	Guide students to: • Induce ethylene for ripening in Bananas, mangoes, pineapples, citrus.	Ethrel, KMnO4 sachets Climacteric fruit samples

	biosynthesis and the role of 1-MCP.	biosynthesis and the role of 1-MCP.	Educational Videos or Documentaries Journals Chemical samples diagrams.			
GENERAL OBJECTIVE 3.0: Know Modified Atmosphere Packaging (MAP) and Controlled Atmosphere (CA) technologies						
5-6	3.1 Define MAP. 3.2 Describe CA. 3.3 Describe how to apply MAP and CA. 3.4 Explain gas permeability dynamics in polymer films.	• Explain MAP • Explain CA • Explain how to apply MAP and CA • Discuss gas permeability dynamics in polymer films.	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Polymer film samples, Gas laws charts.	• Test shelf-life extension using various films. • Write a report	Guide students to: • Test shelf-life extension using various films. • Write a report	Heat sealer, PVC/LDPE films, Gas analyzer.
GENERAL OBJECTIVE 4.0: Know physiological disorders and chilling injuries.						
7-8	4.1 Define physiological disorders. 4.2 Describe preventive measures of physiological disorders. 4.3 Define chilling injuries. 4.4 Outline management of	• Explain physiological disorders • Explain preventive measures of physiological disorders • Explain chilling injuries. • Explain management of	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Specimens of damaged fruit.	• Differentiate between pathological decay, physiological disorders and chilling injuries.	Guide students to: • Differentiate between pathological decay, physiological disorders and chilling injuries.	Hand lenses, sliced fruit specimens.

	chilling injuries. 4.5 State diagnosis of chilling injury, bitter pit, and internal browning.	chilling injuries • Explain diagnosis of chilling injury, bitter pit, and internal browning.				
GENERAL OBJECTIVE 5.0: Understand Agro-chemicals and biological preservatives.						
9-10	5.1 Explain Agro-chemicals in relation to biological preservatives. 5.2 Define Edible coatings. 5.3 Describe the use of edible coatings and fungicides. 5.4 List edible coatings used in the preservation of perishables.	• Explain Agro-chemicals in relation to biological preservatives • Explain Edible coatings • Explain the use of edible coatings and fungicides. • Explain edible coatings used in the preservation of perishables	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Wax emulsions, Botanical extracts.	• Apply edible coatings to perishables. • Prepare edible coatings from locally sourced materials • Apply fungicides to the storage structure	Guide students to: • Apply edible coatings to perishables. • Prepare edible coatings from locally sourced materials • Apply fungicides to the storage structure	Fruit wax Aloe vera gel sprayers weighing scale.
GENERAL OBJECTIVE 6.0: Know specialized postharvest handling for exotic crops.						
11-12	6.1 Define specialised handling of exotic crops 6.2 Describe the handling requirements for exotic crops (e.g., Avocado, Berries, etc.). 6.3 State the importance of	• Explain specialised handling of exotic crops • Describe the handling requirements for exotic crops (e.g., Avocado, Berries, etc.). • Explain the	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Crop handling	• Perform destructive and non-destructive quality tests.	Guide students to: • Perform destructive and non-destructive quality tests.	Penetrometer Refractometer Exotic fruit samples.

	specialised handling of exotic crops	importance of specialised handling of exotic crops	manuals.			
GENERAL OBJECTIVE 7.0: Understand sustainable waste management and byproduct utilization.						
13-14	7.1 Define Waste Management 7.2 Describe byproduct extraction 7.3 Describe byproduct utilisation (Pectin, Essential oils, etc.)	• Explain Waste Management • Explain byproduct extraction • Explain byproduct utilization (Pectin, Essential oils, etc.).	Textbooks, Articles Computer, Projector White board, Marker Educational Videos or Documentaries Journals Waste utilization diagrams.	Extract essential oils or pectin from citrus peels.	• Guide students to: Extract essential oils or pectin from citrus peels.	Distillation kit Citrus peels Solvents.
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



YEAR II SEMESTER I COURSES

PRINCIPLES OF RENEWABLE ENERGY FOR USE IN POSTHARVEST TECHNOLOGIES AND OFF-GRID

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: PRINCIPLES OF RENEWABLE ENERGY FOR USE IN POSTHARVEST TECHNOLOGIES AND OFF-GRID	COURSE CODE: PPT 211	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to provide students with the technical expertise to design, install and maintain renewable energy systems specifically tailored for postharvest operations, focusing on solar, biomass and hybrid systems for off-grid agricultural communities.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand the fundamentals of solar energy and its application in agriculture; 2.0 Know the components and design of Solar Photovoltaic (PV) systems for cold storage; 3.0 Know Solar Thermal applications for crop drying and processing; 4.0 Understand principles of Biomass and Biogas energy in postharvest value addition; 5.0 Understand wind and micro-hydro potential for rural agro-processing; 7.0 Understand the economics and environmental impact of renewable energy adoption;		

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: PRINCIPLES OF RENEWABLE ENERGY FOR USE IN POSTHARVEST TECHNOLOGIES AND OFF-GRID			COURSE CODE: PPT 211		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with the technical expertise to design, install and maintain renewable energy systems specifically tailored for postharvest operations, focusing on solar, biomass and hybrid systems for off-grid agricultural communities.						
GENERAL OBJECTIVE 1.0: Understand the fundamentals of solar energy and its application in agriculture.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Discuss solar energy fundamentals. 1.2 Explain application of solar energy in agriculture. 1.3 Explain solar radiation, peak sun hours, and orientation. 1.4 Define Solar Resource Assessment.	• Explain solar energy fundamentals • Discuss application of solar energy in agriculture • Discuss solar radiation, peak sun hours, and orientation. • Explain Solar Resource Assessment	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Solar radiation maps, Pyranometers.	• Measure solar intensity at different times of the day • Report findings	Guide students to: • Measure solar intensity at different times of the day • Report findings	Solar meters, Tilt angle charts, Protractors Batteries Inverters Solar demonstration training kit Charge controller Solar panels Multimeter
GENERAL OBJECTIVE 2.0: Know the components and design of Solar Photovoltaic (PV) systems for cold storage.						
3 – 5	2.1 Explain solar PV for cold storage. 2.2 Explain PV panels, Inverters, and Charge Controllers.	• Discuss solar PV for cold storage • Discuss PV panels, Inverters, and Charge Controllers.	Textbooks Articles Computer Projector White board	• Connect a basic PV system to power a small cooling fan/unit.	Guide students to: • Connect a basic PV system to power a small cooling fan/unit.	12V/24V batteries, Solar panels, Multimeters.

	2.3 Explain PV system assembly.	Discuss PV system assembly	Marker Educational Videos or Documentaries Journals Solar panels, Inverters, system diagrams.			
GENERAL OBJECTIVE 3.0: Know Solar Thermal applications for crop drying and processing.						
6 – 7	3.1 Define solar thermal applications 3.2 Discuss solar collectors and heat exchangers for drying. 3.3 Discuss solar dryer optimization	- Explain solar thermal applications - Explain solar collectors and heat exchangers for drying. - Explain solar dryer optimisation	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Solar dryer models, black-body collectors.	Measure temperature gain in a solar tunnel dryer.	- Guide students to: - Measure temperature gain in a solar tunnel dryer.	Tunnel dryer, Thermocouples, drying samples.
GENERAL OBJECTIVE 4.0: Understand how to apply the principles of Biomass and Biogas energy in postharvest value addition.						
8 – 9	4.1 Define biomass and biogas energy. 4.2 Explain the principles of biomass and biogas energy in postharvest value addition. 4.3 Describe anaerobic	- Explain biomass and biogas energy. - Discuss the principles of biomass and biogas energy in postharvest value addition. - Explain anaerobic	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals	Calculate the heat output of different agricultural residues. Record findings	- Guide students to: - Calculate the heat output of different agricultural residues. - Record findings	Biomass burner, different crop wastes, Calorimeters.

	digestion and gasification of crop residues. 4.4 Define bio-fuel testing.	digestion and gasification of crop residues. • Explain bio-fuel testing	Biogas digester models, Biomass pellets.			
GENERAL OBJECTIVE 5.0: Understand wind and micro-hydro potential for rural agro-processing.						
10 – 11	5.1 Explain hybrid and alternative systems of power supply. 5.2 Describe rural agro-processing. 5.3 Describe solar-wind hybrids and micro-hydro for agro processing. 5.4 Define hybrid system troubleshooting.	• Discuss hybrid and alternative systems of power supply Explain rural agro-processing. • Explain solar-wind hybrids and micro-hydro for agro processing. • Explain hybrid system troubleshooting	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Hybrid controller diagrams, Small wind turbines.	• Identify common faults in a hybrid power controller • Report findings • Visit to technology incubation centers	Guide students to: • Identify common faults in a hybrid power controller • Report findings • Visit to technology incubation centers	Hybrid inverter, simulation software Prototype of mini hydro demonstrator
GENERAL OBJECTIVE 6.0: Know energy storage systems (Batteries and Thermal Storage) for 24/7 cooling.						
12 – 13	6.1 Describe Energy Storage System (ESS) for cooling. 6.2 Explain the difference between Lithium-ion, Lead-acid, and Phase Change Materials (PCM). 6.3 Explain thermal storage.	• Explain Energy Storage System (ESS) for cooling • Discuss the difference between Lithium-ion, Lead-acid, and Phase Change Materials (PCM). • Discuss thermal storage	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals PCM samples,	• Conduct a thermal storage experiment Evaluate the cooling duration of a PCM-lined insulated box. • Report finding	Guide students to: • Conduct a thermal storage experiment • Evaluate the cooling duration of a PCM-lined insulated box. • Report finding	PCM packs, Insulated containers, Data loggers Inverter Lithium-ion battery Lead-acid battery

			Battery data sheets.			
GENERAL OBJECTIVE 7.0: Understand the economics and environmental impact of renewable energy adoption.						
14 – 15	7.1 Define renewable energy. 7.2 Explain Economics and Maintenance of renewable energy. 7.3 Outline environmental impact of renewable energy adoption. 7.4 Define Maintenance Audit.	• Explain renewable energy • Discuss Economics and Maintenance of renewable energy • Explain environmental impact of renewable energy adoption. • Explain Maintenance Audit	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Financial templates, Maintenance toolkits.	• Calculate Payback Period and Levelized Cost of Energy (LCOE). • Perform a "Health Check" on a solar-powered cold room. • Report findings	Guide students to: • Calculate Payback Period and Levelized Cost of Energy (LCOE). • Perform a "Health Check" on a solar-powered cold room. • Report findings	Cleaning kits, Torque wrenches, Safety PPE.
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

INTRODUCTION TO POSTHARVEST PRODUCE TRANSPORTATION AND LOGISTICS

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO POSTHARVEST PRODUCE TRANSPORTATION AND LOGISTICS	COURSE CODE: PPT 212	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in handling, transportation, logistics and temperature-controlled systems for minimizing postharvest losses.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand principles of produce handling and transportation; 2.0 Know causes of losses during transportation and distribution; 3.0 Understand logistics systems in agricultural supply chains; 4.0 Know cold chain technologies for perishables; 5.0 Know transportation infrastructure and packaging compatibility; 6.0 Know planning and management skills for postharvest logistics; 7.0 Understand digital tools and emerging innovations in postharvest logistics.		

