



NATIONAL BOARD FOR TECHNICAL EDUCATION

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

**NATIONAL DIPLOMA
IN**

PRODUCE INSPECTION AND EXPORT

CURRICULUM AND COURSE SPECIFICATIONS

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.

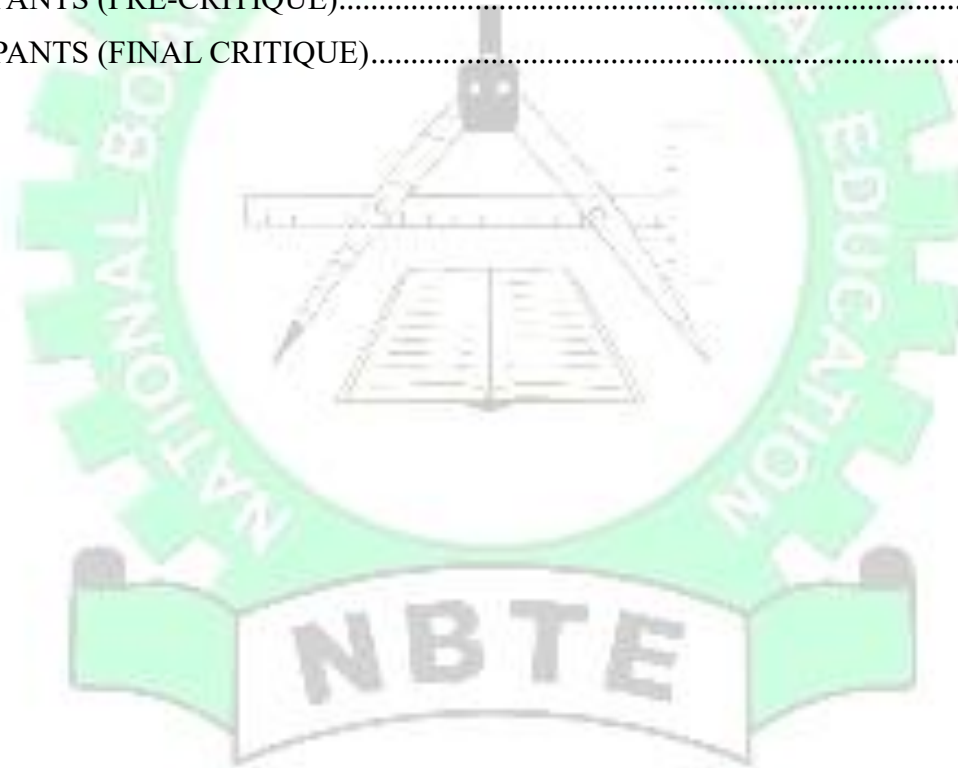
Special appreciation is extended to the members of the agriculture, curriculum specialists, resource persons, academic experts, professional bodies, regulatory agencies, employers, industry practitioners, development partners, and representatives of public and private sector organizations who participated 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.



TABLE OF CONTENTS

PREFACE	ii
ACKNOWLEDGEMENT	iii
GENERAL INFORMATION	vi
CURRICULUM TABLE	xii
YEAR I SEMESTER I.....	1
COURSE TITLE: AGRICULTURAL PRODUCE VALUE CHAINS AND PRODUCTION SYSTEMS	2
AGRICULTURAL PRODUCE VALUE CHAINS AND PRODUCTION SYSTEMS	3
PRODUCE STORAGE MANAGEMENT.....	10
POSTHARVEST SCIENCE AND INTERNATIONAL STANDARDS	18
BASIC FOOD CHEMISTRY AND BIOCHEMISTRY OF PRODUCE	27
PRODUCE GRADING SYSTEMS AND AI ASSISTED DIGITAL GRADING	36
YEAR I SEMESTER II	44
PRODUCE INSPECTION AND QUALITY ASSESSMENT	45
PRINCIPLES OF PRODUCE STANDARDISATION	52
MYCOTOXIN AND PESTICIDE RESIDUE.....	58
RODENTS BIOLOGY, INFESTATION AND INTEGRATED PEST MANAGEMENT (IPM) CONTROL	65
SMART FOOD PACKAGING AND SUSTAINABLE PACKAGING SYSTEMS	72
FOOD SAFETY SYSTEMS.....	79
YEAR II SEMESTER I.....	85
FUMIGATION PRINCIPLES, PHOSPHINE MONITORING AND SAFETY	86
CROP DRYING METHODS AND SMART DRYING TECHNOLOGY	91
STORED PRODUCT PESTS IDENTIFICATION AND BIOASSAY	97
STORED GRAIN PROTECTION AND HERMETIC STORAGE TECHNOLOGY	103

YEAR II SEMESTER II.....	109
PRODUCE STANDARDIZATION, LEGISLATION AND CERTIFICATION	110
GRAIN SAMPLING PRINCIPLES AND PROBE METHODS	115
PESTICIDE RESISTANCE AND INTEGRATED PEST MANAGEMENT (IPM) APPLICATIONS.....	121
SAFETY AND EMERGENCY RESPONSE TO OCCUPATIONAL HAZARDS	127
LIST OF MINIMUM RESOURCES/PHYSICAL FACILITIES	133
LIST OF WORKSHOP PARTICIPANTS (PRE-CRITIQUE).....	142
LIST OF WORKSHOP PARTICIPANTS (FINAL CRITIQUE).....	143



GENERAL INFORMATION

1.0 PROGRAMME NOMENCLATURE

National Diploma (ND) in Produce Inspection and Export Management.

2.0 PROGRAMME GOAL

The National Diploma in Produce Inspection and Export Management programme is designed to produce competent middle-level manpower equipped with practical skills, technical knowledge and professionals who are practically competent, internationally compliant produce inspectors and export management technicians, capable of inspecting, grading, certifying and managing the export of Nigerian agricultural commodities in accordance with national and international standards.

3.0 OBJECTIVES OF THE PROGRAMME

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

- i. Perform produce inspection to national and international quality standards for Nigerian export commodities;
- ii. Apply food safety management systems in produce inspection and export commodities;
- iii. Conduct mycotoxin and pesticide residue testing on produce consignments, according to international standards;
- iv. Prepare complete Phytosanitary export certificates and other compliant documents;
- v. Operate digital traceability systems including QR-code labelling, batch tracking and block chain supply verification;
- vi. Apply principles of fumigation including phosphine gas management, closed-loop fumigation, safety procedures and post-fumigation aeration;
- vii. Manage aflatoxin contamination across the value chain using field testing, hermetic storage techniques and rejection protocols;
- viii. Complete all export documentation forms, Letters of Credit and commodity invoices;
- ix. Apply digital agri-marketing, e-commerce platforms, value chain management skills to promote and sell certified produce;
- x. Conduct produce grading systems such as Manual, NIR-assisted and AI digital tools to achieve consistent export-grade outputs.

4.0 ENTRY REQUIREMENTS

The entry requirements into the ND Produce Inspection and Export Management programme are:

- i. Four (4) O'Level credits in relevant subjects including Mathematics, Agricultural Science or Biology, Chemistry and one other relevant subject;
- ii. Evidence of registration with Joint Administration and Matriculation Board (JAMB).

5.0 STRUCTURE/DURATION OF THE PROGRAMME

The National Diploma in Produce Inspection and Export Management programme is structured to last for two (2) years (four semesters) of classroom work, laboratory, field practicals and workshop practices.

Each semester shall be for 17 weeks, made up as follows:

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

6.0 CURRICULUM

The ND Produce Inspection and Export Management programme consists of four (4) main components. These are:

- a. General studies/General education courses
- b. Foundation courses
- c. Professional courses
- d. Students' Industrial Work Experience Scheme (SIWES), which shall take place in approved agricultural establishments after the second semester of Year I for a period of 3–4 months.

7.0 STAFFING REQUIREMENTS

7.1 Core Teaching Staff

A minimum of four (4) Core teaching staff who should possess at least HND in Post-Harvest Technology, HND Pest Management Technology or B.Sc/B.Agric/B.tech in Agriculture and related disciplines.

7.2 Technical Staff

- i. A minimum of one Technologist with HND in relevant field is required.
- ii. A minimum of one Technician with ND in relevant field is required.
- iii. A Farm Assistant with relevant qualification is required.

7.3 Headship of the Department (HOD)

The Head of Department shall have at least a First and Master's Degree in Agricultural Science or related field, He or she shall not be less than the rank of a Senior Lecturer and must be registered with a relevant professional body.

8.0 CERTIFICATION

A diplomate of this programme shall be awarded National Diploma (ND) in Produce Inspection and Export Management.

9.0 ACCREDITATION

The National Diploma (ND) in Produce Inspection and Export Management 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.

10.0 CONDITIONS FOR THE AWARD OF ND:

10.1 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 116 and 126 semester credit units depending on the programme.

10.2 National Diploma shall be Classify of Diploma

Distinction	–	CGPA	3.50–4.00
Upper Credit	–	CGPA	3.00–3.49
Lower Credit	–	CGPA	2.50–2.99
Pass	–	CGPA	2.00–2.49

10.3 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

11.0 GUIDANCE NOTES FOR TEACHERS OF THE PROGRAMME

The new curriculum is drawn in unit courses. This is 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 wish to transfer the units already completed in an institution of similar standard from which he is transferring. In designing the units, the principles of the modular system by product has been adopted; thus making each of the professional modules, when completed provide the students with technician operative skills, which can be used for employment purposes. As the success of the credit unit system depends on the articulation of programmes between the institutions and industry, the curriculum content has been written in the behavioral objectives, so that it is clear to all, the special Learning objective of the student 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 states categorically, the special learning objective for the students. There is also a deliberate attempt to further involve the staff of the department teaching the course, by having another column called ‘Teaching activities’. This is to ensure that the lecturers deliver the required learning objectives. There is a third column for the Resources required for each learning objective. Each department is expected to develop its own teaching curriculum to facilitate learning from this minimum Guide and ensure that the resources required are available. The Academic Board of the institution may vet departmental submission on the final curriculum. 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 TVET Institutions. The teaching of the 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 if possible.

12.0 PRACTICAL LOGBOOK

A practical Logbook to be kept by each student shall contain all day-to-day, weekly summary and semester summary of all the practical activities from day one to the end of the Programme. This is to be checked, marked, endorsed and recorded by the lecturers concerned at the end of every week.

13.0 FINAL PROJECT

Final year students in this programme are expected to carry out a project work. This could be on individual basis or group work of not more than five students per group, but reporting must be undertaken individually. The project should, as much as possible be related to the programme and core professional discipline. Project reports should be well presented and should be properly supervised. The department should make its own arrangement of schedules for project work.

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 (ITF), Jos. The Placement Officer should discuss and agree with industry on the following
- b. The Placement Officer should discuss and agree with industry 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, cognizance should be taken of the following items:

- i. Punctuality
- ii. Attendance
- iii. General attitude to work
- iv. Respect for authority

- v. Interest in the field/technical area
- vi. 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, which has been 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 task 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 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, s/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 (www.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.	MSQ 111	Mandatory Skills Qualification	1	0	1	2	2
5.	AGR 101	Introduction to Agriculture	1	0	2	3	3
6.	PIE 111	Agricultural Produce Value Chains and Production Systems	1	0	3	4	4
7.	PIE 112	Produce Storage Management	1	0	3	4	4
8.	PIE 113	Postharvest Science and International Standards	1	0	3	4	4
9.	PIE 114	Basic Food Chemistry and Biochemistry of Produce	1	0	3	4	4
10.	PIE 115	Produce Grading Systems and AI-Assisted Digital Grading	1	0	3	4	4
TOTAL			13	0	20	33	33

Year I Semester II

S/N	COURSE CODE	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.	PIE 122	Principles of Produce and Standardization	1	0	3	4	4
6.	PIE 123	Mycotoxin and Pesticide Residue	1	0	3	4	4
7.	PIE 124	Rodents Biology Infestation and Integrated Pest Management Control	1	0	3	4	4
8.	PIE 125	Smart Food Packaging, Active and Sustainable Packaging Systems	1	0	3	4	4
9.	PIE 126	Food Safety Systems	1	0	2	3	3
TOTAL			12	0	18	30	30

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.	PIE 211	Fumigation Principles, Phosphine Monitoring and Safety	1	0	3	4	4
5.	PIE 212	Crop Drying Methods and Smart Drying Technology	1	0	3	4	4
6.	PIE 213	Stored Product Pests Identification and Bioassay	1	0	3	4	4
7.	PIE 214	Stored Grain Protection and Hermetic Storage Technology	1	0	3	4	4
8.	PIE 215	Seminar and Industry Field Trips	1	0	3	4	4
9.	PIE 216	Students Industrial Work Experience Scheme (SIWES)	0	0	4	4	4
TOTAL			10	0	21	31	31

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.	PIE 221	Produce Standardization, Legislation and Certification	1	0	3	4	4
3.	PIE 222	Grain Sampling Principles and Probes Methods	1	0	3	4	4
4.	PIE 223	Pesticide Resistance and Integrated Pest Management Applications	1	0	3	4	4
5.	PIE 224	Safety and Emergency Response to Occupational Hazards	1	0	3	4	4
6.	PIE 225	Project	0	0	4	4	4
TOTAL			6	0	16	22	22



YEAR I SEMESTER I

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: AGRICULTURAL PRODUCE VALUE CHAINS AND PRODUCTION SYSTEMS	COURSE CODE: PIE 111	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: 1 SEMESTER: 1	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge of agricultural production systems and value chain structures as foundations for understanding produce inspection and export management.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concept and structure of agricultural value chains; 2.0 Know key actors and their roles in produce value chains; 3.0 Understand major crop and livestock production systems in Nigeria; 4.0 Understand linkages between production, postharvest handling and market access; 5.0 Know value chain inefficiencies and their impact on produce quality; 6.0 Know value chain mapping of selected commodities; 7.0 Understand global agricultural trade and export value chains.		

AGRICULTURAL PRODUCE VALUE CHAINS AND PRODUCTION SYSTEMS

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: AGRICULTURAL PRODUCE VALUE CHAINS AND PRODUCTION SYSTEMS			COURSE CODE: PIE 111		CONTACT HOURS: 4 HOURS/WEEK	
					THEORETICAL: 1 HOUR/WEEK	
			CREDIT UNIT: 4		PRACTICAL: 3 HOURS/WEEK	
YEAR: 1 SEMESTER: 1					PRE-REQUISITE: NIL	
COURSE SPECIFICATION THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills of agricultural production systems and value chain structures as foundations for understanding produce inspection and export management.						
Theoretical contents				Practical contents		
Week	Specific Learning Outcomes	Teacher’s Activities	Resources	Specific Learning Outcomes	Teacher’s Activities	Resources
General Objective 1.0: Understand the concept and structure of agricultural value chains						
1 – 2	1.1 Define agricultural value chain. 1.2 Differentiate agricultural value chain from a supply chain. 1.3 Describe the stages of a typical produce value chain. 1.4 Explain the importance of value chains in reducing postharvest losses and improving food security.	• Explain agricultural value chain • Discuss the differences between agricultural value chains from a supply chain. • Describe the stages of a typical produce value chain • Explain the importance of value chains in reducing postharvest losses and improving food security	Value chain diagrams, Projector, Whiteboard, Journal, Marker.	• Draw a complete value chain map for a familiar commodity (e.g. tomato or maize) • Identify each stage and the activities carried out at that stage. • Label each stage and the activities. • Carried out at that stage. • Map out critical areas that produce might deteriorate.	Guide students to: • Draw a complete value chain map for a familiar commodity (e.g. tomato or maize) • Identify each stage and the activities carried out at that stage. • Label each	Value chain mapping templates, commodity data sheets, Markers, Projector Cardboards papers Brown papers Sticky note Computer

				• Demonstrate value chain mapping using a template. • Record findings.	stage and the activities carried out at that stage. • Map out critical areas that produce might deteriorate. • Demonstrate value chain mapping using a template. • Record findings.	
General Objective 2.0: Know key actors and their roles in produce value chains						
3 – 4	2.1 State key value chain actors. 2.2 Describe the function and interest of each actor in the chain. 2.3 Explain poor coordination between actors and its consequences on produce losses and price volatility.	• Explain key value chain actors. • Explain the functions and interest of each actor in the chain. • Discuss poor coordination between actors • Discuss the consequences of poor coordination between actors on produce losses and price volatility.	Textbook projector, whiteboard, Journal Internet Marker	• Organize a role-play for a produce value chain transaction involving at least four different actors. • Profile where quality loss or price reduction occurred in the simulation. • Analyse group discussions on actor. Relationships • Record findings.	Guide students to: • Organize a role-play for a produce value chain transaction involving at least four different actors. • Profile where quality loss or price reduction	Role-play scenario cards, Produce samples or Props, Debrief worksheet

					occurred in the simulation. - Analyse group discussions on actor relationships. - Record findings.	
General Objective 3.0: Understand major crop and livestock production systems in Nigeria						
5 – 6	3.1 Describe major food crop systems: - Cereal, - Legume - Root/Tuber, - Horticultural crops 3.2 Describe major livestock systems and their contribution to food exports. 3.3 Explain the influence of agro-ecological zones on crop types and quality in Nigeria.	- Discuss major food crop systems - Cereal, - Legume - Root/Tuber, - Horticultural crops - Discuss major livestock systems and their contribution to food exports. - Discuss the influence of agro-ecological zones on crop types and quality in Nigeria.	Textbook, Projector, Whiteboard, Journal, Internet, Marker	- Map at least eight major Nigerian export crops and livestock to their production zones on a blank Nigerian map - Identify two quality characteristics determined by each zone's climate - Perform mapping and quality descriptions exercise - Report findings	Guide students to: - Map at least eight major Nigerian export crops and livestock to their production zones on a blank Nigerian map - Identify two quality characteristics determined by each zone's climate - Perform mapping and	Blank Nigerian maps, crop production data sheets, livestock production data sheet, coloured pens, projector computer

					quality descriptions exercise • Report findings •	
General Objective 4.0: Understand linkages between production, postharvest handling and market access						
7 – 9	4.1 Describe harvesting decisions as it affect downstream produce quality and market price 4.2 Describe the role of the following in maintaining produce value: - Aggregation - Sorting - Storage 4.3 Explain market standards and buyer requirements that influence on-farm production practices	• Explain harvesting decisions as it affect downstream produce quality and market price • Explain the role of the following in maintaining produce value: - Aggregation - Sorting - Storage • Discuss market standards and buyer requirements that influence on-farm production practices	Textbook Projector, Whiteboard Journal Internet, Marker	• Demonstrate linkage analysis • Carry out Farm-to-market case study analysis • Carry out Backward linkage discussions • Perform discussions and quality description exercises • Report findings	Guide students to: • Demonstrate linkage analysis • Carry out Farm-to-market case study analysis; • Carry out Backward linkage discussions • Perform discussion and quality description exercise • Report findings	Case study handouts, Quality standards sheet, Recommendation worksheet Charts
General Objective 5.0: Know value chain inefficiencies and their impact on produce quality						
10 – 11	5.1 Describe common inefficiencies in produce	• Explain common inefficiencies in	Value chain loss data, price spread	• Calculate price spread and margin	Guide students to:	Price data worksheets,

	inspection 5.2 Explain the effects of each inefficiency in quality degradation or financial loss. 5.3 Describe tools used to assess value chain performance.	produce inspection • Explain the effects of each inefficiency in quality degradation or financial loss • Explain the tools used to assess value chain performance	worksheets, projector, calculators	at each stage of a provided value chain data set • Identify stages that have the highest loss and suggest corrective action • Solve problems involving spread calculation exercises • Show loss data interpretation • Present recorded findings in class	• Calculate price spread and margin at each stage of a provided value chain data set • Identify stages that have the highest loss and suggest corrective action • Solve problems involving spread calculation • Show loss data interpretation • Present recorded findings in class	Calculators, Projector, Computer, Card board, Relevant charts
General Objective 6.0: Know value chain mapping to selected commodities						
12 – 13	6.1 Outline the steps for conducting a value chain study. 6.2 Describe value chain findings clearly 6.3 Present value chain	• Expatiate the steps for conducting a value chain study • Explain • Present value chain findings	Value chain study templates, projector, commodity data sets	• Conduct a simple value chain mapping exercise for an assigned commodity using provided data	Guide students to: • Conduct a simple value chain mapping	Commodity data sets, mapping templates, markers, presentation

	findings clearly. 6.4 Describe value chain mapping role on inspection and export management decisions.	Explain value chain mapping role on inspection and export management decisions		- Present the completed value chain map and key findings to the class - Undertake group mapping project assignments - Report findings	- exercise for an assigned commodity using provided data - Present the completed value chain map and key findings to the class - Undertake group mapping - Report findings	- space - Calculator - Cardboard papers - Brown papers - Internet - Computer - Projector
General Objective 7.0: Understand global agricultural trade and export value chains						
14 – 15	7.1 Describe the structure of global agricultural commodity trade. 7.2 Explain Nigeria's position in global agricultural exports. 7.3 Describe how international buyer requirements shape inspection and export management practices.	- Explain the structure of global agricultural commodity trade - Enumerate Nigeria's position in global agricultural exports - Explain how international buyer requirements shape inspection	Nigeria export statistics, global trade flow charts, buyer specification samples, projector	- Present a one-page profile of one Nigerian export commodity (production, quality requirements, key markets) - Compare buyer specifications from two different importing countries for the same commodity - Analyse Nigeria	Guide students to: - Present a one-page profile of one Nigerian export commodity (production, quality requirements, key markets) - Compare buyer specifications	Internet, Library access, Commodity data, Buyer specification samples, Report template

		and export management practices		export data review • Conduct requirement case study • Report findings and discussions	from two different importing countries for the same commodity • Analyse Nigeria export data review • Conduct requirement case study • Report findings and discussions	
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

PRODUCE STORAGE MANAGEMENT

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: PRODUCE STORAGE MANAGEMENT	COURSE CODE: PIE 112	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to provide students with knowledge and skills in managing stored agricultural produce to minimise losses and maintain quality.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand importance and scope of produce storage management; 2.0 Know causes of quantitative and qualitative losses during storage; 3.0 Understand storage systems and structures for different commodities; 4.0 Know hermetic and modified atmosphere storage technologies; 5.0 Know monitoring and record-keeping systems for stored produce; 6.0 Understand safety, sanitation and pest control in storage management; 7.0 Know storage management operations.		

