



NATIONAL BOARD FOR TECHNICAL EDUCATION

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

HIGHER NATIONAL DIPLOMA

IN

PRODUCE INSPECTION AND EXPORT MANAGEMENT

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.

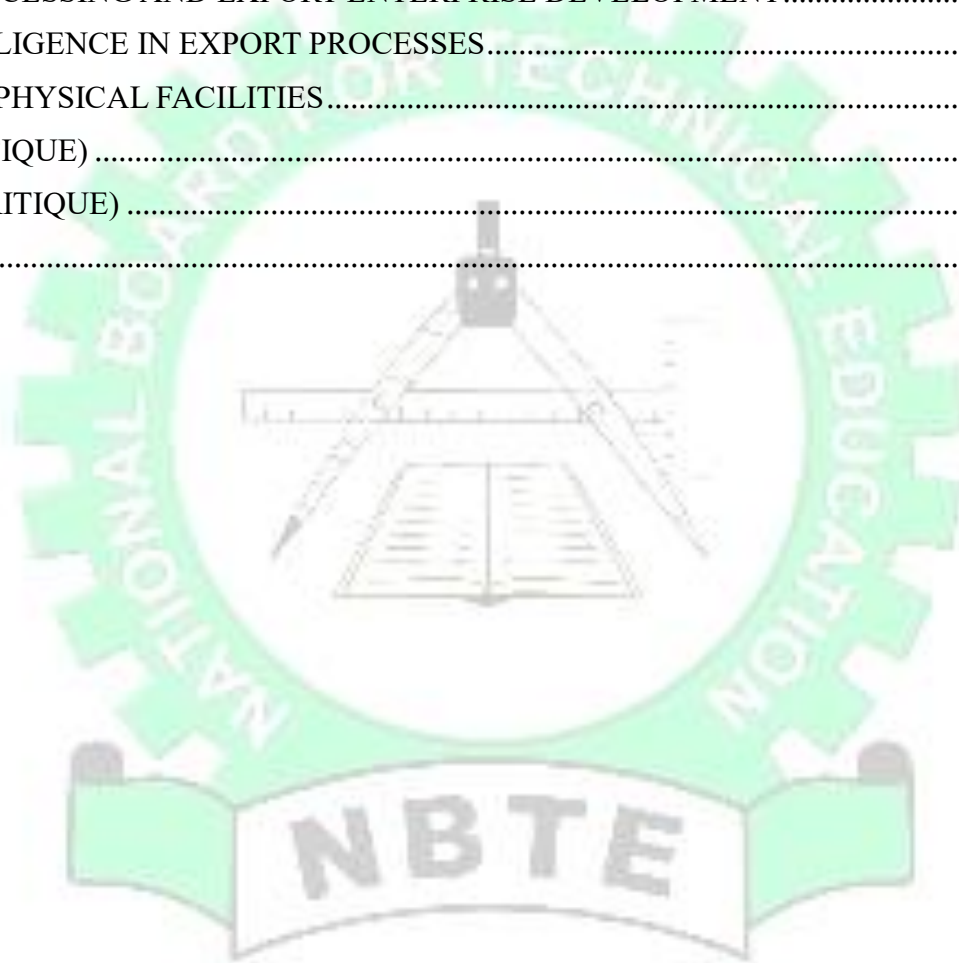
Special appreciation is extended to the members of the agriculture, curriculum specialists, resource persons, academic experts, professional bodies, regulatory agencies, employers, industry practitioners, development partners, and representatives of public and private sector organizations who participated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



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GENERAL INFORMATION

1.0 PROGRAMME NOMENCLATURE

Higher National Diploma (HND) in Produce Inspection and Export Management.

2.0 PROGRAMME GOAL

The Higher National Diploma (HND) in Produce Inspection and Export Management is designed to produce innovative, technologically skilled, entrepreneurial and globally competitive diplomates equipped with competencies in produce inspection, quality assurance, food safety management, export certification, phytosanitary systems, digital inspection technologies, agricultural trade, export logistics and value-chain development for enhanced agricultural exports, food security and national economic development.

3.0 OBJECTIVES OF THE PROGRAMME

At the end of the programme, the diplomates should be able to:

- i. Design and implement risk-based produce inspection systems aligned with ISO 17020 and Codex Alimentarius requirements;
- ii. Manage food safety management systems including HACCP, ISO 22000, BRC, and GLOBAL G.A.P. in export produce operations;
- iii. Conduct analytical testing using HPLC, LC-MS, and immunoassay techniques for mycotoxin and pesticide residue determination;
- iv. Manage cold chain logistics, refrigerated transport systems, and controlled atmosphere storage for export produce;
- v. Administer complete export documentation systems including Letters of Credit, phytosanitary certificates, and digital trade platforms;
- vi. Apply international trade law including WTO/SPS Agreement, EU Food Law, FSMA, and AfCFTA market access provisions;
- vii. Develop and manage digital traceability systems using blockchain, QR-code, RFID, and IoT-enabled supply chain platforms;
- viii. Conduct food safety audits and manage ISO 17020/22000 certification processes for produce inspection bodies;
- ix. Develop integrated resistance management programmes combining IPM, biopesticides, and hermetic storage systems;
- x. Establish produce value addition enterprises and develop export market intelligence for Nigerian agricultural commodities;
- xi. Develop and manage agricultural export organization through effective financial planning, marketing, entrepreneurship, negotiation, communication and project management skills;
- xii. Apply international trade laws, WTO/SPS agreements, AfCFTA protocols, export regulations and market access requirements in agricultural trade;
- xiii. Demonstrate professional ethics, occupational health and safety standards, teamwork and lifelong learning while contributing to agricultural export development, employment generation and national economic growth.

4.0 ENTRY REQUIREMENTS

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

- i. Five (5) Ordinary Level credit passes in relevant subjects including English Language, Mathematics, Agricultural Science or Biology and two other relevant subject;
- ii. A National Diploma (ND) in Produce Inspection and Export Management or related field (Agricultural Technology, Postharvest Technology, Food Science Technology) with a minimum Lower Credit;
- iii. Candidate must have undergone one (1) year post-ND Industrial Training Experience in produce inspection, food safety, export operations, quality assurance or related industry;
- iv. Candidate with a **Pass** grade at the ND level and two (2) or more years post-ND cognate work experience may be considered for admission into the programme.

5.0 STRUCTURE/DURATION OF THE PROGRAMME

The programme is structured to last for two (2) academic years (four semesters) of classroom instruction, laboratory work, field practicals and export management exercises.

Each semester shall consist of:

- i. 15 contact weeks of teaching (lectures, practicals, laboratory work, field inspections and export simulations);
- ii. 2 weeks for tests, registration and examinations.

6.0 CURRICULUM

The curriculum of the HND Produce Inspection and Export Management programme consists of four (4) main components:

- i. General Studies Courses
- ii. Foundation Courses
- iii. Professional Courses
- iv. Project Work

7.0 STAFFING REQUIREMENTS

7.1 Core Teaching Staff

A minimum of four (4) Core Lecturers who should be Lecturer II and above, with minimum qualification of HND/B.Sc. and M.Sc. or Ph.D. in Produce Inspection and Export Management or related fields.

7.2 Head of Department (HOD)

The Head of Department shall have at least a Master's degree in Produce Inspection and Export Management programme or related fields. He or she shall not be below the rank of a Senior Lecturer, must be registered with the relevant professional body and must have a minimum of adequate experience in both academic and industry.

7.3 Technical Staff

There should be technical staff:

i) Technologist

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

ii) Technician

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

iii) Farm Assistants

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

8.0 CERTIFICATION

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

9.0 AWARD OF HIGHER NATIONAL DIPLOMA (HND)

The Higher National Diploma qualification in Produce Inspection and Export Management shall be awarded by the authority of the Academic Board of the institution under the following conditions:

- i) Satisfactory performance in all prescribed course work/assignments, tests/quizzes, workshop practice, laboratory work, field trips, etc.;
- ii) Satisfactory performance in all semester examinations;
- iii) Satisfactory completion of written project, seminar papers etc
- iv) Candidate must have completed minimum of 110 to 120 credit unitss

9.1 Conditions for the Award of HND:

Institutions offering accredited programmes will award the Higher National Diploma to candidates who successfully completed the programme after passing the prescribed course-work, examinations, diploma project etc. 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	0.00

9.2 Classification of Diplomas:

Diploma qualification shall be awarded based on the following classifications:

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

10.0 ACCREDITATION OF PROGRAMME

The Higher National Diploma (HND) Produce Inspection and Export Management shall be accredited by the NBTE before the diplomates are awarded the certificates. Details about the process of accrediting a programme for the award of HND are available from the Board's website www.nbte.gov.ng or through correspondence to: The Executive Secretary, NBTE, Plot 'B' Bida Road, P.M.B 2239, Kaduna, Nigeria.

11.0 LOGBOOK

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

12.0 FINAL YEAR PROJECTS

Final year students are expected to carry out project work, either on individual or group basis (not more than 2 per group). The project topics should as much as possible be related to the programme and serve as useful tools for further Research and /or Development. Projects should be properly supervised, and their reports well presented. The Institution should develop formats for presenting and grading projects. The formats should be adopted as applied to each stakeholder.

13.0 GUIDANCE NOTES FOR TEACHERS OF THE PROGRAMME:

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

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

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

13.4 The teaching of theory and practical work should, as much as possible, be integrated. Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation from the theory.

14.0 GUIDELINES ON MANDATORY SKILLS QUALIFICATIONS (MSQ)

Please, refer to NBTE guidelines for implementation of MSQ in Polytechnics. This can be downloaded from NBTE website (web.nbte.gov.ng)

CURRICULUM TABLE**YEAR I SEMESTER I**

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 301	Use of English III	2	0	0	2	2
2.	MSQ 311	Principles of Quality Assurance and Assessment	1	0	1	2	2
3.	PIE 311	Export Value Chain Analysis and Market Systems	1	0	3	4	4
4.	PIE 312	Postharvest Science and International Regulatory Compliance	1	0	3	4	4
5.	PIE 313	Food Chemistry, Analytical Instrumentation and Quality Control	1	0	3	4	4
6.	PIE 314	Cold Chain Management, Refrigerated Logistics and Temperature Control	1	0	3	4	4
7.	PIE 315	Digital Inspection Systems, Machine Vision and IoT Integration	1	0	3	4	4
8.	PIE 316	Pest Management, Bio control and Integrated Resistance Systems	1	0	3	4	4
TOTAL			9	0	19	28	28

YEAR I SEMESTER II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 302	Communication in English III	2	0	0	2	2
2.	ENT 326	Practice of Entrepreneurship I	2	0	2	4	4
3.	MSQ 321	Principles of Quality Assurance and Management	1	0	1	2	2
4.	AGR 302	Field Experimentation and Data Analysis	1	0	1	2	2
5.	PIE 321	Risk-Based Inspection Systems and Official Control Procedures	1	0	3	4	4
6.	PIE 322	International Standardisation Management and Regulatory Compliance	1	0	3	4	4
7.	PIE 323	Mycotoxin Analytics, HPLC and Aflatoxin Mitigation Systems	1	0	3	4	4
8.	PIE 324	Food Safety Auditing, ISO 22000 and Certification Management	1	0	3	4	4
9.	PIE 325	Fumigation, Phytosanitary Operations and Other Regulatory Compliance	1	0	3	4	4
TOTAL			11	0	19	30	30