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO POSTHARVEST PRODUCE TRANSPORTATION AND LOGISTICS			COURSE CODE: PPT 212		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in handling, transportation, logistics and temperature-controlled systems for minimizing postharvest losses.						
GENERAL OBJECTIVE 1.0: Understand principles of produce handling and transportation						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Explain the postharvest handling chain from farm gate to consumer. 1.2 Describe principles of careful handling to reduce mechanical damage. 1.3 State transportation modes used for agricultural produce (road, rail, air, water).	• Describe the postharvest handling chain from farm gate to consumer • Explain principles of careful handling to reduce mechanical damage • Explain transportation modes used for agricultural produce (road, rail, air, water)	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Supply chain charts, produce samples for handling demonstration	• Carry out a produce handling sequence • Record damage points • Evaluate the packaging integrity of produce after transport • Conduct a roleplay depicting handling chain of agricultural commodity from farm gate to market • Record findings	Guide students to: • Carry out a produce handling sequence • Record damage points • Evaluate the packaging integrity of produce after transport • Conduct a roleplay depicting handling chain of agricultural commodity from farm gate to market • Record findings	Produce samples Transport crates Weighing scale Damage assessment forms Local and Improved Packaging materials Shade (Tree, Thatch Grasses, Hut, Leaves Barn)
GENERAL OBJECTIVE 2.0: Know causes of losses during transportation and distribution						
3 – 5	2.1 Explain the classification mechanical,	• Explain the classification mechanical,	Textbooks Articles Computer	• Subject produce to vibration/impact • Assess resulting	Guide students to: • Subject produce to vibration/impact	Produce samples Vibration platform or Manual

	physiological, and microbial losses during transport. 2.2 Describe the effects of vibration, compression, and impact on produce quality. 2.3 Describe the effects of temperature fluctuations in accelerating postharvest losses in transit.	physiological, and microbial losses during transport • Explain the effects of vibration, compression, and impact on produce quality • Describe the effects of temperature fluctuations in accelerating postharvest losses in transit	Multi-media Boards White board Marker Educational Videos or Documentaries Journals Case study handouts, transport loss data	damage • Calculate percentage loss from transport trial	• Assess resulting damage • Calculate percentage loss from transport trial	simulation Weighing scale Quality assessment forms Packaging Materials Measuring tape Thermometers
GENERAL OBJECTIVE 3.0: Understand logistics systems in agricultural supply chains						
6 – 7	3.1 Define supply chain management. 3.2 Explain the components of supply chain management in agriculture. 3.3 Describe the roles of aggregators, wholesalers, retailers, and exporters in agricultural	• Explainsupply chain management • Discuss the components of supply chain management in agriculture • Discuss the roles of aggregators, wholesalers, retailers, and exporters in agricultural supply chain	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Supply chain diagrams, sample logistics documents,	• Map the supply chain of a selected commodity from farm to market • Complete sample logistics documents (waybill, consignment note) for a simulated shipment • Visit local/export warehouses • Visit to Sea/Air/Dry Ports	• Guide students to: • Map the supply chain of a selected commodity from farm to market • Complete sample logistics documents (waybill, consignment note) for a simulated shipment • Visit local/export warehouses • Visit to Sea/Air/Dry Ports	Supply chain mapping templates, logistics document samples, Multi-media Boards

	supply chain management. 3.4 Describe logistics documentation (waybills, consignment notes, phytosanitary certificates, Fumigation certificates).	management. • 3.4 Describe logistics documentation (waybills, consignment notes, phytosanitary certificates, Fumigation certificates)	Multi-media Boards			
GENERAL OBJECTIVE 4.0: Know cold chain technologies for perishables						
8 – 9	4.1 Define cold chain. 4.2 Explain its importance for perishable produce. 4.3 Describe cooling technologies: forced air cooling, hydrocooling, vacuum cooling, ice. 4.4 Explain refrigerated vehicles, reefer containers, and cold stores.	• Explain cold chain • Discuss its importance for perishable produce • Explain cooling technologies: forced air cooling, hydrocooling, vacuum cooling, ice • Describe refrigerated vehicles, reefer containers, and cold stores	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Multi-media Boards, cooling technology diagrams, cold chain case studies, video resources	• Pre-cool produce samples using ice or a cold room • Record temperature profiles • Compare shelf life of pre-cooled vs non-cooled produce over 5 days	Guide students to: • Pre-cool produce samples using ice or a cold room • Record temperature profiles • Compare shelf life of pre-cooled vs non-cooled produce over 5 days	Ice Cold room or refrigerator Temperature data logger Produce samples Comparison forms
GENERAL OBJECTIVE 5.0: Know transportation infrastructure and packaging compatibility						
10 – 11	5.1 Describe Road and rail networks,	• Explain road network, storage,	Textbooks Articles	• Conduct a field visit or virtual assessment	Guide students to: • Conduct a field visit	Packaging samples Assessment forms

	storage, and market infrastructure in Nigerian produce logistics. 5.2 Explain packaging compatibility with transport modes (ventilation, stacking strength). 5.3 Describe the impact of poor infrastructure on postharvest loss rates.	and market infrastructure in Nigerian produce logistics • Discuss packaging compatibility with transport modes (ventilation, stacking strength) Explain the impact of poor infrastructure on postharvest loss rates	Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Infrastructure data, packaging specifications, Multi-media Boards, local loss assessment reports	of a local produce market logistics point. • Evaluate the suitability of selected packaging types for road/rail transport conditions • Simulate impact of poor road or rail network on produce logistics	or virtual assessment of a local produce market logistics point. • Evaluate the suitability of selected packaging types for road/rail transport conditions • Simulate impact of poor road or rail network on produce logistics	Multi-media Boards Field visit to transport infrastructure
GENERAL OBJECTIVE 6.0: Know planning and management skills for postharvest logistics						
12 – 13	6.1 Outline logistics planning tools: route planning, load scheduling, inventory management. 6.2 Describe risk management in postharvest logistics (contingency planning, insurance). 6.3 Explain a logistics plan for seasonal	• Explain logistics planning tools: route planning, load scheduling, inventory management • Explain risk management in postharvest logistics (contingency planning, insurance) Discuss a logistics plan for	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Route planning templates, inventory management forms, Multi-	• Develop a logistics plan for a simulated seasonal produce distribution scenario • Present the plan • Receive peer and instructor feedback • Visit a Transport Institute	Guide students to: • Develop a logistics plan for a simulated seasonal produce distribution scenario • Present the plan • Receive peer and instructor feedback Visit a Transport Institute	Planning templates Route maps Cost estimation worksheets Multi-media Board Logistics for Visit

	produce distribution.	seasonal produce distribution	media Boards			
GENERAL OBJECTIVE 7.0: Understand digital tools and emerging innovations in postharvest logistics						
14 – 15	7.1 Describe digital logistics platforms (tracking apps, cold chain monitoring software, drones, etc.). 7.2 Explain the role of IoT sensors and data analytics in real-time logistics management. 7.3 Describe relevant agri-tech startups and solutions operating in Nigeria and Africa	• Explain digital logistics platforms (tracking apps, cold chain monitoring software, drones, etc.). • Discuss the role of IoT sensors and data analytics in real-time logistics management. • Describe relevant agri-tech startups and solutions operating in Nigeria and Africa	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Multi-media Boards, smartphones or tablets, logistics app demos, case study articles Drones	• Plan a simulated produce delivery • Use a digital logistics tracking tool or app • Prepare a brief report on a digital postharvest logistics innovation	Guide students to: • Plan a simulated produce delivery • Use a digital logistics tracking tool or app • Prepare a brief report on a digital postharvest logistics innovation	Smartphones/tablets with logistics apps Internet access Report templates Drones
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

INTRODUCTION TO DIGITAL AGRI-MARKETING

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO DIGITAL AGRI-MARKETING	COURSE CODE: PPT 213	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with Knowledge and skills of digital and e-commerce for marketing of postharvest produce in modern agricultural value chains.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Know principles of agricultural marketing; 2.0 Know digital platforms for agri-business promotion; 3.0 Know e-commerce tools for produce sales and distribution; 4.0 Understand branding, pricing and customer engagement strategies. 5.0 Understand digital risks, ethics and payment systems; 6.0 Know entrepreneurial skills for digital agribusiness; 7.0 Understand digital agribusiness plan for a postharvest produce enterprise.		

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO DIGITAL AGRI-MARKETING			COURSE CODE: PPT 213		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with Knowledge and skills of digital and e-commerce for marketing of postharvest produce in modern agricultural value chains.						
GENERAL OBJECTIVE 1.0: Know principles of agricultural marketing.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Define agricultural marketing. 1.2 Explain agricultural marketing roles in postharvest produce value chains. 1.3 Describe marketing concepts: demand, supply, pricing, market segmentation. 1.4 Describe types of agricultural markets (spot markets, contract markets, e-markets, etc.)	- Define agricultural marketing. - Explain agricultural marketing roles in postharvest produce value chains. - Describe marketing concepts: demand, supply, pricing, market segmentation. - Describe types of agricultural markets (spot markets, contract markets, e-markets, etc.)	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Marketing textbooks Local market data Case study handouts	- Conduct a simple market survey for a selected postharvest produce - Carry out recording of price trends, buyer types, and market channels from the survey	Guide students to: - Conduct a simple market survey for a selected postharvest produce - Carry out recording of price trends, buyer types, and market channels from the survey	Survey forms smartphones Notebooks Spreadsheet access produce price data

GENERAL OBJECTIVE 2.0: Know digital platforms for agri-business promotion						
3 – 5	2.1 Describe major digital platforms for agricultural marketing (Facebook, WhatsApp, Instagram, Jiji, Farmcrowdy, etc.) 2.2 Describe features and the reach of each platform for agricultural produce. 2.3 Explain how to set up and optimise a business profile on digital platforms.	• Explain major digital platforms for agricultural marketing (Facebook, WhatsApp, Instagram, Jiji, Farmcrowdy, etc.) • Describe features and the reach of each platform for agricultural produce • Explain how to set up and optimise a business profile on digital platforms	Textbooks Articles Computer White board Marker Educational Videos Documentaries Journals Multi-media Boards, smartphones/laptops, internet access, platform feature comparison chart	• Create a business profile on one digital platform for a selected postharvest produce • Write a product description with photos for the created profile	Guide students to: • Create a business profile on one digital platform for a selected postharvest produce • Write a product description with photos for the created profile	Smartphones/laptops Internet access Camera Product samples for photography
GENERAL OBJECTIVE 3.0: know e-commerce tools for produce sales and distribution						
6 – 7	3.1 Explain e-commerce concepts: online storefronts, product listing, order management. 3.2 Describe online logistics and delivery arrangement for produce. 3.3 Explain integration of	• Discuss e-commerce concepts: online storefronts, product listing, order management • Explain online logistics and delivery arrangement for produce • Discuss integration of packaging and labelling with e-commerce product presentation	Textbooks Articles Computer White board Marker Educational Videos Documentaries Journals Multi-media Boards, e-commerce platform demos, packaging	• Set up a simple online store listing for a postharvest produce item (using a free platform) • Simulate an order, packaging, and dispatch process for an e-commerce sale	Guide students to: • Set up a simple online store listing for a postharvest produce item (using a free platform) • Simulate an order, packaging, and dispatch process for an e-commerce sale	Laptops/smartphones Free e-commerce platform Packaging materials, Dispatch simulation kit

	packaging and labelling with e-commerce product presentation.		samples, internet access			
GENERAL OBJECTIVE 4.0: Understand branding, pricing, and customer engagement strategies						
8 – 9	4.1 Explain branding principles: name, logo, colour, packaging identity, etc. 4.2 Describe pricing strategies for postharvest produce (cost-plus, competitive, value-based, etc.) 4.3 Explain customer engagement tools: reviews, loyalty programmes, social media interaction, etc.	• Discuss branding principles: name, logo, colour, packaging identity, etc. • Explain pricing strategies for postharvest produce (cost-plus, competitive, value-based, etc.) • Discuss customer engagement tools: reviews, loyalty programmes, social media interaction, etc.	Textbooks Articles Computer White board Marker Educational Videos Documentaries Journals Branding samples, Multi-media Boards, cost-pricing worksheets, social media case studies	• Design a brand identity (name, logo sketch, packaging concept) for a produce enterprise • Calculate a selling price using cost-plus and value-based pricing methods • Visit a packaging company	Guide students to: • Design a brand identity (name, logo sketch, packaging concept) for a produce enterprise • Calculate a selling price using cost-plus and value-based pricing methods Visit a packaging company	Design materials (paper, pens, or Canva access) Pricing worksheets Produce cost data Packaging materials
GENERAL OBJECTIVE 5.0: Know digital risks, ethics, and payment systems						
10 – 11	5.1 Outline digital risks: fraud, data theft, fake reviews, platform misuse. 5.2 Describe ethical responsibilities in digital agri-	• Outline digital risks: fraud, data theft, fake reviews, platform misuse • Describe ethical responsibilities in digital agri-marketing (honest labelling, fair	White board Marker Educational Videos Documentaries Journals Multi-media Boards, fraud scenario	• Analyse a digital marketing fraud scenario • Identify warning signs • Simulate a digital payment transaction using	Guide students to: • Analyse a digital marketing fraud scenario • Identify warning signs Simulate a digital payment	Fraud case study Handouts Smartphones Mobile payment apps Worksheets