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: PRODUCE STORAGE MANAGEMENT			COURSE CODE: PIE 112		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: 1 SEMESTER: 1			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills in managing stored agricultural produce to minimise losses and maintain quality.						
			THEORETICAL CONTENT		PRACTICAL CONTENT	
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
General Objective 1.0: Understand the importance and scope of produce storage management						
1 – 2	1.1.Define produce storage management 1.2.Explain the objectives of produce storage management. 1.3.Explain the importance of reducing storage losses. 1.4.Describe the scope of storage management across: i. Grains; ii. Horticultural produce; iii. Livestock products; iv. Processed goods.	- Explain produce storage management - Exemplified the objectives of produce storage management - Prove the importance of reducing storage losses - Explain the scope of storage management across (grains horticultural produce, livestock products and processed goods)	FAO loss statistics, projector, whiteboard, commodity storage overview charts	- Survey current storage practices used for two commodities and one livestock product in the local area - Show gaps between observed practice and make recommendations - Visit local storage facilities, - Survey gaps between observed practices - Review gaps between observed practices	Guide students to: - Survey current storage practices used for two commodities in the local area - Show gaps between observed practice and make recommendations - Visit local storage facilities, - Survey, review and report gaps between observed practice - Guide survey design and administration	Survey forms, storage practice guide, commodity samples, silo, warehouse, thatch room, rhumbus, cold room, store, granaries, Projector Local and improve storage facility Prototype of storage facility

				• Report gaps between observed practices • Perform survey design and administration • Report findings	• Identify the gaps and discuss	Computer, smartphones, etc.
General Objective 2.0: Know causes of quantitative, qualitative and economic losses during storage.						
3 – 4	2.1. Differentiate between quantitative, qualitative and economic losses 2.2. Explain biotic causes 2.3. Explain abiotic causes	• Explain the differences between quantitative and qualitative and economic losses • Explain biotic causes: -Insects; -Rodents; -Fungi; -Bacteria. • Discuss abiotic causes: -Moisture -Temperature -Mechanical damage -Poor packaging, etc.	Damaged grain and produce samples, projector, cause-effect matching worksheet	• Inspect grain samples for insect damage, fungi and foreign matter • Calculate percentage weight loss between healthy and infested samples • Carry out damaged produce examination; cost-effect matching exercise • Perform tests to separate healthy and infested samples • Calculate weight loss • Report finding	Guide students to: • Inspect grain samples for insect damage, fungi and foreign matter • Calculate percentage weight loss between healthy and infested samples • Carry out damaged produce examination; cost-effect matching exercise • Test healthy and infested samples • Calculate weight loss • Report finding	Grain samples, balance, sieves, magnifying lens, weight loss worksheets, smartphones, PPE, etc.
General Objective 3.0: Understand storage systems and structures for different commodities.						
5 – 7	3.1 Describe traditional storage structures.	• Explain traditional storage structures;	Structure photos,	• Sketch a well labelled traditional	Guide students to: • Sketch and label a	Sketching materials,

	3.2 Describe improved and modern structures 3.3 Explain types of storage system based on commodity and scale of operation	-Cribs -Clay pots -Jute bags, -Underground pits, -Local market ice boxes, etc. • Show improved and modern structures; -Silos -Warehouses -Cold rooms -ECS, etc. • Discuss types of storage system based on commodity and scale of operation	comparison table, video resource, projector	and an improved grain storage structure • Evaluate each structure against criteria: -Pest resistance, -Moisture control -Cost -Capacity, etc. • Compare commodity-structures • Make recommendations and report findings	traditional and an improved grain storage structure • Evaluate each structure against criteria: -Pest resistance, -Moisture control -Cost -Capacity, etc. • Compare commodity-structures • Make recommendations and report findings	evaluation criteria worksheet, structure photos Videos Internet Charts Computer, smartphones, PPE, etc.
General Objective 4.0: Know hermetic and modified atmosphere storage technologies						
8 – 10	4.1 Define hermetic storage. 4.2 Explain the effect of oxygen depletion control on pests and diseases. 4.3 Describe hermetic storage products. 4.4 Explain modified atmosphere packaging (MAP) for horticultural produce and its gas requirements	• Define hermetic storage • Discuss the effect of oxygen depletion on pests and disease control • List hermetic storage products: - PICs bags - Super Grain bags - Metal silos - GrainPro	PICs/Hermetic bags, Grain samples, MAP bags, gas indicator strips, Projector	• Fill grain samples in hermetic bags following correct procedures. • Seal grain samples in hermetic bags following correct procedures. • Monitor O₂/CO₂ indicator strips inside hermetic bags over 1 week and record readings	Guide students to: • Fill grain samples in hermetic bags following correct procedure • Seal grain samples in hermetic bags following correct procedure • Monitor O₂/CO₂ indicator strips inside hermetic bags over 1 week	PICs bags, Polythene lined jute bag, Grain samples, O₂/CO₂ indicator strips, Sealing rope, Data recording sheets, Sewing

		cocoons Discuss modified atmosphere packaging (MAP) for horticultural produce and its gas requirements		- Carry out Hermetic bag demonstration; - MAP gas composition exercise - Monitor data	and record readings - Carry out Hermetic bag demonstration; - MAP gas composition exercise - Supervise monitoring and data recordings	machine, MAP package, smartphones, PPE, etc.
General Objective: 5.0 Know monitoring and record-keeping systems for stored produce.						
11 – 12	5.1 Explain parameters to monitor in storage: - Temperature; - Humidity; - Moisture content; - Pest presence, mould etc. 5.2 Describe monitoring tools: - Thermometer - Hygrometer - Moisture meter - Grain probe - Traps, etc. 5.3 Describe how to maintain accurate storage records and inventory logs	- Explain parameters to monitor in storage: -Temperature -Humidity -Moisture content, -Pest presence and mould - Explain monitoring tools: -Thermometer -Hygrometer -Moisture meter -Grain probe -Traps - Discuss how to maintain accurate storage records and inventory logs	Thermometer, hygrometer, moisture meter, monitoring log templates, projector	- Take daily temperature and humidity readings in a designated storage area for one week. - Identify presence of pests in a storage and stored produce. - Record findings in a storage monitoring log - Identify any abnormal readings - Keep records using sample data - Use monitoring instrument - Complete inventory logs.	Guide students to: - Take daily temperature and humidity readings in a designated storage area for one week - Identify presence of pests and moulds in storage and storage products. - Record findings in a storage monitoring log and identify any abnormal readings - Keep records using sample data - Guide instrument use and log	Thermometer, hygrometer, monitoring log forms, grain samples, magnification lens, storage area writing materials work sheets, smartphones, PPE, etc.

					completion	
General Objective 6.0: Understand safety, sanitation and pest control in storage management.						
13 – 14	6.1. Describe pre-storage sanitation steps. 6.2. Explain safety practices for fumigation and pesticide use in stores 6.3. Describe integrated pest management (IPM) approaches in storage	- Discuss pre-storage sanitation steps: -Cleaning, -Disinfection -Fumigation -Gap and crack sealing - Discuss safety practices for fumigation and pesticide use in stores - Highlight integrated pest management (IPM) approaches in storage	Sanitation checklist, PPE samples, IPM strategy chart, projector	- Carry out a pre-storage sanitation exercise on a designated storage area - Use a checklist to exemplify pest entry points and suggest sealing or control measures for each - Carry out sanitation exercise - Carry out fumigation and aeration exercises - Identify moisture and pest entry points - Report findings	Guide students to: - Carry out a pre-storage sanitation exercise on a designated storage area using a checklist - Exemplified pest entry points and suggest sealing or control measures for each - Carry out sanitation, fumigation and aeration exercises - Carry out sanitation exercise - Guide pest and moisture entry points - Report findings	Cleaning tools, disinfectant, sanitation checklist, PPE, storage area, fumigation sheet, sprayers, smartphones.
General Objective 7.0: Know storage management operations						
15	7.1 Describe a complete storage management plan for a facility 7.2 Explain First in First Out (FIFO), Last in Last Out (LILO) and First Expired First Out	- Explain a complete storage management plan for a facility - Discuss First in	Management plan templates, Labelled packages, Projector	- Develop a storage management plan for a simulated small-scale grain store - Present the plan to the class including	Guide students to: - Develop a storage management plan for a simulated small-scale grain store - Present the plan to	Management plan templates, Projector, Marking rubric computer

	(FEFO) inventory management and its importance 7.3 Explain the role of the produce inspector in verifying storage compliance	First Out (FIFO), Last in Last Out (LILO) and First Expired First Out (FEFO) inventory management and its importance • Discuss the role of the produce inspector in verifying storage compliance		monitoring schedule, pest control and FIFO arrangement • Develop plan for small-scale grain store • Present the plan to the class.	the class including monitoring schedule, pest control, and FIFO arrangement • Guide plan development • Facilitate class presentation • Structure a feedback session	Prototype of a store facility, Smartphones, PPE.
--	--	---	--	--	--	---

Course Assessment:

Course work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%



POSTHARVEST SCIENCE AND INTERNATIONAL STANDARDS

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: POSTHARVEST SCIENCE AND INTERNATIONAL STANDARDS	COURSE CODE: PIE 113	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: 1 SEMESTER: 1	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in postharvest physiology principles and international quality and safety standards governing produce trade.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand postharvest physiology of fresh produce. 2.0 Know postharvest factors affecting produce quality and shelf life. 3.0 Understand the role of Heat and Humidity management in postharvest handling. 4.0 Know key international quality and safety standards for produce. 5.0 Understand the structure and requirements of Codex Alimentarius standards. 6.0 Know basic postharvest quality assessment methods. 7.0 Understand awareness of compliance requirements for produce export.		

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: POSTHARVEST SCIENCE AND INTERNATIONAL STANDARDS			COURSE CODE: PIE 113		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 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 knowledge and skills in postharvest physiology principles and international quality and safety standards governing produce trade						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
General Objective 1.0: Understand postharvest physiology of fresh produce						
1-2	1.1 Define postharvest physiology 1.2 Explain postharvest physiology relevant to inspection and export management 1.3 Explain respiration, transpiration and ethylene production in fresh produce 1.4 Explain climacteric and non-climacteric produce	• Explain postharvest physiology • Discuss the relevance of postharvest physiology to inspection and export • Describe respiration, transpiration, and ethylene production in fresh produce • Discuss climacteric and non-climacteric produce	Marker Marker board Thermometer, Hygrometer, Moisture meter, Monitoring log templates, Projector.	• Monitor changes in two produce types; (climacteric and non-climacteric) over 3 days • Record respiration changes in two produce types (climacteric and non-climacteric) over 3 days • Compare findings on a simple graph of	Guide students to: • Monitor changes in two produce types; (climacteric and non-climacteric) over 3 days • Record respiration changes in two produce types (climacteric and non-climacteric) over 3 days • Compare findings on a	Computer Projector Banana, orange, closed containers, CO ₂ indicator, thermometer, graph paper Practical manual Computer Internet Projector

				climacteric classification exercise. • Plot findings on a simple graph of climacteric classification exercise • Set up monitoring experiment • Observe the climacteric and non- climacteric fruits in storage • Record finding	simple graph of climacteric classification exercise. • Plot findings on a simple graph of climacteric classification exercise • Set up monitoring experiment • Observe the climacteric and non- climacteric fruits in storage • Record finding	smartphones, PPE.
General Objective 2.0: Know postharvest factors affecting produce quality and shelf life						
3 – 4	2.1 Describe the following physical factors: i. Mechanical damage ii. Compression, iii. Vibration, etc 2.2 Explain biological factors: microbial spoilage, insect infestation, etc 2.3 Explain environmental factors: temperature, humidity, light, gas composition, etc.	• Explain the following physical factors: i. Mechanical damage ii. Compression, iii. Vibration, etc • Discuss biological factors: microbial spoilage, insect infestation, etc • Discuss environmental factors: temperature, humidity, light, gas composition, etc.	Damaged and spoiled produce samples, factor-damage matching worksheet, projector Computer.	• Subject produce to simulated rough handling • Record resulting damage types • Store produce under different humidity conditions • Compare quality after 4 days • Conduct a factor-damage matching	Guide students to: • Subject produce to simulated rough handling • Record resulting damage types • Store produce under different humidity conditions • Compare quality after 4 days • Conduct a factor-damage	Fresh produce, Sealed bags, humidity sources, Damage assessment forms Computer, Practical Manual Projector Crates Boxes Measuring

				exercise • Simulate Handling of fresh produce • Carryout humidity comparison and quality • Record findings	matching exercise • Simulate Handling of fresh produce • Carryout humidity comparison and quality • Record findings	tape Platform
General Objective 3.0: Understand the role of heat and humidity management in postharvest handling						
5 – 7	3.1 Explain the effect of heat and moisture on respiration rate and shelf life of produce 3.2 Explain pre-cooling methods. 3.3 Explain the following: - chilling injury - Freezing injury - Optimum temperature ranges for key export crops	• Discuss the effect of heat and moisture on respiration rate and shelf life of produce • Discuss pre-cooling methods: - Forced air cooling - Hydrocooling - Ice cooling - Vacuum cooling, etc. Discuss the following: - chilling injury - Freezing injury - Optimum temperature ranges for key export crops	Temperature-shelf-life charts, Projector, Produce cold storage data	• Carry out Pre-cooling of two batches of produce using ice and ambient air respectively • Monitor temperature and quality over 5 days • Compare shelf-life outcomes • Carryout Ice-cooling comparison exercises • Produce temperature range chart of the produce • Carry out temperature	Guide students to: • Carry out Pre-cooling of two batches of produce using ice and ambient air respectively • Monitor temperature and quality over 5 days • Compare shelf-life outcomes • Carryout Ice-cooling comparison exercises • Produce temperature range chart of the produce • Carry out	Ice, Refrigerator or cold box, Temperature data logger, produce samples, Comparison forms Computer, Practical manual Projector

				logging and quality comparison • Report findings	temperature logging and quality comparison • Report findings	
General Objective 4.0: Know key international quality and safety standards for produce						
8 – 9	4.1 List major national and international standards bodies: - NAQS - SON - NAFDAC - FPIS - Codex Alimentarius - ISO - USDA, FDA - EFSA, EU regulations 4.2 Describe a standards quality grades, tolerances and maximum residue limits (MRLs)	• Explain major national and international standards bodies: - NAQS - SON - NAFDAC - FPIS - Codex Alimentarius - ISO - USDA - EFSA, EU regulations • Explain standards quality grades, tolerances and maximum residue limits (MRLs) • Explain the reasons for Nigerian exporters to comply with importing country standards	Printed standards excerpts SON NAFDAC NAQS FPIS (Codex Alimentarius, FDA, EFSA), MRL tables, projector Computer	• Visit any of the regulatory bodies • Obtain standards documents of regulatory bodies • Understand Codex standard for a selected produce • Identify quality grade requirements • Compare MRL as provided by the Codex, EFSA etc., for the same pesticide and produce • Review Standards document • Conduct MRL interpretation exercise • Guide review and comparison exercise	Guide students to: • Visit any of the regulatory bodies • Obtain standards documents of regulatory bodies • Understand Codex standard for a selected produce • Identify quality grade requirements • Compare MRL as provided by the Codex, EFSA etc., for the same pesticide and produce • Review Standards document • Conduct MRL interpretation	Printed standard documents of regulatory bodies, MRL comparison worksheet, Highlighters Practical manual Computer Projector

				Report findings	exercise - Guide review and comparison exercise - Report findings	
General Objective 5.0: Understand the structure and requirements of Codex Alimentarius standards						
10 – 11	5.1. Describe the structure of a Codex Alimentarius standard. 5.2. Explain Codex Alimentarius standards development and means of countries adopting them 5.3. Describe HACCP principles as integrated in Codex Alimentarius food safety standards	- Explain the structure of a Codex Alimentarius standard; - Scope - Definitions - Provisions - Grading - Tolerances - Explain Codex Alimentarius standards development and means of countries adopting them - Explain HACCP principles as integrated in Codex food safety standards	Marker Marker board Sticky note Codex standard document, HACCP chart, projector	- Show each section of a provided Codex Alimentarius standard for a fresh produce item - Add each section for a fresh produce item - Identify critical control points in a simple postharvest handling chain - Standardise document walk-through HACCP principle overview - Report finding	Guide students to: - Show each section of a provided Codex Alimentarius standard for a fresh produce item - Add each section for a fresh produce item - Identify critical control points in a simple postharvest handling chain - Standardise document walk-through HACCP principle overview Report finding	Codex Alimentarius standard printout, HACCP worksheet, highlighters, projector Computer Practical manual Card board paper, smartphone
General Objective 6.0: Know basic postharvest quality assessment methods						
12 – 13	6.1. Describe visual quality assessment.	Explain visual quality assessment:	Refractometer, pH paper, Firmness	Demonstrate the use of	Guide students to: Demonstrate	Fresh produce,

	6.2.Discuss physical measurements 6.3.Describe chemical assessments.	-Colour -Size -Shapes -Surface defects • Explain physical measurements: -Weight -Firmness -Size grading -Bulk density • Explain chemical assessments: - pH - Soluble solids (Brix) - Titrateable acidity	tester, Colour chart, Produce samples, Projector	Instruments: -Refractometer -pH paper, -Firmness tester • Assess three produce samples for colour, firmness, size and surface defects • Measure Brix (soluble solids) and pH of fruit samples • Record measurements against standard requirements • Carry out produce assessment and measurement • Report findings	the use of Instruments: -Refractometer -pH paper, -Firmness tester • Assess three produce samples for colour, firmness, size and surface defects • Measure Brix (soluble solids) and pH of fruit samples • Record measurements against standard requirements • Carry out produce assessment and measurement • Report findings	Refractometer, pH paper, Firmness tester, Colour chart, Recording sheets Penetrometer Projector Card board Computer Practical manual Pictures Weighing scale Measuring cylinder Standard sieve Sizing rings Grader Colour chart
General Objective 7.0: Understand awareness of compliance requirements for produce export						
14-15	7.1 Explain the challenges encountered due to	• Explain the challenges encountered due to	Export rejection case studies,	• Analyse a provided case	Guide students to: • Analyse a	Case study handout,

	failure of meeting buyer or importing country standards. 7.2 Describe the role of the produce inspector in ensuring pre-export compliance 7.3 Outline Nigerian regulatory bodies involved in export produce compliance.	failure of meeting buyer or importing country standards. • Explain the role of the produce inspector in ensuring pre-export compliance • Explain Nigerian regulatory bodies involved in export produce compliance - NAFDAC - SON - NEPC - FPIC - NAQS - Customs etc.)	Regulatory body diagram, Projector	study of an export shipment rejection and • Identify the compliance failure issues. • Develop a pre-export compliance checklist for a selected produce • Carry out regulatory body mapping exercise • Facilitate checklist development exercise • Record findings	provided case study of an export shipment rejection and • Identify the compliance failure issues. • Develop a pre-export compliance checklist for a selected produce • Carry out regulatory body mapping exercise • Facilitate checklist development exercise • Record findings	Compliance checklist Template, Projector Computer Smartphones Card board paper Internet Practical manuals
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



BASIC FOOD CHEMISTRY AND BIOCHEMISTRY OF PRODUCE

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: BASIC FOOD CHEMISTRY AND BIOCHEMISTRY OF PRODUCE	COURSE CODE: PIE 114	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 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 food chemistry and biochemical processes in produce that influence quality, spoilage and inspection decisions.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the chemical composition of major agricultural produce; 2.0 Know the role of water, carbohydrates, proteins and lipids in produce quality; 3.0 Understand enzymatic and non-enzymatic chemical changes during storage; 4.0 Know chemical indicators used in produce quality assessment; 5.0 Understand the biochemistry of ripening and senescence; 6.0 Know chemical analysis techniques to assess produce quality; 7.0 Understand food chemistry in inspection decisions of Agricultural produce.		

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: BASIC FOOD CHEMISTRY AND BIOCHEMISTRY OF PRODUCE				COURSE CODE: PIE 114	CONTACT HOURS: 4 HOURS/WEEK	
YEAR: I SEMESTER: I				CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK	
				PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK	
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
General Objective 1.0: Understand the chemical composition of major agricultural produce						
1 – 2	1.1 List the major chemical components of food. 1.2 Describe typical composition of grains, fruits, vegetables and legumes 1.3 Explain how chemical composition affects storage requirements and inspection criteria	• Explain the major chemical components of food – Water, – Carbohydrates – Proteins – Lipids – Vitamins – Minerals – Phytochemicals • Explain typical composition of grains, fruits, vegetables, and legumes • Discuss how chemical composition	Food composition tables, Food labels, Projector, Whiteboard.	• Analyse food labels of three different produce items • Record their composition • Compare the compositions • Identify any storage differences required • Carry out food label reading exercise • Report findings	Guide students to: • Analyse food labels of three different produce items • Record their composition • Compare the compositions • Identify any storage differences required • Carry out food label reading exercise • Report findings	Food labels composition table, Comparison worksheet, Computer, Projector, Card board, Internet, Practical manual, Marker, Highlighter.

		affects storage requirements and inspection criteria				
General Objective 2.0: Know the role of water, carbohydrates, proteins and lipids in produce quality						
3 – 5	2.1 Define proximate analysis. 2.2 Explain water activity (a_w). 2.3 Explain the relationship of water activity to microbial spoilage and storage stability. 2.4 Explain protein degradation and lipid oxidation effect on quality in stored grain and oilseeds. 2.5 Describe starch-sugar conversion effects on fruit ripening and grain quality.	• Explain proximate analysis • Discuss water activity (a_w) • Describe the relationship of water activity to microbial spoilage and storage stability • Discuss protein degradation and lipid oxidation effect on quality in stored grain and oilseeds • Explain starch-sugar conversion effects on fruit ripening and grain quality	Water activity charts, Marker, Whiteboard Projector.	• Perform iodine test on green and ripe banana to observe starch-to-sugar conversion • Smell fresh and stored groundnut oil, palm oil samples • Monitor rancidity development after smelling • Perform proximate analysis on a known grain • Perform acid value test and peroxide test • Record findings	Guide students to: • Perform iodine test on green and ripe banana to observe starch-to-sugar conversion • Smell fresh and stored groundnut oil, palm oil samples • Describe rancidity development after smelling • Perform proximate analysis on a known grain • Perform acid value test and peroxide test • Record findings	Green and ripe bananas, iodine solution, Groundnut and Palm oil samples, observation sheets Hot air oven Desiccator (with silica gel) Analytical balance Moisture dishes Crucibles/Crucibles tongs Muffle furnace Porcelain/silica Crucibles Burnsen burners Kjeldahl apparatus Fume cupboard Conical and erlnmeyer flask Heating mantle Nitrogen analyser

						Fiber extraction apparatus Soxhlet apparatus, evaporator. Mortar and pestle, Reagents
General Objective 3.0: Understand enzymatic and non-enzymatic chemical changes during storage						
6 – 7	3.1 Describe enzymatic browning (polyphenol oxidase) during inspection and handling. 3.2 Explain the control methods of enzymatic browning. 3.3 Explain non-enzymatic browning (Maillard reaction) 3.4 Explain effect of non-enzymatic browning on dried and processed produce 3.5 Describe oxidative and hydrolytic rancidity, packaging and	- Discuss enzymatic browning (polyphenol oxidase) during inspection and handling. - Describe the control methods of enzymatic browning. - Discuss non-enzymatic browning (Maillard reaction) - Describe effect of non-enzymatic browning on dried and processed produce - Discuss	Projector, Marker, white board, Charts.	- Apply different inhibitors -Lemon juice, -Salt water -Ascorbic acid -no treatment to cut apple, avocado - Record browning rate over 20 minutes - Identify the most effective control of browning in produce - Carry out inhibitor comparison and analyse the results - Carry out basic stability and Free Fatty Acid (FFA) tests - Record findings	Guide students to: - Apply different inhibitors i. Lemon juice, ii. Salt water iii. Ascorbic acid iv. no treatment to cut apple, avocado - Record browning rate over 20 minutes - Identify the most effective control of browning in produce - Carryout inhibitor comparison and analyse the results - Carryout basic stability and Free Fatty Acid (FFA) tests - Record findings	Apples, avocado, Lemon juice, Salt, Ascorbic acid, Water, Knives, Observation sheets, Timer, Computer, Internet, Projector, Practical manual, Old and fresh groundnut/palm oil.

	storage influence on agricultural produce	oxidative and hydrolytic rancidity, packaging and storage influence on agricultural produce				
General Objective 4.0: Identify chemical indicators used in produce quality assessment						
8 – 9	4.1. Define pH 4.2. Explain the significance of pH in fruit quality and safety assessment 4.3. Describe soluble solids content (Brix) as an indicator of fruit sweetness and maturity 4.4. Explain titratable acidity 4.5. Explain the role of titratable acidity 4.6. in quality grading of fruits	• Explain pH • Discuss the significance of pH in fruit quality and safety assessment • Discuss soluble solids content (Brix) as an indicator of fruit sweetness and maturity • Discuss titratable acidity • Discuss the role of titratable acidity in quality grading of fruits	Projector, Whiteboard, Marker, Charts	• Measure Brix of juice from three different ripeness levels of the same fruit • Measure pH of fruit juice and vegetable extract using pH paper • Compare results • Carry out instrument demonstration • Record findings	Guide students to: • Measure Brix of juice from three different ripeness levels of the same fruit • Measure pH of fruit juice and vegetable extract using pH paper • Compare results • Carry out instrument demonstration • Record findings	Refractometer, pH paper, Juice samples at different ripeness stages, Recording sheets, Computer, Smartphones, Internet, Projector, Practical manual
General Objective 5.0: Understand the biochemistry of ripening and senescence						
10 – 11	5.1. Describe the role of ethylene in initiating and regulating fruit	• Explain the role of ethylene in initiating and	Projector, Marker, Whiteboard,	• Monitor ripening of bananas stored with and without an	Guide students to: • Monitor ripening of bananas stored with	Bananas, Sealed bags, Ethylene source (ripe

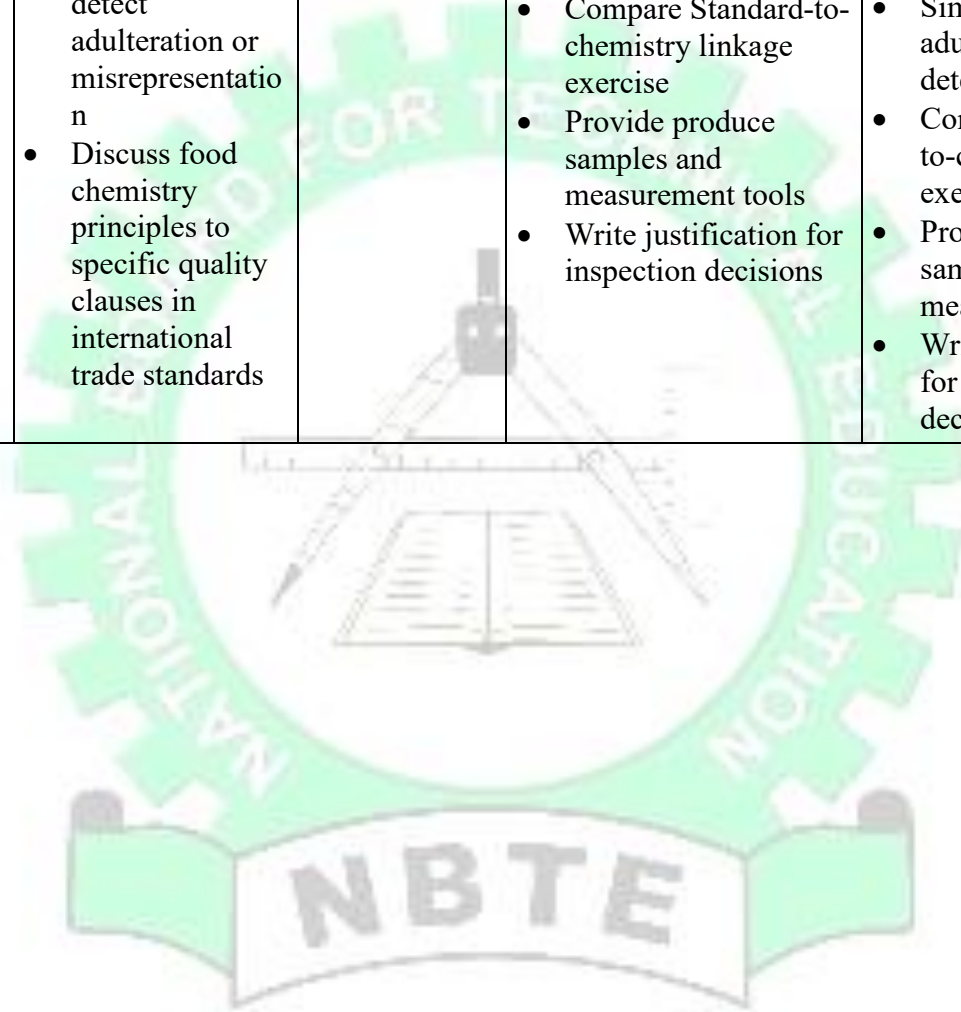
	ripening 5.2.Explain climacteric respiration patterns 5.3.Explain the significance of climacteric respiration patterns in inspection 5.4.Describe senescence processess of: i. Cell wall breakdown ii. Chlorophyll degradation 5.5.Flavour changes, etc. 5.6.Describe the effects of senescence processes on grading of agricultural produce	regulating fruit ripening - Discuss climacteric respiration patterns - Discuss the significance of climacteric respiration patterns in inspection - Explain senescence processess of: iii. Cell wall breakdown iv. Chlorophyll degradation - Flavour changes, etc. - Discuss the effects of senescence processes on grading of agricultural produce	charts.	ethylene source - Record colour, firmness and smell changes over 5 days - Score each sample against a ripening stage chart - Set up ethylene experiment; - Carryout daily monitoring and ripening stages - Score points. - Report findings	and without an ethylene source - Record colour, firmness and smell changes over 5 days - Score each sample against a ripening stage chart - Set up ethylene experiment; - Carryout daily monitoring and ripening stages - Score points. - Report findings	apple), Ripening stage chart, Observation sheets Computer Internet Practical manual Projector Pictures
General Objective 6.0: Know chemical analysis techniques to assess produce quality						
-13	6.1. Describe	Discuss	Projector,	Determine moisture	Guide students to:	Oven, Weighing

	moisture content determination by oven drying method 6.2. Explain crude protein estimation using Kjeldahl methods 6.3. Describe ash content determination 6.4. Explain the relevance of ash content determination to mineral assessment in grains	moisture content determination by oven drying method - Describe crude protein estimation using Kjeldahl methods - Explain ash content determination - Discuss the relevance of ash content determination to mineral assessment in grains	whiteboard, Marker, Charts.	content of grain samples using the oven drying method - Calculate percentage moisture content - Compare to safe storage limit - Record percentage moisture content compared to safe storage limit - Record findings	- Determine moisture content of grain samples using the oven drying method - Calculate percentage moisture content Compare to safe storage limit - Record percentage moisture content compared to safe storage limit - Record findings	balance, crucibles, Grain samples, Calculation worksheet Computer Projector Practical manual Internet.
--	--	--	-----------------------------	--	---	---

General Objective 7.0: Understand food chemistry in produce inspection decisions of Agricultural produce.