YEAR II SEMESTER I

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 401	Communication in English IV	2	0	0	2	2
2.	ENT 416	Practice of Entrepreneurship II	2	0	2	4	4
3.	AGR 401	Research Methodology and Scientific Writing	1	0	1	2	2
4.	PPT 412	Postharvest Loss Assessment Methodology (FAO/World Bank Tools)	1	0	3	4	4
5.	PIE 411	Export Documentation, Letters of Credit and Digital Trade Systems	1	0	3	4	4
6.	PIE 412	Supply Chain Management, Agri-Logistics and Export Operations	1	0	3	4	4
7.	PIE 413	International Trade Law, WTO/SPS and AfCFTA Market Access	1	0	3	4	4
8.	PIE 414	Market Intelligence, Agri-Export Business Development and Negotiations	1	0	3	4	4
TOTAL			10	0	18	28	28

YEAR II SEMESTER II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	PIE 421	Quality Management Systems in Agricultural Produce Export	1	0	3	4	4
2.	PIE 422	Produce Inspection, Statistical Process Control and Official Certification	1	0	3	4	4
3.	PIE 423	Digital Agriculture, Precision Inspection and Blockchain Traceability	1	0	3	4	4
4.	PIE 424	Produce Value Addition, Processing and Export Enterprise Development	1	0	3	4	4
5.	PIE 425	Integrating Artificial Intelligence in Export Processes	1	0	3	4	4
6.	PIE 426	Project	0	0	4	4	4
TOTAL			5	0	19	24	24

KEY:

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



EXPORT VALUE CHAIN ANALYSIS AND MARKET SYSTEMS

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: EXPORT VALUE CHAIN ANALYSIS AND MARKET SYSTEMS	COURSE CODE: PIE 311	CONTACT HOURS: 4 HOURS/WEEK
YEAR: I SEMESTER: I	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with analytical knowledge and skills to assess, map and optimize agricultural export value chains.		
GENERAL OBJECTIVES: At the end of this course, the students should be able to: 1.0 Understand agricultural export value chain systems using mapping and governance frameworks; 2.0 Evaluate value chain actor dynamics and transaction cost structures in produce export; 3.0 Understand global value chain theory to Nigerian export commodity positioning and upgrading; 4.0 Know market intelligence systems and export market entry strategies; 5.0 Evaluate value chain financing and risk management instruments for agri-export; 6.0 Understand the competitiveness improvement plan for a produce export value chain; 7.0 Know evidence-based export market development report for a Nigerian commodity; 8.0 Know Climate Change, El Nino Southern Oscillation (ENSO) and Export Value Chain Resilience.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: EXPORT VALUE CHAIN ANALYSIS AND MARKET SYSTEMS		COURSE CODE: PIE 311		CONTACT HOURS: 4 HOURS/WEEK		
		CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK		
YEAR: I SEMESTER: I		PRE-REQUISITE: -		PRACTICAL: 3 HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with analytical knowledge and skills to assess, map, and optimise agricultural export value chains.						
GENERAL OBJECTIVE 1.0: Understand agricultural export value chain systems using mapping and governance frameworks						
THEORETICAL CONTENT				PRACTICAL CONTENT		
WEEK	SPECIFIC LEARNING OUTCOME	TEACHER’S ACTIVITIES	RESOURCES	SPECIFIC LEARNING OUTCOME	TEACHER’S ACTIVITIES	RESOURCES
1-2	1.1 Define value chain analysis (VCA) and supply chain management 1.2 Distinguish between value chain analysis (VCA) and supply chain management at the systems level 1.3 Explain Porter's Value Chain model and M4P market systems framework to Nigerian agri-export chains	• Explain value chain analysis (VCA) and supply chain management • Discuss the differences between value chain analysis (VCA) and supply chain management at the systems level. • Discuss Porter's Value Chain model and M4P market systems framework to Nigerian agri-export chains • Explain governance structures in global value chains: buyer-	Laptop computers, smart board, projector, writing materials, white board, markers, internet etc	• Construct a full diagnostic value chain map for a selected Nigerian export commodity • Identify all chain actors, value addition stages, governance relationships, and power asymmetries • Present diagnostic findings with improvement recommendations	Guide students to: • Construct a full diagnostic value chain map for a selected Nigerian export commodity (sesame or cocoa) • Identify all chain actors, value addition stages, governance relationships, and power asymmetries • Present diagnostic findings with improvement recommendations	VCA diagnostic templates, commodity trade data, governance analysis worksheet, projector, internet, PPE, smartphones.

	1.4 Explain governance structures in global value chains: buyer-driven vs producer-driven chains	driven vs producer-driven chains				
General Objective 2.0: Evaluate value chain actor dynamics and transaction cost structures in produce export						
3-4	2.1 Explain transaction cost theory and its application to agri-export value chains 2.2 Explain sources of information asymmetry between farmers, aggregators, exporters, and buyers 2.3 Describe contract farming models as a transaction cost reduction mechanism	- Describe transaction cost theory and its application to agri-export value chains - Discuss sources of information asymmetry between farmers, aggregators, exporters, and buyers - Discuss contract farming models as a transaction cost reduction mechanism	Laptop Computers, Smart Board, Projector, Writing Materials, White Board, Markers, Internet, etc.	- Calculate transaction costs at three stages of a provided export value chain scenario - Compare costs under spot market, contract farming, and vertical integration coordination mechanisms - Recommend the most efficient coordination mechanism with justification	Guide students to: - Calculate transaction costs at three stages of a provided export value chain scenario - Compare costs under spot market, contract farming, and vertical integration coordination mechanism - Recommend the most efficient coordination mechanism with justification	Transaction cost calculation worksheets, scenario cards, calculators, computers, projector, Internet, PPE, smartphones.
General Objective 3.0: Understand global value chain theory to Nigerian export commodity positioning and upgrading						
5-6	3.1 Explain global value chain (GVC) theory; upgrading pathways (process, product, functional, intersectoral) 3.2 Explain Nigeria's	- Describe global value chain (GVC) theory: upgrading pathways (process, product, functional, intersectoral) - Discuss Nigeria's	Laptop Computers, Smart Board, Projector, Writing Materials, White Board,	- Present a GVC position paper for one Nigerian export commodity - Identify current value chain position, upgrading barriers, and recommended	Guide students to: - Examine and present a GVC position paper for one Nigerian export commodity - Identify current value chain position,	Internet access, GVC analysis templates, commodity trade statistics, Presentation space, computers,

	current GVC positions in sesame, cashew, cocoa, groundnut, etc. 3.3 Explain compliance-to-market linkage	current GVC positions in sesame, cashew, cocoa, and groundnut commodity chains • Describe compliance-to-market linkage: how quality and standards compliance enable chain upgrading	Markers, Internet, Pictures, etc.	upgrading pathway • Present with data evidence from ITC Trade Map or COMTRADE	upgrading barriers, and recommended upgrading pathway • Present with data evidence from ITC Trade Map or COMTRADE	PPE, smartphones.
General Objective 4.0: Know market intelligence systems and export market entry strategies						
7-8	4.1 Explain market intelligence sources. 4.2 Describe market entry strategies. 4.3 Explain Revealed Comparative Advantage (RCA) index to identify Nigeria's most competitive export commodities	• Describe market intelligence sources: ITC Trade Map, COMTRADE, EU Agri-Portal, USDA FAS, Tridge, and Mintec • Discuss market entry strategies: direct export, agent/distributor, joint venture, own representative office • Explain Revealed Comparative Advantage (RCA) index to identify Nigeria's most competitive export commodities	Laptop Computers, Smart Board, Projector, Writing Materials, White Board, Markers, Internet, etc.	• Access ITC Trade Map to retrieve trade flow data for Nigerian sesame seeds exports to 5 target markets • Calculate RCA index for sesame and 2 other commodities • Develop a market entry recommendation with supporting data • Record findings	Guide students to: • Access ITC Trade Map to retrieve trade flow data for Nigerian sesame exports to 5 target markets • Calculate RCA index for sesame and 2 other commodities • Develop a market entry recommendation with supporting data	ITC Trade Map access (computers), COMTRADE data, RCA calculation worksheets, projector, PPE, smartphones.
General Objective 5.0: Evaluate value chain financing and risk management instruments for agri-export						

9 - 10	5.1 Explain value chain finance instruments. 5.2 Explain export credit insurance products. 5.3 Describe commodity price risk management.	• Describe value chain finance instruments: warehouse receipt financing, invoice discounting, contract farming credit, and export factoring • Discuss export credit insurance products: Coface, Euler Hermes, Export Credit Insurance Facility, etc • Describe commodity price risk management: forward contracts, futures markets, and minimum price guarantees	Laptop Computers, Smart Board, Projector, Writing Materials, White Board, Markers, Internet Pictures Videos, etc.	• Construct a financing plan for a hypothetical 100-tonne sesame or cocoa export operation • Identify financing gaps at each value chain stage and match to appropriate instruments • Calculate cost of financing and net profit impact • Record findings	Guide students to: • Construct a financing plan for a hypothetical 100-tonne sesame or cocoa export operation • Identify financing gaps at each value chain stage and match to appropriate instruments • Calculate cost of financing and net profit impact	Financing plan templates, NEXIM product guide, calculation worksheets, computers, projector, PPE, smartphones.
General Objective 6.0: Understand the competitiveness improvement plan for a produce export value chain						
11 - 12	6.1 Explain value chain competitiveness drivers. 6.2 Explain value chain development (VCD) methodologies. 6.3 Explain gender and inclusion dimensions in value chain upgrading.	• Describe value chain competitiveness drivers: cost, quality, reliability, flexibility, responsiveness, and sustainability • Discuss value chain development (VCD) methodologies: USAID VEGA, GIZ M4P, and Making Markets Work for the	Laptop Computers, Smart Board, Projector, Writing Materials, White Board, Markers, Internet Pictures Videos, etc.	• Apply VCD tool to a provided export value chain scenario • Identify top 3 competitiveness constraints with evidence • Design a targeted intervention plan with SMART indicators and budget estimate • Record findings	Guide students to: • Apply VCD tool to a provided export value chain scenario • Identify top 3 competitiveness constraints with evidence • Design a targeted intervention plan with SMART indicators and budget estimate	VCD diagnostic worksheets, intervention plan templates, computers, projector, internet, PPE, Smartphones.

		Poor • Discuss gender and inclusion dimensions in value chain upgrading: women aggregators, youth entrepreneurs, smallholder integration				
General Objective 7.0: Know evidence-based export market development report for a Nigerian commodity						
13 - 14	7.1 Describe the structure of an export market development report. 7.2 Explain the role of certification and branding in premium market capture 7.3 Explain AfCFTA's impact on intra-African commodity trade flows and Nigerian export competitiveness.	• Discuss the structure of an export market development report: executive summary, market analysis, competitive landscape, compliance requirements, business case, etc. • Discuss the role of certification and branding in premium market capture: Organic, Fair Trade, GLOBALG.A.P., and origin branding • Discuss AfCFTA's impact on intra-African commodity trade flows and Nigerian export competitiveness	Laptop Computers, Smart Board, Projector, Writing Materials, White Board, Markers, Internet Pictures Videos, etc.	• Develop a structured export market development report for an assigned Nigerian commodity targeting a specified market • Incorporate market data, compliance requirements, certification strategy, and financial projections • Present findings before the class.	Guide students to: • Develop a structured 5-page export market development report for an assigned Nigerian commodity targeting a specified market • Incorporate market data, compliance requirements, certification strategy, and financial projections • Present and defend findings before class	Report templates, ITC Trade Map, AfCFTA portal access, commodity data, computers, projector, PPE, Smartphones.