	marketing (honest labelling, fair pricing). 5.3 Explain digital payment systems in Nigeria (bank transfers, USSD, POS, mobile wallets, etc.)	pricing) • Discuss digital payment systems in Nigeria (bank transfers, USSD, POS, mobile wallets, etc.)	handouts, payment system guides, internet access	a mobile wallet or USSD service	transaction using a mobile wallet or USSD service	
GENERAL OBJECTIVE 6.0: Know entrepreneurial skills for digital agribusiness						
12 – 13	6.1 Explain entrepreneurship concepts in digital agribusiness (opportunity, value proposition, scaling) 6.2 Describe record-keeping, financial management, and reporting for small agribusinesses 6.3 Explain funding and support sources for digital agribusinesses in Nigeria (NIRSAL, CBN grants, BOA, etc.)	• Explain entrepreneurship concepts in digital agribusiness (opportunity, value proposition, scaling) • Describe record-keeping, financial management, and reporting for small agribusinesses • Discuss funding and support sources for digital agribusinesses in Nigeria (NIRSAL, CBN grants, BOA, SMEDAN, etc.)	White board Marker Educational Videos Documentaries Journals Business record templates, Multi-media Boards, funding source handouts, case studies	• Prepare a simple income and expense record for a produce trading for 5 weeks • Search one funding source available to agribusinesses in Nigeria	Guide students to: • Prepare a simple income and expense record for a produce trading for 5 weeks • Search one funding source available to agribusinesses in Nigeria	Business record templates Internet access Multi-media Boards Case study handouts

	SMEDAN, etc.)					
GENERAL OBJECTIVE 7.0: Understand digital agribusiness plan for a postharvest produce enterprise						
14 – 15	7.1 Describe agribusiness plan for a postharvest produce enterprise. 7.2 Describe components of a digital agribusiness plan (market analysis, platform strategy, pricing, logistics). 7.3 Describe how to present and pitch a business plan to stakeholders.	• Explain agribusiness plan for a postharvest produce enterprise • Explain components of a digital agribusiness plan (market analysis, platform strategy, pricing, logistics) • Explain how to present and pitch a business plan to stakeholders	White board Marker Educational Videos Documentaries Journals Business plan templates, Multi-media Boards, sample agribusiness plans	• Develop a digital agribusiness plan for a chosen postharvest produce • Deliver a 5-minute pitch to the class • Receive structured feedback	• Guide students to: • Develop a digital agribusiness plan for a chosen postharvest produce • Deliver a 5-minute pitch to the class • Receive structured feedback	Business plan templates Multi-media Boards Marking rubric Peer feedback forms
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

PINTRODUCTION TO FOOD SAFETY SYSTEMS

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO FOOD SAFETY SYSTEMS	COURSE CODE: PPT 214	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills required to implement international food safety standards and quality management systems in the agricultural value chain		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand the principles of the Hazard Analysis and Critical Control Point (HACCP) system; 2.0 Understand the requirements and implementation of Global GAP standards for primary production; 4.0 Understand Good Agricultural Practices (GAP) and Good Manufacturing Practices (GMP); 5.0 Understand the process of food safety auditing and certification; 6.0 Understand traceability and recall procedures in the food supply chain; 7.0 Understand the regulatory roles of National and International food safety bodies.		

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO FOOD SAFETY SYSTEMS			COURSE CODE: PPT 214		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and practical skills required to implement international food safety standards and quality management systems in the agricultural value chain						
GENERAL OBJECTIVE 1.0: Understand the principles of the Hazard Analysis and Critical Control Point (HACCP) system.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Explain HACCP Principles. 1.2 Describe the 7 principles of HACCP. 1.3 Explain the 5 preliminary steps involved in HACCP Principles.	• Discuss HACCP Principles • Explain the 7 principles of HACCP • Discuss the 5 preliminary steps involved in HACCP Principles.	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals HACCP Handbook Projector.	• Conduct a hazard analysis for a specific produce (e.g., fresh-cut leafy greens, etc). • Conduct hazard analysis exercise • Record findings	Guide students to : • Conduct a hazard analysis for a specific produce (e.g., fresh-cut leafy greens, etc). • Conduct hazard analysis exercise Record findings	Flowcharts Decision tree diagrams Flipcharts.
GENERAL OBJECTIVE 2.0: Understand the requirements and implementation of Global GAP standards for primary production.						
3 – 5	2.1 Explain Global GAP Standards. 2.2 Describe the requirements and implementation of Global GAP standards for primary production.	• Discuss Global GAP Standards • Explain the requirements and implementation of Global GAP standards for primary	Textbooks Articles Computer Projector White board Marker Educational Videos or	• Perform a compliance check on a campus farm site. • Record findings	• Guide students to: Perform a compliance check on a campus farm site. • Record findings	PPE Checklist forms Digital cameras Source Global GAP documents from different countries

	2.3 Explain Integrated Farm Assurance (IFA) and "Major Musts." 2.4 Describe Farm Inspection.	production • Discuss Integrated Farm Assurance (IFA) and "Major Musts." • Explain Farm Inspection	Documentaries Journals Global GAP Checklists			
GENERAL OBJECTIVE 3.0: Understand the framework of ISO 22000 Food Safety Management Systems (FSMS).						
6 – 7	3.1 Describe ISO 22000 Framework. 3.2 Explain Food Safety Management Systems. 3.3 Describe the PDCA (Plan-Do-Check-Act) cycle in FSMS. 3.4 Explain SOP development.	• Describe ISO 22000 Framework. • Discuss Food Safety Management Systems. • Describe the PDCA (Plan-Do-Check-Act) cycle in FSMS. • Discuss SOP development.	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals ISO 22000 Standard documents.	• Draft a Standard Operating Procedure (SOP) for equipment cleaning or calibrating an instrument.	Guide students to: • Draft a Standard Operating Procedure (SOP) for equipment cleaning or calibrating an instrument.	Templates, Sample SOPs Instruments.
GENERAL OBJECTIVE 4.0: Understand Good Agricultural Practices (GAP) and Good Manufacturing Practices (GMP).						
8 – 9	4.1 Describe GAPs and GMPs. 4.2 Discuss the application of GAP and GMP. 4.3 Outline the requirements for sanitary facilities and pest control. 4.4 Describe facility audit.	• Explain GAPs and GMPs. • Discuss the application of GAP and GMP. • Discuss the requirements for sanitary facilities and pest control. • 4.4 Describe facility audit.	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals GMP guidelines,	• Audit the packing house for GHP/GMP compliance. • Record findings	Guide students to: • Audit the packing house for GHP/GMP compliance. • Record findings	Audit logs, ATP swabs (simulated) Internet Multimedia board Computer

			visuals of sanitary designs.			
GENERAL OBJECTIVE 5.0: Understand the process of food safety auditing and certification.						
10 – 11	5.1 Explain food safety auditing and certification 5.2 Differentiate between first, second, and third-party audits. 5.3 Describe role-play auditing	• Discuss food safety auditing and certification • Explain the differences between first, second, and third-party audits. • Explain role-play auditing	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Certification flow diagrams.	• Simulate an opening and closing audit meeting. • Record findings	Guide students to: • Simulate an opening and closing audit meeting. • Record findings	Case studies, recording sheets Internet Multimedia board Computer
GENERAL OBJECTIVE 6.0: Understand traceability and recall procedures in the food supply chain.						
12 – 13	6.1 Explain traceability and recall procedures in food supply chain. 6.2 Explain forward and backward traceability logic. 6.3 Describe mock recall simulation.	• Discuss traceability and recall procedures in food supply chain Discuss forward and backward traceability logic. • Explain mock recall simulation	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Traceability software demos, sample labels.	• Execute a product recall within a specified timeframe. • Record findings	Guide students to: • Execute a product recall within a specified timeframe. • Record findings	Batch codes, Logbooks, Stopwatches.
GENERAL OBJECTIVE 7.0: General Objective 7.0: Understand the regulatory roles of national and international food safety bodies.						
14 – 15	7.1 Describe regulatory	• Explain regulatory	Textbooks Articles	• Prepare a formal	Guide students to:	Calculators, Laptops.

	frameworks. 7.2 Discuss the regulatory roles of national and international food safety bodies. 7.3 Describe the roles of NAFDAC, SON, Codex Alimentarius, etc. 7.4 Explain compliance reporting.	frameworks • Explain the regulatory roles of national and international food safety bodies • Explain the roles of NAFDAC, SON, and Codex Alimentarius, etc. • Discuss compliance reporting	Computer Projector White board Marker Educational Videos or Documentaries Journals Regulatory gazettes, Internet access.	food safety compliance report.	• Prepare a formal food safety compliance report.	
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

INTRODUCTION TO VALUE ADDITION AND FOOD PROCESSING TECHNOLOGY

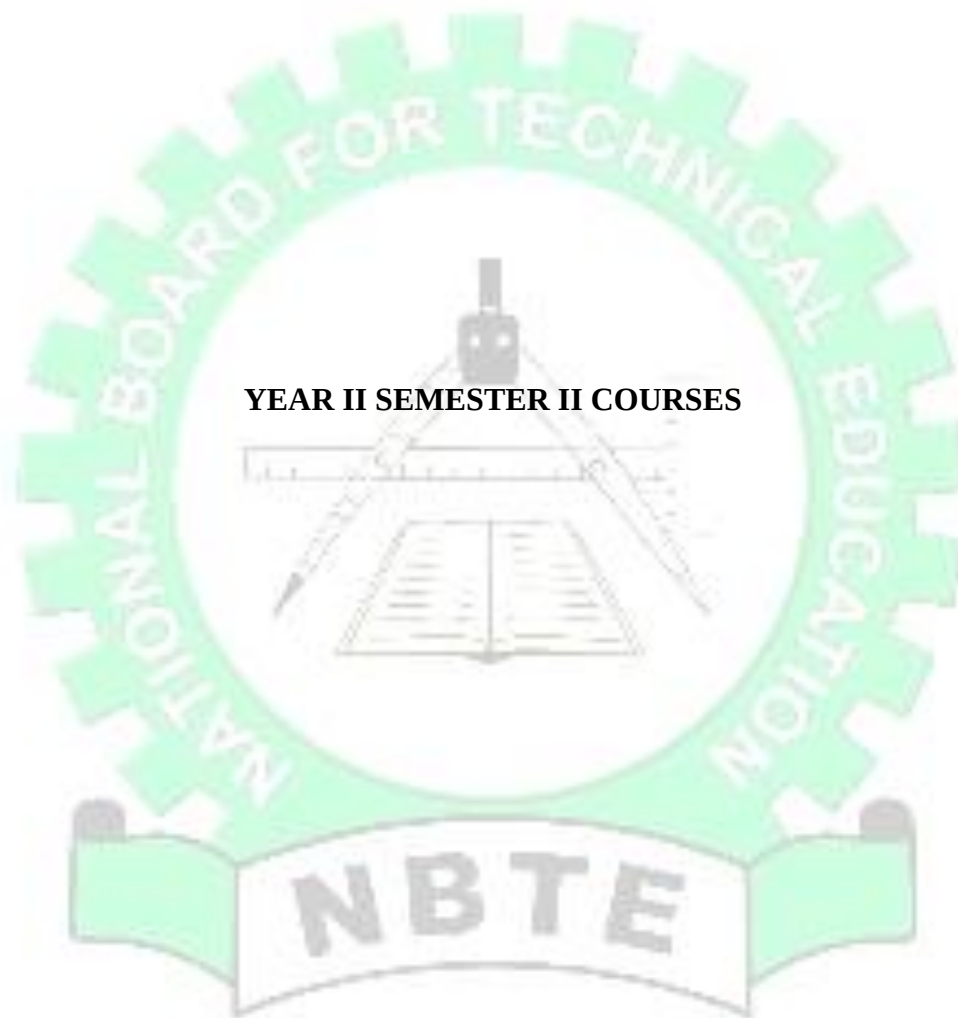
PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO VALUE ADDITION AND FOOD PROCESSING TECHNOLOGY	COURSE CODE: PPT 215	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills of food processing principles in transforming raw agricultural produce into high-value and shelf-stable products.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand the principles of food preservation and value addition; 2.0 Understand the techniques for drying and dehydration of agricultural produce; 3.0 Understand thermal processing techniques; 4.0 Understand fermentation and pickling technologies; 5.0 Know the production of fruit concentrates, juices and jams; 6.0 Know the principles of extrusion and flour processing for grains and tubers; 7.0 Know the packaging and labeling requirements for processed foods.		