14-15	7.1.Explain chemical changes 7.2.Inform acceptance or rejection decisions 7.3.Describe the role of inspector knowledge to detect adulteration or misrepresentation 7.4.Explain food chemistry principles	- Discuss chemical changes -Brix; -pH; -Moisture; -Browning - Discuss acceptance or rejection decisions - Explain the role	Whiteboard, Marker, Decision worksheet	- Conduct a multi-parameter quality assessment of a typical produce sample - Recommend accept/reject produce - Write a brief justification for the decision citing relevant chemical measurements	Guide students to: - Conduct a multi-parameter quality assessment of a typical produce sample - Recommend accept/reject produce - Write a brief justification for the decision citing	Produce samples, Refractometer, pH paper, Moisture meter, Decision worksheet Computer Internet Practical manual Projector
-------	---	--	--	---	---	--

	to specific quality clauses in international trade standards	of inspector knowledge to detect adulteration or misrepresentation • Discuss food chemistry principles to specific quality clauses in international trade standards		• Simulate adulteration detection case study • Compare Standard-to-chemistry linkage exercise • Provide produce samples and measurement tools • Write justification for inspection decisions	relevant chemical measurements • Simulate adulteration detection case study • Compare Standard-to-chemistry linkage exercise • Provide produce samples and measurement tools • Write justification for inspection decisions	
--	--	--	--	---	---	--



Course Assessment:

Course work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%



PRODUCE GRADING SYSTEMS AND AI ASSISTED DIGITAL GRADING

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: PRODUCE GRADING SYSTEMS AND AI ASSISTED DIGITAL GRADING	COURSE CODE: PIE 115	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: 1 SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills of conventional produce grading systems and emerging AI-assisted digital grading technologies for accurate and efficient quality classification.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles and purpose of produce grading; 2.0 Know conventional grading methods and equipment; 3.0 Know manual grading techniques to fresh and dried produce; 4.0 Understand image processing and AI principles in digital grading; 5.0 Know digital grading tools and software to produce assessment; 6.0 Understand accuracy and limitations of AI-assisted grading systems; 7.0 Understand competence in integrating conventional and digital grading in inspection workflows.		

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: PRODUCE GRADING SYSTEMS AND AI ASSISTED DIGITAL GRADING				COURSE CODE: PIE 115		CONTACT HOURS: 4 HOURS/WEEK
				CREDIT UNIT: 4		PRACTICAL: 3 HOURS/WEEK
YEAR: 1 SEMESTER: 1				PRE-REQUISITE: NIL		THEORETICAL: 1 HOUR/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills of conventional produce grading systems and emerging AI-assisted digital grading technologies for accurate and efficient quality classification						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
General Objective 1.0: Understand the principles and purpose of produce grading						
1 – 2	1.1 Define grading. 1.2 Distinguish grading from sorting and inspection. 1.3 Explain the economic and trade benefits of consistent produce grading. 1.4 Describe how grading is linked to pricing, market access and export compliance.	• Explain grading • Discuss how to distinguish grading from sorting and inspection • Discuss the economic and trade benefits of consistent produce grading • Explain how grading is linked to pricing, market access, and export compliance	Grading principles chart, projector, Market price data, Showing grade premiums Markers, Marker board, Highlighter, etc.	• Sort three batches of mixed-quality produce -Grain; -Pulses; -Fruit in to quality groups using only visual judgment. • Calculate the price premium if Grade 1 produce were sold separately or mixed • Record	Guide students to: • Sort three batches of mixed-quality produce -Grain; -Pulses; -Fruit in to quality groups using only visual judgment. • Calculate the price premium if Grade 1 produce were sold separately or mixed • Record findings	Different produce batch (grain, pulses, fruit), Price data, Sorting trays, Calculators Projector Computer Internet Card board papers Sticky notes, Practical manual, Charts.

				findings		
General Objective 2.0: Know conventional grading methods and equipment						
3 – 4	2.1. Describe manual grading: - Visual assessment - Ring gauges - Calipers - Colour charts - Weighing balance 2.2. Describe mechanical grading systems: - Roller graders - Belt graders - Weight sorters - Optical sorters 2.3. Explain the advantages and limitations of conventional grading methods	- Explain manual grading: - Visual assessment - Ring gauges - Calipers - Colour charts - Weighing balance - Explain mechanical grading systems: - Roller graders - Belt graders - Weight sorters - Optical sorters - Discuss the advantages and limitations of conventional grading methods	Ring gauge, Caliper, Colour chart, Weighing balance, Mechanical grader, Photos, Projector	- Use a ring gauge and caliper to measure and grade the three batches of produce by size - Use a colour chart to classify produce into colour grades - Record the distribution of the colour and size - Record findings	guide students to: - Use a ring gauge and caliper to measure and grade the three batches of produce by size - Use a colour chart to classify produce into colour grades - Record the distribution of the colour and size Record findings	Ring gauge, Caliper, Colour chart, Different produce batch (grain, pulses, fruit) samples, Grading record sheets, Computer, Projector, Internet, Card board papers, Practical manual, Sticky note, Marker, Weighing balance.
General Objective 3.0: Know manual grading techniques to fresh and dried produce						
5 – 7	3.1 Describe grading criteria specific to fresh fruits and vegetables:	- Explain grading criteria specific to fresh fruits and vegetables: -Size	Ring gauge, Caliper, Colour chart, Weighing balance, Mechanical grader	Grade a batch of fresh fruit and	Guide students to: Grade a batch of fresh fruit and vegetable produce	Fresh produce, Dried grains, Fruit and Vegetable

	-Size -Colour -Shape -Freedom from defects 3.2 Describe grading criteria for dried produce and grains under the following: -Moisture content -Foreign matter -Insect damage -Discolouration -Live and dead insects -Whether damage - Animal droppings and body parts 3.3 Explain how to calculate grade percentages and lot acceptance decisions	-Colour -Shape -Freedom from defects • Explain grading criteria for dried produce and grains under the following: -Moisture content -Foreign matter -Insect damage -Discolouration -Live and dead insects -Whether damage - Animal droppings and body parts • Discuss how to calculate grade percentages and lot acceptance decisions	Photos, Projector.	vegetable produce following standard criteria • Record grade distribution • Grade a sample of dried grains for insect damage, foreign matter and moisture to determine lot acceptability • Record findings	following standard criteria • Record grade distribution • Grade a sample of dried grains for insect damage, foreign matter and moisture to determine lot acceptability • Record findings	produce, Grading guides, Moisture meter, weighing balance, Calculation worksheets Computer Projector Internet Practical manual Charts.
General Objective 4.0: Understand image processing and AI principles in digital grading						
8 – 9	4.1.Explain how machine vision systems capture and analyse produce images	• Discuss how machine vision systems capture and analyse produce images:	Machine vision system diagrams, Projector, AI grading case study,	• Examine sample produce images	guide students to: • Examine sample produce images • Identify features in AI	Printed or digital produce images, Annotation

	4.2. Describe how AI/Machine Learning models are trained to classify produce quality from images 4.3. Explain the role of colour analysis, shape detection and defect recognition in AI grading	i. Cameras ii. Image processing • Explain how AI/machine learning models are trained to classify produce quality from images • Discuss the role of colour analysis, shape detection and defect recognition in AI grading	Sample produce images	• Identify features in AI system used for grading: - Colour zones, - Defect spots, - Shape • Show images indicating defect type and location as a training data exercise • Record findings	system used for grading; i. Colour zones, ii. Defect spots, iii. Shape • Show images indicating defect type and location as a training data exercise • Record findings	worksheets, Colour markers Computer Projector Internet Card board papers Cameras Practical manual
General Objective 5.0: Know digital grading tools and software to produce assessment						
10 – 12	5.1. Enumerate examples of commercially available AI grading systems. 5.2. Explain the capabilities of AI grading systems. 5.3. Explain smartphone-based grading apps	• Discuss examples of commercially available AI grading systems: - TOMRA - GREEFA - Key Technology, etc. • Describe the capabilities of AI grading systems.	Smartphones/Tablets, Digital grading app, Projector Computer	• Use a smartphone-based produce grading app to grade a batch of produce	Guide students to: • Use a smartphone-based produce grading app to grade a batch of produce • Record the outputs • Compare digital grading results with manual grading results	Smartphones/Tablets with grading app, Produce samples, Comparison record sheets Computer Projector

	and their applicability in field inspection 5.4. Describe how to input parameters 5.5. Describe how to interpret grade outputs from digital grading software	- Discuss smartphone-based grading apps and their applicability in field inspection - Explain how to input parameters - Discuss how to interpret grade outputs from digital grading software		- Record the outputs - Perform produce assessment to compare digital grading results with manual grading results from the same batch - Record findings	from the same batch Record findings	Card board paper Sticky note Practical manual
General Objective 6.0: Understand the accuracy and limitations of AI-assisted grading systems						
13 – 14	6.1. Explain the accuracy metrics in AI-assisted grading: - Precision - Recall - confusion matrix in simple terms 6.2. Describe limitations of AI-assisted grading: - Lighting conditions, - Novel defects,	- Discuss the accuracy metrics in AI-assisted grading: -Precision -Recall -confusion matrix in simple terms - Explain limitations of AI-assisted grading: -Lighting conditions, -Novel defects,	Confusion matrix worksheet, Projector Computer Markers Marker board	Compare AI-assisted grading results against expert manual grading for 30 produce	Guide students to: - Compare AI-assisted grading results against expert manual grading for 30 produce items - Calculate agreement percentage - Identify systematic errors - Suggest how the AI system could be	AI-assisted App, Expert grading data sets, Agreement Calculation worksheet, Projector Computer Assorted produce Charts

	iii. Cultural variety differences 6.3. Explain how AI-assisted grading should be validated and calibrated for local produce varieties	-Cultural variety differences • Discuss how AI-assisted grading should be validated and calibrated for local produce varieties		items • Calculate agreement percentage • Identify systematic errors • Suggest how the AI system could be improved • Record findings	improved • Record findings	Smartphones
General Objective 7.0: Understand competence in integrating conventional and digital grading in inspection workflows						
15 - 15	7.1. Describe conventional grading. 7.2. Explain digital grading. 7.3. Discuss conventional and digital grading complementing each other in a commercial inspection workflow. 7.4. Explain the use of digital grading as a pre-screening tool when manual confirmation is required	• Discuss conventional and digital grading complementing each other in a commercial inspection workflow • Discuss the use of digital grading as a pre-screening tool when manual confirmation is required	Grading workflow diagram, Inspection report template, Projector	• Design an integrated grading workflow for a simulated export consignment combining digital pre-screening and manual confirmation • Produce a	Guide students to: • Design an integrated grading workflow for a simulated export consignment combining digital pre-screening and manual confirmation • Produce a final grading report from combined digital and manual results • Record findings	Workflow design template, Grading tools, Digital grading app, Inspection report template Computer Projector Internet Practical manual Digital grading app

				final grading report from combined digital and manual results • Record findings		
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

YEAR I SEMESTER II



PRODUCE INSPECTION AND QUALITY ASSESSMENT

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: PRODUCE INSPECTION AND QUALITY ASSESSMENT	COURSE CODE: PIE 121	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: 1 SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills required to conduct produce inspection and quality assessment for local trade and export.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles and objectives of produce inspection and export management. 2.0 Know inspection procedures for fresh and dried produce for export. 3.0 Understand visual and physical quality assessment techniques. 4.0 Know sampling methods for produce inspection. 5.0 Understand documentation and reporting in produce inspection. 6.0 Understand quality of produce in line with national and international standards 7.0 Know professional competence in conducting and reporting inspections.		

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: PRODUCE INSPECTION AND QUALITY ASSESSMENT				COURSE CODE: PIE 121	CONTACT HOURS: 4 HOURS/WEEK	
YEAR: 1 SEMESTER: II				CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK	
				PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge procedures and skills required to conduct produce inspection and quality assessment for local trade and export.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
General Objective 1.0: Understand the principles and objectives of produce inspection and export management						
1 – 2	1.1 Define produce inspection. 1.2 State the objectives of produce inspection in trade and export contexts. 1.3 Describe the role of the produce inspector and the agencies that mandate inspections in Nigeria. 1.4 Distinguish between pre-harvest inspection, point-of-sale inspection and pre-export inspection.	• Explain produce inspection • Discuss the objectives of produce inspection in trade and export contexts • Explain the role of the produce inspector and the agencies that mandate inspections in Nigeria • Differentiate between pre-harvest inspection, point-of-	Inspector role description, Nigerian inspection agency chart, Projector, Computer	• Identify stages where inspection occurs in the export of a selected commodity • Simulate the role of an inspector conducting a pre-export inspection • Record findings	Guide students to: • Identify stages where inspection occurs in the export of a selected commodity • Simulate the role of an inspector conducting a pre-export inspection • Record findings	Commodity export flow diagram, Role simulation script, Debrief worksheet Computer Internet Projector Charts Practical manual Produce inspection documents Sample

		sale inspection and pre-export inspection				analysis certificates, Sample request letter, Sample of standard export contract, Quality checklist, Smartphones, PPE.
General Objective 2.0: Know inspection procedures for fresh and dried produce for export						
3 – 4	2.1 Describe step-by-step inspection procedure for fresh fruits and vegetables. 2.2 Describe the inspection procedure for dried grains, pulses and spices. 2.3 Explain inspection procedures for export consignments and domestic market lots	• Discuss step-by-step inspection procedure for fresh fruits and vegetables • Explain the inspection procedure for dried grains, pulses, and spices • Discuss inspection procedures for export consignments and domestic market lots	Inspection procedure flowcharts, Fresh and dried produce samples, Projector	• Follow a provided inspection procedure checklist to inspect a batch of fresh produce. • Follow a separate checklist to inspect a sample of dried grain • Record results	Guide students to: • Follow a provided inspection procedure checklist to inspect a batch of fresh produce • Follow a separate checklist to inspect a sample of dried grain • Record results	Inspection checklists, Fresh produce, dried grain samples, Recording forms Computer Projector Internet Practical manual Charts, PPE, Smartphones.
General Objective 3.0: Understand visual and physical quality assessment techniques						

5 – 7	3.1 Describe visual assessment criteria. 3.2 Explain physical measurements. 3.3 Describe sensory assessment.	- Discuss visual assessment criteria: - Colour uniformity - Surface defects - Shape - Size - Cleanliness - Describe physical measurements: - Weigh - Size grading - Caliper - Ring gauge - Firmness, etc - Explain sensory assessment: - Smell - Sound (for crispness) - Touch/Feel, etc	Inspection procedure flowcharts, Fresh and dried produce samples, Projector	- Identify five produce samples using colour, size, surface defect, and firmness criteria - Assign each sample to a quality grade based on the assessment - Record justification	Guide students to: - Identify five produce samples using colour, size, surface defect, and firmness criteria - Assign each sample to a quality grade based on the assessment - Record justification	Produce samples, Colour chart, Caliper, firmness tester, Grading record sheets Computer Projector Internet Ring gauge Practical manual PPE, Smartphones, etc.
General Objective 4.0: Know sampling methods for produce inspection						
8 – 9	4.1 Explain why representative sampling is critical in produce inspection 4.2 Describe sampling plans: - Random sampling - Systematic sampling - Acceptance sampling (AQL)	- Discuss why representative sampling is critical in produce inspection - Describe sampling plans: - Random sampling - Systematic sampling	Sampling tables, Lot size-sample size charts, Projector, Calculators, Marker boards, Markers	- Select a random sample from a simulated produce lot following a stated sampling plan - Calculate the required sample size for two different lot sizes using AQL tables - Record results.	Guide students to: - Select a random sample from a simulated produce lot following a stated sampling plan - Calculate the required sample size for two different lot sizes	Simulated produce lots (bags/boxes), Sampling tables, Calculators, Moisture tester, Temperature logger, Recording

	4.3 Explain the sample size for a given lot size using a provided sampling table in 4.2	iii. Acceptance sampling (AQL) Discuss the sample size for a given lot size using a provided sampling table.			using AQL tables Record results.	sheets Computer Projector Internet, Practical manual, PPE, Smartphones,
--	---	--	--	--	-------------------------------------	---

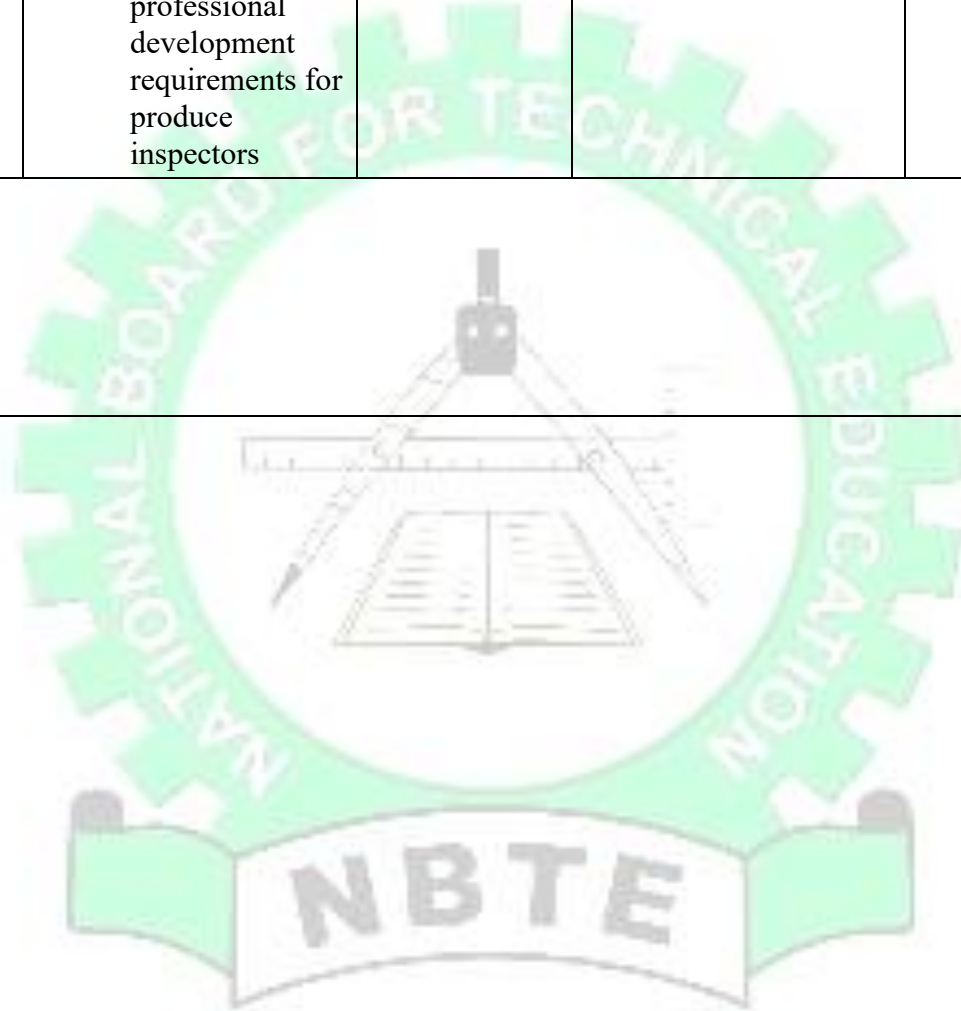
General Objective 5.0: Understand documentation and reporting in produce inspection

10– 11	5.1 Describe the documents generated during produce inspection. 5.2 Describe the key information fields in each inspection document. 5.3 Explain how inspection reports are used by exporters, buyers and regulatory agencies.	- Explain the documents generated during produce inspection - Inspection report, - Certificate of quality, - Phytosanitary certificate, etc.) - Discuss the key information fields in each inspection document. - Discuss how inspection reports are used by exporters, buyers and regulatory agencies.	Sample inspection documents, Blank report templates, Projector	- Complete a produce inspection report for a simulated inspection exercise. - Prepare a draft certificate of quality based on inspection findings. - Record findings.	Guide students to: - Complete a produce inspection report for a simulated inspection exercise. - Prepare a draft certificate of quality based on inspection findings. - Record findings.	Blank inspection report and certificate templates, Simulated inspection data, Pens Computer Internet Practical manual Projector Charts PPE, smartphones.
--------	--	--	--	---	--	--

General Objective 6.0: Understand quality of produce in line with national and international standards

12 – 13	6.1 Describe Codex Alimentarius grade specifications to assess produce samples. 6.2 Explain Nigerian SON standards to assess agricultural produce quality. 6.3 Explain the accept/reject decisions based on tolerance levels specified in standards.	- Discuss Codex Alimentarius grade specifications to assess produce samples. - Discuss Nigerian SON standards to assess agricultural produce quality. - Discuss the accept/reject decisions based on tolerance levels specified in standards.	Codex and SON standards excerpts, Assessment forms, Projector, etc.	- Assess a produce sample against Codex grade I and II requirements - Record defect percentages. - Determine whether the lot meets export grade tolerance. - Record findings.	Guide students to: - Assess a produce sample against Codex grade I and II requirements. - Record defect percentages. - Determine whether the lot meets export grade tolerance - Record findings.	Produce samples, Codex/SON standards, defect counting worksheet, Calculators, PPE and Smartphones.
General Objective 7.0: Know professional competence in conducting and reporting inspections						
14-15	7.1 Describe professional conduct expected of a produce inspector (objectivity, confidentiality, accuracy; etc.) 7.2 Explain how to handle disputes between exporters and buyers over inspection findings. 7.3 Describe continuous professional development requirements for produce inspectors	- Explain professional conduct expected of a produce inspector (objectivity, confidentiality, accuracy; etc.) - Discuss how to handle disputes between exporters and buyers over inspection findings	Professional conduct guidelines, Dispute scenario cards, Charts, Marker boards, Markers Projector	- Conduct a complete simulated produce inspection from sampling to final written report. - Present inspection findings to a simulated buyer panel - Respond to challenges - Record findings	Guide students to: - Conduct a complete simulated produce inspection from sampling to final written report - Present inspection findings to a simulated buyer panel - Respond to challenges - Record findings	Produce samples, Inspection tools, Report template, and Buyer panel scenario, marking Rubric, PPE, and Smartphones.