General Objective 8.0: Know Climate Change, El Nino Southern Oscillation (ENSO) and Export Value Chain Resilience						
15	8.1 Explain ENSO (El Niño-Southern Oscillation) cycle impacts on Nigerian agricultural production. 8.2 Explain climate-smart export value chain strategies. 8.3 Describe climate risk disclosure and Environmental, Social and Governance (ESG) reporting obligations for agri-export organization.	• Discuss ENSO (El Niño-Southern Oscillation) cycle impacts on Nigerian agricultural production: El Niño drought effects (reduced harvest, elevated aflatoxin risk), La Niña flooding effects (moisture stress, storage losses), and commodity-specific seasonal quality implications • Discuss climate-smart export value chain strategies: drought-tolerant variety adoption, climate-indexed insurance instruments, adaptive procurement systems, and quality risk buffering for export consignments • Discuss climate risk disclosure and ESG reporting obligations for agri-export	Laptop Computers, Smart Board, Projector, Writing Materials, White Board, Markers, Internet Pictures Videos, etc.	• Analyse a 10-year historical ENSO index dataset and correlate with Nigerian export commodity quality and RASFF rejection trends for groundnut or sesame or cocoa • Identify the most climate-vulnerable stages of the export value chain • Develop a climate risk adaptation plan for a sesame export enterprise including risk mitigation actions and seasonal procurement adjustments. • Present the recorded findings.	Guide students to: • Analyse a 10-year historical ENSO index dataset and correlate with Nigerian export commodity quality and RASFF rejection trends for groundnut or sesame or cocoa • Identify the most climate-vulnerable stages of the export value chain • Develop a climate risk adaptation plan for a sesame export enterprise including risk mitigation actions and seasonal procurement adjustments • Record and present findings	ENSO index dataset (provided), RASFF rejection trend data, FEWS NET bulletins, climate risk adaptation plan template, computers, internet, PPE, smartphones.

		organization: EU Corporate Sustainability Reporting Directive (CSRD), EU Deforestation Regulation (EUDR), and emerging supply chain sustainability due diligence requirements				
COURSE ASSESSMENT: Course Work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

POSTHARVEST SCIENCE AND INTERNATIONAL REGULATORY COMPLIANCE

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: POSTHARVEST SCIENCE AND INTERNATIONAL REGULATORY COMPLIANCE	COURSE CODE: PIE 312	CONTACT HOURS: 4 HOURS/WEEK
YEAR: I 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 of postharvest physiology, biochemistry, regulatory compliance, and sensory quality evaluation for Nigerian agricultural export commodities.		
GENERAL OBJECTIVES: At the end of this course, the students should be able to: 1.0 Understand postharvest physiology mechanisms governing produce quality during export; 2.0 Analyse postharvest technology systems for commercial export operations; 3.0 Know EU, US, and Gulf export regulatory compliance frameworks for fresh produce; 4.0 Understand pre-cooling and cold chain management systems for export produce handling; 5.0 Evaluate phytosanitary compliance requirements under IPPC standards for Nigerian exporters; 6.0 Understand pre-export compliance verification programme for a produce consignment; 7.0 Know food safety incident management and product recall systems in export operations; 8.0 Understand Sensory Evaluation Methods and Consumer Quality Perception for Export Produce.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: POSTHARVEST SCIENCE AND INTERNATIONAL REGULATORY COMPLIANCE			COURSE CODE: PIE 312		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I 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 of postharvest physiology, biochemistry, regulatory compliance, and sensory quality evaluation for Nigerian agricultural export commodities.						
General Objective 1.0: Understand postharvest physiology mechanisms governing produce quality during export						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain the biochemical basis of senescence. 1.2 Explain the Q10 principle and its application to temperature management in produce export cold chains. 1.3 Differentiate between climacteric and non-climacteric produce in the context of export handling, temperature management, and ethylene control	• Discuss the biochemical basis of senescence: ethylene signal transduction, cell wall degradation enzymes (PG, PME, cellulase), and ROS-mediated quality deterioration • Discuss the Q10 principle and its application to temperature management in produce export cold chains • Compare the differences between climacteric and non-climacteric produce in the context of export handling, temperature	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	• Compare ethylene production rates, firmness, and soluble solids in two climacteric produce varieties at three storage temperatures over 5 days • Plot deterioration curves and calculate Q10 values • Recommend optimal storage temperature for each variety with	Guide students to: • Compare ethylene production rates, firmness, and soluble solids in two climacteric produce varieties at three storage temperatures over 5 days • Plot deterioration curves and calculate Q10 values • Recommend	Ethylene sensor, refractometer, penetrometer, temperature/relative humidity data logger, graph paper, computers, practical manual, programmable temperature and humidity (climatic/stability) test chamber, integrated sensor/alarm/reporting system, water activity (a _w) meter, analytical

		management, and ethylene control		justification • Record findings	optimal storage temperature for each variety with justification	balance (0.001 g), voltage stabiliser/UPS, PPE, smartphones.
General Objective 2.0: Analyse postharvest technology systems for commercial export operations						
3 - 4	2.1 Explain controlled atmosphere (CA) storage 2.2 Explain 1-methylcyclopropene (1-MCP) technology 2.3 Explain UV-C radiation and ozone treatment for postharvest pathogen control	• Discuss controlled atmosphere (CA) storage: gas composition requirements for key export crops, CA equipment types, and commercial feasibility for Nigerian exporters • Discuss 1-methylcyclopropene (1-MCP) technology: mode of action, application systems, effective concentrations, and regulatory status in key export markets • Describe UV-C radiation and ozone treatment for postharvest pathogen control: efficacy, safety considerations, and market acceptance	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	• Set up CA comparison experiment • Monitor gas concentrations and quality • Calculate shelf life extension • Interpret the Recorded findings	Guide students to: • Set up CA comparison experiment • Monitor gas concentrations and quality • Calculate shelf-life extension • Facilitate interpretation	MAP bags, gas analyser, penetrometer, colour chart, monitoring log sheets, computers, projector, internet, PPE, smartphones.
General Objective 3.0: Know EU, US, and Gulf export regulatory compliance frameworks for fresh produce						

5 - 6	3.1 Explain EU regulatory framework for fresh produce imports 3.2 Explain US FSMA Produce Safety Rule (21 CFR 112) 3.3 Explain Gulf/UAE import requirements	• Discuss EU regulatory framework for fresh produce imports: EC 178/2002 (food law), EC 852/2004 (food hygiene), EU pesticide MRL Regulation (EC 396/2005), and EU quality standards (EU 543/2011) • Discuss US FSMA Produce Safety Rule (21 CFR 112): irrigation water standards, worker hygiene, soil amendments, and traceability requirements • Describe Gulf/UAE import requirements: GCC standards, municipality inspection, Halal certification requirements, and Arabic labelling compliance	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, etc.	• Review 5 recent EUROPHYT interception notifications for Nigerian produce. • Identify pest issue, causal pathway for each interception • Compare EU (EC 178/2002, EC 852/2004, EC 396/2005, EU 543/2011), US FSMA (21 CFR 112), and Gulf/GCC import requirements for a selected Nigerian fresh-produce export • Develop a compliance briefing recommending protocol improvements for a Nigerian	Guide students to: • Review 5 recent EUROPHYT interception notifications for Nigerian produce; for each interception identify pest issue, causal pathway • Compare EU (EC 178/2002, EC 852/2004, EC 396/2005, EU 543/2011), US FSMA (21 CFR 112), and Gulf/GCC import requirements for a selected Nigerian fresh-produce export • Develop a compliance matrix and briefing recommending protocol	EU MRL database access (pesticides.eu), US EPA MRL data, NAFDAC limit tables, compliance matrix template, computers, PPE, smartphones.
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				produce exporter • Record findings	improvements for the exporter; • Record findings	
General Objective 4.0: Understand pre-cooling and cold chain management systems for export produce handling						
7 – 8	4.1 Explain pre-cooling systems at commercial scale 4.2 Outline reefer container specifications 4.3 Explain cold chain failure modes	• Discuss pre-cooling systems at commercial scale: hydro-cooling capacity calculations, forced-air cooling with room design parameters, and vacuum cooling for leafy vegetables • Describe reefer container specifications: temperature range, humidity control, CA capability, and pre-trip inspection (PTI) requirements for produce export • Discuss cold chain failure modes: door openings, compressor malfunctions, pre-cooling omissions, and their produce quality impact quantified through TTI data	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	• Calculate pre-cooling time and energy requirements for a 5-tonne fresh mango export consignment using hydrocooling and forced-air cooling methods • Develop reefer container temperature management settings for the consignment • Present and justify pre-cooling and cold chain recommendations	Guide students to: • Calculate pre-cooling time and energy requirements for a 5-tonne fresh mango export consignment using hydrocooling and forced-air cooling methods • Develop reefer container temperature management settings for the consignment • Present and justify pre-cooling and cold chain recommendations	Pre-cooling calculation worksheets, reefer spec sheets, calculators, computers, projector, practical manual, PPE, smartphones.