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO VALUE ADDITION AND FOOD PROCESSING TECHNOLOGY			COURSE CODE: PPT 215		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills of food processing principles in transforming raw agricultural produce into high-value and shelf-stable products.						
GENERAL OBJECTIVE 1.0: Understand the principles of food preservation and value addition.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Define food preservation. 1.2 Define value addition. 1.3 Explain the Principles of food preservation and value addition. 1.4 Describe the concept of value addition and economic benefits. 1.5 Explain market survey and analysis.	• Explain food preservation • Explain value addition (Sorting, Cleaning, Grading, etc.) • Discuss the Principles of food preservation and value addition • Explain the concept of value addition and economic benefits. • Discuss market survey and analysis	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Processing flowcharts, Projector.	• Compare the prices of raw vs. processed produce. • Carry out the following: Sorting Cleaning Grading, etc. • Record findings	Guide students to: • Compare the prices of raw vs. processed produce. • Carry out the following: Sorting Cleaning Grading, etc. • Record findings	Market data sheets, Notebooks Processing equipment Fresh and dry produce Food preservatives Packaging materials
GENERAL OBJECTIVE 2.0: Understand the techniques for drying and dehydration of agricultural produce.						
3 – 5	2.1 Describe the	• Explain the concept	Textbooks	• Produce dried	Guide students to:	Cabinet dryer,

	concept of Drying and Dehydration. 2.2 Explain the techniques for drying and dehydration of agricultural produce. 2.3 Explain solar, cabinet, and spray drying mechanisms.	of Drying and Dehydration • Discuss the techniques for drying and dehydration of agricultural produce • Discuss solar, cabinet, and spray drying mechanisms.	Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Solar dryer models, Psychrometric charts	vegetable chips or fruit leather. • Produce powdered agricultural produce	• Produce dried vegetable chips or fruit leather. • Produce powdered agricultural produce	Slicers, Blanching baskets. Produce sample Animal products
GENERAL OBJECTIVE 3.0: Understand thermal processing techniques						
6 – 7	3.1 Describe thermal processing. 3.2 Explain thermal processing techniques. 3.3 Differentiate between pasteurisation, sterilisation, and canning.	• Explain thermal processing • Discuss thermal processing techniques • Explain the differences between pasteurization, sterilization, and canning.	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Canning jars, Pressure cookers.	• Pasteurize fresh milk or fruit juice.	Guide students to: • Pasteurize fresh milk or fruit juice.	Thermometers, Induction cookers, Glass bottles Milk samples Fresh Fruits
GENERAL OBJECTIVE 4.0: Understand fermentation and pickling technologies.						
8 – 9	4.1 Describe fermentation technology. 4.2 Explain pickling technologies.. 4.3 Describe the role of	• Explain fermentation technology Discuss pickling technologies. • Explain the role of	Textbooks Articles Computer Projector White board Marker	• Produce yogurt from fresh milk using starter cultures. • Produce pickled product	Guide students to: • Produce yogurt from fresh milk using starter cultures. • Produce pickled	pH meters, Incubator, Milk, Culture preservatives Packaging materials

	microbes in value addition (Lactic acid/yeast). 4.4 Describe yogurt production.	microbes in value addition (Lactic acid/yeast) Explain yogurt production	Educational Videos or Documentaries Journals Starter cultures, Incubation charts.		product	
GENERAL OBJECTIVE 5.0: Understand the production of fruit concentrates, juices, and jams.						
10 – 11	5.1 Describe Jams and Concentrates. 5.2 Explain the role of sugar, pectin, and acid in gel formation. 5.3 Describe Jam and Marmalade Making.	• Explain Jams and Concentrates • Discuss the role of sugar, pectin, and acid in gel formation. • Explain Jam and Marmalade Making	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Pectin samples, Citric acid	• Prepare jam from seasonal fruits (e.g., Mango, Pineapple etc.).	Guide students to: • Prepare jam from seasonal fruits (e.g., Mango, Pineapple etc.).	Refractometer, Cooking pots, Sterilized jars. Packaging materials Sugar Acid Pectin Gel Starch Fruits
GENERAL OBJECTIVE 6.0: Understand the principles of extrusion and flour processing for grains and tubers.						
12 – 13	6.1 Describe flour and extrusion technology. 6.2 Explain flour processing for grains and tubers. 6.3 Describe milling and extrusion of grains/tubers. 6.4 Describe milling and flour quality	• Explain flour and extrusion technology • Discuss flour processing for grains and tubers • Explain milling and extrusion of grains/tubers. • Explain milling and flour quality	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Samples of extruded	• Produce high-quality root and tuber flour or grain flour.	Guide students to: • Produce high-quality root and tuber flour or grain flour.	Cutter/Slicer/Knives Grater, Hydraulic press, Hammer mill Dryer Sieve Packaging materials Roots and tubers Grains Moisture analyzer Pulveriser Calorimeter Weighing scale Laboratory oven De-stoner Sifter

			snacks.			Stainless steel trays pH meter
GENERAL OBJECTIVE 7.0: Understand the packaging and labeling requirements for processed foods.						
14 – 15	7.1 Describe Packaging and Labelling. 7.2 Outline packaging and labelling requirements for processed foods. 7.3 State NAFDAC/SON labelling requirements. 7.4 Describe product packaging design.	• Explain Packaging and Labelling • Explain packaging and labeling requirements for processed foods. • Explain NAFDAC/SON labeling requirements. • Explain product packaging design	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Packaging materials (Plastic, Glass, Foil).	• Design a label • Package a finished product. • Visit to packaging company	Guide students to: • Design a label • Package a finished product. • Visit to packaging company	Sealers, Labels, Design software/Templates Samples of various packaging materials
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



INTRODUCTION TO WAREHOUSE DESIGN MANAGEMENT AND INVENTORY SYSTEMS

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO WAREHOUSE DESIGN MANAGEMENT AND INVENTORY SYSTEMS	COURSE CODE: PPT 221	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills of warehouse design and logistics to manage inventory systems specifically for agricultural produce		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand the functions and types of agricultural warehouses and silos; 2.0 Understand the principles of warehouse layout and space optimization; 3.0 Understand inventory management techniques; 4.0 Know the documentation and administrative procedures in warehousing; 5.0 Understand digital inventory systems and Warehouse Management Software; 6.0 Know the safety, security and pest control protocols in a warehouse environment; 7.0 Know the logistics of receiving, dispatch and material handling.		

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO WAREHOUSE DESIGN MANAGEMENT AND INVENTORY SYSTEMS			COURSE CODE: PPT 221		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills of warehouse design and logistics to manage inventory systems specifically for agricultural produce						
GENERAL OBJECTIVE 1.0: Understand the functions and types of agricultural warehouses and silos.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Define warehouse typology. 1.2 List types of agricultural warehouses. 1.3 Explain functions of agricultural warehouses. 1.4 Differentiate between bonded, cold-chain, and bulk storage (silos). 1.5 Define Site Assessment.	• Explain warehouse typology • Explain types of agricultural warehouses • Discuss functions of agricultural warehouses • Explain the differences between bonded, cold-chain, and bulk storage (silos). • Explain Site Assessment	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Warehouse diagrams, Projector.	• Identify key features of a local agricultural warehouse. • Visit to market/ warehouses • Record findings .	Guide students to: • Identify key features of a local agricultural warehouse. • Visit to market/ warehouses • Record findings.	Inspection checklist, Notebooks
GENERAL OBJECTIVE 2.0: Understand the principles of warehouse layout and space optimization.						
3 – 5	2.1 Define Space Optimization. 2.2 Explain the principles of warehouse layout	• Explain Space Optimization • Discuss the principles of warehouse layout	Textbooks Articles Computer Projector White board	• Design a warehouse layout to maximize storage density. • Visit a warehouse • Write a report	Guide students to: • Design a warehouse layout to maximize storage density.	Graph paper, Measuring tapes Prototype warehouse Incinerators

	2.3 Explain pallet racking systems and vertical space utilization. 2.4 Define Floor Planning.	• Discuss pallet racking systems and vertical space utilization • Explain Floor Planning	Marker Educational Videos or Documentaries Journals Racking system models		• Visit a warehouse • Write a report	
GENERAL OBJECTIVE 3.0: Understand inventory management techniques.						
6 – 7	3.1 Explain Inventory Control Principles. 3.2 Outline inventory management techniques. 3.3 Explain First-In-First-Out (FIFO) and First-Expired-First-Out (FEFO) Last-In-Last-Out (LILO). 3.4 Describe Stock Rotation Exercise.	• Discuss Inventory Control Principles • Explain inventory management techniques • Discuss First-In-First-Out (FIFO) and First-Expired-First-Out (FEFO) Last-In-Last-Out (LILO) • Explain Stock Rotation Exercise	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Stock cards, Shelf-life charts.	• Arrange produce batches based on harvest dates and expiry. • Arrange produce based on FIFO, FEFO and LILO • Report findings	Guide students to: • Arrange produce batches based on harvest dates and expiry. • Arrange produce based on FIFO, FEFO and LILO • Report findings	Dummy produce crates, Batch labels Prototype warehouse Pallets Incinerators Fire control apparatus Inventory bin PPE Store apparatus Sprayers
GENERAL OBJECTIVE 4.0: Know the documentation and administrative procedures in warehousing.						
8 – 9	4.1 Define Warehouse Documentation. 4.2 Outline administrative procedures in warehousing. 4.3 Describe Goods Received Notes (GRN) and Waybills. 4.4 Define	• Explain Warehouse Documentation • Explain administrative procedures in warehousing. • Explain Goods Received Notes (GRN) and Waybills. • Explain	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Sample	• Complete a full cycle of warehouse entry documents. • Report findings	Guide students to: • Complete a full cycle of warehouse entry documents. • Report findings	Document templates, Folders Waybill sample GRN