		Discuss continuous professional development requirements for produce inspectors				
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



PRINCIPLES OF PRODUCE STANDARDISATION

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: PRINCIPLES OF PRODUCE STANDARDISATION	COURSE CODE: PIE 122	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: 1 SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to provide students with knowledge of produce standardisation systems, grading principles and their application in national and international trade.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concept and importance of produce standardisation; 2.0 Know national and international standardisation bodies and frameworks; 3.0 Understand the structure and content of produce quality standards; 4.0 Know grading and classification criteria to produce; 5.0 Understand labelling and marking requirements in standardisation; 6.0 Know the impact of standardisation on produce trade and market access; 7.0 Understand practical skills in standardising produce for trade.		

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: PRINCIPLES OF PRODUCE STANDARDISATION			COURSE CODE: PIE 122		CONTACT HOURS: 4 HOURS/WEEK	
YEAR: I SEMESTER: II			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge of produce standardisation systems, grading principles and their application in national and international trade.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
General Objective 1.0: Understand the concept and importance of produce standardisation						
1– 2	1.1.Define standardisation 1.2.Describe the role of standardisation in facilitating fair produce trade 1.3.Explain the economic benefits of standardisation for farmers, traders, and exporters	• Explain standardization • Discuss the role of standardisation in facilitating fair produce trade • Discuss the economic benefits of standardisation for farmers, traders, and exporters	Standardisation concept diagrams, Economic benefit data, Marker board, Marker, Projector.	• Use provided market data to compare prices received for standardised vs non-standardised produce using provided market data • Calculate the price premium associated with meeting a stated quality standard	Guide students to: • Compare prices received for standardised vs non-standardised produce using provided market data • Calculate the price premium associated with meeting a stated quality standard	Market price data, Calculation worksheet, Projector
General Objective 2.0: Know national and international standardisation bodies and frameworks						
3 – 4	2.1 Describe Nigerian standardisation	• Explain the role of Nigerian	Standardisation body chart,	• Compare a Nigerian SON	Guide students to: • Compare a	SON and Alimentarius

	bodies. 2.2 Describe the role of international bodies 2.3 Explain how national standards are harmonised with international standards	standardisation bodies: -SON -NAFDAC -NEPC • Explain the role of international bodies: -Codex Alimentarius Commission, -ISO, -UNECE, IPPC • Discuss how national standards are harmonised with international standards	Role matching worksheet, Projector, Marker board, Marker.	standard with the equivalent Alimentarius Codex standard for one produce item • Identify areas of agreement and difference and suggest how they could be harmonised	Nigerian SON standard with the equivalent Alimentarius Codex standard for one produce item • Identify areas of agreement and difference • Suggest how they could be harmonised	Codex standard excerpts, comparison worksheet
--	--	--	---	--	--	---

General Objective 3.0: Understand the structure and content of produce quality standards

5 – 7	3.1 Describe standard sections. 3.2 Explain minimum quality requirements applicable to all grades. 3.3 Describe extra class, class I, and II quality distinctions	• Explain standard sections: i. Scope, Definitions, ii. Minimum requirements, iii. Provisions on quality, grading, tolerances, iv. Presentation • Discuss minimum quality requirements applicable to all grades • Explain extra class, class I, and II quality distinctions	Codex fresh produce standard, Grade distinction table, Projector	• Read a Codex standard • Annotate each section with its purpose • Assess a produce sample against minimum requirements • Classify into extra class, class I, or class II	Guide students to: • Read a Codex standard • Annotate each section with its purpose • Assess a produce sample against minimum requirements Classify into extra class, class I, or class II	Codex standard printout, Produce samples, Annotation guide, Classification worksheet
-------	---	---	--	--	--	--

General Objective 4.0: Know grading and classification criteria for produce

8 – 10	4.1 Describe grading criteria. 4.2 Discuss tolerance levels: maximum allowable percentage of off-grade produce per lot 4.3 Describe grading of fresh produce using a standard grading guide	• Explain grading criteria: size, colour, shape, freedom from defects, maturity • Explain tolerance levels: maximum allowable percentage of off-grade produce per lot • Discuss grading of fresh produce using a standard grading guide	Grading guide, produce samples, projector, tolerance calculation worksheet	• Grade a batch of 50 produce items using a provided grading guide • Record grade distribution • Calculate the percentage of each grade • Determine whether tolerance limits are met	Guide students to: • Grade a batch of 50 produce items using a provided grading guide • Record grade distribution • Calculate the percentage of each grade • Determine whether tolerance limits are met	Numerous produce items, Grading guide, Counting tray, Weighing balance, Calculation worksheet
General Objective 5.0: Understand labelling and marking requirements in standardisation						
11 – 12	5.1 List mandatory labelling information for export produce 5.2 Describe optional labelling information and its marketing value 5.3 Explain how incorrect or missing labelling causes export rejection	• Discuss the mandatory labelling information for export produce i. Country of origin, ii. variety, iii. grade, iv. weight, v. producer ID • Explain optional labelling information and its marketing value • Explain how incorrect or missing labelling causes export rejection	Export produce labels (compliant and non-compliant), Labelling requirements guide, Projector, Marker board, Marker	• Examine three produce labels • Identify compliance with export labelling requirements • Redesign one non-compliant label to meet the stated requirements	Guide students to: • Examine three produce labels • Identify compliance with export labelling requirements • Redesign one non-compliant label to meet the stated requirements	Produce labels, Labelling requirements guide, Blank label templates, Pens
General Objective 6.0: Know the impact of standardisation on produce trade and market access						
13 – 14	6.1 Explain how meeting international	• Describe how meeting international standards	Export rejection case	• Analyse a case study of a rejected	Guide students to: • Analyse a case	Case study handout,

	standards opens premium markets for Nigerian exporters 6.2 Describe how poor standardisation leads to trade disputes, rejections, and loss of market share 6.3 Describe the role of produce inspectors in enforcing standardisation at national borders	opens premium markets for Nigerian exporters • Explain how poor standardisation leads to trade disputes, rejections, and loss of market share • Explain the role of produce inspectors in enforcing standardisation at national borders	studies, Market access data, Projector, Marker boards, marker	export consignment • Identify the standardisation failures • Construct a standardisation improvement plan to prevent future rejection	study of a rejected export consignment • Identify the standardisation failures • Construct a standardisation improvement plan to prevent future rejection	Improvement plan template, Projector
General Objective 7.0: Understand practical skills in standardising produce for trade						
15-16	7.1 Describe the end-to-end produce standardisation workflow: -Receiving -Inspection -Grading -Labelling -Packaging -Certification 7.2 Explain how to train farm-level workers in basic standardisation practices 7.3 List record keeping requirements for a standardised produce operation	• Discuss the end-to-end produce standardisation workflow: -Receiving -Inspection -Grading -Labelling -Packaging -Certification • Discuss how to train farm-level workers in basic standardisation practices • Explain record keeping requirements for a standardised produce operation	Standardisation workflow chart, training plan template, record keeping forms, projector	• Execute a complete produce standardisation exercise from inspection to labelled, graded packages • Complete a standardisation record for the exercise batch	Guide students to; • Execute a complete produce standardisation exercise from inspection to labelled, graded packages • Complete a standardisation record for the exercise batch	Produce samples, grading guide, packaging materials, labels, Standardisation record forms

Course Assessment:

Course work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%



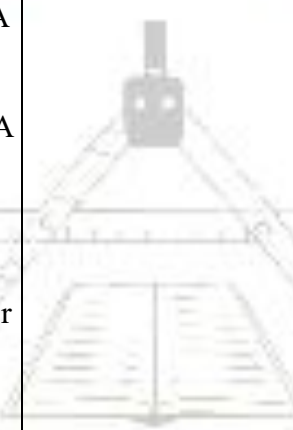
MYCOTOXIN AND PESTICIDE RESIDUE

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: MYCOTOXIN AND PESTICIDE RESIDUE	COURSE CODE: PIE 123	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: 1 SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge of mycotoxin and pesticide residue risks in agricultural produce and skills in Enzyme-Linked Immunosorbent Assay ELISA-based detection methods for export compliance.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand mycotoxins types, producing organisms and affected commodities; 2.0 Understand pesticide residues sources, types and regulatory limits; 3.0 Understand ELISA principles and its application in food safety testing; 4.0 Know ELISA-based mycotoxin detection tests; 5.0 Know ELISA-based pesticide residue screening; 6.0 Understand ELISA results against regulatory standards; 7.0 Know competence in laboratory safety and analytical record keeping.		

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: MYCOTOXIN AND PESTICIDE RESIDUE			COURSE CODE: PIE 123		CONTACT HOURS: 4 HOURS/WEEK	
YEAR: I SEMESTER: II			CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK	
			PRE-REQUISITE: NIL		PRACTICAL: 3HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge of mycotoxin and pesticide residue risks in agricultural produce and skills in Enzyme-Linked Immunosorbent Assay ELISA-based detection methods for export compliance.						
THEORETICAL CONTENT					PRACTICAL CONTENT	
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
General Objective 1.0: Understand mycotoxins types, producing organisms and affected commodities						
1 – 2	1.1 Define mycotoxins and pesticide residues 1.2 Describe major mycotoxins. 1.3 Describe commodities at highest risk.	- Explain mycotoxins and pesticide residues - Examine major mycotoxins: i. Aflatoxins (B1, B2, G1, G2), ii. Fumonisin, iii. Ochratoxin iv. Deoxynivalenol (DON) - Explain	Mycotoxin type chart, Affected commodity photos, Outbreak case study, Projector	- Examine photographs of mould-affected produce samples - Identify likely mycotoxin risk - Prepare a risk matrix linking mycotoxin types to commonly exported Nigerian commodities - Explain preventive measures of aflatoxin and	Guide Students to: - Examine photographs of mould-affected produce samples - Identify likely mycotoxin risk - Prepare a risk matrix linking mycotoxin types to commonly exported Nigerian commodities - Explain preventive measures of	Mould-affected grain, Blank risk matrix template, Commodity export data

		commodities at highest risk: i. maize, ii. groundnut, iii. sorghum, iv. wheat, v. dried fruits, vi. dried meat, vii. melon seed, viii. sesame, ix. ginger etc.		pesticide residue on agricultural produce	aflatoxin and pesticide residue on agricultural produce	
General Objective 2.0: Understand pesticide residue sources, types and regulatory limits						
3 – 4	2.1 Describe how pesticide residues enter produce 2.2 Describe chemical classes of pesticides. 2.3 Describe residue persistence. 2.4 Explain banned pesticides. 2.5 Explain maximum residue limits (MRLs) set by SON, Codex, EU, importing countries. 2.6 Explain how exceedances cause	- Explain how pesticide residues enter produce; -Pre-harvest application, -Post-harvest treatment, -Environmental contamination - Discuss chemical classes of pesticides; - Organophosphates -Carbamates -Pyrethroids	MRL comparison tables, SON, Codex Alimentarius and EU pesticide databases, Projector, Marker boards, Marker	- Look up MRLs for three pesticides on two selected export crops from SON, Codex Alimentarius and EU databases. - Identify which country has stricter limits. - Identify the export compliance	Guide students to: - Look up MRLs for three pesticides on two selected export crops from SON, Codex Alimentarius and EU databases - Identify which country has stricter limits - Identify the export	Computers Internet, SON/Codex Alimentarius /EU MRL data sheets, Comparison worksheet

	export rejection.	- Describe residue persistence - Discuss banned pesticides. - Explain maximum residue limits (MRLs) set by SON, Codex Alimentarius, EU, and importing countries - Discuss how exceedances cause export rejection		implication. Make a profile of banned pesticides available in Nigerian markets.	compliance implication Make a profile of banned pesticides available in Nigerian markets	
General Objective 3.0: Understand ELISA principles and its application in food safety testing						
5 – 7	3.1 Define ELISA (Enzyme-Linked Immunosorbent Assay) 3.2 Explain types of ELISA used in food testing: -Direct, -Indirect, -Sandwich, -Competitive 3.3 Discuss the roles of ELISA in rapid screening and confirmatory analytical methods (HPLC, LC-MS)	- Explain ELISA (Enzyme-Linked Immunosorbent Assay) and the antigen-antibody reaction principle - Discuss the types of ELISA used in food testing: - Direct, -Indirect, -Sandwich, -Competitive - Explain the role of ELISA in rapid screening and confirmatory analytical methods (HPLC, LC-MS)	ELISA principle diagrams, Type comparison chart, Projector	- Examine an ELISA kit components -Microplate, -Reagents, -Reader. - Identify the role of each component - Watch a demonstration of the ELISA procedure - Record each step in sequence - Record findings - Interpret findings	Guide students to: - Examine an ELISA kit components -Microplate, -Reagents, -Reader. - Identify the role of each component - Watch a demonstration of the ELISA procedure - Record each step in sequence - Record findings - Interpret findings	ELISA kit (or training kit), ELISA component identification worksheet, lab manual

General Objective 4.0: Know ELISA-based mycotoxin detection tests						
8 – 10	4.1 List the sample preparation steps for mycotoxin ELISA. 4.2 Describe the ELISA plate setup for aflatoxin competitive ELISA. 4.3 Describe how to read and record optical density (OD) values from a microplate reader.	• Explain the sample preparation steps for mycotoxin ELISA; i. extraction, ii. dilution, iii. filtration • Explain the ELISA plate setup for aflatoxin competitive ELISA • Discuss how to read and record optical density (OD) values from a microplate reader	ELISA principle diagrams, Type comparison chart, Projector, Marker board, Marker 	• Extract mycotoxin from a grain sample following the ELISA kit protocol • Set up an aflatoxin competitive ELISA • Run an aflatoxin competitive ELISA • Read OD values from the plate reader • Record findings • Interpret findings	Guide students to: • Extract mycotoxin from a grain sample following the ELISA kit protocol • Set up an aflatoxin competitive ELISA • run an aflatoxin competitive ELISA • Read OD values from the plate reader • Record findings • Interpret findings	Aflatoxin ELISA kit, Grain samples, Extraction solvents, Pipettes, Microplate reader, Lab coats, Gloves, PPE.
General Objective 5.0: Know ELISA-based pesticide residue screening like Quick Easy Cheap Effective Rugged Safe (QuEChERS)						
11– 12	5.1 Describe sample preparation for pesticide residue ELISA using Quick Easy Cheap Effective Rugged Safe (QuEChERS) extraction in simple terms 5.2 Describe how lateral flow immunoassay	• Explain sample preparation for pesticide residue ELISA (QuEChERS extraction in simple terms) • Explain how lateral flow immunoassay	Pesticide ELISA kit or rapid test strips, projector, Marker boards, Marker.	• Perform a rapid test strip screening for pesticide residues on provided produce extract • Run an ELISA for one pesticide class	Guide students to: • Perform a rapid test strip screening for pesticide residues on provided produce extract • Run an ELISA for one	Pesticide rapid test strips, ELISA kit, Produce samples, Extraction solvents, Pipettes, Gloves

	(rapid test strips) can be used for field screening 5.3 Describe the ELISA procedure for organophosphate or pyrethroid residue screening	(rapid test strips) can be used for field screening Explain the ELISA procedure for organophosphate or pyrethroid residue screening		using provided kit Record results	pesticide class using provided kit Record results	
General Objective 6.0: Understand ELISA results against regulatory standards						
15	6.1 Describe how to construct a standard curve from ELISA OD values 6.2 Describe how to calculate analyte concentration from the standard curve	- Explain how to construct a standard curve from ELISA OD values - Explain how to calculate analyte concentration from the standard curve	Sample OD data, standard curve worksheets, SON/ Codex Alimentarius /EU limit tables, calculators, projector	- Plot a standard curve from provided ELISA OD data - Calculate concentrations for three unknown samples - Compare calculated concentrations to regulatory limits - Write an accept/reject recommendation	Guide students to: - Plot a standard curve from provided ELISA OD data - Calculate concentrations for three unknown samples - Compare calculated concentrations to regulatory limits - Write an accept/reject recommendation	Graph paper or spreadsheet, OD data sets, Regulatory limit tables, Calculators, Recommendation form
General Objective 7.0: Know competence in laboratory safety and analytical record keeping						

15	7.1 Describe laboratory safety requirements for working with solvents, biological reagents, and microplate readers. 7.2 Discuss Good Laboratory Practice (GLP) principles relevant to food testing laboratories 7.3 Describe how to maintain analytical records.	• Explain laboratory safety requirements for working with solvents, biological reagents, and microplate readers • Explain Good Laboratory Practice (GLP) principles relevant to food testing laboratories • Explain how to maintain analytical records i. chain of custody, ii. raw data iii. calculation sheets, iv. reports	Pesticide ELISA kit or rapid test strips, projector, Marker boards, Marker	• Complete a chain of custody record for a simulated sample submission • Compile a complete analytical record for a previous ELISA exercise including raw data, calculations, and conclusion • Record findings	Guide students to: • Complete a chain of custody record for a simulated sample submission • Compile a complete analytical record for a previous ELISA exercise including raw data, calculations, and conclusion • Record findings	Chain of custody forms, Analytical record templates, Previous ELISA data, GLP guide
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

RODENTS BIOLOGY, INFESTATION AND INTEGRATED PEST MANAGEMENT (IPM) CONTROL

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: RODENTS BIOLOGY, INFESTATION AND IPM CONTROL	COURSE CODE: PIE 124	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: 1 SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skill of rodent biology, infestation patterns, damage assessment and integrated pest management strategies for stored produce protection.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the biology and ecology of rodent pests of stored produce. 2.0 Know common rodent species and their infestation signs. 3.0 Understand quantitative and qualitative losses caused by rodents. 4.0 Understand rodent exclusion and physical control methods. 5.0 Know chemical and biological rodent control methods 6.0 Know the implementation of rodent IPM monitoring plan. 7.0 Understand regulatory and public health dimensions of rodent control.		

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: RODENTS BIOLOGY, INFESTATION AND IPM CONTROL				COURSE CODE: PIE 124		CONTACT HOURS: 4 HOURS/WEEK
YEAR: 1 SEMESTER: II				CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK
				PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skill of rodent biology, infestation patterns, damage assessment and integrated pest management strategies for stored produce protection						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
General Objective 1.0: Understand the biology and ecology of rodent pests of stored produce						
1 – 2	1.1.Describe the main rodent pest species. 1.2.Explain rodent reproductive biology. 1.3.Explain why populations grow rapidly in stores. 1.4.Describe rodent behaviour patterns.	- Discuss the main rodent pest species: i. Rattus rattus (black rat), ii. Rattus norvegicus (brown rat), iii. Mus musculus (house mouse) - Discuss rodent reproductive biology - Discuss why populations grow rapidly in stores	Rodent species Photos, Biology comparison chart, Projector	- Examine rodent pest specie. - Identify species using specimens - Enumerate key physical features - Draw a diagram illustrating rodent entry routes and harborage points in a typical grain store - Record findings	Guide students to: - Examine rodent pest specie. - Identify species using specimens - Describe key physical features - Design a diagram illustrating rodent entry routes and harborage points in a typical grain store - Record findings	Rodent skull/track specimens or photos, Store diagram template, Pencils

		- Explain rodent behaviour: - gnawing, - burrowing, - hoarding, - nocturnal activity patterns				
General Objective 2.0: Know common rodent species and their infestation signs						
3 – 4	2.1. Describe infestation signs 2.2. Describe how to estimate infestation severity from sign density 2.3. Describe the difference between active and old infestation signs	- Describe infestation signs: -droppings -Urine trails -Gnaw marks -Burrows -Runways -Smear marks - Explain how to estimate infestation severity from sign density - Describe the difference between active and old infestation signs	Infestation sign photos, Sign identification worksheet, Severity estimation guide, Projector	- Inspect a simulated storage area - Identify infestation signs - Record all infestation signs observed - Estimate infestation severity based on sign density using a provided rating scale - Record findings	Guide students to: - Inspect a simulated storage area - Identify infestation signs - Record all infestation signs observed - Estimate infestation severity based on sign density using a provided rating scale - Record findings	Simulated store with infestation signs, Identification checklist, Severity rating scale
General Objective 3.0: Understand quantitative and qualitative losses caused by rodents						
5 – 6	3.1 Explain how to calculate weight loss	Discuss how to calculate weight loss	projector, export rejection scenario	Weigh rodent-damaged and	Guide students to: Weigh rodent-	Rodent-damaged

	caused by rodent feeding and grain spillage 3.2 Describe qualitative losses. 3.3 Explain how rodent damage reduces produce grade and causes export rejection	caused by rodent feeding and grain spillage - Describe qualitative losses: - mycotoxin contamination from rodent-damaged grain, - contamination with droppings and urine - Discuss how rodent damage reduces produce grade and causes export rejection	cards	intact grain samples - Calculate percentage weight loss - Inspect rodent-damaged grain for secondary mould growth and foreign matter contamination - Record findings	damaged and intact grain samples - Calculate percentage weight loss - Inspect rodent-damaged grain for secondary mould growth and foreign matter contamination - Record findings	grain, Intact grain, Weighing balance, Sieves, Magnifying lens, worksheets Computer Projector Practical manual
--	---	--	-------	---	---	---

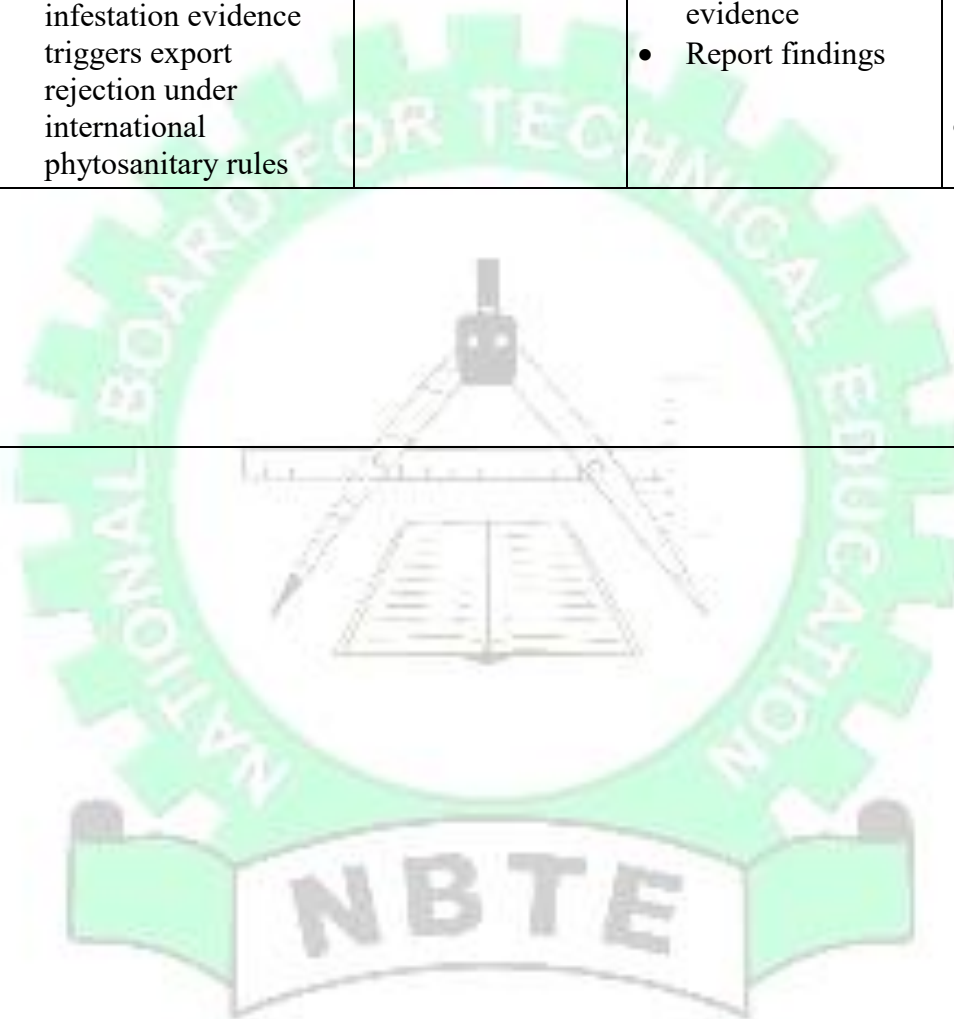
General Objective 4.0: Understand rodent exclusion and physical control methods