General Objective 5.0: Evaluate phytosanitary compliance requirements under IPPC standards for Nigerian exporters						
9 – 10	5.1 Describe key ISPMs relevant to Nigerian produce export. 5.2 Explain NAQS compliance capacity and phytosanitary certification procedures for key Nigerian export commodities 5.3 Explain interception statistics	• Explain key ISPMs relevant to Nigerian produce export: ISPM 5 (Glossary), ISPM 12 (Phytosanitary Certificates), ISPM 23 (inspection guidelines), ISPM 31 (methodologies for sampling) • Explain NAQS compliance capacity and phytosanitary certification procedures for key Nigerian export commodities • Discuss interception statistics: EUROPHYT data for Nigerian produce, most frequent phytosanitary findings, and their implications for export protocol improvement	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	• Review 5 recent EUROPHYT interception notifications for Nigerian produce, For each interception: identify the pest/issue, causal pathway, and recommended preventive action • Develop a compliance briefing recommending protocol improvements for a Nigerian produce exporter • Record findings	Guide students to: • Review 5 recent EUROPHYT interception notifications for Nigerian produce For each interception, identify the pest/issue, causal pathway, and recommended preventive action • Develop a compliance briefing recommending protocol improvements for a Nigerian produce exporter	EUROPHYT database access, interception analysis worksheet, compliance brief template, computers, internet, projector, PPE, smartphones.
General Objective 6.0: Understand pre-export compliance verification programme for a produce consignment						
11 - 12	6.1 Describe the pre-export verification sequence.	• Explain the pre-export verification sequence:	Laptop computers,	• Design a complete pre-	Guide students to: • Design a	Verification programme

	6.2 Explain sampling and testing protocols for different risk levels. 6.3 Explain compliance failure consequences.	production records review, residue testing (sampling, laboratory analysis, result interpretation), phytosanitary inspection, and certificate issuance • Discuss sampling and testing protocols for different risk levels: high-risk (EU Annex II commodities), medium-risk, and standard inspection regimes • Explain compliance failure consequences: RASFF notifications, commercial costs, market bans, and reputational damage	smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos, etc.	export compliance verification programme for a 200-tonne produce export lot destined for Europe • Specifications for all testing requirements, sampling plan, timeline, documentation, and decision rules • Present programme before a simulated buyer compliance panel • Report findings	complete pre-export compliance verification programme for a 200-tonne produce export lot destined for Europe • Specify all testing requirements, sampling plan, timeline, documentation, and decision rules • Present programme before a simulated buyer compliance panel • Report findings	template, EU compliance checklist, sesame export scenario cards, computers, projector, PPE, smartphones.
General Objective 7.0: Know food safety incident management and product recall systems in export operations						
13 - 14	7.1 Describe RASFF (Rapid Alert System for Food and Feed) notification and response mechanisms. 7.2 Explain product recall	• Explain RASFF (Rapid Alert System for Food and Feed) notification and response mechanisms:	Laptop computers, smart board, Projector, Writing	• Access RASFF portal and identify 3 food safety notifications relevant to West	Guide students to: • Access RASFF portal and identify 3 food safety	RASFF portal access, crisis communication templates, buyer notification script,

	procedures. 7.3 Explain crisis communication.	notification types (alert, information, border rejection), information sharing, and Nigerian NAFDAC interface • Explain product recall procedures: voluntary vs mandatory recall, recall strategy (consumer-level, retail-level, trade-level), effectiveness checks, and documentation • Explain crisis communication: regulatory body notification, buyer communication, consumer communication, and media management during a food safety incident	Materials, White board, Markers, Internet, Pictures, Videos, etc.	African produce in the past 2 years For the highest-risk notification • Draft a simulated exporter crisis response plan including buyer notification, regulatory communication, and corrective action • Present crisis response plan to class • Peer review and report	notifications relevant to West African produce in the past 2 years For the highest-risk notification, • Draft a simulated exporter crisis response plan including buyer notification, regulatory communication, and corrective action • Present crisis response plan • Peer review and report	computers, internet, projector, PPE, smartphones.
General Objective 8.0: Understand sensory Evaluation Methods and Consumer Quality Perception for Export Produce						
15	8.1 Explain sensory evaluation methods for export produce 8.2 Explain consumer quality perception in key export markets. 8.3 Describe the application of sensory evaluation data in	• Describe sensory evaluation methods for export produce: affective methods (hedonic rating scales, preference tests), discriminative methods	Laptop computers, smart board, Projector, Writing Materials, White	• Conduct hedonic rating panel with blinded samples • Apply triangle test methodology correctly • Analyse results	Guide students to: • Conduct hedonic rating panel with blinded samples • Apply triangle	Sesame oil samples (3 origins/methods), hedonic rating scale forms, triangle test score cards,

	produce export.	(triangle test, duo-trio test), and descriptive analysis methods (Quantitative Descriptive Analysis, texture profile analysis vocabulary for produce) • Explain consumer quality perception in key export markets: EU consumer expectations for fresh produce appearance, texture, and flavour; Asian and Gulf market colour and firmness preferences; and how consumer preferences drive buyer specification requirements • Discuss the application of sensory evaluation data in produce export: informing grading standard calibration, supporting premium pricing strategy, reducing post-import rejection rates, and guiding product development for value-added exports	board, Markers, Internet, Pictures, Videos, etc.	statistically • Determine commercial grade implication • Present the Recorded findings in class as a seminar	test methodology correctly • Analyse results statistically • Determine commercial grade implication • Facilitate presentations • Organize interactive session with an industrialist • Record findings and present above in class as a seminar	blinding apparatus, statistical table for binomial test, computers, projector, peroxide value / rancidity test kit, PPE, smartphones.
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Course Assessment:

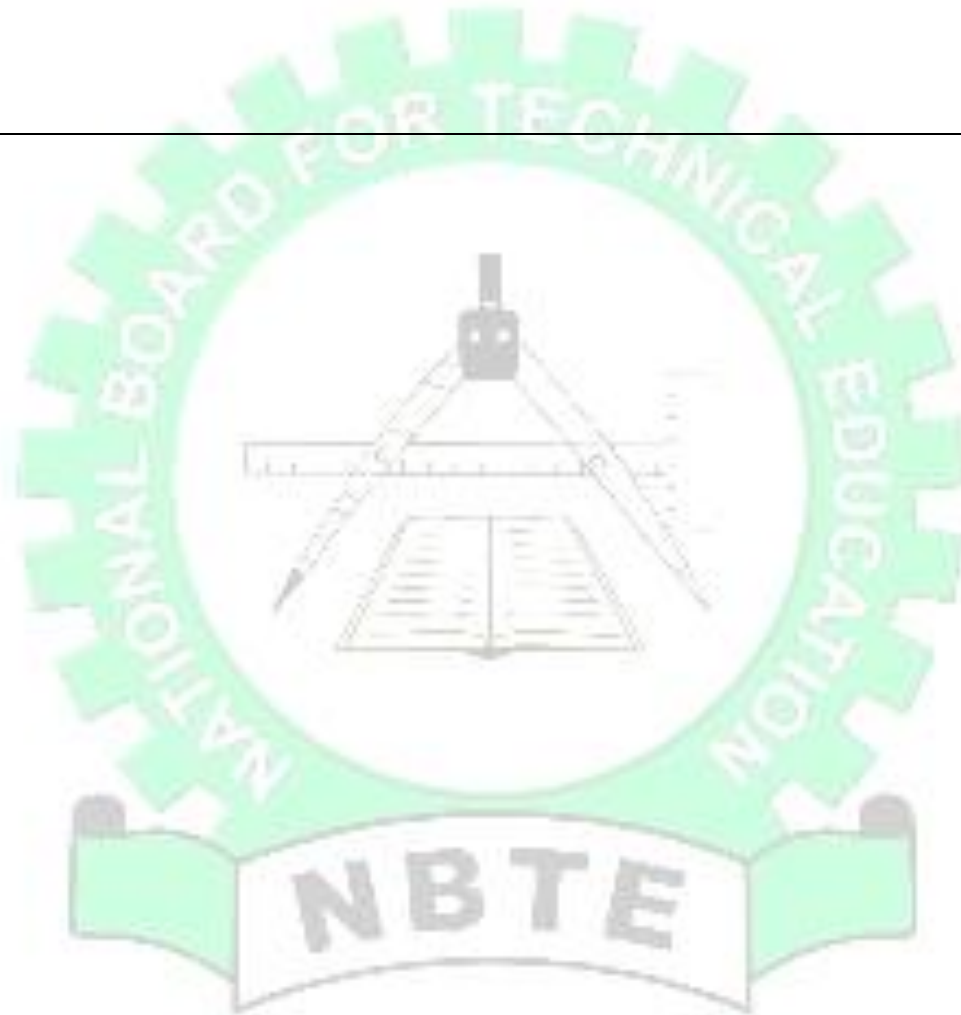
Course work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%



FOOD CHEMISTRY, ANALYTICAL INSTRUMENTATION AND QUALITY CONTROL

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: FOOD CHEMISTRY, ANALYTICAL INSTRUMENTATION AND QUALITY CONTROL	COURSE CODE: PIE 313	CONTACT HOURS: 4 HOURS/WEEK
YEAR: I 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 food chemistry analysis, analytical instrumentation operation, statistical quality control, and microbiological safety testing		
GENERAL OBJECTIVES: At the end of this course, the students should be able to: 1.0 Know analytical chemistry principles to produce quality assessment; 2.0 Understand HPLC and UV-Vis spectrophotometry for produce quality analysis; 3.0 Understand LC-MS and GC-MS principles for pesticide and mycotoxin residue analysis; 4.0 Know Near-InfraRed light (NIR) spectroscopy for rapid produce quality screening; 5.0 Understand statistical quality control methods to produce inspection data; 6.0 Understand sensory and texture evaluation methods in produce grading; 7.0 Know analytical results in export compliance decision systems; 8.0 Understand Food Microbiology and Microbiological Safety for Export Produce.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: FOOD CHEMISTRY, ANALYTICAL INSTRUMENTATION AND QUALITY CONTROL			COURSE CODE: PIE 313	CONTACT HOURS: 4 HOURS/WEEK		
			CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK		
YEAR: I 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 in food chemistry analysis, analytical instrumentation operation, statistical quality control, and microbiological safety testing						
General Objective 1.0: Know analytical chemistry principles to produce quality assessment						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1 - 2	1.1 Explain analytical method performance parameters. 1.2 Describe analytical method validation requirements per adherence to strict sanitation and hygiene standard per the EU SANTE/12682/2019 guidelines for produce export compliance laboratories. 1.3 Explain the concept of fitness for purpose.	• Discuss analytical method performance parameters: accuracy, precision, specificity, linearity, LOD, LOQ, and measurement uncertainty — applied to produce quality and compliance testing • Describe analytical method validation requirements per Adherence to strict Sanitation and hygiene standard (SANTE) for produce export compliance laboratories • Discuss the concept of fitness for purpose: how	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	• Calculate LOD, LOQ, and recovery from provided calibration data for a refractometer-based Brix measurement and a UV-Vis vitamin C determination • Plot calibration curves and evaluate method linearity • Determine whether the methods meet	Guide students to: • Calculate LOD, LOQ, and recovery from provided calibration data for a refractometer-based Brix measurement and a UV-Vis vitamin C determination • Plot calibration curves and evaluate method linearity • Determine whether the	Calibration data sets, graph paper/computers, spreadsheet software, calculators, practical, manual, PPE, smartphones.

		analytical method performance requirements are set by MRL limits, measurement uncertainty, and decision rules		fitness-for-purpose requirements for the intended analytical application.	methods meet fitness-for-purpose requirements for the intended analytical application • Organize interactive session with an industrialist	
General Objective 2.0: Understand HPLC and UV-Vis spectrophotometry for produce quality analysis						
3 - 4	2.1 Explain HPLC system components. 2.2 Explain HPLC method parameters. 2.3 Explain UV-Vis spectrophotometry operating principles, Beer-Lambert law, and calibration procedure for food quality parameters	• Describe HPLC system components: pump, injector, column types (C18, C8, HILIC), detectors (UV, DAD, FLD, MS), and data system — and how each component affects separation quality • Discuss HPLC method parameters: mobile phase composition, gradient elution, flow rate, column temperature, and injection volume — and their effects on peak resolution and analysis time • Describe UV-Vis	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	• Operate UV-Vis spectrophotometer to measure vitamin C content in two produce juice samples at 265 nm • Construct calibration curve from 5 ascorbic acid standards and calculate sample concentration • Operate HPLC system (or interpret provided HPLC chromatogram)	Guide students to: • Operate UV-Vis spectrophotometer to measure vitamin C content in two produce juice samples at 265 nm • Construct calibration curve from 5 ascorbic acid standards and calculate sample concentrations • Operate HPLC system (or interpret provided HPLC	UV-Vis spectrophotometer, ascorbic acid standards, juice samples, pipettes, cuvettes, lab manual, HPLC chromatogram data sets, Internet, PPE, smartphones.