	Documentation Practice.	Documentation Practice	Waybills, Bin cards.			
GENERAL OBJECTIVE 5.0: Understand digital inventory systems and Warehouse Management Software (WMS).						
10 – 11	5.1 Define Digital Inventory. 5.2 Explain Warehouse Management Software (WMS). 5.3 Outline the role of Barcoding and RFID in inventory tracking. 5.4 Explain Software Implementation.	• Explain Digital Inventory • Discuss Warehouse Management Software (WMS). • Explain the role of Barcoding and RFID in inventory tracking. • Discuss Software Implementation	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals WMS Demos, Barcode scanners.	• Input stock data into an electronic inventory system. • Generate “Low Stock” and “Expiry” alerts	Guide students to: • Input stock data into an electronic inventory system. • Generate “Low Stock” and “Expiry” alerts	Laptops, Inventory software/Excel Internet Barcode reader RFID
GENERAL OBJECTIVE 6.0: Know the safety, security, and pest control protocols in a warehouse environment.						
12 – 13	6.1 Define Safety and Pest Management 6.2 Describe security in a warehouse environment. 6.3 Outline pest control protocols. 6.4 Explain fire safety, LOTO, and Integrated Pest Management (IPM). 6.5 Define Pest Monitoring.	• Explain Safety and Pest Management • Explain security in a warehouse environment. • Explain pest control protocols Discuss fire safety, LOTO, and Integrated Pest Management (IPM). • Explain Pest Monitoring	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Fire extinguishers, Safety signage.	• Set up pheromone traps and bait stations.	Guide students to: • Set up pheromone traps and bait stations.	Sprayers, Traps, PPE Bait pheromone
GENERAL OBJECTIVE 7.0: Know the logistics of receiving, dispatch, and material handling.						
14 – 15	7.1 Define dispatch and	• Explain dispatch	Textbooks,	• Conduct a physical	Guide students to:	Calculators,

	logistics. 7.2 Explain the logistics of receiving material. 7.3 Explain the logistics of material handling. 7.4 Describe cross-docking and shipping container loading. 7.5 Define Stock Audit (Physical Count).	and logistics Discuss the logistics of receiving material. • Discuss the logistics of material handling. • Explain cross-docking and shipping container loading. • Explain Stock Audit (Physical Count)	Articles Computer, Projector White board, Marker Educational Videos or Documentaries Journals Loading diagrams, Pallet jacks.	inventory count and reconcile with records. • Conduct a physical inventory count and reconcile with records.	Audit sheets. Store ledger Record books Record tags
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%					

INTRODUCTION TO PACKAGING TECHNOLOGY

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: INTRODUCTION TO PACKAGING TECHNOLOGY	COURSE CODE: PPT 222	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to provide students with knowledge and skills of modern packaging technologies for quality preservation, marketability and sustainability.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand fundamentals and functions of packaging; 2.0 Know conventional and modern packaging materials; 3.0 Understand smart, active and nano packaging technologies; 4.0 Know sustainable and eco-friendly packaging systems; 5.0 Know packaging principles of various agricultural commodities; 6.0 Know practical packaging design and quality assessment skills; 7.0 Understand regulatory, labelling and consumer safety requirements in packaging.		

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: INTRODUCTION TO PACKAGING TECHNOLOGY			COURSE CODE: PPT 222		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills of modern packaging technologies for quality preservation, marketability and sustainability.						
GENERAL OBJECTIVE 1.0: Understand fundamentals and functions of packaging						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Define packaging. 1.2 Describe its primary, secondary, and tertiary functions. 1.3 Explain the role of packaging in postharvest loss reduction. 1.4 Describe the relationship between packaging, shelf life, and market value.	• Explain packaging • Explain its primary, secondary, and tertiary functions • Explain the role of packaging in postharvest loss reduction • Explain the relationship between packaging, shelf life, and market value	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Packaging samples, Multi-media Boards, textbooks on packaging technology	• Examine various types of packaging used for selected agricultural produce • Classify each sample by function (containment, protection, information, convenience)	• Guide students to: Examine various types of packaging used for selected agricultural produce • Classify each sample by function (containment, protection, information, convenience)	Assorted packaging samples Classification worksheets Camera for documentation
GENERAL OBJECTIVE 2.0: Know conventional and modern packaging materials						
3 – 5	2.1 Describe properties of glass, metals, paper/board, and plastics (PE, PP,	• Explain properties of glass, metals, paper/board, and plastics (PE, PP,	Textbooks Articles Computer Multi-media	• Conduct moisture and gas permeability tests on selected packaging films	Guide students to: • Conduct moisture and gas permeability tests	Packaging film samples, Permeability test kit,

	PET, PVC). 2.2 Explain selection criteria: barrier properties, strength, permeability, cost, etc. 2.3 List modern materials: biodegradable films, nanocomposites, edible coatings/ packaging.	PET, PVC) Discuss selection criteria: barrier properties, strength, permeability, cost, etc. • Explain modern materials: biodegradable films, nanocomposites, edible coatings/ packaging	Boards White board Marker Educational Videos or Documentaries Journals Material samples, property data sheets, Multi-media Boards, packaging textbooks	• Prepare an edible coating solution • Apply edible coating solution to fresh produce	on selected packaging films • Prepare an edible coating solution • Apply edible coating solution to fresh produce	Carboxymethyl cellulose, Glycerol Fresh produce
GENERAL OBJECTIVE 3.0: Understand smart, active and nano packaging technologies						
6 – 7	3.1 Define active packaging. 3.2 Describe types of active packaging: oxygen scavengers, moisture absorbers, antimicrobial films. 3.3 Define smart packaging: Time-temperature indicators (TTI) Freshness indicators RFID tags. 3.4 Explain how active and smart packaging interact with the produce and consumer	• Explain active packaging • Explain types of active packaging: oxygen scavengers, moisture absorbers, antimicrobial films • Explain smart packaging: Time-temperature indicators (TTI) Freshness indicators RFID tags • Describe how	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Smart/active packaging samples, TTI examples, Multi-media Boards, journal articles	• Incorporate an oxygen scavenger sachet into a MAP • Monitor oxygen depletion • Examine a time-temperature indicator under different temperature exposures • Interpret a time-temperature indicator under different temperature exposures	• Guide students to: • Incorporate an oxygen scavenger sachet into a MAP • Monitor oxygen depletion • Examine a time-temperature indicator under different temperature exposures • Interpret a time-temperature indicator under different temperature	O ₂ scavenger sachets TTI samples MAP bags Gas analyser Produce samples

	3.5 Define nano packaging technology	active and smart packaging interact with the produce and consumer • Explain nano packaging technology			exposures	
GENERAL OBJECTIVE 4.0: Know sustainable and eco-friendly packaging systems						
8 – 9	4.1 Explain sustainability in packaging: reduce, reuse, recycle principles. 4.2 Describe bioplastics and compostable packaging materials (PLA, starch-based films). 4.3 Explain life cycle assessment (LCA) of conventional vs sustainable packaging.	• Discuss sustainability in packaging: reduce, reuse, recycle principles • Explain bioplastics and compostable packaging materials (PLA, starch-based films) • Explain life cycle assessment (LCA) of conventional vs sustainable packaging	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Bioplastic samples, LCA case studies, Multi-media Boards, sustainability guidelines	• Compare degradation rates of conventional plastic and bioplastic films under simulated conditions • Prepare a simple starch-based film • Evaluate starch-based film mechanical properties • Prepare a simple starch-based film • Evaluate starch-based film life cycle assessment on a known produce	Guide students to: • Compare degradation rates of conventional plastic and bioplastic films under simulated conditions • Prepare a simple starch-based film • Evaluate starch-based film mechanical properties • Prepare a simple starch-based film • Evaluate starch-based film life cycle assessment on a known produce	Conventional and bioplastic film samples Starch Glycerol Water Tensile tester or ruler
GENERAL OBJECTIVE 5.0: Know packaging principles to various agricultural commodities						
10 – 11	5.1 Explain appropriate packaging for fresh	• Discuss appropriate	Textbooks Articles	• Package three different	• Guide students to:	Packaging materials (films,

	produce (mango, tomato, leafy greens, etc.) 5.2 Describe packaging requirements for processed and dried produce. 5.3 Describe packaging for cereal and legume grains storage.	packaging for fresh produce (mango, tomato, leafy greens, etc.) • Explain packaging requirements for processed and dried produce • Explain packaging for cereal and legume grains storage	Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Commodity packaging recommendation tables, Multi-media Boards, sample packages	commodities using selected appropriate materials • Carryout the following: Monitor, compare and record quality parameters (weight loss, appearance, etc.) of the produce over 7 days	• Package three different commodities using selected appropriate materials • Carryout the following: Monitor, compare and record quality parameters (weight loss, appearance, etc.) of the produce over 7 days	bags, boxes) Produce samples Balance Colour chart Weighing Scale Penetrometer Refractometer
GENERAL OBJECTIVE 6.0: Know practical packaging design and quality assessment skills						
12 – 13	6.1 Explain principles of packaging design (graphics, labelling, structural design). 6.2 Describe packaging quality tests (compression, drop, vibration tests, bruises, etc.) 6.3 Outline consumer research methods for packaging acceptability.	• Discuss principles of packaging design (graphics, labelling, structural design) • Explain packaging quality tests (compression, drop, vibration tests, bruises, etc.) • Explain consumer research methods for packaging acceptability	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals Design samples, Multi-media Boards, quality test equipment, survey templates	• Design a simple label for a selected packaged produce item • Conduct a compression/ vibration test on selected packages • Record results • Administer a consumer preference survey for packaging designs	• Guide students to: • Design a simple label for a selected packaged produce item • Conduct a compression/ vibration test on selected packages • Record results • Administer a consumer preference survey for packaging designs	Label design templates Compression tester/weights Printed survey forms Packaging samples Produce sample
GENERAL OBJECTIVE 7.0: Understand regulatory, labelling, and consumer safety requirements in packaging						

14 – 15	7.1 Outline NAFDAC, FSS, Consumer Protection Council, National Bio-safety Management Agency (NBMA) and SON labelling requirements for packaged food produce. 7.2 Describe food contact material safety regulations and migration limits. 7.3 Explain consumer rights in relation to packaging information.	• Explain NAFDAC, FSS, Consumer Protection Council, National Bio-safety Management Agency (NBMA) and SON labelling requirements for packaged food produce • Discuss food contact material safety regulations and migration limits • Explain consumer rights in relation to packaging information	Textbooks Articles Computer Multi-media Boards White board Marker Educational Videos or Documentaries Journals NAFDAC labelling guidelines, sample food labels, Multi- media Boards	• Analyse a commercial food label for regulatory compliance • Redesign a non-compliant label to meet regulatory standards	• Guide students to: • Analyse a commercial food label for regulatory compliance • Redesign a non-compliant label to meet regulatory standards	Commercial food labels Regulatory guidelines Blank label templates pens
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

STORAGE MANAGEMENT OF PERISHABLES AND SEMI-PERISHABLES**PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY**

COURSE TITLE: STORAGE MANAGEMENT OF PERISHABLES AND SEMI-PERISHABLES	COURSE CODE: PPT 223	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK

GOAL: This course is designed to equip students with the knowledge and skills in managing the environmental and structural requirements for storing high-moisture agricultural produce to minimise losses.

GENERAL OBJECTIVES: On completion of this course, the student should be able to:

- 1.0 Understand the classification and storage characteristics of perishables and semi-perishables;
- 2.0 Know the principles of psychrometry and humidity control in storage;
- 3.0 Know the design and operation of traditional and modern cooling structures;
- 4.0 Know the management of cold chains and refrigerated storage systems;
- 5.0 Understand specialized storage techniques for bulbs, root, tuber crops, etc;
- 6.0 Know the protocols for multi-crop storage and compatibility;
- 7.0 Understand the economics and energy management of perishable produce storage systems.



PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: STORAGE MANAGEMENT OF PERISHABLES AND SEMI-PERISHABLES			COURSE CODE: PPT 223		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills in managing the environmental and structural requirements for storing high-moisture agricultural produce to minimise losses.						
GENERAL OBJECTIVE 1.0: Understand the classification and storage characteristics of perishables and semi-perishables produce.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Define perishables and semi-perishables produce. 1.2 List examples of perishables and semi-perishables produce. 1.3 Explain perishables and semi-perishables produce. 1.4 Explain Storage Characteristics of perishables and semi-perishables produce. 1.5 Differentiate storage needs for leafy greens, pome fruits, bulbs and root and tubers.	• Explain perishables and semi-perishables produce. • Explain examples of perishables and semi-perishables produce. • Discuss perishables and semi-perishables produce. • Discuss Storage Characteristics of perishables and semi-perishables produce. • Differentiate storage needs for leafy greens, pome fruits, bulbs and root and tubers.	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Physiological charts, Projector.	• Monitor the deterioration rate of various perishable and semi-perishables at room temperature • Report findings.	Guide students to: • Monitor the deterioration rate of various perishable and semi-perishables at room temperature • Report findings.	Digital scales, Color charts, assorted produce. Root and tubers, grains, bulbs, fruits and vegetables Cold room Prototypes of different storage structures

	1.6 Describe Shelf-life Assessment.	• Discuss Shelf-life Assessment				
GENERAL OBJECTIVE 2.0: Know the principles of psychrometry and humidity control in storage.						
3 – 5	2.1 Define psychrometry in storage. 2.2 Explain humidity control in storage. 2.3 Describe relative humidity (RH), dew point, and vapor pressure deficit (VPD). 2.4 Outline Psychrometric Calculations.	• Explain psychrometry in storage • Explain humidity control in storage. • Discuss relative humidity (RH), dew point, and vapor pressure deficit (VPD). • Explain Psychrometric Calculations	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Psychrometric charts, Sling psychrometers.	• Determine RH using dry-bulb and wet-bulb hygrometers. • Report findings	Guide students to: • Determine RH using dry-bulb and wet-bulb hygrometers. • Report findings	Hygrometers, Data loggers, Psychrometric software.
GENERAL OBJECTIVE 3.0: Know the design and operation of traditional and modern cooling structures						
6 – 7	3.1 Define Cooling Structures 3.2 List types of traditional and modern cooling structures. 3.3 Describe the design and operation of cooling structures. 3.4 Explain evaporative cooling system (ECS) and zero energy cool chambers (ZECC).	• Explain Cooling Structures • Explain types of traditional and modern cooling structures. • Explain the design and operation of cooling structures. • Discuss evaporative cooling system (ECS) and zero energy cool chambers (ZECC).	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals ZECC diagrams, Bricks, Sand.	• Construct a mini-evaporative cooling chamber. • Study the Local Clay pot capacity for cooling	Guide students to; • Construct a mini-evaporative cooling chamber. • Study the Local Clay pot capacity for cooling	Charcoal, Bricks, Wire mesh, Water source River bed sand Thatch grass DC Electric Fan
GENERAL OBJECTIVE 4.0: Know the management of cold chains and refrigerated storage systems.						

8 – 9	4.1 Define cold chain and refrigeration. 4.2 Discuss the management of cold chains and storage systems. 4.3 Describe the vapor compression cycle and forced-air cooling. 4.4 Discuss cold room monitoring.	• Explain cold chain and refrigeration • Explain the management of cold chains and storage systems. • Explain the vapor compression cycle and forced-air cooling. • Explain cold room monitoring	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Refrigeration cycle diagrams, Videos.	• Map the temperature distribution within a cold storage unit. • Report findings	Guide students to: • Map the temperature distribution within a cold storage unit. • Report findings	Digital thermometers, Cold room access, Clipboards Meteorological unit
GENERAL OBJECTIVE 5.0: Understand specialized storage techniques for bulbs, root and tuber crops, etc.						
10 – 11	5.1 Define bulbs, roots and tubers storage. 5.2 Outline storage techniques for bulbs, root and tubers. 5.3 Describe the Curing process for Yam, Sweet Potato, Onions etc. 5.4 Explain curing simulation.	• Explain bulbs, roots and tubers storage • Explain storage techniques for bulbs, root and tubers • Explain the Curing process for Yam, Sweet Potato, Onions etc. • Discuss curing simulation	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Curing protocol manuals, Tuber samples.	• Perform a curing exercise for bruised yams or potatoes. • Report findings	Guide students to: • Perform a curing exercise for bruised yams or potatoes. • Report findings	Humidifiers, Heating mats, Injured tubers.
GENERAL OBJECTIVE 6.0: Know the protocols for multi-crop storage and compatibility.						
12 – 13	6.1 Define storage compatibility. 6.2 Describe multi-crop	• Explain storage compatibility • Explain multi-crop storage	Textbooks Articles Computer Projector	• Design a storage plan for 5 different crops in one facility.	Guide students to: • Design a storage plan for 5 different crops	Floor plan templates, Compatibility charts Multi-crop

	storage. 6.3 State the protocols for multi-crop storage. 6.4 Outline the effects of multi-crop storage. 6.5 List ethylene-producers and ethylene-sensitive crops. 6.6 Explain mixed storage audit.	• Explain the protocols for multi-crop storage Explain the effects of multi-crop storage • Explain ethylene-producers and ethylene-sensitive crops. • Discuss mixed storage audit	White board Marker Educational Videos or Documentaries Journals Compatibility tables, odor- sensitive samples.	• Report findings	in one facility. • Report findings	storage structure Ventilation system Sealed storage containers CO2 Analyser Odor barrier film
GENERAL OBJECTIVE 7.0: Understand the economics and the energy management of perishable produce storage systems.						
14 – 15	7.1 Define Energy management and Economics. 7.2 Explain the cost-benefit of storage vs. immediate sale. 7.3 Explain loss/profit analysis.	• Explain Energy management and Economics • Discuss the cost-benefit of storage vs. immediate sale. • Discuss loss/profit analysis.	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Energy meters, Economic data sets.	• Calculate the cost-benefit of storage vs. immediate sale. • Calculate the "Break-even" storage duration for a specific crop.	Guide students to: • Calculate the cost-benefit of storage vs. immediate sale. • Calculate the "Break-even" storage duration for a specific crop.	Calculators, Laptops, Sample market prices Internet Subscription to market information system.

COURSE ASSESSMENT:

Course work:	10%
Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%



PRINCIPLES OF PACKING HOUSE MANAGEMENT AND AUTOMATION

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: PRINCIPLES OF PACKING HOUSE MANAGEMENT AND AUTOMATION	COURSE CODE: PPT 224	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to provide students with knowledge and skills required to operate modern packing house facilities, focusing on workflow optimization, machinery automation and industrial safety.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Know the functions, design and layout principles of a modern packing house: 2.0 Know the operational principles of automated reception and cleaning systems: 3.0 Know the mechanics of automated sorting, grading and sizing machinery: 4.0 Know specialized surface treatments using automated systems: 5.0 Understand materials handling, palletization and unit loading techniques: 6.0 Know packing house sanitation, good hygiene practice (GHP) and personnel management 7.0 Know the maintenance protocols and safety standards for packing house automation.		



PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: PRINCIPLES OF PACKING HOUSE MANAGEMENT AND AUTOMATION			COURSE CODE: PPT 224		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills required to operate modern packing house facilities, focusing on workflow optimization, machinery automation and industrial safety.						
GENERAL OBJECTIVE 1.0: Know the functions, design, and layout principles of a modern packing house.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Explain Packing House Design and Layout. 1.2 State the functions of packing house. 1.3 Describe the management of packing house. 1.4 Describe the layout principles of a modern packing house. 1.5 Differentiate between "U-Flow" and "Straight-Through" layouts. 1.6 Describe facility layout design	• Discuss Packing House Design and Layout • Explain the functions of packing house. • Explain the management of packing house • Explain the layout principles of a modern packing house. • Explain the differences between "U-Flow" and "Straight-Through" layouts. • Explain facility layout design	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Floor plans, Blueprints.	• Sketch an optimized layout for a specific crop (e.g., Citrus or Tomato). • Visit any packing house available	Guide students to: • Sketch an optimized layout for a specific crop (e.g., Citrus or Tomato). • Visit any packing house available	Graph paper, Drawing tools, CAD software Prototype warehouse

GENERAL OBJECTIVE 2.0: Know the operational principles of automated reception and cleaning systems.

3 – 5	2.1 Define Automated Reception and Cleaning. 2.2 Describe operational principles of automated reception. 2.3 Describe cleaning systems. 2.4 Discuss dumper systems, flumes, and automated washers. 2.5 Explain Water Quality and Sanitisation.	• Explain Automated Reception and Cleaning • Explain operational principles of automated reception • Explain cleaning systems • Explain dumper systems, flumes, and automated washers. • Discuss Water Quality and Sanitisation	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Photos of industrial washers, chemical specs.	• Monitor chlorine levels and pH in a simulated wash tank. • Simulate automated reception and cleaning system	Guide students to: • Monitor chlorine levels and pH in a simulated wash tank. • Simulate automated reception and cleaning system	pH meters, Chlorine test strips, Water tanks Prototype wash line Containers of different sizes PPE Sanitisers
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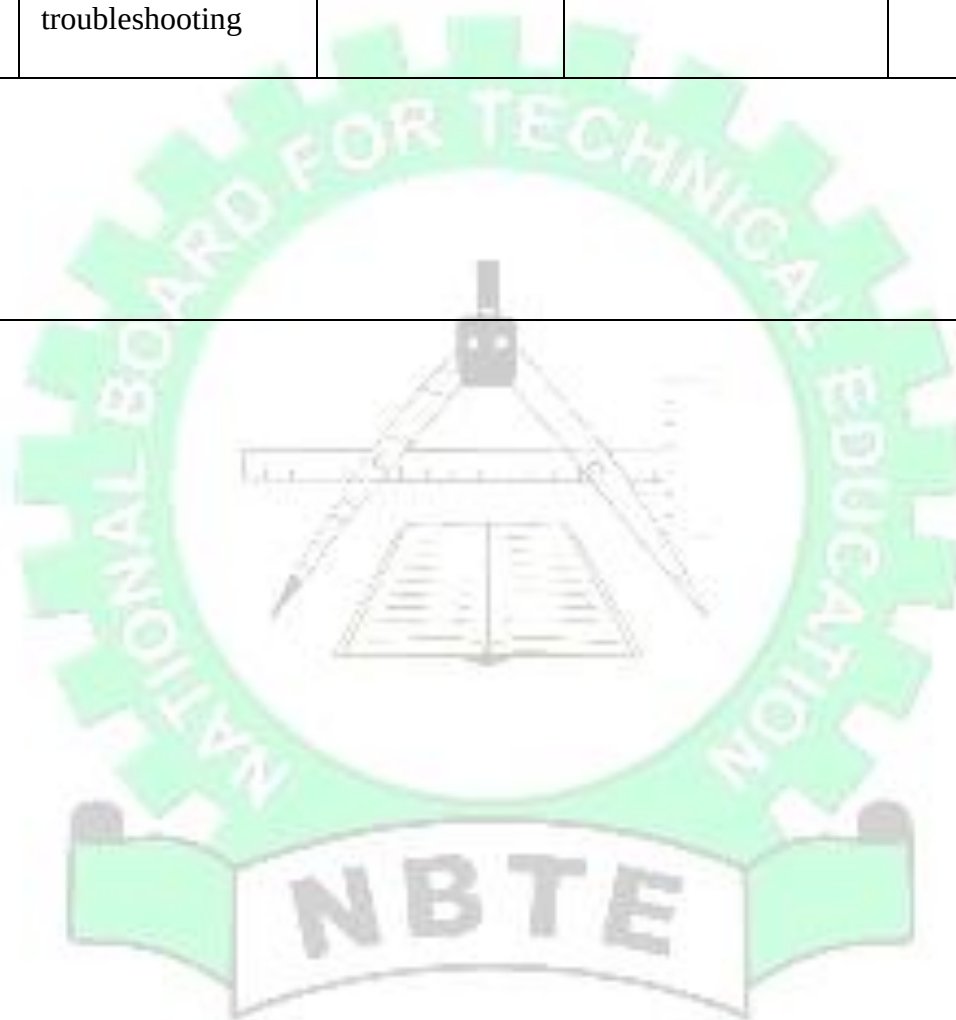
GENERAL OBJECTIVE 3.0: Know the mechanics of automated sorting, grading, and sizing machinery.