7 – 9	4.1 Describe proofing measures: 4.2 Discuss the followings: - Snap trap - Cage trap - Glue trap use - Placement baiting and their safety precaution measures 4.3 Describe ultrasonic repellers	- Explain proofing measures: -Blocking entry points (steel wool, cement, metal sheeting, etc.), -Raised floors, -Smooth	Proofing materials samples, Trap types (snap, cage, glue), Placement diagram, Projector	- Identify entry points on a store plan - Recommend appropriate proofing materials for each - Set up snap and cage traps correctly in a simulated storage area	Guide students to: - Identify entry points on a store plan - Recommend appropriate proofing materials for each - Set up snap and cage traps correctly in a simulated storage	Store plan diagram, Snap traps, Cage traps, Trap placement worksheet
-------	--	--	--	--	---	---

	4.4 Explain their limited effectiveness	walls • Explain the followings: -Snap trap -Cage trap -Glue trap use -Placement baiting and their safety precaution measures • Explain ultrasonic repellers • Discuss their limited effectiveness		• Record placement rationale • Record findings • Present findings in the class	area • Record placement rationale • Record findings - Present findings in the class	
General Objective 5.0: Know chemical and biological rodent control methods						
10-11	5.1 Describe rodenticide types. 5.2 Discuss bait station setup, bait placement principles and safety for non-target species 5.3 Describe biological control: barn owls, natural predators, and their limitations 5.4 Explain safety precautions in application of rodenticides	• Explain rodenticide types: - anticoagulants (first and second generation), - acute poisons • Explain bait station setup, bait placement principles, and safety for non-target species • Explain biological control: barn owls, natural predators, and their limitations • Discuss safety precautions in	Rodenticide labels, Bait stations, Safety guide, Projector	• Set up bait stations correctly in a simulated store following safety guidelines • Read a rodenticide label • Complete a safety compliance checklist • Apply rodenticides in a controlled environment following the safety precautions • Record findings • Make	Guide students to: • Set up bait stations correctly in a simulated store following safety guidelines • Read a rodenticide label • Complete a safety compliance checklist • Apply rodenticides in a controlled environment following the safety precautions	Bait stations, Rodenticide label samples, Safety compliance checklist, PPE Computer Projector Practical manual

		application of rodenticides		recommendations	- Record findings - Make recommendations	
General Objective 6.0: Know and implement a rodent IPM monitoring plan						
12-14	6.1 Describe components of a rodent IPM plan. 6.2 Explain tracking indices and monitoring data interpretation 6.3 Describe how to evaluate IPM programme effectiveness and adapt the plan	- Explain the components of a rodent IPM plan: - inspection schedule, - control methods, - record keeping - review - Discuss tracking indices and monitoring data interpretation - Explain how to evaluate IPM programme effectiveness and adapt the plan	IPM plan template, Tracking index data, Monitoring record template, Projector	- Develop a rodent IPM plan for a simulated produce store - Implement a 1-week monitoring exercise, - Record findings, - Evaluate effectiveness - Record findings	Guide students to: - Develop a rodent IPM plan for a simulated produce store - Implement a 1-week monitoring exercise, - Record findings, - Evaluate effectiveness - Record findings	IPM plan template, Monitoring record sheets, Trap types, Store simulation area
General Objective 7.0: Understand regulatory and public health dimensions of rodent control						
15-16	7.1 Explain public health risks of rodents. 7.2 Describe Nigerian regulations on rodenticide registration, use (NAFDAC) and SON 7.3 Explain how rodent	- Explain public health risks of rodents: - leptospirosis, - salmonellosis, - Hantavirus, - rat bite fever - Explain Nigerian regulations on rodenticide registration and use (NAFDAC)	NAFDAC rodenticide regulations, Phytosanitary rejection Data, Projector	- Review NAFDAC rodenticide guidelines - Identify key user compliance requirements - Analyse a scenario where a consignment was rejected due to	Guide students to: - Review NAFDAC rodenticide guidelines - Identify key user compliance requirements - Analyse a scenario where a	NAFDAC guidelines, Rejection scenario card, Analysis worksheet

	infestation evidence triggers export rejection under international phytosanitary rules	and SON Discuss how rodent infestation evidence triggers export rejection under international phytosanitary rules		rodent contamination evidence Report findings	consignment was rejected due to rodent contamination evidence Report findings	
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



SMART FOOD PACKAGING AND SUSTAINABLE PACKAGING SYSTEMS

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: SMART FOOD PACKAGING AND SUSTAINABLE PACKAGING SYSTEMS	COURSE CODE: PIE 125	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: 1 SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills of modern packaging technologies including smart, and sustainable systems and their application in maintaining quality of inspected and export-ready produce.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the functions of packaging in produce trade. 2.0 Know conventional packaging materials and their properties. 3.0 Understand active packaging technologies and their mechanisms. 4.0 Understand smart packaging technologies and their application in produce monitoring. 5.0 Know sustainable and eco-friendly packaging systems. 6.0 Understand packaging selection and quality assessment skills to export produce. 7.0 Understand packaging regulations, labelling requirements, and compliance for export.		

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE SMART FOOD PACKAGING AND SUSTAINABLE PACKAGING SYSTEMS				COURSE CODE: PIE 125		CONTACT HOURS: 4 HOURS/WEEK
YEAR: 1 SEMESTER: II				CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK
				PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOALThis course is designed to equip students with knowledge of modern packaging technologies including smart, and sustainable systems and their application in maintaining quality of inspected and export-ready produce						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
General Objective 1.0: Understand the functions of packaging in produce trade						
1 – 2	1.1 Define packaging 1.2 Explain the functions of packaging 1.3 Describe primary, secondary, and tertiary packaging 1.4 Explain their roles in produce trade 1.5 Explain how packaging protects produce quality during handling, storage, and export 1.6 Describe how packaging contributes to brand identity, marketability, and compliance	• Explain packaging • Discuss the functions of packaging • Explain primary, secondary, and tertiary packaging • Discuss their roles in produce trade • Discuss how packaging protects produce quality during handling, storage, and export • Explain how packaging contributes to brand identity, marketability, and compliance	Assorted packaging samples (primary, secondary, tertiary), Projector, Classification worksheet	• Classify ten provided packaging samples by level (primary, secondary, tertiary) • Identify which samples would be suitable for export produce • Justify the selection • Record findings	Guide students to: • Classify ten provided packaging samples by level (primary, secondary, tertiary) • State the function of each • Identify which samples would be suitable for export produce • Justify the selection • Record findings	Ten assorted packaging samples, Classification worksheet, Suitability justification sheet

General Objective 2.0: Know conventional packaging materials and their properties						
3 – 5	2.1 Describe properties of glass, metals, paper/board, and plastics (PE, PP, PET, PVC, OPP, etc.) relevant to produce packaging 2.2 Explain barrier properties 2.3 Explain how they affect produce shelf life 2.4 Explain packaging selection criteria.	Discuss properties of glass, metals, paper/board, and plastics (PE, PP, PET, PVC, OPP, etc.) relevant to produce packaging Discuss barrier properties -Moisture -Gas -Light Describe how they affect produce shelf life Discuss packaging selection criteria: -Commodity type, -Storage conditions, -Transport mode, -Cost	Material samples, Barrier property data table, Projector, Selection criteria worksheet	• Conduct a moisture permeability comparison between two packaging film types over 5 days • Select the most appropriate packaging material for three different export commodities • Justify each choice • Record findings	Guide students to: • Conduct a moisture permeability comparison between two packaging film types over 5 days • Select the most appropriate packaging material for three different export commodities • Justify each choice • Record findings	Packaging film samples, Moisture indicator, Produce samples, Selection justification worksheet
General Objective 3.0: Understand active packaging technologies and their mechanisms						
6 – 7	3.1 Define active packaging 3.2 Describe how it interacts with the produce or its environment 3.3 Describe types. 3.4 Explain the application of each active system to specific produce types	• Explain active packaging • Discuss how it interacts with the produce or its environment • Explain types; - oxygen scavengers, - moisture absorbers (desiccants), - ethylene absorbers, - CO₂ emitters, - antimicrobial film • Discuss the application of each active system to	Projector, Marker board, Marker, Selection criteria worksheet, Pictures, Charts.	• Incorporate an oxygen scavenger sachet into a MAP package • Monitor O₂ depletion over 5 days • Apply an ethylene absorber to a ripening banana batch • Compare ripening rate with	Guide students to: • Incorporate an oxygen scavenger sachet into a MAP package • Monitor O₂ depletion over 5 days • Apply an ethylene absorber to a ripening banana batch • Compare ripening	O₂ scavenger sachets, Ethylene absorbers, MAP bags, gas analyser strips, Bananas, Observation sheets.

		specific produce types		untreated banana • Record findings	rate with untreated banana • Record findings	
General Objective 4.0: Understand smart packaging technologies and their application in produce monitoring						
8-10	4.1 Define smart packaging 4.2 Describe key technologies. 4.3 Explain how TTI and freshness indicators signal quality status to inspectors and consumers 4.4 Describe how RFID and NFC enable traceability from farm to export destination	• Explain smart packaging • Discuss key technologies: - Time-temperature indicators (TTI) - Freshness indicators - RFID - NFC tags - QR codes • Discuss how TTI and freshness indicators signal quality status to inspectors and consumers • Explain how RFID and NFC enable traceability from farm to export destination	TTI samples, RFID tag demo, QR code samples, freshness indicator strip, Projector, Marker boards, Marker.	• Expose TTI samples to different temperature conditions • Record colour change at each stage • Interpret colour change at each stage • Scan a QR code on a produce package • Record the traceability information retrieved • Record findings	• Expose TTI samples to different temperature conditions • Record colour change at each stage • Interpret colour change at each stage • Scan a QR code on a produce package • Record the traceability information retrieved • Record findings	TTI samples, heat source (warm water), QR-coded produce labels, Smartphones, Observation sheets.
General Objective 5.0: Evaluate sustainable and eco-friendly packaging systems						
11-12	5.1 Explain sustainability in packaging: - Reduce - reuse, - recycle (3R) principles 5.2 Describe bioplastics and compostable	• Discuss sustainability in packaging: reduce, reuse, recycle (3R) principles • Explain bioplastics and compostable materials: -PLA, -Starch-based films, -Bagasse trays	Bioplastic and conventional packaging samples, LCA concept worksheet, Projector,	• Compare degradation of conventional plastic and bioplastic film under simulated burial conditions over 2 weeks	Guide students to: • Compare degradation of conventional plastic and bioplastic film under simulated burial conditions	Bioplastic and plastic film samples, Starch, Glycerol, Water, Ruler, Degradation observation

	materials. 5.3 Explain how to evaluate life cycle assessment (LCA) concepts for conventional and sustainable packaging 5.4 Explain cost benefit analysis of packaging	- Evaluate life cycle assessment (LCA) concepts for conventional and sustainable packaging - Discuss cost benefit analysis of packaging	Marker board, Marker.	- Prepare a simple starch-based film - Test its tensile strength against conventional film - Evaluate cost benefit analysis of packaging	over 2 weeks - Prepare a simple starch-based film - Test its tensile strength against conventional film - Evaluate cost benefit analysis of packaging	forms.
General Objective 6.0: Understand packaging selection and quality assessment skills to export produce						
13-14	6.1 Explain export packaging requirements: 6.2 Describe packaging quality tests. 6.3 Explain how packaging failure causes produce damage and export rejection.	- Discuss export packaging requirements: -Compression strength -Vibration resistance -Moisture resistance - label compliance - Explain packaging quality tests: -Compression test, -Drop test, -Seal integrity test - Discuss how packaging failure causes produce damage and export rejection.	Export packaging samples, , Projector, Marker boards, Marker.	- Conduct compression and seal integrity tests on provided packaging samples - Record results - Select simulated export produce lot in appropriate packaging - Pack a simulated export produce lot in appropriate packaging - Assess suitability of	Guide students to: - Conduct compression and seal integrity tests on provided packaging samples - Record results - Select simulated export produce lot in appropriate packaging - Pack a simulated export produce lot in appropriate packaging - Assess	Packaging samples, Compression tester, Seal tester, Produce samples, Packaging test Record sheets Charts Pictures

				- packaging - Record findings	suitability of packaging Record findings	
General Objective 7.0: Understand packaging regulations, labelling requirements, and compliance for export						
14-15	7.1 Outline NAFDAC, SON, and EU food contact material regulations 7.2 Explain how they apply to export produce packaging 7.2 Describe mandatory export package labelling: 7.3 Explain how an inspector verifies packaging compliance during pre-export inspection	- Explain NAFDAC, SON, and EU food contact material regulations - Discuss how they apply to export produce packaging - Explain mandatory export package labelling: - Country of origin - Grade - Net weight - Dates - Producer traceability code - Describe how an inspector verifies packaging compliance during pre-export inspection	NAFDAC/EU packaging regulations, compliant and non-compliant export labels, projector, Marker boards, Marker.	- Inspect three export produce packages for label and packaging compliance against stated requirements - Write a compliance report for each package recommending pass or fail with reasons - Record findings	Guide students to: - Inspect three export produce packages for label and packaging compliance against stated requirements - Write a compliance report for each package recommending pass or fail with reasons - Record findings	Export packaging samples, Labelling compliance checklist, Compliance report template, Internet, Computer, Projector, Charts.

Course Assessment:

Course work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%



FOOD SAFETY SYSTEMS

PROGRAMME: NATIONAL DIPLOMA POSTHARVEST TECHNOLOGY		
COURSE TITLE: FOOD SAFETY SYSTEMS	COURSE CODE: PIE 126	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: 1 SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 2 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 students should be able to: 1.0 Understand the principles of the Hazard Analysis Critical Control Point (HACCP) system. 2.0 Understand the requirements and implementation of Global GAP standards for primary production. 3.0 Understand the framework of Food Safety Management Systems (FSMS). 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.		

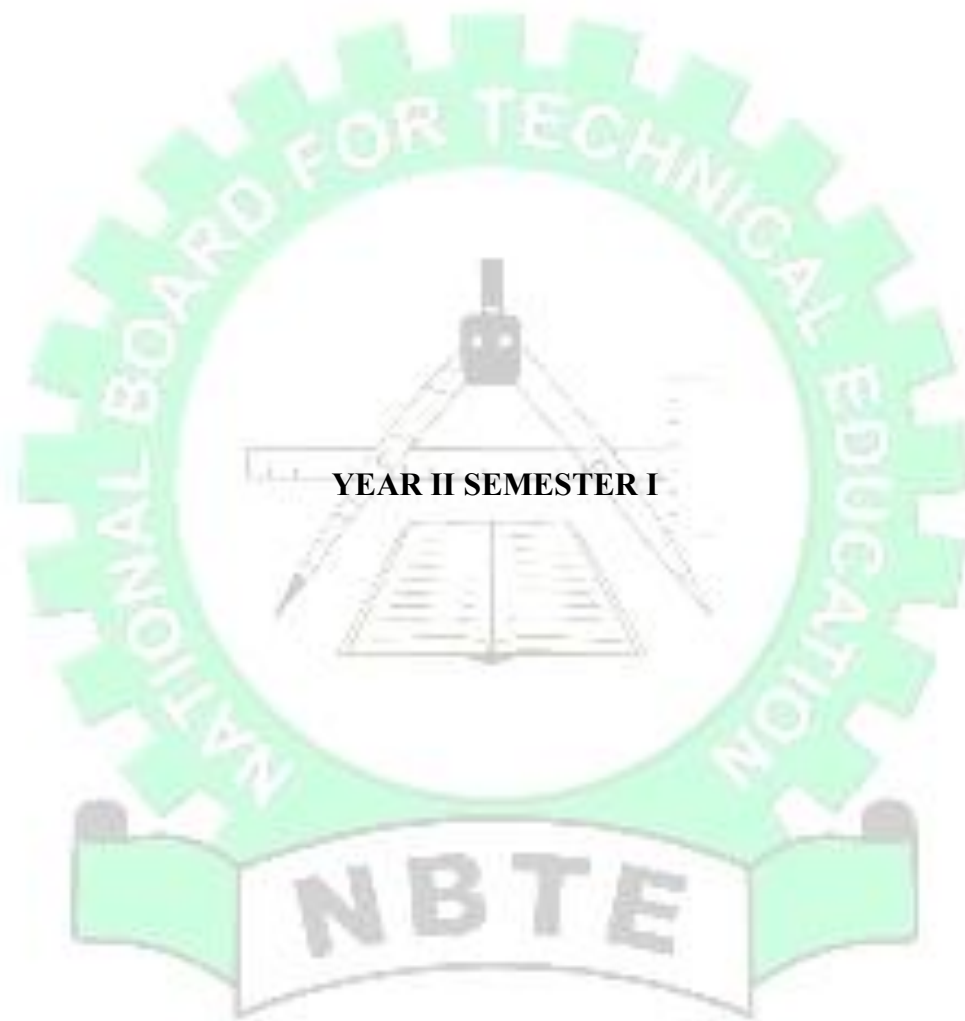
PROGRAMME: NATIONAL DIPLOMA POSTHARVEST TECHNOLOGY						
COURSE TITLE: FOOD SAFETY SYSTEMS			COURSE CODE: PIE 126		CONTACT HOURS: 2 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills 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 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 Define HACCP 1.2 Explain HACCP Principles 1.3 Explain the 7 principles of HACCP 1.4 Explain the 5 preliminary steps. 1.5 Explain Hazard Analysis Exercise	- Discuss HACCP and its principles - Describe the 7 principles of HACCP and the 5 preliminary steps. - Discuss Hazard Analysis Exercise	HACCP Handbook, Projector Videos Charts, Marker boards, Marker.	- Conduct a hazard analysis for a specific produce (e.g., fresh-cut leafy greens). - Conduct a visit to food processing facilities - Identify CCPs using a decision tree - Carry out hazard analysis exercise - Record findings	Guide students to: - Conduct a hazard analysis for a specific produce (e.g., fresh-cut leafy greens). - Conduct a visit to food processing facilities - Identify CCPs using a decision tree - Carry out hazard analysis exercise - Record findings	Flowcharts decision Tree diagrams, flipcharts, HACCP documents Internet, Computer, Projector
General Objective 2.0: Understand the requirements and implementation of Global Good Agricultural Practice (GAP) standards for primary production.						
3-4	2.1 Explain Global GAP Standards 2.2 Explain the	- Discuss Global GAP Standards - Explain the	Global GAP Checklists HACCP ₈₀	Perform a compliance check on a campus farm	Guide students to: Perform a compliance check	PPE, Checklist forms, digital

	requirements and implementation of Global GAP standards for primary production 2.3 Describe Integrated Farm Assurance (IFA) and "Major Musts." 2.4 Describe Farm Inspection	requirements and implementation of Global GAP standards for primary production • Discuss Integrated Farm Assurance (IFA) and "Major Musts." • Discuss Farm Inspection.	Documents Projector Videos Charts, Marker boards, Marker.	site • Identify requirements of Global GAP for primary production • Carry out farm inspection • Record findings	on a campus farm site • Identify requirements of Global gap for primary production • Simulate farm inspection • Record findings	cameras, farm.
General Objective 3.0: Understand the framework of ISO 22000 Food Safety Management Systems (FSMS).						
5-6	3.1 Explain ISO Framework 3.2 Explain Food Safety Management Systems 3.3 Explain the PDCA (Plan-Do-Check-Act) cycle in FSMS. 3.4 Explain SOP Development and other common technical documents.	• Discuss ISO Framework • Discuss Food Safety Management Systems • Discuss the PDCA (Plan-Do-Check-Act) cycle in FSMS. • Discuss SOP Development and other common technical documents.	ISO 22000 Standard documents Videos, charts. PDCA act	• Draft a Standard Operating Procedure (SOP) for equipment cleaning. • Demonstrate PDA cycle in FSMS • Carry out food safety management system exercise • Conduct a mock SOP development • Record findings	Guide students to: • Draft a Standard Operating Procedure (SOP) for equipment cleaning. • Demonstrate PDA cycle in FSMS • Carry out food safety management system exercise • Conduct a mock SOP development • Record findings	Templates, Sample SOPs. Internet Computer Projector Chart, PPE

General Objective 4.0: Understand how to Apply Good Agricultural Practices (GAP) and Good Manufacturing Practices (GMP).						
7-8	4.1 Explain GAPs and GMPs 4.2 Explain how to apply (GAP) and (GMP) in agricultural enterprises. 4.3 Explain the requirements for sanitary facilities and pest control. 4.4 Explain Facility Audit	• Discuss GAPs and GMPs • Describe how to Apply (GAP) and (GMP). • Discuss the requirements for sanitary facilities and pest control. • Discuss Facility Audit	GMP guidelines, Visuals of sanitary designs, Videos.	• Audit the packing house for GHP/GMP compliance. • Carry out GAPs and GMP protocols • Operate sanitary facilities and pest control using the provided requirements. • Record findings	Guide students to: • Audit the packing house for GHP/GMP compliance. • Carry out GAPs and GMP protocols • Provide the requirements for sanitary facilities and pest control • Record findings	Audit logs, ATP swabs simulate, Internet Computer, GMP documents GAP documents Sanitary reagents Pest control equipment
General Objective 5.0: Understand the process of food safety auditing and certification.						

9-10	5.1 Explain food safety Auditing and Certification 5.2 Explain the differences between first, second, and third-party audits. 5.3 Explain the principles of auditing.	• Discuss food safety Auditing and Certification • Discuss the differences between first, second, and third-party audits. • Discuss the principles of auditing	Certification flow diagrams Videos.	• Simulate an opening and closing audit meeting. • Carry out a Role-Play on Auditing exercise • Conduct a mock documentation on first, second, and third-party audits. • Record findings	Guide the students to: • Simulate an opening and closing audit meeting. • Carry out a Role-Play on Auditing exercise • Conduct a mock documentation on first, second, and third-party audits • Record findings	Case studies, Recording sheets Computer Markers Projectors Internet Card board paper
General Objective 6.0: Understand traceability and recall procedures in the food supply chain.						
11-12	6.1 Explain Traceability and recalls in food supply chain. 6.2 Explain traceability, distribution and recall procedures in the food supply chain. 6.3 Explain forward and backward traceability logic.	• Discuss Traceability and recalls in food supply chain. • Discuss traceability, distribution and recall procedures in the food supply chain. • Discuss forward and backward traceability logic.	Traceability software demos, sample labels Videos.	• Execute a product recall within a specified timeframe. • Carry out a simulation on recall food supply chain • Implement traceability and recall procedures in the food supply chain • Record findings	Guide students to: • Execute a product recall within a specified timeframe. • Carry out a simulation on recall food supply chain • Implement traceability and recall procedures in the food supply chain • Record findings	Batch codes, Logbooks, Stopwatches. Charts Internets Computer

General Objective 7.0: Understand the regulatory roles of national and international food safety bodies.						
13-14	7.1 Explain national and international food safety bodies 7.2 Explain Regulatory Frameworks on food safety 7.3 Explain the regulatory roles of national and international food safety bodies 7.4 Describe Compliance Report on food safety	• Discuss national and international food safety bodies • Discuss Regulatory Frameworks on food safety • Describe the regulatory roles of national and international food safety bodies • Discuss Compliance Reporting on food safety	Regulatory gazettes, Internet, Marker, Marker boards.	• Prepare a formal food safety compliance report • Conduct research on roles of national and international food safety bodies • Carry out simulations of compliances report on food safety • Record findings	Guide students to: • Prepare a formal food safety compliance report • Conduct research on roles of national and international food safety bodies • Carry out simulations of compliances report on food safety • Record findings •	Calculators, Laptops. Charts Internet Computer
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



FUMIGATION PRINCIPLES, PHOSPHINE MONITORING AND SAFETY

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT (ND-PIE)		
COURSE TITLE: FUMIGATION PRINCIPLES, PHOSPHINE MONITORING AND SAFETY	COURSE CODE: PIE 211	CONTACT HOURS: 4 HOURS /WEEK
YEAR: II SEMESTER: I	CREDIT UNITS: 4	THEORETICAL: 1 HOUR /WEEK
	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip the students with knowledge and skills of safety competency in fumigation principles, phosphine gas behaviour, dosage calculation, monitoring and safe operational procedures.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Know the principles of fumigation and the modes of action of major fumigants. 2.0 Understand phosphine chemistry, gas behaviour and concentration 3.0 Know fumigant dosage for stores of various sizes and structural configurations. 4.0 Know Federal Produce Inspection Services (FPIS) and Nigerian Agricultural Quarantine Services (NAQS)-compliant fumigation procedures. 5.0 Understand correct use of PPE for fumigation and response to fumigation emergencies.		