		spectrophotometry operating principles, Beer-Lambert law, and calibration procedure for food quality parameters		to assess method resolution and peak purity	chromatogram) to assess method resolution and peak purity	
General Objective 3.0: Understand LC-MS and GC-MS principles for pesticide and mycotoxin residue analysis						
5 – 6	3.1 Explain LC-MS/MS system components and operating principles. 3.2 Explain QuEChERS extraction procedure for pesticide residue analysis. 3.3 Describe GC-MS applications for volatile food contaminants.	- Describe LC-MS/MS system components and operating principles: electrospray ionisation (ESI), triple quadrupole mass analyser, MRM transitions, and sensitivity - Discuss QuEChERS extraction procedure for pesticide residue analysis: acetonitrile extraction, salting-out, dispersive-SPE cleanup, and solvent exchange - Describe GC-MS applications for volatile food contaminants: headspace GC-MS for flavour compounds and halogenated solvents in food packaging	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, etc.	- Perform QuEChERS extraction from a spiked groundnut sample and prepare extract for LC-MS analysis - Interpret a provided LC-MS/MS chromatogram identifying pesticide residue peaks - Compare identified residue concentrations against EU and Codex Alimentarius MRL limits and classify compliance status - Report findings	Guide students to: - Perform QuEChERS extraction from a spiked groundnut sample and prepare extract for LC-MS analysis - Interpret a provided LC-MS/MS chromatogram identifying pesticide residue peaks - Compare identified residue concentrations against EU and Codex Alimentarius MRL limits and	Groundnut samples, QuEChERS reagents, centrifuge, LC-MS/MS chromatogram data sets, EU MRL tables, Codex MRL tables, computers, PPE, smartphones.

					classify compliance status	
General Objective 4.0: Know Near-InfraRed light (NIR) spectroscopy for rapid produce quality screening						
7 – 8	4.1 Explain NIR spectroscopy principles. 4.2 Explain NIR applications in produce inspection. 4.3 Describe NIR calibration model limitations.	- Describe NIR spectroscopy principles: diffuse reflectance, overtone absorption bands, chemometric analysis (PLS, PCR), and calibration model development - Discuss NIR applications in produce inspection: grain moisture, protein, oil content, aflatoxin screening, and intact fruit quality (Brix, firmness, acidity) - Discuss NIR calibration model limitations: matrix effects, geographic variation, seasonal variation, and the need for local reference method validation	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc	- Operate portable NIR device to measure moisture content and protein content of 5 grain samples - Record NIR predictions and compare to oven-drying reference moisture values - Calculate prediction error and evaluate whether the NIR calibration meets ISO 17025 fitness-for-purpose requirements - Report findings	Guide students to: - Operate portable NIR device to measure moisture content and protein content of 5 grain samples - Record NIR predictions and compare to oven-drying reference moisture values - Calculate prediction error and evaluate whether the NIR calibration meets ISO 17025 fitness-for-purpose requirements	Portable NIR device, grain samples, laboratory oven, weighing balance, correlation calculation worksheet, computers, internet, PPE, smartphones.
General Objective 5.0: Understand statistical quality control methods to produce inspection data						
9 - 10	5.1 Explain statistical process control (SPC) concepts.	Describe statistical process control (SPC) concepts: control charts	Laptop computers, smart board,	Construct an Xbar-R control chart from 20	Guide students to: Construct an Xbar-R control	Weight measurement data sets, control chart

	5.2 Explain acceptance sampling theory. 5.3 Describe measurement system analysis (MSA) and gauge RandR studies for produce quality measurement instruments	(Xbar-R, p-chart, np-chart, c-chart, u-chart), control limits vs specification limits, and process capability indices (Cp, Cpk) • Discuss acceptance sampling theory: QC curves, AQL, LTPD, producer's risk, consumer's risk, and MIL-STD-1916/ISO 2859 sampling plans • Discuss measurement system analysis (MSA) and gauge RandR studies for produce quality measurement instruments	Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	subgroups of produce weight measurement • Calculate process capability index (Cpk) and determine whether the process is capable of meeting export weight specification • Interpret control chart signals and recommend corrective actions	chart from 20 subgroups of produce weight measurement • Calculate process capability index (Cpk) and determine whether the process is capable of meeting export weight specification • Interpret control chart signals and recommend corrective	templates, calculators, computers, projector, SPC manual, PPE, smartphones.
General Objective 6.0: Understand sensory and texture evaluation methods in produce grading						
11 - 12	6.1 Explain instrumental texture analysis. 6.2 Explain electronic nose (e-nose) and electronic tongue (e-tongue) applications in produce quality and authenticity assessment 6.3 Describe sensory panel design for analytical sensory evaluation.	• Describe instrumental texture analysis: texture profile analysis (TPA) parameters — hardness, cohesiveness, springiness, gumminess, chewiness — and penetrometer testing for produce firmness • Discuss electronic nose (e-nose) and electronic tongue (e-tongue)	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	• Conduct a texture profile analysis (TPA) of three produce samples using penetrometer or texture analyser • Record all TPA parameters and compare against export quality specification	Guide students to: • Conduct a texture profile analysis (TPA) of three produce samples using penetrometer or texture analyser • Record all TPA parameters and compare against export quality	Penetrometer or texture analyser, produce samples, sensory evaluation forms, statistical tables, computers, projector, colorimeter, analytical balance (0.001 g), PPE,

		applications in produce quality and authenticity assessment • Discuss sensory panel design for analytical sensory evaluation: trained panel recruitment, training protocol, reference standards, and statistical analysis of panel data		limits • Design a triangle test discriminative panel for detecting quality differences between two produce treatments; conduct test with class as panelists and analyse results • Record findings	specification limits • Design a triangle test discriminative panel for detecting quality differences between two produce treatments; conduct test with class as panellists and analyse results	smartphones.
General Objective 7.0: Know analytical results in export compliance decision systems						
13 - 14	7.1 Explain decision rules for interpreting analytical results with measurement uncertainty. 7.2 Explain Laboratory Information Management System (LIMS) functionality for produce export laboratories. 7.3 Describe proficiency testing programmes for produce export laboratories.	• Describe decision rules for interpreting analytical results with measurement uncertainty: expanded uncertainty, guard band approach, ISO/IEC 17025 conformity assessment requirements • Discuss Laboratory Information Management System (LIMS) functionality for produce export laboratories: sample	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	• Apply the guard band decision rule to 5 borderline analytical results for pesticide residues — where expanded measurement uncertainty is provided • Determine whether each result should be classified as compliant, non-compliant, or	Guide students to: • Apply the guard band decision rule to 5 borderline analytical results for pesticide residues — where expanded measurement uncertainty is provided • Determine whether each result should be classified as	Analytical result data sets, measurement uncertainty worksheets, ISO 17025 conformity decision table, test report template, computers, internets, PPE, smartphones.

		login, result validation, certificate generation, and data archiving • Discuss proficiency testing programmes for produce export laboratories: FAPAS, BIPEA, EAPHL — selection criteria, z-score interpretation, and accreditation implications		inconclusive • Draft ISO 17025-compliant test reports for 2 of the results • Report findings	compliant, non-compliant, or inconclusive • Draft ISO 17025-compliant test reports for 2 of the results • Report findings	
General Objective 8.0: Understand Food Microbiology and Microbiological Safety for Export Produce						
15	8.1 Explain microbiological safety criteria for export produce under EU Commission Regulation (EC) 2073/2005. 8.2 Explain rapid microbiological testing methods for export compliance. 8.3 Explain microbiological risk management across the produce export chain.	• Describe microbiological safety criteria for export produce under EU Commission Regulation (EC) 2073/2005: process hygiene criteria (Total Viable Count/TVC, Enterobacteriaceae) and food safety criteria (Salmonella spp., E. coli O157:H7, Listeria monocytogenes) — and how to apply these to Nigerian export produce categories • Discuss rapid microbiological testing	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	• Conduct ATP bioluminescence hygiene monitoring at 5 critical points in a simulated produce handling facility (harvest knife, packing table, water tank, storage box, worker hands) • Perform a Salmonella lateral flow immunoassay on a produce wash water extract prepared from 25g	Guide students to: • Conduct ATP bioluminescence hygiene monitoring at 5 critical points in a simulated produce handling facility (harvest knife, packing table, water tank, storage box, worker hands) • Perform a Salmonella lateral flow immunoassay on a produce wash	ATP luminometer, ATP swab kits, Auto clave, Incubator, laminar flow cabinet, microbiological media, MPN table, Salmonella lateral flow immunoassay kits, produce wash water extract, EC 2073/2005 criteria reference table, corrective action decision matrix,

		methods for export compliance: ATP bioluminescence for hygiene monitoring of surfaces and water, lateral flow immunoassay (LFI) for rapid Salmonella detection, and real-time PCR methods for pathogen identification • Discuss microbiological risk management across the produce export chain: pre-harvest irrigation water quality testing (Codex WHO water quality criteria for E. coli), post-harvest decontamination options (chlorine wash, peracetic acid, UV-C), and investigation of microbiological exceedances		of produce seeds • Interpret both sets of results against EC 2073/2005 process hygiene criteria (ATP: <100 RLU pass threshold) and food safety criteria (Salmonella: absent in 25g) • Carry out coliform test for any known seeds • Determine corrective action requirements for any exceedances and record all findings	water extract prepared from 25g of sesame seeds • Interpret both sets of results against EC 2073/2005 process hygiene criteria (ATP: <100 RLU pass threshold) and food safety criteria (Salmonella: absent in 25g) • Determine corrective action requirements for any exceedances and record all findings	lab coats, disposable gloves, protective eyewear, PPE, smartphones.
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

COLD CHAIN MANAGEMENT, REFRIGERATED LOGISTICS AND TEMPERATURE CONTROL

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: COLD CHAIN MANAGEMENT, REFRIGERATED LOGISTICS AND TEMPERATURE CONTROL	COURSE CODE: PIE 314	CONTACT HOURS: 4 HOURS/WEEK
YEAR: I 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 cold chain system design, refrigerated transport management, temperature monitoring technology, international cold chain compliance standards, and cold chain performance optimisation for agricultural export operations.		
GENERAL OBJECTIVES: At the end of this course, the students should be able to: 1.0 Understand thermodynamic principles governing cold chain design for produce export; 2.0 Know controlled atmosphere and modified atmosphere systems for export produce; 3.0 Understand temperature/relative humidity monitoring technologies and cold chain data management systems; 4.0 Understand refrigerated transport systems and cold chain logistics for export operations; 5.0 Understand international cold chain compliance standards and food safety regulations; 6.0 Understand cold chain management plan for a perishable export operation; 7.0 Understand cold chain performance metrics and continuous improvement systems.		