6 – 7	3.1 Define sorting and grading. 3.3 Explain grading and sizing automation. 3.4 Describe optical sorters and weight-based sizing machines. 3.5 Explain machinery calibration.	• Explain sorting and grading • Discuss grading and sizing automation • Explain optical sorters and weight-based sizing machines. • Discuss machinery calibration	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Diagrams of mechanical sizers, Video of optical sorters.	• Calibrate a mechanical sizer for different diameter grades.	Guide students to: • Calibrate a mechanical sizer for different diameter grades.	Mechanical grader, calipers, fruit samples Optical sorters Weighing balance Packaging materials Manual sizers Multi-media Boards
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GENERAL OBJECTIVE 4.0: Know specialised surface treatments using automated systems.						
8 – 9	4.1 Discuss the concept of surface treatments. 4.2 Describe the mechanics of automated waxing and fungicide application. 4.3 Describe coating application technology.	• Explain the concept of Surface Treatments • Explain the mechanics of automated waxing and fungicide application. • Explain coating application technology	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Wax emulsions, Spray nozzle samples.	• Evaluate the coverage of spray nozzles at different pressures. • Demonstrate different technologies in waxing and coating on agricultural produce • Compare and contrast their shelf life • Record findings	Guide students to: • Evaluate the coverage of spray nozzles at different pressures • Demonstrate different technologies in waxing and coating on agricultural produce • Compare and contrast their shelf life • Record findings	Spray rig, Fluorescent dye (for coverage testing). Display shelves Different types of wax and coatings Sprayers Different brushes Stainless steel containers Forceps Foam Wax emulsions, Spray nozzle samples
GENERAL OBJECTIVE 5.0: Understand materials handling, palletization, and unit loading techniques						
10 – 11	5.1 Define materials handling. 5.2 Explain unit loading techniques. 5.3 Define palletization. 5.4 Describe palletization standards and the use of forklifts/conveyors. 5.5 Explain pallet stacking and strapping.	• Explain materials handling • Discuss unit loading techniques • Explain palletization • Explain palletization standards and the use of forklifts/conveyors • Discuss pallet stacking and strapping	• Textbooks • Articles • Computer • Projector • White board • Marker • Educational • Videos or • Documentaries • Journals • Pallet samples, strapping tools.	• Practice stacking crates in a stable, ventilated pattern. • Demonstrate different stacking techniques • Carry out pallet stacking and strapping	Guide students to: • Practice stacking crates in a stable, ventilated pattern. • Demonstrate different stacking techniques • Carry out pallet stacking and strapping	Crates, Pallets, Tensioners Strapping coils Pallet Truck Forklift Strapping Machine Strapping roll PPE Packaging materials
GENERAL OBJECTIVE 6.0: Know packing house sanitation, good hygiene practice (GHP) and personnel management.						
12 – 13	6.1 Explain personnel	• Discuss personnel	• Textbooks	• Conduct a surface	• Guide students to:	Hygiene swabs,

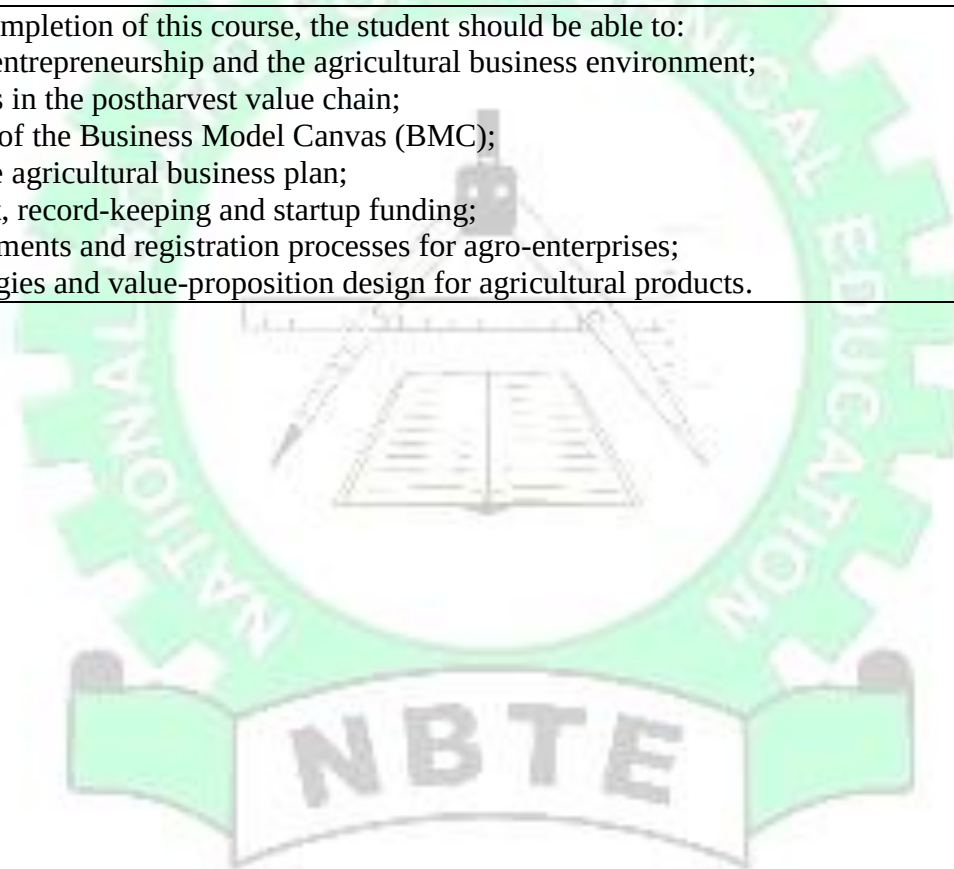
	and hygiene management in handling of agricultural produce. 6.2 Describe worker safety Occupational safety and Health Administration (OSHA) and Good Hygiene Practices (GHP). 6.3 Explain hygiene audit and swabbing.	and hygiene management in handling of agricultural produce • Explain worker safety Occupational safety and Health Administration (OSHA) and Good Hygiene Practices (GHP). • Discuss hygiene audit and swabbing	Articles Computer Projector White board Marker Educational Videos or Documentaries Journals GHP Checklists, Safety signage.	hygiene test on a conveyor belt • Demonstrate Personal and hygiene management in handling of agricultural produce • Carry out roleplay on workers safety and health administration • Carry out hygiene audit and swabbing • Identify muster point in case of emergency • Simulate an emergency drill scenario	Conduct a surface hygiene test on a conveyor belt • Demonstrate Personal and hygiene management in handling of agricultural produce • Carry out roleplay on workers safety and health administration • Carry out hygiene audit and swabbing • Identify muster point in case of emergency • Simulate an emergency drill scenario	Luminometer, Sanitizers First aid kit OSHA charts Flyers Fire extinguishers Sand buckets Emergency shower Hygiene audit checklist PPE
GENERAL OBJECTIVE 7.0: Know the maintenance protocols and safety standards for packing house automation.						
14 – 15	7.1 Describe automation maintenance and safety. 7.2 Describe the safety standard protocols. 7.3 Discuss the preventive maintenance (PM) schedules and	• Explain automation maintenance and safety • Explain the safety standard protocols • Explain the preventive maintenance (PM) schedules and Lock-Out/Tag-Out	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Journals Maintenance	• Perform a daily maintenance check on a packing line	Guide students to: • Perform a daily maintenance check on a packing line	Hygiene swabs, Luminometer, Sanitizers First aid kit OSHA charts Flyers Fire extinguishers Sand buckets Emergency shower Hygiene audit checklist

	Lock-Out/Tag-Out (LOTO). 7.4 Describe maintenance troubleshooting.	(LOTO). • Explain maintenance troubleshooting	logs, LOTO kits.			PPE
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



AGRI-ENTREPRENEURSHIP, BUSINESS PLANNING AND ENTERPRISES

PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY		
COURSE TITLE: AGRI-ENTREPRENEURSHIP, BUSINESS PLANNING AND ENTERPRISES	COURSE CODE: PPT 225	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to empower students with the knowledge and skills necessary to identify, plan and manage commercially viable Postharvest enterprises.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand the concepts of entrepreneurship and the agricultural business environment; 2.0 Know business opportunities in the postharvest value chain; 3.0 Understand the components of the Business Model Canvas (BMC); 4.0 Understand a comprehensive agricultural business plan; 5.0 Know financial management, record-keeping and startup funding; 6.0 Understand the legal requirements and registration processes for agro-enterprises; 7.0 Understand marketing strategies and value-proposition design for agricultural products.		



PROGRAMME: NATIONAL DIPLOMA IN POSTHARVEST PRODUCE TECHNOLOGY						
COURSE TITLE: AGRI-ENTREPRENEURSHIP, BUSINESS PLANNING AND ENTERPRISES			COURSE CODE: PPT 225		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to empower students with the knowledge and skills necessary to identify, plan and manage commercially viable Postharvest enterprises.						
GENERAL OBJECTIVE 1.0: Understand the concepts of entrepreneurship and the agricultural business environment.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Define Agri-Entrepreneur. 1.2 Define entrepreneurship and risk-taking in agriculture. 1.3 Discuss the concepts of agricultural business environment. 1.4 Discuss Ideation Workshop. 1.5 Define SWOT Analysis.	• Explain Agri-Entrepreneur • Explain entrepreneurship and risk-taking in agriculture. • Explain the concepts of agricultural business environment. • Explain Ideation Workshop • Explain SWOT Analysis	• Textbooks • Articles • Computer • Projector • White board • Marker • Educational Videos or Documentaries • Entrepreneurship journals, Projector.	• Generate five business ideas focused on reducing food waste • Report findings	• Guide students to: Generate five business ideas focused on reducing food waste • Report findings	Post-it notes, Flipcharts Writing materials Internet Computer Cardboard paper
GENERAL OBJECTIVE 2.0: Know business opportunities in the postharvest value chain.						
3 – 5	2.1 Describe Opportunity Identification 2.2 Describe	• Explain Opportunity Identification • Explain	• Textbooks • Articles • Computer • Projector	• Map a local crop and livestock path from farm to consumer. • Visit a market and	• Map a local crop and livestock path from farm to consumer.	Market data, local crop and livestock profiles.

	postharvest value chain. 2.3 Outline business opportunities in the postharvest value chain. 2.4 Outline gaps in storage, transport, and processing. 2.5 Define Value-Chain Mapping.	postharvest value chain. • Explain business opportunities in the postharvest value chain • Explain gaps in storage, transport, and processing. • Explain Value-Chain Mapping	White board Marker Educational Videos or Documentaries Value-chain diagrams.	identify opportunities in the postharvest value chain. • Report findings	• Visit a market and identify opportunities in the postharvest value chain. • Report findings	
GENERAL OBJECTIVE 3.0: Understand the components of the Business Model Canvas (BMC).						
6 – 7	3.1 Define BMC Design. 3.2 Describe Business Model Canvas (BMC). 3.3 Discuss the components of the Business Model Canvas (BMC). 3.4 Explain the 9 building blocks of the BMC.	Explain BMC Design Explain Business Model Canvas (BMC) Explain the components of the Business Model Canvas (BMC). Discuss the 9 building blocks of the BMC.	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries BMC Templates.	Create a one-page business model for a PPT service. Report findings	Guide students to: Create a one-page business model for a PPT service. Report findings	Large BMC posters, Markers Writing materials Calculators Computer Internet facility
GENERAL OBJECTIVE 4.0: Understand a comprehensive agricultural business plan.						
8 – 9	4.1 Describe Business Plan 4.2 State the importance of Business Plan. 4.3 List the components of a	• Explain Business Plan • Discuss the importance of Business Plan • Explain the components of a	Textbooks Articles Computer Projector White board Marker Educational Videos or	• Draft the "Operations" and "Management" sections of a plan. • Report findings	• Guide students to: Draft the "Operations" and "Management" sections of a plan. • Report findings	Laptops, Business plan templates Internet facilities