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT (ND-PIE)							
COURSE TITLE: FUMIGATION PRINCIPLES, PHOSPHINE MONITORING AND SAFETY				COURSE CODE: PIE 211		CONTACT HOURS: 4 HOURS/WEEK	
				CREDIT UNITS: 4		THEORETICAL: 1 HOUR /WEEK	
YEAR: II SEMESTER: I				PRE-REQUISITE:		PRACTICAL: 3 HOURS /WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL							
GOAL: This course is designed to equip the students with knowledge and skills of safety competency in fumigation principles, phosphine gas behaviour, dosage calculation, monitoring and safe operational procedures.							
General Objective 1.0: Know the principles of fumigation and the modes of action of major fumigants.							
THEORETICAL CONTENT				PRACTICAL CONTENT			
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources	
1-3	1.1 Explain fumigation principles. 1.2 Explain the modes of action. 1.3 Explain Fumigant concentration 1.4 Explain effectiveness of fumigation threshold for major stored product pests.	- Discuss fumigation principles - Describe the modes of action - Discuss Fumigant concentration - Discuss effectiveness of fumigation threshold for major stored product pests.	Laptop, Smart board, Projector, Whiteboard, Markers, Internet, Videos	- Calculate phosphine Concentration Time (CT) product for 3 different dosage/exposure scenarios. - Determine if each achieves minimum CT value for pest mortality - Record findings	Guide students to: - Calculate phosphine CT product for 3 different dosage/exposure scenarios. - Determine if each achieves minimum CT value for weevil mortality - Record findings	Laboratory equipment, Instruments worksheets, Samples, Sprayers CPP samples, Material Safety Data Sheet (MSDS), PPE.	
General Objective 2.0: Understand phosphine chemistry, gas behaviour and concentration monitoring.							
4-6	2.1 Describe phosphine chemistry. 2.2 Explain reaction of phosphide with	- Explain phosphine chemistry: -Aluminium phosphide -Magnesium	Laptop, Smart board, Projector, Whiteboard	Conduct an air tightness test on a simulated sealed chamber.	Guide students to: Conduct an air tightness test on a simulated sealed chamber.	Laboratory equipment, Instruments Worksheets, Samples, Pressure gauge	

	moisture 2.3 Explain the importance of air tightness for effective fumigation.	phosphide) - Discuss reaction of phosphide with moisture - Discuss the importance of air tightness for effective fumigation.	d, Markers, Internet, Video,	- Determine if the chamber meets minimum fumigation air tightness standard. - Report findings - Present in class.	- Determine if the chamber meets minimum fumigation air tightness standard. - Supervise student activities - Report findings - Present in class.	Aluminium Phosphides/Magnesium Phosphide, Fumigation Chamber, PPE.
General Objective 3.0: Know fumigant dosage for various store sizes and structural configurations.						
7-9	3.1 Explain fumigant dosage for different store types. 3.2 Describe NAQS recommended dosage rates for phosphine tablets and pallets use. 3.3 Explain safety re-entry in the store.	- Describe fumigant dosage for different store types: - Rectangular - Cylindrical - Irregular shapes - Discuss NAQS recommended dosage rates for phosphine tablets and pellets use. - Discuss safety re-entry in the store	Laptop, smart board, Projector, Whiteboard, Markers, Internet, Videos	- Calculate phosphine tablet dosage for 3 different store sizes - 5m×5m×3m flat store, 200m³ -Cylindrical silo -Irregular warehouse. - Prepare fumigation dosage schedule. - Review dosage schedules - Verify dosage	Guide students to: - Calculate phosphine tablet dosage for 3 different store sizes 5m×5m×3m flat store, 200m³ cylindrical silo - irregular warehouse). - Prepare fumigation dosage schedule. - Review dosage schedules - Verify dosage schedules - Report findings	Laboratory equipment, Instruments, Worksheets, Samples, Writing materials Storage structures Prototype NAQS template, Calculator, PPE, Smartphones,

				schedules • Report findings		
General Objective 4.0: Know Federal Produce Inspection Services (FPIS) and Nigerian Agricultural Quarantine Services (NAQS)-compliant fumigation procedures.						
10-12	4.1.Explain FPIS and NAQS-compliant fumigation procedure: i. Pre-fumigation checklist ii. Store sealing iii. Tablet placement/distribution iv. Gas monitoring schedule v. Minimum exposure period, etc. 4.2.Outline safety procedures employed in fumigation of storage structures 4.3.Explain re-entry and threshold ventilation procedure.	• Describe NAQS-compliant fumigation procedure: – Pre-fumigation checklist – -Store sealing – -Tablet placement/distribution – -Gas monitoring schedule – -Minimum exposure period, etc. • Describe safety procedures employed in fumigation of storage structures • Discuss re-entry and threshold ventilation procedure.	Laptop, Smart board, Projector, Whiteboard, Markers, Internet, Vidoes	• Complete a full mock fumigation documentation set: – -Pre-fumigation checklist, – Dosage calculation worksheet, – Gas monitoring log (simulated 5-day monitoring data), – Ventilation clearance record • Carry out gas monitoring log completion. • Review compliance with FPIS and NAQS protocol • Report findings	Guide students to: • Complete a full mock fumigation documentation set: – -Pre-fumigation checklist, – -Dosage calculation worksheet, – Gas monitoring log (simulated 5-day monitoring data), – Ventilation clearance record • Carry out gas monitoring log completion. • Review compliance with FPIS and NAQS protocol • Report findings	Laboratory equipment, Instruments, Worksheets, Samples, Writing materials Computer NAQS Pre fumigation check list Internet Practical manual

General Objective 5.0: Understand correct use of PPE for fumigation and response to fumigation emergencies.						
13-15	5.1. Describe correct PPE selection, donning, doffing, and seal testing for fumigation operations. 5.2. Explain phosphine safety measures in sealed structure 5.3. Explain fumigation emergency procedures in case of gas leakage	• Explain correct PPE selection, donning, doffing, and seal testing for fumigation operations. • Discuss phosphine safety measures in sealed structure • Describe fumigation emergency procedures in case of gas leakage	Laptop, smart board, projector, whiteboard, markers, internet	• Carry out complete PPE donning and doffing procedure in correct sequence. • Demonstrate correct emergency response to 3 fumigation emergency scenarios • Report findings	Guide students to: • Demonstrate complete PPE donning and doffing procedure in correct sequence. • Demonstrate correct emergency response to 3 fumigation emergency scenarios • Report findings	Lab equipment, Instruments, Worksheets, Samples, PPE FPIS and NAQS documents Computer Internet Projector Practical manual
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

CROP DRYING METHODS AND SMART DRYING TECHNOLOGY

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT (ND-PIE)		
COURSE TITLE: CROP DRYING METHODS AND SMART DRYING TECHNOLOGY	COURSE CODE: PIE 212	CONTACT HOURS: 4 HOURS/WEEK
YEAR: II SEMESTER: I	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in crop drying principles, and drying technologies using smart IoT-enabled dryers		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know the impacts of crop drying; 2.0 Understand drying technologies of sun drying, solar dryers, mechanical dryers; 3.0 Know smart drying technologies such as IoT sensors, solar bubble dryers and automated monitoring; 4.0 Understand drying quality control, moisture testing, colour assessment and export compliance checking; 5.0 Understand ILO and Nigerian OSH Act requirements to produce inspection and export operations.		

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT (ND-PIE)							
COURSE TITLE: CROP DRYING METHODS AND SMART DRYING TECHNOLOGY				COURSE CODE: PIE 212		CONTACT HOURS: 4 HOURS/WEEK	
				CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I				PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL							
GOAL: This course is designed to equip students with competency in crop drying principles, drying technologies using smart IoT-enabled dryers							
1.0 General Objective 1.0: Know the impacts of crop drying.							
THEORETICAL CONTENT				PRACTICAL CONTENT			
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources	
1-3	1.1.Explain crop drying principles 1.2.Describe different methods of drying agricultural produce 1.3.State the importance of drying agricultural produce. 1.4.Explain the followings: i. -Free moisture ii. -Bound moisture iii. -Constant rate drying iv. -Falling rate drying periods v. -Drying rate equation vi. -Equilibrium moisture content (EMC) for major	- Discuss crop drying principles - Discuss different methods of drying agricultural produce - Discuss on the followings: -Free moisture -Bound moisture -Constant rate drying -Falling rate drying periods -Drying rate equation -Equilibrium moisture content (EMC) for major Nigerian export crops	Laptop, Smart board, Projector, Whiteboard, Markers, Internet, Videos	- Carry out moisture meter calibration - Set up cabinet dryer - Plot a drying curve for 3 produce types - Record weight at 2-hour intervals over 8 hours in a cabinet dryer. - Calculate drying rate (% MC/hr) for each drying period - Show EMC tables for groundnut, sesame, maize, etc. - Record findings	Guide students to: - Carry out moisture meter calibration - Set up cabinet dryer - Plot a drying curve for 3 produce types - Record weight at 2-hour intervals over 8 hours in a cabinet dryer. - Calculate drying rate (% MC/hr) for each drying period - Show EMC tables for groundnut, sesame, maize,	Laboratory equipment, Instruments, Worksheets, Samples, Writing materials Weighing balance Drying record forms Computer Prototype of dryers Internet Practical manual Projector	

	Nigerian export crops 1.5.Explain factors affecting drying	Discuss factors affecting drying			etc. Record findings	
General Objective 2.0: Understand drying technologies of sun drying, solar dryers, mechanical dryers.						
4-6	2.1 Explain the following drying technologies: - Traditional sun drying - Solar tunnel dryer - Solar bubble dryer - Cabinet dryer -Fluidised bed dryer. 2.2 Explain each of the above on; 2.3 drying efficiency - Product quality - Energy cost - Output capacity 2.4 Explain the following factors as they affect drying quality of agricultural produce: - Under-drying - Over-drying - Case hardened drying	- Discuss the following drying technologies: -Traditional sun drying -Solar tunnel dryer -Solar bubble dryer -Cabinet dryer -Fluidised bed dryer - Describe each of the above on drying efficiency: - Product quality - Energy cost - Output capacity - Discuss on the followings factors as they affect drying quality of agricultural produce: - Under-drying - Over-drying - Case hardened drying	Laptop, Smart board, Projector, Whiteboard, Markers, Internet.	- Carry out Sun and cabinet drying parallel batches of perishable crops. - Measure moisture content and colour - Score at the end of drying period. - Compare drying time, final moisture content, and product quality. - Record findings	Guide students to: - Carry out Sun and cabinet drying parallel batches of perishable crops. - Measure moisture content and colour - Score at the end of drying period. - Compare drying time, final moisture content, and product quality. - Record findings	Laboratory equipment, Instruments, Worksheets, Samples, Writing material Prototype of dryers Computer Internet Sample of the products Practical Manual Projector Calculator.
General Objective 3.0: Know smart drying technologies, IoT sensors, solar bubble dryers and automated monitoring.						
9-11	3.1 Differentiate	Explain the	Laptop, Smart	Set up IoT sensors	Guide students to:	Laboratory

	between Solar and Cabinet dryers 3.2 Explain smart drying technologies: 3.3 Explain smart drying as it reduces contamination risk.	differences between Solar and Cabinet dryers - Discuss smart drying technologies: -IoT temperature/humidity sensors integrated into -Solar dryers -Automated moisture monitoring -Data-driven dryer management - Discuss smart drying as it reduces contamination risk.	board, Projector, Whiteboard, Markers, Internet, Videos	in a drying simulation - Configure temperature and humidity loggers - Record dryer environment data over 6 hours - Download data - Interpret data - Perform data analysis - Carry out sensor placement for optimal monitoring - Record finding	- Set up IoT sensors in a drying simulation - Configure temperature and humidity loggers - Record dryer environment data over 6 hours - Download data - Interpret data - Perform data analysis - Provide sensor placement for optimal monitoring - Record finding	equipment, Instruments, Worksheets, Samples, IoT sensors, Temperature Prototype of Solar and Cabinet dryers Practical Manual, Projector, Calculator, Sample of the products
General Objective 4.0: Understand drying quality control, moisture testing, colour assessment and export compliance checking						
12-14	4.1.Explain drying quality control 4.2.Describe export compliance testing before storage 4.3.Explain aflatoxin and microbial contamination risks from under-drying.	- Discuss drying quality control - Discuss export compliance testing before storage - Discuss aflatoxin and microbial contamination risks from under-drying.	Laptop, Smart board, projector, Whiteboard, Markers, Internet	- Conduct end-of-drying quality inspection on 3 dried produce batches - Record moisture content, colour score, and visual defects. - Classify each batch as export-compliant or requiring further drying - Record findings	Guide students to: - Conduct end-of-drying quality inspection on 3 dried produce batches - Record moisture content, colour score, and visual defects. - Classify each batch as export-compliant or requiring further	Laboratory equipment, Instruments, Worksheets, samples, Standard cards Produce batches, Moisture meter, Colour charts Sample of the products

					drying • Guide inspection • Record findings	Computer Internet Projector Practical manual
General Objective 5.0: Understand ILO and Nigerian OSH Act requirements to produce inspection and export operations.						
15	5.1 Explain labour requirement for effective drying. 5.2 State OSHA requirement for drying operations. 5.3 Explain the differences between OSH and OSHA 5.4 Explain Nigerian labour laws and international labour laws guiding operations. 5.5 Explain drying capacity requirements for a produce export facility 5.6 Describe a simple drying floor layout	• Discuss labour and OSHA requirement for effective drying. • Discuss the differences between OSH and OSHA • Discuss Nigerian labour laws and international labour laws guiding operations. • Discuss drying capacity requirements for a produce export facility • Discuss drying floor layout	Laptop, smart board, Projector, Whiteboard, Markers, Internet, Videos	• Calculate labour requirements for a 5-tonne/day agricultural produce drying operation. • Design a simple solar drying floor layout showing tray arrangement, walkways and rain cover provision • Record findings	Guide students to: • Calculate drying requirements for a 5-tonne/day sesame drying operation. • Design a simple solar drying floor layout showing tray arrangement, walkways and rain cover provision • Review calculations and designs. • Record findings	Laboratory equipment, Instruments, Worksheets, Samples, Computer Internet Projector Practical manual Product sample
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40%						

Total: 100%



STORED PRODUCT PESTS IDENTIFICATION AND BIOASSAY

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT (ND-PIE)		
COURSE TITLE: STORED PRODUCT PESTS IDENTIFICATION AND BIOASSAY	COURSE CODE: PIE 213	CONTACT HOURS: 4 HOURS/WEEK
YEAR: II SEMESTERS: I	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills to develop competency in morphological identification of stored product pests, and bioassay methodology for testing pesticide efficacy		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know stored product insect species using morphological characteristics 2.0 Understand the biology and damage patterns of key stored product pests relevant to Nigerian export. 3.0 Know standardized contact and residual bioassay experiments. 4.0 Understand bioassay results and LD50/LC50 calculation values using probit analysis. 5.0 Understand resistance management strategies based on bioassay and monitoring data.		

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT (ND-PIE)							
COURSE TITLE: STORED PRODUCT PESTS IDENTIFICATION AND BIOASSAY				COURSE CODE: PIE 213		CONTACT HOURS:4 HOURS/WEEK	
				CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I				PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL							
GOAL: This course is designed to equip students with knowledge and skills competency in morphological identification of stored product pests, and bioassay methodology for testing pesticide efficacy							
General Objective 1.0: Know stored product insect species using morphological characteristics							
THEORETICAL CONTENT				PRACTICAL CONTENT			
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources	
1-3	1.1.Explain the primary, secondary and beneficial pests 1.2.Describe their functions. 1.3.Describe major stored product insect pests up to species level using morphological characters. 1.4.Explain economic importance of insects 1.5.Explain African Postharvest Losses Information System (APHLIS) data caused by the major insects found in the tropics	- Discuss the primary, secondary and beneficial pests - Discuss their functions. - Explain major stored product insect pests up to species level using morphological characters: i. <i>Sitophilus zeamais</i> ii. <i>Sitophilus oryzae</i>, iii. <i>Prostephanus truncatus</i>, iv. <i>Callosobruchus maculatus</i> v. <i>Tribolium castaneum</i>, i. <i>Sitotroga cerealella</i> - Discuss economic importance of insects	Laptop, Smart board, Projector, Whiteboard, Markers, Internet	- Identify the primary, secondary and beneficial pests - Identify 15 stored product insect specimens up to species level using dichotomous key and stereomicroscope. - Record diagnostic features - Record results in a structured identification data sheet.	Guide students to: - Identify the primary, secondary and beneficial pests - Identify 15 stored product insect specimens up to species level using dichotomous key and stereomicroscope. - Record diagnostic features - Record results in a structured identification data sheet.	Laboratory equipment, Instruments, Worksheets, Samples, Computer Internet Insect box Project Insect album Practical manual.	

		Describe APHLIS data caused by the major insects found in the tropics				
General Objective 2.0: Know the biology and damage patterns of key stored product pests relevant to Nigerian export.						
4-6	2.1. Describe life cycles of major stored product pests 2.2. Describe temperature and grain moisture effects on insect population growth 2.3. Explain complete metamorphosis and incomplete metamorphosis of insects	- Explain life cycles of major stored product pests: <i>Sitophilus zeamais</i> <i>Callosobruchus maculatus</i> <i>Prostephanus truncatus</i> - Discuss temperature and grain moisture effect on insect population growth. - Discuss complete metamorphosis and incomplete metamorphosis of insects	Laptop, Smart board, Projector, Whiteboard, Markers, Internet	- Set up a small insect rearing colony - Provide grain substrate for <i>Sitophilus zeamais</i> adults in sealed containers at ambient conditions. - Record adult count, egg count and temperature over 3 weeks - Report findings	- Set up a small insect rearing colony - Provide grain substrate for <i>Sitophilus zeamais</i> adults in sealed containers at ambient conditions. - Record adult count, egg count and temperature over 3 weeks - Facilitate monitoring schedule - Report findings	Laboratory equipment, Instruments, Worksheets, Insect box Insect album Computer Internet Projector Practical manual
General Objective 3.0: Know standardized contact and residual bioassay experiments.						
7 - 9	3.1 Explain bioassay methodology using the followings: - Filter paper contact bioassay protocol - Grain residual bioassay 3.2 Explain Probit analysis for: - LD50 calculation - Abbott's correction	- Discuss bioassay methodology using the followings: -Filter paper contact bioassay protocol -Grain residual bioassay - Discuss Probit analysis for: -LD50 calculation -Abbott's correction	Laptop, Smart board, Projector, Whiteboard, Markers, Internet	- Conduct bioassay using the following: -Filter paper contact bioassay protocol -Grain residual bioassay - Carry out Probit analysis for: -LD50 calculation	Guide students to: - Conduct bioassay using the following: - Filter paper contact bioassay protocol - Grain residual bioassay - Carry out Probit	Laboratory equipment, Instruments, Worksheets, Samples, Computer Internet Projector Practical manual

	formula iii. Resistance detection principles 3.3 Describe safety procedures in conducting bioassays	formula -Resistance detection principles • Discuss safety procedures in conducting bioassays		-Abbott's correction formula i. Resistance detection principles • Demonstrate safety procedures in conducting bioassay • Report findings	analysis for: - LD50 calculation - Abbott's correction formula - Resistance detection principles • Demonstrate safety procedures in conducting bioassay • Report findings	
General Objective 4.0: Understand bioassay results and calculate LD50/LC50 values using probit analysis.						
10 - 12	4.1.Explain probit analysis to calculate: - LD50 estimation - confidence intervals - Susceptible reference strain 4.2.Explain resistance management 4.3.Describe resistance ratio (RR)	• Discuss probit analysis to calculate: - LD50 estimation - confidence intervals - Susceptible reference strain • Discuss resistance management • Explain resistance ratio (RR)	Laptop, Smart board, Projector, Whiteboard, Markers, Internet	• Calculate LD50 from bioassay data from week 9-11 using probit analysis in Excel. • Calculate resistance ratio against reference LD50. • Report a resistance management recommendation • Report findings	Guide students to: • Calculate LD50 from bioassay data from week 9-11 using probit analysis in Excel. • Calculate resistance ratio against reference LD50. • Report a resistance management recommendation • Report findings	Laboratory equipment, Instruments, Worksheets, samples, Computer Internet Projector Practical manual
General Objective 5.0: Understand resistance management strategies based on bioassay and monitoring data.						

13 - 15	5.1.Explain an integrated pest monitoring programme for a produce export warehouse sampling protocol 5.2.Describe pheromone trap placement in a warehouse action threshold 5.3.Explain species-specific traps used in warehouse pest managements	• Discuss an integrated pest monitoring programme for a produce export warehouse sampling protocol • Discuss pheromone trap placement in a warehouse action threshold • Discuss species-specific traps used in warehouse pest managements	Laptop, Smart board, Projector, Whiteboard, Markers, Internet	• Design a complete pest monitoring programme for a 500-tonne export warehouse comprising of trap placement floor plan, species-specific traps, monitoring schedule, and action thresholds. • Monitor trap intervals • Review procedures for the pheromone and traps on a Quarterly basis. • Record observations • Demonstrate findings in class.	Guide students to: • Design a complete pest monitoring programme for a 500-tonne export warehouse comprising of trap placement floor plan, species-specific traps, monitoring schedule, and action thresholds. • Monitor trap intervals • Review procedures for the pheromone and traps on a Quarterly basis. • Record observations • Demonstrate findings in class.	Laboratory equipment, Instruments, Worksheets, samples, Computer Internet Projector Practical manual
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40%						

Total: 100%



STORED GRAIN PROTECTION AND HERMETIC STORAGE TECHNOLOGY

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: STORED GRAIN PROTECTION AND HERMETIC STORAGE TECHNOLOGY	COURSE CODE: PIE 214	CONTACT HOURS: 4 HOURS/WEEK
YEAR: II SEMESTER: I	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills in protecting stored produce from insects, microbes and quality deterioration using protection methods.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know produce quality deterioration processes during storage and their economic impact. 2.0 Understand approved Crop Protection Products (CPP) following NAQS-compliant procedures. 3.0 Know hermetic storage systems using PICS bags, GrainPro cocoons and silo bags. 4.0 Know IoT-based produce storage monitoring for quality and pest management. 5.0 Understand how produce storage protection programme meets export market requirements.		



PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT							
COURSE TITLE: STORED GRAIN PROTECTION AND HERMETIC STORAGE TECHNOLOGY				COURSE CODE: PIE 214		CONTACT HOURS: 4 HOURS/WEEK	
				CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I				PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL							
GOAL: This course is designed to equip students with the knowledge and skills in protecting stored produce from insects, microbes and quality deterioration using protection methods.							
General Objective 1.0: Know produce quality deterioration processes during storage and their economic impact.							
THEORETICAL CONTENT				PRACTICAL CONTENT			
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources	
1-3	1.1.Explain produce quality deterioration mechanisms in storage under the following: i. Insect feeding damage ii. Fungal growth iii. Nutritional loss iv. Germination reduction v. Chemical changes. 1.2.Explain the economic impact of produce quality deterioration using APHLIS data 1.3.Explain methods of mitigating produce quality deterioration	• Describe grain quality deterioration mechanisms in storage under the followings: i. Insect feeding damage ii. Fungal growth iii. Nutritional loss iv. Germination reduction v. Chemical changes. • Discuss economic impact of produce quality deterioration using APHLIS data • Discuss methods of mitigating produce	Laptop, Smart board, Projector, Whiteboard, Markers, Internet.	• Measure produce quality parameters (fresh and 12-month-old stored produce samples) • Quantify quality losses • Estimate the economic impact • Measure moisture content using moisture meter • Test viability using germination test kit. • Calculate	Guide students to: • Measure produce quality parameters (fresh and 12-month-old stored produce samples) • Quantify quality losses • Estimate the economic impact • Measure moisture content using moisture meter • Test viability using germination test kit.	Laboratory equipment, Instruments, Worksheets, Samples, Computer Internet Projector Practical manual Produce samples (non-infested), PPE.	

		quality deterioration		economic loss of produce samples Record findings	- Calculate economic loss of produce samples - Record findings	
General Objective 2.0: Understand approved Crop protection products following NAQS compliant procedures.						
4-6	2.1. List approved Crop protection products 2.2. Explain mode of action of some crop protection products application rates residue MRL 2.3. Explain the implications for export 2.4. Explain safe handling procedures of Crop protection products	- Discuss approved Crop protection products - Discuss mode of action of some crop protection products application rates residue MRL - Discuss the implications for export - Discuss safe handling procedures of Crop protection products	Laptop, Smart board, Projector, Whiteboard, Markers, Internet.	- Apply pirimiphos-methyl protectant to a grain sample at recommended application rate. - Calculate quantity required for 500 kg treatment. - Observe safe handling during application - Record treatment in Crop Protection products application log - Record findings	Guide students to: - Apply pirimiphos-methyl dust protectant to a grain sample at recommended application rate. - Calculate quantity required for 500 kg treatment. - Record treatment in Crop Protection products application log - Review log completion. - Record findings	Laboratory equipment, Instruments, Worksheets, Samples, Grain samples, PPE, Application log forms Computer Internet Crop protection product (CPP) samples, Practical manual
General Objective 3.0: Know hermetic storage systems using PICS bags, GrainPro cocoons and silos.						
7-9	3.1 Explain hermetic storage principles. 3.2 Explain modified atmosphere lethal to insects and fungi.	Discuss hermetic storage principles: Commodity respiration depletes O₂, elevates CO₂, creates modified	Laptop, Smart board, projector, Whiteboard, Markers, Internet.	Seal grain samples in PICS bags, polythene lined jute bags and GrainPro bags using	Guide students to: Seal grain samples in PICS bags, polythene lined jute bags and GrainPro	Laboratory equipment, Instruments, Worksheets, Samples, PICS bags,

	3.3 Describe PICS bag 3-layer design and polythene lined jute bags. 3.4 Explain correct sealing technique and integrity testing.	atmosphere lethal to insects and fungi. - Discuss PICS bag 3-layer design and polythene lined jute bags. - Describe correct sealing technique and integrity testing.		correct procedure. - Monitor O₂ and CO₂ concentrations over 14 days - Set up gas monitoring - Test seal integrity - Record findings	bags using correct procedure. - Monitor O₂ and CO₂ concentrations over 14 days - Set up gas monitoring - Test seal integrity - Record findings	Polythene lined jute bags, GrainPro cocoons Grain samples Pressure test kit Gas analyser Computer Internet Projector Practical manual
General Objective 4.0: Know IoT-based produce storage monitoring for quality and pest management.						
10-12	4.1. Explain IoT-based produce storage monitoring 4.2. Describe IoT based produce parts 4.3. Explain quality risk event associated with IoT monitors	- Discuss IoT-based produce storage monitoring - Discuss IoT based produce parts - Discuss quality risk event associated with IoT monitors	Laptop, smart board, projector, whiteboard, markers, internet	- Deploy IoT sensors in a simulated produce store - Configure temperature and CO₂ alert thresholds. - Download 7-day monitoring data - Perform any quality risk events - Place sensor in grain store - Carry out data analysis. - Report findings	Guide students to: - Deploy IoT sensors in a simulated produce store - Configure temperature and CO₂ alert thresholds. - Download 7-day monitoring data - Demonstrate any quality risk events - Demonstrate sensor placement in produce store	Lab equipment, instruments, worksheets, samples, writing materials Computer internet Projector Practical manual Produce samples

					• Deploy IoT sensor • Configure IoT sensors • Facilitate data analysis. • Report findings	
General Objective 5.0: Understand how produce storage protection programme meets export market requirements.						
13-15	5.1 Explain produce storage protection programme for a 200-tonne produce export facility intake inspection protocol 5.2 Explain pre-export inspection 5.3 Explain the reasons for re-inspection of agricultural produce 5.4 Describe the roles of FPIS and NAQS	• Discuss produce storage protection programme for a 200-tonne maize export facility intake inspection protocol • Discuss pre-export inspection • Discuss the reasons for re-inspection of agricultural produce • Explain the roles of FPIS and NAQS	Laptop, smart board, projector, whiteboard, markers, internet	• Prepare a complete produce storage protection programme for a 200-tonne produce export facility. • Include all protection layers, monitoring schedule, re-inspection criteria, and export release protocol • Write report	Guide students to: • Prepare a complete produce storage protection programme for a 200-tonne produce export facility. • Include all protection layers, monitoring schedule, re-inspection criteria, and export release protocol • Facilitate group design exercise • Guide development review • Write feedback	Laboratory equipment, instruments, worksheets, samples, writing materials Computer Internet Intake inspection protocol documents Projector Practical manual
Course Assessment: Course work: 10%						

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%





YEAR II SEMESTER II

PRODUCE STANDARDIZATION, LEGISLATION AND CERTIFICATION

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: PRODUCE STANDARDIZATION, LEGISLATION AND CERTIFICATION	COURSE CODE: PIE 221	CONTACT HOURS: 4 HOURS/WEEK
YEAR: II SEMESTER: II	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills in produce standardization, legislation, food certification processes and other Nigerian regulatory compliances for produce export.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand Codex Alimentarius and its application to Nigerian produce export compliance. 2.0 Know Nigerian food regulators NAFDAC Act, SON Act, and other stakeholders. 3.0 Understand national and international food legislation, Food Laws and regulations. 4.0 Understand organic, fair trade and export quality certification procedures to produce operations. 5.0 Know regulatory compliance documentation for domestic and export market access.		

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT (ND-PIE)						
COURSE TITLE: PRODUCE STANDARDISATION, LEGISLATION AND CERTIFICATION			COURSE CODE: PIE 221		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills in produce standardization, legislation, food certification processes and other Nigerian regulatory compliances for produce export.						
General Objective 1.0: Understand Codex Alimentarius and its application to Nigerian produce export compliance.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1.Explain Codex Alimentarius Commission structure 1.2.Explain standard types of MRLs, commodity standards and codes of practice. 1.3.Explain Codex Alimentarius database to extract standards relevant to Nigerian produce exports.	- Describe Codex Alimentarius Commission structure - Discuss standard types of MRLs, commodity standards and codes of practice. - Describe how to extract standards relevant to Nigerian produce exports using the Codex database.	Laptop, smart board, Projector, Whiteboard, Markers, Internet	- Retrieve Codex MRL standards for 5 pesticides on Nigerian agricultural produce. - Build compliance table comparing Codex MRL, EU MRL and SON limit. - Identify where Nigerian produce is most vulnerable - Record findings	Guide students to: - Retrieve Codex MRL standards for 5 pesticides on Nigerian sesame, groundnut, etc - Build compliance table comparing Codex MRL, EU MRL and SON limit. - Identify where Nigerian produce is most vulnerable. - Retrieve documents - Review compliance table	Laboratory equipment, instruments, worksheets, samples, writing materials Computer Internet Projector Codex Alimentarius, MRL standards EU MRL standard documents US MRL standard documents SON Checklist

						Practical manuals
General Objective 2.0: Know Nigerian food regulators NAFDAC Act, SON Act, and other stakeholders.						
4-5	2.1. Explain the following Nigerian food regulators: - NAFDAC Act Cap - Standards Enterprise of Nigeria Act (SON), - Nigerian Industrial Standards (NIS) act 2.2. Explain the roles of food regulators mentioned in Nigerian agricultural produce development 2.3. Explain the functions and limitations of the regulatory bodies 2.4. Describe the contributory roles of research institute and tertiary institutions	- Describe the followings Nigerian food regulators: -NAFDAC Act Cap, -Standards Enterprise of Nigerian Act (SON), -Nigerian Industrial Standards (NIS) act - Discuss the roles of NAFDAC, SON and NIS in Nigerian agricultural produce development - Discuss the functions and limitations of the regulatory bodies - Discuss the contributory roles of research institute and tertiary institutions.	Laptop, Smart board, Projector, Whiteboard, Markers, Internet	- Examine NAFDAC product registration requirements for a processed produce product (sesame oil or dried groundnut pack). - Identify all required documents, tests, labelling requirements, and fees. - Investigate the challenges associated with the requirements - Report findings	Guide students to: - Examine NAFDAC product registration requirements for a processed produce product (sesame oil or dried groundnut pack): - Identify all required documents, tests, labeling requirements, and fees. - Investigate the challenges associated with the requirements - Report findings and recommendations for improvement	Instruments, worksheets, samples, writing materials computer Projector Practical manual Regulatory Policy documents
General Objective 3.0: Understand national and international food legislations, food Laws and regulations.						

6 - 8	3.1 Explain Nigerian, Food and Drug Administration (FDA), EU Food Laws (Regulation general), etc. 3.2 Explain the principles of food safety, traceability obligations and food safety responsibility. 3.3 Describe US Food Safety Modernization Act (FSMA) preventive controls	• Discuss Nigerian, Food and Drug Administration (FDA), EU Food Law (Regulation general), etc. • Discuss the principles of food safety, traceability obligations and food safety responsibility. • Explain US Food Safety Modernization Act (FSMA) preventive controls	Laptop, smart board, projector, whiteboard, markers, internet	• Identify 3 recent Rapid Alert System for Food and Feed (RASFF) alerts involving Nigerian or African produce. • Identify the hazard, product, action taken, and specific lesson for Nigerian exporters. • Report findings and present in class	Guide students to: • Identify 3 recent RASFF alerts involving Nigerian or African produce. • Identify the hazard, product, action taken, and specific lesson for Nigerian exporters. • Report findings and present in class	Instruments, worksheets, samples, writing materials RASFF database access Computer Projector Internet Practical manual
General Objective 4.0: Understand organic, fair trade and export quality certification procedures to produce operations.						
9 - 11	4.1. Explain organic and fair-trade certification processes 4.2. Explain market access and price premium benefits 4.3. Describe different certifications for EU, US and Nigerian produce	• Describe organic and fair-trade certification processes • Discuss market access and price premium benefits • Discuss different certifications for EU, US and Nigerian produce with examples.	Laptop, smart board, projector, whiteboard, markers, internet	• Prepare a certification strategy for a Nigerian agricultural produce exporter targeting EU organic market • Carry out certification process such as audit process, annual fees and expected price premium per tonne of organic produce	Guide students to: • Prepare a certification strategy for a Nigerian sesame exporter targeting EU organic market • Carry out certification process such as audit process, annual fees and expected price premium per tonne of organic	Laboratory equipment, instruments, worksheets, samples, writing materials Computer Projector

				• Present in class • Report findings	• produce • Facilitate class presentation • Report findings	
General Objective 5.0: Know regulatory compliance documentation for domestic and export market access.						
12 - 15	5.1.Explain compliant export labels for produce exports to EU, US and Gulf markets detailing all mandatory elements 5.2.Explain the relevance of voluntary elements for export 5.3.Explain strategies for mitigating export complaint	• Discuss compliant export labels for produce exports to EU, US and Gulf markets detailing all mandatory elements • Discuss the relevance of voluntary elements for export • Discuss strategies for mitigating export complaint	Laptop, smart board, projector, whiteboard, markers, internet	• Provide labelling standard references and design templates • Design compliant export labels for sesame (EU), groundnut (US) and dried pepper (UAE). • Prepare all mandatory documents • Present for each market • Peer-review labels.	Guide students to: • Provide labeling standard references and design templates • Design compliant export labels for sesame (EU), groundnut (US) and dried pepper (UAE). • Prepare all mandatory documents • Present for each market • Guide design • Peer-review labels.	Laboratory equipment, instruments, worksheets, samples of produce writing materials Computer Internet Projector Regulatory policy documents Practical manual
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

GRAIN SAMPLING PRINCIPLES AND PROBE METHODS

PROGRAMME: NATIONAL DIPLOMA PRODUCE INSPECTION STANDARDISATION EXPORT MANAGEMENT (ND-PIE)		
COURSE TITLE: GRAIN SAMPLING PRINCIPLES AND PROBE METHODS	COURSE CODE: PIE 222	CONTACT HOURS: 4 HOURS/WEEK
YEAR: II SEMESTER: II	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills in the development of grain sampling competency, mechanical and digital probe operation results for export documentation.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand statistical principles of grain sampling, lot heterogeneity, representative sampling and sampling error. 2.0 Know manual and digital probe sampling equipment for grain inspection. 3.0 Understand grain sampling standards to commercial grain lots. 4.0 Know official grain quality moisture determination, weight testing, broken kernels and foreign material. 5.0 Understand official grain inspection certificates for interpretation for trade decisions.		

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT (ND-PIE)							
COURSE TITLE: GRAIN SAMPLING PRINCIPLES, PROBES AND STATISTICAL METHODS				COURSE CODE: PIE 222		CONTACT HOURS: 4 HOURS/WEEK	
				CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II				PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL							
GOAL: This course is designed to equip students with the knowledge and skills in the development of grain sampling competency, mechanical and digital probe operation results for export documentation.							
General Objective 1.0: Understand statistical principles of grain sampling, lot heterogeneity, representative sampling and sampling error.							
THEORETICAL CONTENT				PRACTICAL CONTENT			
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources	
1-3	1.1.Explain statistical principles of Produce samplings under the followings: i. Lot heterogeneity ii. Hot-spot distribution Sources of sampling error iii. Minimum sample size iv. Sampling representativeness 1.2.Describe factors affecting inspection reliability 1.3.Explain the advantages of conducting sampling of agricultural produce	- Discuss statistical principles of grain samplings under the followings: i. Lot heterogeneity ii. Hot-spot distribution iii. Sources of sampling error iv. Minimum sample size v. Sampling representativeness - Discuss factors affecting inspection reliability - Describe the advantages of conducting sampling of agricultural produce with examples.	Laptop, smart board, projector, whiteboard, markers, internet	- Demonstrate the effect of sampling location on result accuracy - Sample a simulated heterogeneous produce lot (with deliberate contamination zone) from 5 positions. - Compare results between positions - Demonstrate how non-representative sampling leads to incorrect results - Conduct sampling exercises - Facilitate result comparison and discussion	Guide students to: - Demonstrate the effect of sampling location on result accuracy - Sample a simulated heterogeneous produce lot (with deliberate contamination zone) from 5 positions. - Compare results between positions - Demonstrate how non-representative sampling leads to incorrect results - Conduct sampling exercises	Laboratory equipment, Instruments, worksheets, Samples, Probes Sampling containers Computer Projector	

					Facilitate result comparison and discussion	
General Objective 2.0: Know manual and digital probe sampling equipment for grain inspection.						
4-6	2.1 Describe the following grain probe types: - Compartment trier (manual) - Double-tube spear - Probe automatic grain sampler - Digital pneumatic probe 2.2 Explain the following: - Probe operations - Probe placement pattern - Minimum probing frequency 2.3 Describe the safety precautions to be employed in conducting grain sampling probe	- Explain the following grain probe types: - Compartment trier (manual) -Double-tube spear -Probe automatic grain sampler -Digital pneumatic probe. - Discuss the following: - Probe placement pattern - Minimum probing frequency - Explain the safety procedures to be employed in conducting grain sampling probe	Laptop, smart board, projector, whiteboard, markers, internet	- Probe-sample 10 grain bags using correct probe technique: 3 penetrations per bag at specified positions. - Collect samples using probe - Reduce samples to workable size using riffle divider - Carry out digital probe operation - Demonstrate manual trier operation on grain bag - Conduct a visit to grain processing factory or Strategic Grain Reserve (SGR) - Report findings	Guide students to: - Probe-sample 10 grain bags using correct probe technique: 3 penetrations per bag at specified positions. - Collect samples using probe - Reduce samples to workable size using riffle divider - Carry out digital probe operation - Demonstrate manual trier operation on grain bag - Conduct a visit to grain processing factory or Strategic Grain Reserve (SGR) - Report findings	Laboratory equipment, instruments, worksheets, samples, writing materials Probes Computer Internet Projector Practical manual Produce samples riffle divider
General Objective 3.0: Understand grain sampling standards to commercial grain lots.						
9-11	3.1 Explain the followings in produce quality determination:	Discuss the followings in produce quality determination:	Laptop, smart board, projector, whiteboard,	Simulate produce official quality determination on 3 produce samples	Simulate produce official quality determination on 3 maize samples for:	Laboratory equipment, instruments, worksheets,

	i. Moisture content ii. Test weight bulk density using Chondrometer or hectoliter weight tester iii. -Broken kernel percentage iv. -Foreign material v. -Heat-damaged kernels vi. -Dockage percentage 3.2 Outline produce quality determination procedures 3.3 Explain the importance of produce quality at national and international level	-Moisture content -Test weight bulk density using Chondrometer or hectoliter weight tester -Broken kernel percentage -Foreign material -Heat-damaged kernels -Dockage percentage • Discuss produce quality determination procedures • Discuss the importance of produce quality at national and international level	markers, internet, etc	for: -Moisture content -Test weight -Broken kernels -Foreign material. -Heat-damaged kernels -Dockage percentage • Assign official grade designation for each • Carry out chondrometer operation • Carry out grade assignment calculation • Report findings	i. Moisture content ii. Test weight iii. Broken kernels iv. Foreign material. v. Heat-damaged kernels vi. Dockage percentage • Assign official grade designation for each • Demonstrate chondrometer operation • Work through grade assignment calculation • Report findings	samples, writing materials Grade table Computer Internet Projector Practical manual
General Objective 4.0: Know official grain quality moisture determination, test weight, broken kernels and foreign materials						
9-11	4.1.Explain the following ISO 6644 produce sampling standard: i. Minimum lot size ii. Number of increments iii. Combined sample iv. mass Sample reduction v. Sub-sampling for	• Discuss the following ISOs produce sampling standard: -Minimum lot size -Number of increments -Combined sample -Mass Sample reduction -Sub-sampling for	Laptop, smart board, projector, whiteboard, markers, internet	• Conduct an ISO 6644-compliant sampling of a simulated 20-tonne agricultural produce lot. • Calculate number of increments required • Probe-sample the lot	Guide students to: • Conduct an ISO 6644-compliant sampling of a simulated 20-tonne agricultural produce lot. • Calculate number of increments	Laboratory equipment, instruments, worksheets, samples, writing materials Computer Projector Practical manual

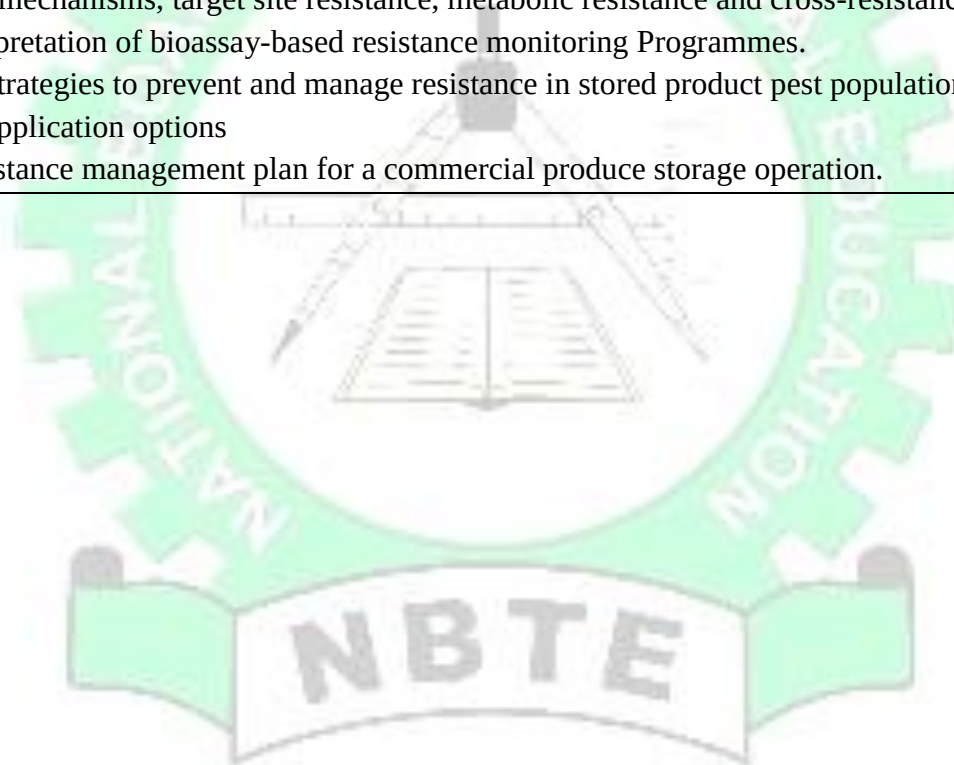
	laboratory analysis. 4.2.Explain sampling procedures of agricultural produce. 4.3.Explain ISO-compliant sampling for agricultural produce.	laboratory analysis. - Discuss sampling procedures of agricultural produce. - Discuss ISO-compliant sampling for agricultural produce.		- Combine and reduce to laboratory sample - Measure moisture content - Record findings	required Probe-sample the lot - Combine and reduce to laboratory sample. - Measure moisture content. - Review sample records Record findings	
General Objective 5.0: Understand official grain inspection certificates for interpretation for trade decisions.						
12-15	5.1.Explain official produce inspection certificates using SON format 5.2.Describe all data fields, assign official grade and inspector signature with certificate number. 5.3.Explain standard certification role and trade implications for export trade decisions.	- Discuss official produce inspection certificates using SON format: - Explain all data fields, assign official grade and inspector signature with certificate number - Discuss standard certification role and trade implications for export trade decisions.	Laptop, smart board, projector, whiteboard, markers, internet	- Prepare official produce inspection certificates for 3 produce samples inspected - Complete all fields accurately. - Conduct mock certificate verification exercise with a partner. - Report finding - Give feed back	Guide students to: - Prepare official produce inspection certificates for 3 produce samples inspected; Complete all fields accurately. - Conduct mock certificate verification exercise with a partner. - Guide preparation - Report finding - Facilitate class feed back	Laboratory equipment, instruments, worksheets, samples, writing materials Computer Internet Projector Practical manual
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40%						

Total: 100%



PESTICIDE RESISTANCE AND INTEGRATED PEST MANAGEMENT (IPM) APPLICATIONS

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT (ND-PIE)		
COURSE TITLE: PESTICIDE RESISTANCE AND IPM APPLICATIONS	COURSE CODE: PIE 223	CONTACT HOURS: 4 HOURS/WEEK
YEAR: II SEMESTERS: II	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills on pesticide resistance mechanisms and IPM strategies.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know pesticide resistance mechanisms, target site resistance, metabolic resistance and cross-resistance. 2.0 Know the design and interpretation of bioassay-based resistance monitoring Programmes. 3.0 Understand IPM rotation strategies to prevent and manage resistance in stored product pest populations. 4.0 Understand bio pesticide application options 5.0 Understand integrated resistance management plan for a commercial produce storage operation.		



PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT (ND-PIE)						
COURSE TITLE: PESTICIDE RESISTANCE AND IPM APPLICATIONS			COURSE CODE: PIE 223		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTERS: II			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills on pesticide resistance mechanisms and IPM strategies.						
General Objective 1.0: Know pesticide resistance mechanisms, target site resistance, metabolic resistance and cross-resistance.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain pesticide resistance mechanisms 1.2 Describe cross-resistance and multiple resistance. 1.3 Explain metabolic resistance	• Discuss pesticide resistance mechanisms • Discuss cross-resistance and multiple resistance. • Discuss metabolic resistance	Laptop, smart board, projector, whiteboard, markers, internet	• Analyse 3 resistance mechanism scenarios for each of the following: -Cross-resistance -Multiple resistance • Identify the mechanisms affecting insecticide, class, cross-resistance and implications to the produce • Draw a resistance Management	Guide students to: • Analyse 3 resistance mechanism scenarios for each of the following: -Cross-resistance -Multiple resistance • Identify the mechanisms affecting insecticide, class, cross-resistance and implications to the produce • Draw a resistance	Laboratory equipment, instruments, worksheets, samples, writing materials Computer Projector Practical manual

				decision tree. • Report finding	Management decision tree. • Report finding	
General Objective 2.0: Know the design and interpretation of bioassay-based resistance monitoring programmes						
4-6	2.1. Describe resistance monitoring programmes: i. Baseline susceptibility data ii. Resistance ratio threshold criteria iii. Discriminating dose bioassay 2.2. Explain Insecticide Resistance Action Committee (IRAC) management cycle. 2.3. Describe bioassay setup resistance programmes	• Describe resistance monitoring programmes: i. Baseline susceptibility data ii. Resistance ratio threshold criteria iii. Discriminating dose bioassay • Discuss Insecticide Resistance Action Committee (IRAC) management cycle. • Discuss bioassay setup resistance programmes	Laptop, smart, board, projector, whiteboard, markers, internet, etc	• Design a resistance monitoring programme for a 500-tonne produce facility • Specify bioassay frequency, discriminating dose level, resistance ratio threshold and action decision criteria • Record findings	Guide students to; • Design a resistance monitoring programme for a 500-tonne produce facility • Specify bioassay frequency, discriminating dose level, resistance ratio threshold, and action decision criteria • Record findings	Laboratory equipment, instruments, worksheets, samples, writing materials Computer Internet Projector Practical manual IRAC document
General Objective 3.0: Understand IPM rotation strategies to prevent and manage resistance in stored product pest populations						
9-11	3.1 Explain IPM rotation strategies 3.2 Explain IRAC mode of action: 3.3 Describe differences	• Discuss IPM rotation strategies • Discuss IRAC mode of action: -Classification for	Laptop, smart, board, projector, whiteboard,	• Design a 12-month IPM rotation schedule for	Guide students to: • Design a 12-month IPM rotation	Laboratory equipment, instruments, worksheets, samples,

	between chemical and non-chemical rotations.	rotation -Resistance management rotation schedules -Clean-out fumigation • Discuss differences between chemical and non-chemical rotations	markers, internet, etc	a produce export warehouse • Specify insecticide rotations (by IRAC group) hermetic storage periods biopesticide intervals and monitoring checkpoints • Report findings	schedule for a produce export warehouse • Specify insecticide rotations (by IRAC group), hermetic storage periods, biopesticide intervals and monitoring checkpoints • Report findings	writing materials Computer Internet Projector Practical IPM rotation chart
• General Objective 4.0: Understand biopesticide application options						
12-15	4.1.Describe biopesticide applications for stored product management 4.2.Explain essential oil vapour fumigation: i. Neem oil, powder, etc ii. Citronella iii. Pyrethrum iv. Diatomaceous earth produce protectant v. Spinosad 4.3.Explain how to compare efficacy and MRL implications.	• Explain biopesticide applications for stored product management • Discuss essential oil vapour fumigation; i. Neem oil, powder, etc ii. Citronella iii. Pyrethrum iv. Diatomaceous earth produce protectant v. Spinosad • Discuss how to compare efficacy and MRL	Laptop, smart board, projector, whiteboard, markers, internet	• Conduct an essential oil fumigation bioassay using neem and eucalyptus oils at 2 dose levels. • Expose adult weevils to the fumigation	Guide students to: • Conduct an essential oil fumigation bioassay using neem and eucalyptus oils at 2 dose levels. • Expose adult weevils to the	Laboratory equipment, instruments, worksheets, samples crop protection produce, writing materials Neem oil powder Citronella Pyrethrum, Diatomaceou

		implications		test - Record mortality at 24h, 48h and 72h. - Compare to pirimiphos-methyl control. - Report findings	fumigation test - Record mortality at 24h, 48h and 72h. - Compare to pirimiphos-methyl control. - Report findings	s earth produce protectant, Spinosad
General Objective 5.0: Understand integrated resistance management plan for a commercial produce storage operation						
16	5.1.Explain an integrated resistance management plan for a commercial produce export storage operation 5.2.Explain the following: - Resistance monitoring - Rotation schedule, - Biopesticide windows - Hermetic storage integration - Annual review protocol based on 5.1 above 5.3.Explain the advantages and disadvantages of integrated resistance management plan for a commercial produce	- Discuss an integrated resistance management plan for a commercial produce export storage operation - Discuss the following: -Resistance monitoring -Rotation schedule, -Biopesticide windows -Hermetic storage integration -Annual review protocol based on the above - Describe the advantages and disadvantages of integrated resistance management plan for a commercial produce	Laptop, Smart board, Projector, Whiteboard, markers, Internet	- Prepare a complete resistance management plan for a 200-tonne produce export facility, 12-month rotation schedule, monitoring programme, biopesticide integration and annual resistance review protocol - Record	Guide students to: Prepare a complete resistance management plan for a 200-tonne produce export facility, 12-month rotation schedule, monitoring programme, biopesticide integration and annual resistance review protocol.	Laboratory equipment, instruments, worksheets, samples, writing materials Computer Projector Internet

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



SAFETY AND EMERGENCY RESPONSE TO OCCUPATIONAL HAZARDS

PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT (ND-PIE)		
COURSE TITLE: SAFETY AND EMERGENCY RESPONSE TO OCCUPATIONAL HAZARDS	COURSE CODE: PIE 224	CONTACT HOURS: 4 HOURS/WEEK
YEAR: II SEMESTER: II	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to provide students with knowledge and skills in occupational health and safety management within produce inspection and export environments.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know identification and classification of occupational hazards in produce inspection and export facilities. 2.0 Know PPE for different hazardous operations. 3.0 Know risk assessment procedure for a produce handling facility. 4.0 Know emergency response procedures. 5.0 Understand ILO and Nigerian OSH Act requirements to produce inspection and export operations.		