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COURSE TITLE: COLD CHAIN MANAGEMENT, REFRIGERATED LOGISTICS AND TEMPERATURE CONTROL			COURSE CODE: PIE 314		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I 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 in cold chain system design, refrigerated transport management, temperature monitoring technology, international cold chain compliance standards, and cold chain performance optimisation for agricultural export operations.						
General Objective 1.0: Understand thermodynamic principles governing cold chain design for produce export						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain refrigeration thermodynamics. 1.2 Explain cooling load calculation methods. 1.3 Describe cold room design parameters.	• Discuss refrigeration thermodynamics: vapour compression cycle, Absorption Refrigeration System (ARS), Coefficient of Performance (COP), heat load components, and cooling capacity calculations for produce cold rooms • Describe cooling load calculation methods: product heat, respiration heat, transmission heat, infiltration heat, and equipment heat for export produce facilities	Laptop Computers, Smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	• Calculate the total cooling load for a cold room storing 10 tonnes of mangoes at 12°C; include product heat, respiration heat, transmission heat, and infiltration heat components • Determine the refrigeration size and specify key parameters • Report findings	Guide students to: • Calculate the total cooling load for a cold room storing 10 tonnes of mangoes at 12°C; include product heat, respiration heat, transmission heat, and infiltration heat components • Determine the	Cooling load calculation worksheets, Produce respiration data tables, Refrigeration sizing charts, Calculators, Computers, Projector, Smartphones, PPE.

		• Discuss cold room design parameters: insulation U-values, vapour barriers, refrigerant selection, and energy efficiency standards (ASHRAE 90.1)			refrigeration size and specify key parameters	
General Objective 2.0: Know controlled atmosphere and modified atmosphere systems for export produce						
4 - 5	2.1 Differentiate Controlled Atmosphere (CA) storage from Modified Atmosphere Packaging (MAP) 2.2 Explain optimal CA gas compositions for major Nigerian export crops. 2.3 Explain CA equipment systems.	• Differentiate Controlled Atmosphere (CA) storage from Modified Atmosphere Packaging (MAP): active and passive gas management, cost implications, and suitability by produce category • Evaluate optimal CA gas compositions for major Nigerian export crops: mango, fresh pepper, and dried produce categories • Describe CA equipment systems: O₂ scrubbers, CO₂ scrubbers, N₂ generators, gas analysers, and	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	• Set up a small-scale modified atmosphere package for mango with three different gas compositions (21/0 O₂/CO₂, 5/5 O₂/CO₂, 3/10 O₂/CO₂) • Monitor gas concentrations, colour, and firmness daily for 5 days • Assess quality outcomes and determine optimal gas composition • Report findings	Guide students to: • Set up a small-scale modified atmosphere package for mango with three different gas compositions (21/0 O₂/CO₂, 5/5 O₂/CO₂, 3/10 O₂/CO₂) • Monitor gas concentrations, colour, and firmness daily for 5 days • Assess quality outcomes and determine optimal gas	MAP bags, gas injection kit, O ₂ /CO ₂ gas analyser, ethylene sensor, produce samples, monitoring forms, colorimeter, penetrometer, computers, projector smartphones, PPE.

		emergency protocols			composition	
General Objective 3.0: Understand temperature/relative humidity (RH) monitoring technologies and cold chain data management systems						
6-7	3.1 Explain temperature/RH monitoring technologies. 3.2 Explain cold chain data management systems. 3.3 Describe Global Food Safety Initiative (GS1) standard for temperature/RH data exchange and EPCIS event data for cold chain traceability	- Describe temperature/RH monitoring technologies: calibrated data loggers (USB, WiFi, cellular), IoT-enabled temperature sensors, time-temperature indicators (TTI), and RFID temperature tags - Discuss cold chain data management systems: real-time monitoring platforms, alert thresholds, exception reporting, and integration with export traceability systems - Describe GS1 standard for temperature/RH data exchange and EPCIS event data for cold chain traceability	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, etc.	- Carry out configuration and deploy of USB temperature/RH data loggers in a simulated produce storage scenario - Download and Analyse 5-day temperature/RH downloaded data and identify cold chain deviations - Prepare a cold chain compliance report identifying breaches and calculating product quality impact - Report findings	Guide students to: - Configure and deploy USB temperature/RH data loggers in a simulated produce storage scenario - Download and analyse 5-day temperature/RH data and identify cold chain deviations - Prepare a cold chain compliance report identifying breaches and calculating product quality impact	USB temperature/RH data loggers, computer, data logger software, cold chain simulation area, thermometer, hygrometer, compliance report template smartphones, PPE.
General Objective 4.0: Evaluate refrigerated transport systems and cold chain logistics for export operations						

8-9	4.1 Explain reefer container specifications. 4.2 Explain reefer Pre-Trip Inspection (PTI) procedures. 4.3 Explain cold chain insurance and liability.	• Describe reefer container specifications: Carrier, Daikin, and Thermo King systems; temperature ranges; humidity control; CA capability; and Pre-Trip Inspection (PTI) requirements • Discuss reefer Pre-Trip Inspection (PTI) procedures: temperature pull-down test, unit defrost test, and pre-cooling verification • Discuss cold chain insurance and liability: ATP Agreement (Agreement on the International Carriage of Perishable Foodstuffs), temperature excursion documentation, and commercial disputes	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	• Complete a Pre-Trip Inspection (PTI) checklist for a simulated reefer container, verifying temperature accuracy, humidity settings, and ventilation • Develop temperature/RH management recommendations for a mixed produce shipment with three different temperature requirements • Present the recorded findings	Guide students to: • Complete a Pre-Trip Inspection (PTI) checklist for a simulated reefer container, verifying temperature accuracy, humidity settings, and ventilation • Develop temperature/RH management recommendations for a mixed produce shipment with three different temperature requirements • Record and present findings	PTI checklist forms, reefer container spec sheets, mixed produce transport scenario cards, temperature/RH data logger, computers, projector, smartphones, PPE.
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General Objective 5.0: Understand international cold chain compliance standards and food safety regulations						
10-11	5.1 Explain ATP Agreement requirements. 5.2 Explain EU cold chain regulations. 5.3 Describe FSMA FSVP cold chain verification requirements.	• Describe ATP Agreement requirements: temperature ranges for perishable foods, vehicle equipment categories, and ATP certificate requirements for international shipments • Discuss EU cold chain regulations: Regulation (EC) 852/2004 temperature/RH requirements, EU 37/2005 temperature monitoring in transport, and EU 1169/2011 storage condition labelling • Discuss FSMA FSVP cold chain verification requirements: supplier verification activities for temperature-controlled commodities	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	• Review a provided cold chain temperature record for a reefer shipment from Lagos to Rotterdam • Identify temperature deviations, classify each against ATP/EU compliance requirements • Prepare a compliance assessment report with corrective action and recommendations • Report findings	Guide students to: • Review a provided cold chain temperature record for a reefer shipment from Lagos to Rotterdam • Identify temperature deviations, classify each against ATP/EU compliance requirements • Prepare a compliance assessment report with corrective action recommendations	Simulated temperature records, ATP/EU compliance checklists, compliance report template, temperature/RH data logger, computers, projector smartphones, PPE.
General Objective 6.0: Understand a cold chain management plan for a perishable export operation						
12 - 13	6.1 Explain components of a cold chain	• Describe components of a cold chain	Laptop computers,	• Develop a complete cold chain	Guide students to: • Develop a	Cold chain management

	management plan. 6.2 Describe cold chain risk assessment 6.3 Explain cold chain investment cost-benefit analysis.	management plan: pre-cooling protocol, transport specifications, monitoring requirements, temperature deviation response, documentation, and continuous improvement • Discuss cold chain risk assessment: FMEA approach to cold chain risk identification, probability and severity scoring, critical control point designation • Discuss cold chain investment cost-benefit analysis: equipment costs, energy costs, spoilage reduction savings, and premium market price benefits	smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	management plan for a 100-tonne mango export operation from Benue to Rotterdam; include pre-cooling protocol, reefer specifications, temperature monitoring plan, deviation response procedure, and cost-benefit estimate • Present and defend plan before class	complete cold chain management plan for a 100-tonne mango export operation from Benue to Rotterdam; include pre-cooling protocol, reefer specifications, temperature monitoring plan, deviation response procedure, and cost-benefit estimate • Present and defend plan before class	plan template, reefer specs, monitoring equipment list, cost-benefit worksheet, temperature/RH data logger, computers, projector, smartphones, PPE.
General Objective 7.0: Understand cold chain performance metrics and continuous improvement systems						
14 - 15	7.1 Describe KPIs for cold chain performance. 7.2 Explain cold chain audit protocols. 7.3 Explain emerging cold chain technologies.	• Discuss KPIs for cold chain performance: Mean Kinetic Temperature (MKT), temperature excursion frequency, cold chain	Laptop computers, smart board, Projector, Writing Materials,	• Calculate Mean Kinetic Temperature (MKT) from a 10-day temperature dataset of a reefer	Guide students to: • Calculate Mean Kinetic Temperature (MKT) from a 10-day	Temperature/RH data logger/sets, MKT calculation formula

		compliance rate, product spoilage rate, and energy efficiency metrics • Discuss cold chain audit protocols: BRC Distribution Standard, GFSI cold chain audit requirements, and internal cold chain audit procedures • Discuss emerging cold chain technologies: active MAP reefer containers, blockchain-connected temperature monitoring, AI-powered predictive quality alerts	White board, Markers, Internet, Pictures, Videos, etc.	consignment • Determine whether the consignment temperature complies with product storage specifications • Prepare a cold chain audit report identifying improvement opportunities • Report findings	temperature dataset of a reefer consignment • Determine whether the consignment temperature complies with product storage specifications • Prepare a cold chain audit report identifying improvement opportunities	worksheet, computers, spreadsheet software, cold chain audit report template, smartphones, PPE.
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

DIGITAL INSPECTION SYSTEMS, MACHINE VISION AND IOT INTEGRATION

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: DIGITAL INSPECTION SYSTEMS, MACHINE VISION AND IoT INTEGRATION	COURSE CODE: PIE 315	CONTACT HOURS: 4 HOURS/WEEK
YEAR: I 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 digital produce inspection technologies including machine vision, hyperspectral imaging, IoT sensor systems, artificial intelligence applications, and blockchain traceability.		
GENERAL OBJECTIVES: At the end of this course, the students should be able to: 1.0 Know machine vision systems for produce grading and defect detection; 2.0 Understand hyperspectral and multispectral imaging for produce quality assessment; 3.0 Understand the design and how to deploy IoT sensor networks for produce inspection and storage monitoring; 4.0 Know artificial intelligence and machine learning applications in produce inspection; 5.0 Understand digital traceability technologies for export produce supply chains; 6.0 Know how to manage automated inspection workflow and digital quality management systems; 7.0 Understand the future trajectory of digital inspection technologies and regulatory readiness.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: DIGITAL INSPECTION SYSTEMS, MACHINE VISION AND IoT INTEGRATION			COURSE CODE: PIE 315		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I 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 in digital produce inspection technologies including machine vision, hyperspectral imaging, IoT sensor systems, artificial intelligence applications, and blockchain traceability.						
General Objective 1.0: Know machine vision systems for produce grading and defect detection						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain machine vision system architecture. 1.2 Explain colour space models used in produce grading. 1.3 Explain commercial machine vision grading systems.	- Describe machine vision system architecture: illumination design (structured light, LED arrays), camera types (CCD, CMOS, line-scan, area-scan), image acquisition parameters, and signal processing pipeline - Discuss colour space models used in produce grading: RGB, HSV, L*a*b* (CIELAB) — and how colour parameters correlate with ripeness, defect, and quality grade - Discuss commercial	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	- Analyse a set of 30 produce images using image processing software (or a provided pre-labelled dataset) - Calculate L*, a*, b* colour parameters for each image and build a classification model distinguishing 3 quality grades - Construct a confusion matrix and calculate classification accuracy, precision, and recall - Record findings	Guide students to: - Analyse a set of 30 produce images using image processing software (or a provided pre-labelled dataset) - Calculate L*, a*, b* colour parameters for each image and build a classification model distinguishing 3 quality	Produce image dataset, image analysis software (ImageJ or equivalent), colour parameter calculation worksheet, computers, projector, smartphones, PPE.