	Business Plan. 4.4 Describe the Executive Summary, Operations, and Marketing plans.	Business Plan • Discuss the Executive Summary, Operations, and Marketing plans.	Documentaries Sample Business Plans.			
GENERAL OBJECTIVE 5.0: Understand financial management, record-keeping, and startup funding.						
10 – 11	5.1 Define Financial Management. 5.2 Define Record keeping. 5.3 State the importance of Record keeping. 5.4 List types of record keeping. 5.5 Describe startup funding. 5.6 Outline ways of getting startup funding. 5.7 Describe Cash Flow, Profit/Loss, and Break-even Analysis. 5.8 Define Financial Forecasting.	• Explain Financial Management • Explain Record keeping • Explain the importance of Record keeping • Explain types of record keeping • Explain startup funding. • Explain ways of getting startup funding. • Explain Cash Flow, Profit/Loss, and Break-even Analysis. • Explain Financial Forecasting	• Textbooks • Articles • Computer • Projector • White board • Marker • Educational Videos or Documentaries • Financial calculators, Spreadsheets.	• Calculate the startup costs and "Break-even" point for a startup. • Report findings	Guide students to: • Calculate the startup costs and "Break-even" point for a startup. • Report findings	Laptops, Excel templates.
GENERAL OBJECTIVE 6.0: Understand the legal requirements and registration processes for agro-enterprises.						
12 – 13	6.1 Define Legal and Regulatory Framework. 6.2 Explain the legal requirements for	• Explain Legal and Regulatory Framework the • Discuss legal requirements for	Textbooks Articles Computer Projector White board Marker	• Complete mock registration forms for a new enterprise. • Visit CAC Report findings	• Guide students to: Complete mock registration forms for a new enterprise.	CAC online portal demo, forms.

	agro-enterprises. 6.3 List the steps for CAC registration and NAFDAC compliance. 6.4 State the importance of CAC registration.	agro-enterprises. • Explain the steps for CAC registration and NAFDAC compliance. • Explain the importance of CAC registration	Educational Videos or Documentaries CAC forms, Tax guidelines.		• Visit CAC Report findings	
GENERAL OBJECTIVE 7.0: Understand how to apply marketing strategies and value-proposition design for agricultural products.						
14 – 15	7.1 Define Marketing and Pitching. 7.2 Outline marketing strategies for agricultural products. 7.3 Explain value-proposition design for agricultural products. 7.4 Define the Elevator Pitch. 7.5 Explain the 4Ps of marketing and the "Elevator Pitch."	• Explain Marketing and Pitching • Explain marketing strategies for agricultural products. • Discuss value-proposition design for agricultural products. • Explain the Elevator Pitch Discuss the 4Ps of marketing and the "Elevator Pitch."	Textbooks Articles Computer Projector White board Marker Educational Videos or Documentaries Branding examples, Video pitches.	• Deliver a 3-minute pitch to a mock panel of investors. • Visit nearby agricultural market Report findings	• Deliver a 3-minute pitch to a mock panel of investors. • Visit nearby agricultural market Report findings	Stopwatch, Feedback rubrics. Internet computer Agricultural products
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

LIST OF MINIMUM RESOURCES

1.0 POSTHARVEST PRODUCE LABORATORY

S/N	Equipment / Item	Quantity
1	Activated charcoal	1 bag
2	Aflatoxin standards	50 (downloadable)
3	Alert mechanisms	Assorted
4	Ascorbic acid	250 ml
5	Demo automated sorting / grading equipment	2
6	Weighing balance	10 (assorted)
7	Biopesticide samples	5 types
8	Burnt bricks	500 pieces
9	Calculator	30
10	Calibrated digital thermometers	10
11	Calibrated hygrometers	10
12	Calorimeter	10
13	Digital camera	2
14	Cardboard	5 bundles
15	Chart of different insects	5
16	Closed jars	100
17	Cloud storage system	1 (subscription)
18	CO ₂ / O ₂ sensors	5 each
19	Cold chain	1
20	Colour score chart	10
21	Commercial food label charts	10
22	Compressors	2
23	Condensers	2
24	Measuring tapes	10 (assorted)
25	Conventional and bioplastic film samples	5 each
26	Cooling chamber	1
27	Tomato and egg crates	20 each
28	Culture specimens	5
29	Damage assessment forms	Customised
30	Data loggers	5
31	Diatomaceous earth	25 kg
32	Different types of drones	3
33	Electronic moisture meters (soil / seed)	5 each

34	Ethylene sensors	10
35	Evaporative cooler (clay pot)	20 (assorted)
36	Evaporators	3
37	FPIS certificates	Downloadable
38	Refrigerator	2
39	Fumigation simulation kit	3 (assorted)
40	Gas analyser	2
41	Gas chromatograph	1
42	Gas permeability tester	1
43	Gas sachets	3
44	Glass flushing apparatus	1
45	Glycerol	50 ml
46	GPS trackers	10
47	GrainPro cocoon bag	3 (assorted)
48	HACCP templates	Downloadable
49	Humidity chamber	1
50	Incubator	2
51	Insect chart / calendar	5 (assorted)
52	IoT logger	5
53	IPM guidelines	Downloadable
54	Potassium permanganate (KMnO ₄)	1 kg
55	Desktop computer	2
56	Router / modem	1
57	Local and improved packaging materials	10 (assorted)
58	Magnifying lenses	50
59	MAP bags	500 (assorted)
60	Marking rubric	Designed
61	Micrometer	20
62	Microscope	20 (assorted)
63	Multi-media boards	1
64	NAFDAC certificate prototype	30
65	NAQS certificate prototype	30
66	Nutrient agar	1 kg
67	O ₂ scavenger sachets	1 000
68	Open vehicle / cart	1 each
69	Carboxymethyl cellulose	25 kg
70	Potato dextrose agar (PDA)	1 kg
71	Penetrometer	20
72	Personal Protective Equipment (PPE)	30

73	Pesticide label samples	Provided
74	Pesticide samples	10 different types
75	Pheromone trap	5 types
76	PICS bags	30
77	Pipettes	50
78	Portable ethylene analyser	1
79	Printed regulatory export documents	50 each
80	Vibration platform or manual simulator	2
81	Projector	1
82	Prototype chamber for CA and MA	1 each
83	Prototype cold room	1
84	Prototype storage system	5 (assorted)
85	Real-time alert systems	5
86	Refractometer	20
87	Thermohygrometer	20
88	Sacks	20 (different sizes)
89	Safety data sheets	50 (downloadable)
90	Fire extinguisher	1
91	Sand buckets	5
92	Sensory assessment forms	Improvised
93	Shade (tree, thatch, hut, leaves, etc.)	Improvised
94	Sieves	10 (assorted)
95	Simulated store area	Improvised
96	Specimens of money	Improvised
97	Sprayers	10 (assorted)
98	Staining kits	50
99	Suction fan / extractor fan	10
100	Tanks	2 (different sizes)
101	Temperature and RH data loggers	5 each
102	Tensile tester	1
103	Stopwatch	30
104	Thin Layer Chromatography (TLC) plates	100
105	Stainless steel trays	50 (assorted)
106	Transmission Time Interval (TTI) samples	50
107	Ultraviolet lamp (UV)	30
108	Water Vapour Transmission Rate (WVTR) tester	10
109	Gas / Bunsen burner	20
110	Greenhouse	1

2.0 MICROBIOLOGY, ENTOMOLOGY AND PATHOLOGY LABORATORY

S/N	Equipment / Item	Quantity
1	Autoclave	1
2	Refrigerator	1
3	Freezer	1
4	Platinum wire loops	30
5	Incubator	1
6	Anaerobic jar	2
7	Lovibond colour comparators	2
8	Milk sampling outfit	2
9	Colony counter	1
10	Centrifuge	2
11	Water bath	1
12	Electronic balance (digital and manual)	2
13	Microscopes: simple, compound, digital screen	2 each
14	Microscope slides and cover slips (box)	20
15	Staining troughs	15
16	Magnifying glasses	15
17	Insect cages and cabinets	5
18	Specimen bottles	20
19	Insect nets	30
20	Lamps	10
21	Mist nets	10
22	Cool boxes	10
23	PPE (lab coat, gloves, boots, etc.)	20 sets
24	Petri dishes (glass and plastic)	Assorted
25	Insect killing jars	10
26	First aid kit (chemical exposure)	1
27	IPM decision threshold reference cards	20

3.0 METEOROLOGICAL STATION

S/N	Equipment / Item	Quantity
1	Stevenson screen	1
2	Thermohydrograph	1
3	Maximum and minimum thermometer	2
4	Digital thermometer	2
5	Rain gauge	2
6	Measuring glasses	2
7	Wind vane	1
8	Anemometer	2
9	Evaporimeter	2
10	Hygrometer (digital and manual)	2
11	Barometer	2
12	Automated weather station	1
13	Climate data records — Nigeria (30-year)	1 set
14	Climate change maps and charts (Nigeria)	1 set
15	Drought and flood risk maps (agro-ecological zones)	1 set
16	Computer with NIMET data analysis software	1

4.0 AUDIO-VISUAL ROOM

S/N	Equipment / Item	Quantity
1	Seminar / training room (seats 40 students)	1
2	Video recorder	2
3	Slide projector	2
4	Overhead projector	2
5	Film projector	2
6	Magnetic board	2
7	Public address system	1
8	Television set	2
9	Cameras	5
10	Enlarger	1
11	Photo dryer	1
12	Photo cutter	1
13	Tables for drawing	5
14	Water colours	2 sets
15	Drawing pencils	2 sets
16	Drawing pens	2 sets

17	Display cabinets and boards	2
18	Interactive smartboard	1
19	Laptop (for presentation)	2
20	Printer	1
21	Calculator sets (scientific)	20

5.0 PEST CONTROL EQUIPMENT STORE

S/N	Equipment / Item	Quantity
1	Knapsack pressure sprayer	2
2	Motorized mist sprayer	1
3	Handy sprayer	5
4	Hand sprayer with container	5
5	Flood-jet nozzles (1.5 OK)	4
6	Boom sprayer	2
7	PPE for chemical application (gloves, masks, goggles, overalls, boots)	20 full sets

6.0 CROP STORAGE AND PROCESSING FACILITIES

S/N	Equipment / Item	Quantity
1	Rice milling machine	1
2	Rice thresher	1
3	Rice parboiling machine	1
4	Groundnut decorticator	1
5	Maize sheller	1
6	Hand oil press	1
7	Grain drier	1
8	Cassava peeler	1
9	Cassava grater	1
10	Silos	Assorted
11	Cribs (traditional and improved)	Various
12	Yam barns	Various
13	Rhumbu	Various
14	Refrigerated warehouse / cold room	1
15	Garri fryer	1
16	Palm oil press (hand-operated)	1
17	PICS hermetic bags (assorted sizes)	Assorted

18	Weighing scales (0–100 kg platform)	4
19	Food safety PPE (aprons, gloves, hair nets, masks)	40 sets
20	Laboratory thermometer (food processing)	6
21	pH meter (food grade)	2

7.0 WOOD / METAL / MAINTENANCE WORKSHOP

S/N	Equipment / Item	Quantity
WOODWORK SECTION		
1	Working benches with vice	10
2	Band saw	2
3	Surface planer	2
4	Thickness planer	1
5	Drilling machine	2
6	Hand tools — saws, chisels, T-square, gauges, rulers, screwdrivers, drill bits, hammers, pincers, oil stones, planers, etc.	15 sets
METAL WORK SECTION		
7	Lathe machine	1
8	Pipe benders	3
9	Anvils	3
10	Micrometers (inside, outside)	1 set
11	Stock and die set	5
12	Drill sets	5
13	Electrical hand drills	2
14	Hydraulic jack (12 and 15 tonnes)	1 each
15	Tool boxes	5
16	Box of drill bits	4
17	Battery charger	1
18	Grease gun	2
19	Pipe cutters	1
20	Scribers	1
21	Steel ruler	5
22	Mallet sets	2
23	Pipe screwing / threading set	2
24	Arc-welding equipment and working benches	8
25	Arc welder	4
26	Electric grinder	2
27	Welding gloves	15

28	Welding helmet	15
29	Wire brush	5
30	Welding boots and screens / soldering equipment	15
31	Blow torch	3
32	Tin snips	4
33	Soldering flux	4
34	Sheet metal shear	4
35	Mallet hammer	4
36	Hacksaw	4
37	Oxygen and acetylene bottles	4
38	Oxygen and acetylene regulators	2
39	Cylinder wrenches	2
40	Spark lighter	3
MAINTENANCE WORKSHOP		
41	Tool boxes	5
42	Hydraulic jack	2
43	Service pit	1
44	Teaching model or scraps of tractor engines	5
45	Trailers	2
46	Plough	2

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