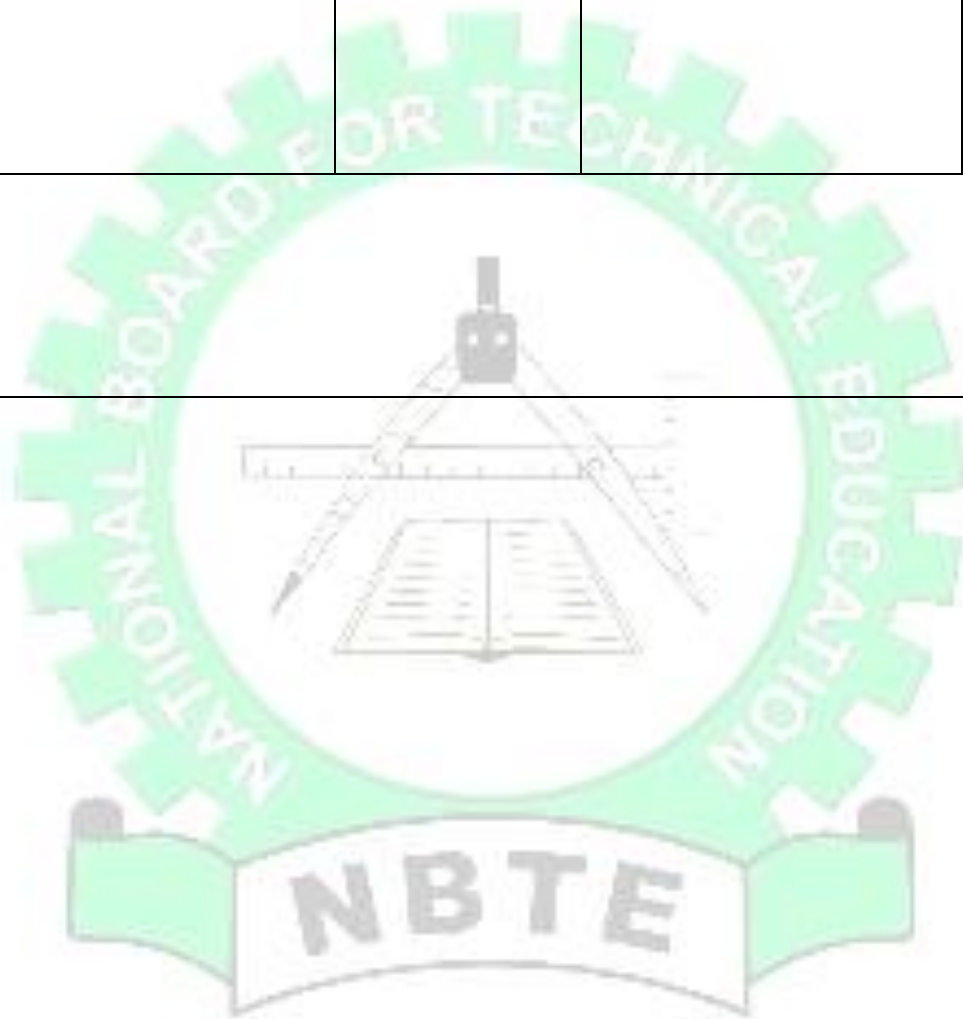
PROGRAMME: NATIONAL DIPLOMA IN PRODUCE INSPECTION AND EXPORT MANAGEMENT (ND-PIE)							
COURSE TITLE: SAFETY AND EMERGENCY RESPONSE TO OCCUPATIONAL HAZARDS				COURSE CODE: PIE 224		CONTACT HOURS: 4 HOURS/WEEK	
				CREDIT UNITS: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II				PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL							
GOAL: This course is designed to provide students with knowledge and skills in occupational health and safety management within produce inspection and export environments.							
General Objective 1.0: Know identification and classification of occupational hazards in produce inspection and export facilities							
THEORETICAL CONTENT				PRACTICAL CONTENT			
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources	
1-3	1.1. Describe occupational hazards in produce inspection and export facilities 1.2. Explain the classification of occupational hazards 1.3. Explain the following hazards: i. Chemical hazards (fumigants ii. pesticides iii. aflatoxin dust, etc) iv. Physical hazards (lifting, machinery, noise, etc) v. Biological hazards (fungi, rodent vectors, etc) vi. Ergonomic hazards.	• Explain occupational hazards in produce inspection and export facilities • Discuss the classification of occupational hazards • Discuss the following hazards: -Chemical hazards (fumigants -Pesticides -Aflatoxin dust, etc) -Physical hazards (lifting, machinery, noise, etc) Biological hazards (fungi, rodent, vectors, etc)	Laptop, Smart board, Projector, Whiteboard, Markers, Internet	• Conduct a hazard identification walkthrough of a simulated produce handling facility • Identify minimum of 10 hazards using a structured hazard identification form. • Classify minimum of 10 hazards using a structured hazard identification form • Record findings	Guide students to; • Conduct a hazard identification walkthrough of a simulated produce handling facility • Identify minimum of 10 hazards using a structured hazard identification form. • Classify minimum of 10 hazards using a structured hazard	Laboratory equipment, instruments, worksheets, samples, writing materials Computer Internet Projector Practical manual Charts	

		Ergonomic hazards.			identification form	
					Record findings	
General Objective 2.0: Know PPE for different hazardous operations						
4-6	2.1 Define PPE 2.2 Explain the use of PPE in hierarchy: - Elimination - Substitution - Engineering controls - Administrative controls - PPE as last resort. 2.3 Explain the appropriate PPE for: - Fumigation operations - Aflatoxin dust exposure - Chemical pesticide mixing - grain dust environments	- Explain PPE - Discuss the use of PPE in hierarchy: -Elimination -Substitution -Engineering controls -Administrative controls -PPE as last resort. - Discuss the appropriate PPE for: - Fumigation operations - Aflatoxin dust exposure - Chemical pesticide mixing - Grain dust environments	Laptop, Smart board, projector, Whiteboard, Markers, Internet	- Select appropriate PPE for 5 assigned work scenarios in a produce inspection facility. - Demonstrate correct donning and doffing sequence for fumigation PPE (full-face respirator and suit). - Record findings	Guide students to; - Select appropriate PPE for 5 assigned work scenarios in a produce inspection facility. - Demonstrate correct donning and doffing sequence for fumigation PPE (full-face respirator and suit). - Record findings	Laboratory equipment, instruments, worksheets, samples, writing materials Computer internet Projector PPE Practical manual Different sprayers
General Objective 3.0: Know risk assessment for a produce handling facility						
7 - 9	3.1 Define risk assessment 3.2 Explain methods of risk assessment 3.3 Explain hazard identification	- Explain risk assessment - Discuss methods of risk assessment - Discuss hazard identification risk rating matrix	Laptop, smart board, projector, whiteboard, markers, internet	- Complete a full risk assessment for an assigned produce handling operation (grain inspection, fumigation, or grading) - Identify hazards, rate	Guide students to; Complete a full risk assessment for an assigned produce handling operation (grain	Laboratory equipment, instruments, worksheets, samples, writing materials

	risk rating matrix (likelihood and severity) - Existing controls - Residual risk - Additional control recommendations applied to a produce inspection and grading facility.	(likelihood and severity) - Existing controls - Residual risk - Additional control recommendations applied to a produce inspection and grading facility		risks and record controls - Calculate residual risk and recommend improvements. - Record findings	inspection, fumigation, or grading) - Identify hazards, rate risks and record controls - Calculate residual risk and recommend improvements. - Record findings	Computer Internet Projector Marker board Practical manual
General Objective 4.0: Know emergency response procedures.						
10 - 12	4.1. Define emergency response procedures: 4.2. Describe emergency response procedures: - Fire emergency (fire alarm, evacuation, fire extinguisher use) - Chemical spill (containment	- Explain emergency response procedures - Discuss emergency response procedures: - Fire emergency (fire alarm, evacuation, fire extinguisher use) - Chemical spill (containment PPE notification) - Phosphine	Laptop, smart board, projector, whiteboard, markers, internet	- Execute emergency response for 3 assigned scenarios: -Fire in grain store; -Phosphine leak during fumigation; -Worker with aflatoxin dust inhalation. - Execute correct response for each. - Record findings	Guide students to: - Execute emergency response for 3 assigned scenarios: (1) fire in grain store; (2) phosphine leak during fumigation; (3) Worker with aflatoxin dust inhalation. - Execute correct response for	Laboratory equipment, instruments, worksheets, samples, writing materials PPE Notification Fire extinguishers Computer Internet Projector Fumigation

	PPE notification) iii. Phosphine exposure (evacuation, emergency services call and antidote limitations, etc) iv. Personal injury (first aid, incident report, etc). 4.3.Explain the advantages of adhering to emergency response	exposure (evacuation, emergency services call and antidote limitations, etc) iv. Personal injury (first aid, incident report, etc). • Discuss the advantages of adhering to emergency response			each. • Record findings	equipment Mist blower Practical manual First aid Box
General Objective 5.0: Understand ILO and Nigerian OSHA act requirements to produce inspection and export operations.						
13 - 15	5.1 Explain ILO guidelines on Occupational Safety and Health (OSHA 2001) 5.2 Explain Nigeria's Employees Compensation Act 2010 to produce inspection and export operations.	• Discuss ILO guidelines on Occupational Safety and Health (OSHA 2001) • Discuss Nigeria's Employees Compensation Act 2010 to produce inspection and export operations. • Discuss workplace OSH policy statement and	Laptop, smart board, projector, whiteboard, markers, internet	• Prepare a workplace OSHA policy statement and 30-minute safety induction programme outline for a produce export facility, • Include all legal requirements and key hazard communications • Record findings	Guide students to: • Prepare a workplace OSHA policy statement and 30-minute safety induction programme outline for a produce export facility, • Include all legal requirements and key hazard	Laboratory equipment, instruments, worksheets, samples, writing materials OSHA policy document Employee compensation Act Computer

	5.3 Explain workplace OSHA policy statement and safety induction programme.	safety induction programme.			communication s • Record findings	Internet Projector Safety Charts Practical manual
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



LIST OF MINIMUM RESOURCES/PHYSICAL FACILITIES

1.0 PRODUCE INSPECTION LABORATORY

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Active packaging sachets	50
2.	Airtightness test demonstration kit	10
3.	Alert mechanisms	10
4.	Ambient rack	10
5.	Assorted packaging samples	50
6.	Assorted Regulatory guidelines	10
7.	Assorted traps	10
8.	Automated sorting/grading equipment.	10
9.	Weighing Balance (Various types)	10
10.	Biopesticide samples	5
11.	Biosecurity monitoring plan template (printed)	2
12.	Biuret reagent for protein testing	5
13.	Produce Boxes (cardboard, papers, woods)	10
14.	Cabinet dryer (1 unit)	1
15.	Calculator	20
16.	Calibrated digital thermometers	20
17.	Calibrated hygrometers	20
18.	Calorimeter	20
19.	Digital Camera	2
20.	Carboxymethyl cellulose	500g
21.	Cardboard	2 bundles
22.	Career development plan templates (printed, 1 per student)	80
23.	Certification strategy worksheet template (printed)	80
24.	Charts	Various
25.	Citric acid,	2 litres
26.	Closed jars	80

27.	Cloud transmission systems/ (External drive)	3
28.	CO ₂ /O ₂ sensors	10
29.	Codex, NAQS, RASFF, and APHLIS platform accounts	Access/code
30.	Colony counter	10
31.	Color score card.	50
32.	Colour chart	Various
33.	Colour reference charts	Various
34.	Commercial food labels	10
35.	Compression tester/weights	5
36.	Compression testing apparatus (or improvised drop test)	5
37.	Compressors	2
38.	Condensers	2
39.	Cooling chamber	2
40.	Crate	10
41.	Damage assessment forms	50
42.	Data loggers	50
43.	Data recording worksheet	50
44.	Diatomaceous earth	1kg
45.	Different types of drones	2 types
46.	Digital grain moisture meters	5
47.	Digital grain sampling probe	5
48.	Dissection kits	5
49.	Divider/riffle divider for sample reduction	5
50.	Ethylene absorber	5
51.	Electronic moisture meters	5
52.	ELISA aflatoxin rapid test kit	2
53.	ELISA fumonisin and OTA rapid test kits	2
54.	Essential oils: neem, eucalyptus, pyrethrum (food grade)	50ml each
55.	Ethylene sensors	5
56.	Export cartons with ventilation holes and tissue paper liners	10

57.	Export label design template (A4 printed)	Assorted
58.	Export offer blank template forms (printed)	Assorted
59.	FAO grain storage manual summary (printed)	Assorted
60.	First aid kit	2
61.	FPIS Certificates sample	Assorted
62.	Freezer/Refrigerator	1 Each
63.	Fumigation logbook forms (printed)	1
64.	Fumigation simulation kit	2
65.	Gas analyzer	2
66.	Gas chromatography	1
67.	Gas permeability tester	1
68.	Gas sachets	5
69.	Glass flushing apparatus	2
70.	Global GAP produce handling checklist sets (printed)	80
71.	Glycerol	100ml
72.	GPS trackers	5
73.	Grading Containers assorted	2 sets
74.	Grading rings and size templates for each produce type	2 sets
75.	Grain inspection record forms (printed)	80
76.	Grain Pro cocoon bags	5
77.	HACCP document	80
78.	Humidity chambers	1
79.	Insect incubator	1
80.	Insect Chart/Calendar	Various
81.	Iodine solution for starch testing	500ml
82.	IoT logger	2
83.	IPM rotation design worksheet (printed)	80
84.	IPPC model certificate reference (printed)	80
85.	KMnO ₄ (ripening agents)	500ml
86.	Label design templates (A4 printable)	80

87.	Local and Improved Packaging materials	Assorted
88.	Magnifying lenses	20
89.	MAP packaging materials	Assorted
90.	Micrometer	5
91.	Microplate reader or spectrophotometer	1
92.	Microscope	5
93.	MRL compliance comparison table template (printed)	80
94.	Samples of Regulatory Agencies Certificate	Various
95.	Nutrient agar	500ml
96.	O ₂ scavenger sachets	10
97.	Penetrometer	10
98.	Permeability test kit	5
99.	Personal Protective Equipment (PPE)	10
100.	Pest Risk Assessment (PRA) worksheet template (printed)	80
101.	pH meter	10
102.	Pheromone traps	5
103.	Phosphine gas detector tubes	2
104.	Crop Protection Products (CPP)	Assorted
105.	Portable ethylene analysers	5
106.	PPE: food-safe gloves, hairnet, etc.	Assorted
107.	Pressure gauge and hand pump	1 Each
108.	Prototype storage system	Assorted
109.	Quarantine pest identification image	2
110.	RASFF alert analysis worksheet (printed)	80
111.	Real-time alert systems	2
112.	Refractometer	10
113.	Samples of Pesticide label	Assorted
114.	Sieves	Assorted
115.	Snap traps	Assorted
116.	Sprayers	Assorted

117.	Starch	500g
118.	Stereomicroscopes	2
119.	Suction fan	2
120.	Sun drying trays (wire mesh screens, min. 5)	Assorted
121.	Tensile tester or ruler	2
122.	TTI indicator label strips (chemical type)	5
123.	UV lamp (365nm) for aflatoxin fluorescence demonstration	1
124.	Water vapor tester	2
125.	Wood and plastic pallets	5 each

2.0 AUDIO VISUAL STUDIO

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Video recorder	2
2.	Slide projector	2
3.	Overhead projector	2
4.	Film projector	2
5.	Magnetic board	2
6.	Public address system	1
7.	Television set	2
8.	Cameras	5
9.	Enlarger	1
10.	Photo dryer	1
11.	Photo cutter	1
12.	Tables for drawing	5
13.	Water colours	2 set
14.	Drawing pencils	2 set
15.	Drawing pens	2 set
16.	Display cabinets and boards	2
17.	Interactive smartboard	1

18.	Laptop (for presentation)	2
19.	Printer	1
20.	Calculator sets (scientific)	20

Note: Audio Visual Studio can serve as seminar /training room (seats 40 students)

3.0 WOOD WORKSHOP

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Working benches with vices	2
2.	Band saw	2
3.	Surface planer	2
4.	Thickness planer	1
5.	Drilling machine	2
	HAND TOOLS	
6.	Saws, chisel, Tee square, gauges, rulers, tapes, screwdrivers, set of drill bit hammers, pincers, oil stones, planners etc.	15

4.0 METEOROLOGICAL STATION

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Stevensons screen	1
2.	Thermo hydrographs	1
3.	Maximum and minimum thermometer	2
4.	Digital thermometer	2
5.	Rain gauge	2
6.	Measuring glasses	2
7.	Wind vane	1
8.	Anemometers	2
9.	Evaporimeters	2
10.	Hygrometers (digital and manual)	2
11.	Barometers	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

5.0 BIOLOGY LABORATORY

S/N	DISCRIPTION OF ITEMS	QUANTITY REQUIRED
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, boot etc.)	20(set)
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

6.0 CHEMISTRY LABORATORY

S/N	DISCRIPTION OF ITEMS	QUANTITY
1.	Drying oven soils	1
2.	Digital pH metre	1
3.	Electric furnace	1
4.	Electric balance	2
5.	Beam balance	2
6.	Soil sieve (mesh)	2
7.	Soil sedimentation apparatus	2
8.	Soil capillary determination	2
9.	Soil humidity determination apparatus	2
10.	Soil testing outfit	3
11.	Soil augers (bucket, screw, and Dutch types)	5
12.	Humidity cabinet	1
13.	Soil moisture meter	2
14.	Soil salt tester	1
15.	Portable digital pH meters	4
16.	GPS devices	1
17.	GPS-enabled smartphones or tablets	5
18.	First aid kit	1

LIST OF WORKSHOP PARTICIPANTS (PRE-CRITIQUE)

S/N	FULL NAMES	CONTACT ADDRESSES	EMAIL/PHONE NO
1.	Prof. Idris M. Bugaje	Chairman Implementation Committee, Executive Secretary, National Board for Technical Education (NBTE), Kaduna	es@nbte.gov.ng
2.	Dr. Rufai Ibrahim	College of Agriculture and Animal Science (CAAS), ABU Mando, Kaduna	rufai37@yahoo.co.uk
3.	Prof. Abdullahi Namakka	Division of Agricultural Colleges (DAC) A.B.U., Zaria	nafisat111@gmail.com
4.	Bashir Barau PhD	Federal College of Agric. Produce Technology, (FCAPT), Kano	bashbarau2008@gmail.com
5.	Isika Peter	Imo State Polytechnic. Agricultural Technology Department Omuma,	isikapeter@gmail.com
6.	Engr. Usman Tomsu	Agro machinery department, Dhaka Investment and Development Agency, Bangladesh (DIDA)	um.tomsu@gmail.com
7.	Dr. Ibrahim Garba Halilu	Federal College of Agric. Produce Technology, (FCAPT), Kano	ighalilu@gmail.com
8.	Dr. O.O. Bello	Director Curriculum Development Department National Board for Technical Education (NBTE), Kaduna	engrbello@gmail.com
9.	Dr. Ayo Aroge	Director Polytechnic and Allied Programmes National Board for Technical Education (NBTE), Kaduna	ayoaroge2@gmail.com
10.	Dr. Kubura Jauro Danlawan	Deputy Director, Agricultural Technology Division National Board for Technical Education (NBTE), Kaduna	kuburagombe@yahoo.com
11.	Nsan Tiku Nsan	National Board for Technical Education (NBTE), Kaduna	Santoadaape2@gmail.com
12.	Ramatu Adeiza	National Board for Technical Education (NBTE), Kaduna	ramatuishaq04@gmail.com
13.	Abdulrahman Idris	National Board for Technical Education (NBTE), Kaduna	Idrisabdulraham12@gmail.com
14.	Rabi Sani	National Board for Technical Education (NBTE), Kaduna	rabohio1@gamil.com

LIST OF WORKSHOP PARTICIPANTS (FINAL CRITIQUE)

S/N	NAME	INSTITUTION	EMAIL ADDRESS
1.	Prof. Idris M. Bugaje	Chairman Implementation Committee, Executive Secretary, National Board for Technical Education (NBTE), Kaduna	es@nbte.gov.ng
2.	Sheriff Balogun	Federation of Agricultural Commodity Association of Nigeria.	sheriff.Balogun@gmail.com
3.	Dr. Abubakar Sani Abdullahi	Sector Skill Council for Agriculture, Abuja.	abubakargreat@gmail.com
4.	Dr. Ibrahim Garba Halilu	Federal College of Agricultural Produce Technology, Kano.	ighalilu@gmail.com
5.	Bashir Barau PhD	Federal college of Agricultural Produce Technology, Kano.	bashbarau2008@gmail.com
6.	Dr. Umar Etsu Shehu	Federal College of Agriculture and Technology Nabanje, Katsina State.	engretumar@gmail.com
7.	Engr Dr. Folorunsho F. Olayemi	Sanmorf Agro Consults Ltd.	offlinenspri@gmail.com
8.	Godwin Odaudu	Dala Foods Nig Ltd Kano.	odaudugodwin@gmail.com
9.	Ibrahim S. Dalatu	Ramat Polytechnic, Maiduguri.	dalatu.ibrahim@gmail.com
10.	Dr. O.O. Bello	Director Curriculum Development Department National Board for Technical Education (NBTE), Kaduna	engrbello@gmail.com
11.	Dr. Ayo Aroge	Director Polytechnic and Allied Programmes National Board for Technical Education (NBTE), Kaduna	ayoaroge2@gmail.com
12.	Dr. Kubura Jauro Danlawan	Deputy Director, Agricultural Technology Division National Board for Technical Education (NBTE), Kaduna	kuburagombe@yahoo.com
13.	Ramatu Adeiza	National Board for Technical Education (NBTE),	ramatuishaq04@gmail.com

		Kaduna	
14.	Muhammad Aliyu Sani	National Board for Technical Education (NBTE), Kaduna	mzaleeyu@gmail.com
15.	Hassana A. Ennamusa	National Board for Technical Education (NBTE), Kaduna	hassanaennamusa@gmail.com
16.	Abdulrahman Idris	National Board for Technical Education (NBTE), Kaduna	Idrisabdulraham12@gmail.com
17.	Ahmad Ibrahim Ahmad	National Board for Technical Education (NBTE), Kaduna	ahmadkhaleefa12@gmail.com