		machine vision grading systems: GREEFA, TOMRA, Key Technology — grading accuracy benchmarks and operational requirements			grades • Construct a confusion matrix and calculate classification accuracy, precision, and recall	
General Objective 2.0: Understand hyperspectral and multispectral imaging for produce quality assessment						
4-5	2.1 Explain hyperspectral imaging principles. 2.2 Explain multispectral imaging applications. 2.3 Describe drone-based multispectral imaging for pre-harvest quality prediction.	- Describe hyperspectral imaging principles: spectral acquisition process, band selection for specific quality parameters, data cube structure, and chemometric analysis (PCA, PLSR) - Discuss multispectral imaging applications: NDVI and NIR band combinations for produce maturity assessment, early disease detection, and bruise detection under intact skin - Discuss drone-based multispectral imaging for pre-harvest quality prediction: NDVI mapping for crop	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	- Analyse a provided hyperspectral image data file for a produce sample. - Identify spectral bands associated with moisture content and mycotoxin-associated fluorescence - Apply PCA to reduce data dimensionality and classify samples into quality categories - Use drone to capture or pre-harvest quality - Interpret spectral profiles and validate classification - Record findings	Guide students to: - Analyse a provided hyperspectral image data file for a produce sample and identify spectral bands associated with moisture content and mycotoxin-associated fluorescence - Apply PCA to reduce data dimensionality and classify samples into quality	Hyperspectral image datasets (provided), PCA analysis software or spreadsheet, computers, projector, drone, practical manual smartphones, PPE.

		uniformity, stress detection, and targeted harvest management			categories • Use drone to capture or pre-harvest quality • Interpret spectral profiles and validate classification	
General Objective 3.0: Understand the design and how to deploy IoT sensor networks for produce inspection and storage monitoring						
6-7	3.1 Explain IoT network architectures for produce monitoring. 3.2 Explain sensor specifications for produce quality monitoring. 3.3 Describe IoT data management.	• Discuss IoT network architectures for produce monitoring: sensor node types, gateway protocols (LoRaWAN, WiFi, NB-IoT), cloud connectivity, data storage, and dashboard visualization • Discuss sensor specifications for produce quality monitoring: temperature, relative humidity, CO₂, ethylene, VOC sensors — calibration requirements and drift management • Describe IoT data management: cloud platform options (AWS IoT, ThingSpeak, Azure IoT Hub), edge	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, etc.	• Deploy an IoT sensor network in a simulated produce storage scenario using 3 temperature/humidity sensor nodes • Configure alert thresholds for temperature (25, 30, 35°C) and relative humidity (70%) • Monitor data for 24 hours. • Identify any alert events and prepare a storage condition report • Report findings	Guide students to: • Deploy an IoT sensor network in a simulated produce storage scenario using 3 temperature/humidity sensor nodes • Configure alert thresholds for temperature (25, 30, 35°C) and relative humidity (70%) • Monitor and download data for 24 hours;	IoT temperature/humidity sensor nodes, gateway device, IoT platform access (ThingSpeak or equivalent), computers, internet, projector, smartphones, PPE.

		computing for local alarm processing, and data security			identify any alert events and prepare a storage condition report	
General Objective 4.0: Know artificial intelligence (AI) and machine learning (ML) applications in produce inspection						
8-9	4.1 Describe AI/ML model types used in produce inspection. 4.2 Explain AI model training requirements. 4.3 Explain deployment challenges for AI inspection systems. 4.4 Explain principles of predictive modelling using AI tools.	• Discuss AI/ML model types used in produce inspection: convolutional neural networks (CNN) for visual defect detection, regression models for quality parameter prediction, and anomaly detection algorithms for process monitoring • Discuss AI model training requirements: labelled training datasets, data augmentation, transfer learning from pre-trained models, and model validation approaches • Describe deployment challenges for AI inspection systems: model accuracy vs speed tradeoffs, environmental lighting variability,	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	• Use a pre-trained image classification model (Google Teachable Machine or equivalent) to classify produce samples into accept/reject quality categories • Evaluate model accuracy against human expert classification for 20 samples • Document model performance metrics and identify failure modes • Perform predictive modelling using AI tools of a given data set for perishable commodity • Report findings	Guide students to: • Use a pre-trained image classification model (Google Teachable Machine or equivalent) to classify produce samples into accept/reject quality categories • Evaluate model accuracy against human expert classification for 20 samples • Document model performance metrics and identify failure	Smartphones or computers with internet, Google Teachable Machine access, produce samples, AI Apps., accuracy calculation worksheet, computers, PPE.

		operator acceptance, and regulatory acceptance of AI-based official inspection • Discuss principles of predictive modelling using AI tools.			modes • Perform predictive modelling using AI tools of a given data set for perishable commodity	
General Objective 5.0: Understand digital traceability technologies for export produce supply chains						
10-11	5.1 Explain blockchain technology applications in produce traceability. 5.2 Explain QR code, RFID, and NFC data carrier technologies for produce traceability. 5.3 Describe international traceability requirements.	• Discuss blockchain technology applications in produce traceability: permissioned vs public blockchain, IBM Food Trust, FarmTrace, Provenance — comparing throughput, governance, cost, and regulatory acceptance • Discuss QR code, RFID, and NFC data carrier technologies for produce traceability: read range, data capacity, environmental durability, and integration with inspection records • Describe international traceability requirements: EU General Food Law	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	• Design a traceability system for a Nigerian sesame export lot from farm to EU customer delivery • Map all traceability data capture points and specify the data carrier, data fields, and responsible party at each point • Create mock blockchain traceability entries for 3 critical events using a simulated platform • Report findings	Guide students to: • Design a traceability system for a Nigerian sesame export lot from farm to EU customer delivery • Map all traceability data capture points and specify the data carrier, data fields, and responsible party at each point	Smartphones, QR code generator, IBM Food Trust App., mock blockchain simulation platform, traceability design template, computers, internet, PPE.

		(EC 178/2002) one-step-forward one-step-back traceability, FSMA Rule 204 enhanced traceability, and GS1 EPCIS standard			• Create mock blockchain traceability entries for 3 critical events using a simulated platform	
General Objective 6.0: Know automated inspection workflow and digital quality management systems						
12-13	6.1 Explain integrated digital inspection workflow. 6.2 Explain Electronic Document Management Systems (EDMS) for inspection bodies. 6.3 Describe cybersecurity requirements for inspection systems.	• Discuss integrated digital inspection workflow: digital sampling records → automated grading → LIMS analytical results → blockchain certificate → digital phytosanitary certificate (ePhyto) • Discuss Electronic Document Management Systems (EDMS) for inspection bodies: document control, version management, access control, and audit trail requirements per ISO 17020 • Explain cybersecurity requirements for inspection systems: data integrity, authentication, encrypted transmission, and backup systems	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	• Map a complete digital inspection workflow for a simulated 20-tonne sesame export consignment from field sampling to ePhyto certificate issuance • Identify workflow failure points and document recovery procedures • Demonstrate document version control using a cloud-based EDMS simulation • Record findings	Guide students to: • Map a complete digital inspection workflow for a simulated 20-tonne sesame export consignment from field sampling to ePhyto certificate issuance • Identify workflow failure points and document recovery procedure • Demonstrate document	Digital workflow template, EDMS simulation (Google Drive or SharePoint), computers, internet, projector, smartphones, PPE.

					version control using a cloud-based EDMS simulation	
General Objective 7.0: Understand the future trajectory of digital inspection technologies and regulatory readiness						
14-15	7.1 Explain emerging inspection technologies. 7.2 Explain regulatory digitalisation trends. 7.3 Describe professional development pathways for digital inspection roles.	• Discuss emerging inspection technologies: terahertz spectroscopy for sub-surface contaminant detection, acoustic emission sensing for internal quality, and X-ray imaging for internal defect detection in intact produce • Discuss regulatory digitalisation trends: IPPC ePhyto Hub expansion, EU Digital Product Passport requirements, and WTO digital trade facilitation developments affecting produce inspection • Explain professional development pathways for digital inspection roles: relevant certifications (ISO 17020 lead auditor, IRCA food safety auditor, digital agriculture certificates),	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc	• Research one emerging digital inspection technology not covered in the course (e.g., terahertz imaging, acoustic emission, X-ray inspection) • Prepare a structured presentation covering: technology principles, current commercial applications; limitations, and readiness for Nigerian export inspection deployment • Present the findings to the class and respond to peer questions • Visit an industrialized grain milling facility or an automated agricultural sorting plant equipped with optical sortation technology (e.g BUHLER facility in Northern Nigeria Flour Mill in Kano) • Record activities	Guide students to: • Research one emerging digital inspection technology not covered in the course (e.g., terahertz imaging, acoustic emission, X-ray inspection) Prepare a 3-minute structured presentation covering: technology principles, current commercial applications, limitations, and readiness for Nigerian export inspection	Internet access, presentation software, computers, projector, research evaluation rubric, smartphones, PPE.

		and global professional networks			deployment • Present to class and respond to peer questions • Visit an industrialized grain milling facility or an automated agricultural sorting plant equipped with optical sortation technology (e.g BUHLER facility in Northern Nigeria Flour Mill in Kano) • Record activities	
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

PEST MANAGEMENT, BIOCONTROL AND INTEGRATED RESISTANCE SYSTEMS

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: PEST MANAGEMENT, BIOCONTROL AND INTEGRATED RESISTANCE SYSTEMS	COURSE CODE: PIE 316	CONTACT HOURS: 4 HOURS/WEEK
YEAR: I SEMESTER: I	CREDIT UNITS: 4	THEORETICAL: 1 HOUR/WEEK
	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is design to equips students with knowledge and skills in pesticide resistance management, biocontrol-integrated IPM, and comprehensive resistance management systems meeting international export compliance standards.		
GENERAL OBJECTIVES: At the end of this course, the students should be able to: 1.0 Know pesticide resistance mechanisms in stored product pests; 2.0 Understand bioassay protocols for resistance monitoring; 3.0 Know biological control agents for stored product pest management; 4.0 Understand hermetic storage management for insecticide resistance prevention; 5.0 Understand 12-month integrated resistance management plan; 6.0 Know phosphine resistance management in large-scale grain storage; 7.0 Understand pest management compliance documentation for export certification.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: PEST MANAGEMENT, BIOCONTROL AND INTEGRATED RESISTANCE SYSTEMS			COURSE CODE: PIE 316		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE: -		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is design to equips students with knowledge and skills in pesticide resistance management, biocontrol-integrated IPM, and comprehensive resistance management systems meeting international export compliance standards.						
General Objective 1.0: Know pesticide resistance mechanisms in stored product pests						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain target site resistance. 1.2 Explain metabolic resistance. 1.3 Describe cross-resistance patterns in <i>Tribolium castaneum</i> and <i>Sitophilus zeamais</i> and implications for insecticide/fumigant selection	- Discuss target site resistance: insensitive Acetylcholinesterase and Knockdown resistance (AChE, kdr) mutations in sodium channels, GABA receptor alterations in stored product insects - Discuss metabolic resistance: cytochrome P450 overexpression, esterase amplification, glutathione S-transferase	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	- Analyse a resistance monitoring dataset for a grain facility (5 insecticide classes, 3 years) - Calculate resistance ratios and identify required rotation strategy - Draw a resistance management decision tree - Record and present findings	Guide students to: - Analyse a resistance monitoring dataset for a grain facility (5 insecticide classes, 3 years) - Calculate resistance ratios and identify required rotation strategy - Draw a resistance management decision tree - Record and present findings	Resistance monitoring data sets, resistance ratio worksheet, decision tree template, computers, PPE, smartphones.

		upregulation • Explain cross-resistance patterns in <i>Tribolium castaneum</i> and <i>Sitophilus zeamais</i> and implications for insecticide/fumigant selection				
General Objective 2.0: Understand bioassay protocols for resistance monitoring						
4-5	2.1 Describe discriminating dose bioassay. 2.2 Explain IRAC Susceptibility Test Methods Committee standardised protocols for stored product insects 2.3 Explain statistical methods.	• Discuss discriminating dose bioassay: selection of discriminating dose, susceptible reference strain, bioassay frequency, result interpretation • Discuss IRAC Susceptibility Test Methods Committee standardised protocols for stored product insects • Discuss statistical methods: Abbott's correction, probit analysis for LD50/LC50, confidence interval reporting	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc	• Conduct a discriminating dose bioassay for deltamethrin resistance in <i>Tribolium castaneum</i> • Calculate mortality at discriminating dose and resistance ratio versus susceptible strain • Perform Abbott's correction and interpret resistance status • Record findings. • write recommendations	Guide students to: • Conduct a discriminating dose bioassay for deltamethrin resistance in <i>Tribolium castaneum</i> • Calculate mortality at discriminating dose and resistance ratio versus susceptible strain • Perform Abbott's correction and interpret resistance status • Record findings	<i>Tribolium castaneum</i> colony, deltamethrin solution, filter paper, exposure chambers, mortality count worksheets, incubator/environmental cabinet, stereo (dissecting) microscope, analytical balance, micropipettes, smartphones.

					and write recommendation s	
General Objective 3.0: Know biological control agents for stored product pest management						
6-7	3.1 Explain entomopathogenic fungi. 3.2 Describe parasitoid wasps (<i>Anisopteromalus*calandreae</i>), predatory mites, and entomopathogenic nematodes as biocontrol agents 3.3 Explain NAFDAC registration requirements and compatibility with organic export certification	• Discuss entomopathogenic fungi: <i>Beauveria bassiana</i> and <i>Metarhizium anisopliae</i> — production, formulation, mode of action, efficacy data • Explain parasitoid wasps (<i>Anisopteromalus*calandreae</i>), predatory mites, and entomopathogenic nematodes as biocontrol agents • Discuss NAFDAC registration requirements and compatibility with organic export certification	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, etc.	• Apply <i>Beauveria bassiana</i> spore suspension to produce and compare bioassay mortality to pirimiphos-methyl control over 7 days • Record mortality at 24, 48, and 72 hours • Compare efficacy • Record findings	Guide students to: • Apply <i>Beauveria bassiana</i> spore suspension to produce and compare bioassay mortality to pirimiphos-methyl control over 7 days • Record mortality at 24, 48, and 72 hours • Calculate and compare efficacy • Record findings	<i>Beauveria bassiana</i> spore suspension, pirimiphos-methyl control, produce samples, exposure chambers, observation sheets, PPE, smartphones, incubator, stereo microscope, haemocytometer, hand counter.
General Objective 4.0: Understand hermetic storage management for insecticide resistance prevention						
8-9	4.1 Explain large-scale hermetic systems. 4.2 Describe how	• Discuss large-scale hermetic systems: GrainPro Super	Laptop computers, smart board,	• Design a hermetic storage programme for a 50-tonne maize	Guide students to: • Design a hermetic storage	Hermetic system specification sheets, prototype of inert

	hermetic storage prevents resistance development by eliminating chemical selection pressure 4.3 Explain hermetic integration with organic certification, maximum storage periods, re-inspection criteria	Grain bag, inert atmosphere silo, deployment, management protocols - Discuss how hermetic storage prevents resistance development by eliminating chemical selection pressure - Discuss hermetic integration with organic certification, maximum storage periods, re-inspection criteria	Projector, Writing Materials, White board, Markers, Internet etc	export facility - Specify: system selection, filling, seal integrity monitoring, gas monitoring, resistance prevention rotation, export release criteria - Present programme to class - Record findings	programme for a 50-tonne maize export facility - Specify: system selection, filling, seal integrity monitoring, gas monitoring, resistance prevention rotation, export release criteria - Present programme to class - Record findings	atmosphere silo, programme design template, computers, projector, PPE, smartphones.
General Objective 5.0: Understand a 12-month integrated resistance management plan						
10-11	5.1 Describe 5-component IRM framework. 5.2 Explain IRAC MoA classification for rotation. 5.3 Explain IRM plan integration with export requirements.	- Explain 5-component IRM framework: monitoring, rotation, biopesticide windows, hermetic integration, annual review - Discuss IRAC MoA classification for rotation: Group 1 (OPs), Group 3 (pyrethroids), Group 28 (diamides), non-	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	- Develop a 12-month IRM plan for a 200-tonne sesame export facility; include quarterly bioassay schedule, 3-IRAC-group rotation, biopesticide windows, hermetic integration, pre-export testing protocol - Present the RM plan to the class	Guide students to: Develop a 12-month IRM plan for a 200-tonne sesame export facility; include quarterly bioassay schedule, 3-IRAC-group rotation, biopesticide windows, hermetic	IRM plan template, IRAC classification chart, bioassay schedule template, sesame export facility scenario, computers, smartphones, PPE.

		chemical alternatives • Discuss IRM plan integration with export requirements: MRL compliance, organic certification, pre-export testing		• Record findings	integration, pre-export testing protocol • Present and defend plan • Record findings	
General Objective 6.0: Know phosphine resistance management in large-scale grain storage						
12 -13	6.1 Explain phosphine resistance prevalence in Nigerian stored insects. 6.2 Describe phosphine resistance prevention protocol. 6.3 Explain sulfuryl fluoride as alternative.	• Discuss phosphine resistance prevalence in Nigerian stored insects: <i>Sitophilus zeamais</i> resistance data and impact on fumigation efficacy • Explain phosphine resistance prevention protocol: minimum CT product (ppm·h), sealed structure requirements, monitoring at 24h and 120h • Discuss sulfuryl fluoride as alternative: mode of action, registration status, efficacy against resistant populations, safety requirements	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures, Videos, etc.	• Calculate phosphine CT product for a simulated 500-tonne produce store fumigation • Determine whether CT achieves minimum 900 ppm·h for resistant populations • Modify dosage schedule to achieve resistance-defeating CT • Record all calculations with justifications	Guide students to: • Calculate phosphine CT product for a simulated 500-tonne produce store fumigation • Determine whether CT achieves minimum 900 ppm·h for resistant populations • Modify dosage schedule to achieve resistance-defeating CT • Record all calculations with justifications	CT product calculation worksheets, phosphine resistance protocol guide, calculators, computers, smartphones, PPE.
General Objective 7.0: Understand pest management compliance documentation for export certification						

14-15	7.1 Explain pest management records for export compliance. 7.2 Explain how pest management documentation supports GLOBAL G.A.P. and BRC certification audits 7.3 Explain role of pest management records in dispute resolution and rejection appeals	• Discuss pest management records for export compliance: pesticide application logs, bioassay results, fumigation records, NAQS certificates • Discuss how pest management documentation supports GLOBAL G.A.P. and BRC certification audits • Discuss role of pest management records in dispute resolution and rejection appeals	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures, Videos, etc.	• Compile a complete pest management documentation file for a simulated 90-day produce storage period; include IPM logs, fumigation records, bioassay results, corrective actions, and pre-export certificate • Conduct mock certification audit of the file • Record findings	Guide students to: • Compile a complete pest management documentation file for a simulated 90-day produce storage period Include: IPM logs, fumigation records, bioassay results, corrective actions, and pre-export certificate • Conduct mock certification audit of the file • Record findings	Pest management record templates, monitoring log forms, fumigation records, mock audit checklist, computers, smartphones, PPE.
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



RISK-BASED INSPECTION SYSTEMS AND OFFICIAL CONTROL PROCEDURES

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: RISK-BASED INSPECTION SYSTEMS AND OFFICIAL CONTROL PROCEDURES	COURSE CODE: PIE 321	CONTACT HOURS: 4 HOURS/WEEK
YEAR: I SEMESTER: II	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 designing risk-based inspection systems, applying ISO 17020 official control procedures, and managing inspection documentation meeting global export standards.		
GENERAL OBJECTIVE: At the end of this course, the students should be able to: 1.0 Understand risk-based inspection principles and the WHO/FAO risk analysis framework; 2.0 Know ISO 17020 requirements for produce inspection body management; 3.0 Know how to design official sampling plans and inspection protocols for produce export; 4.0 Know official inspection process meeting EU, US, and Gulf export market requirements; 5.0 Understand management of official inspection documentation and digital certification systems; 6.0 Understand how to manage non-conformance, disputes, and appeals in official produce inspection; 7.0 Understand continuous improvement and inspector competence assessment systems.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: RISK-BASED INSPECTION SYSTEMS AND OFFICIAL CONTROL PROCEDURES		COURSE CODE: PIE 321		CONTACT HOURS: 4 HOURS/WEEK		
		CREDIT UNIT: 4		THEORETICAL: 1 HOURS/WEEK		
YEAR: I SEMESTER: II		PRE-REQUISITE: -		PRACTICAL: 3 HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in designing risk-based inspection systems, applying ISO 17020 official control procedures, and managing inspection documentation meeting global export standards.						
General Objective 1.0: Understand risk-based inspection principles and the WHO/FAO risk analysis framework						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain WHO/FAO risk analysis framework. 1.2 Explain commodity risk profile construction for Nigerian export commodities (sesame, groundnut, cashew, cocoa, etc.) 1.3 Describe risk-based approach to inspection resource allocation and frequency prioritisation decisions	•Discuss WHO/FAO risk analysis framework: hazard identification, exposure assessment, risk characterisation, and risk management in official produce control •Discuss commodity risk profile construction for Nigerian export commodities (sesame, groundnut, cashew) •Explain risk-based approach to inspection resource allocation and frequency prioritisation	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	•Construct a risk profile for Nigerian groundnut: rate probability and severity of key hazards (aflatoxin, pesticide residue, physical contamination) •Map out inspection areas based on risk scores •Present findings to the class	Guide students to: • Construct a risk profile for Nigerian groundnut: rate probability and severity of key hazards (aflatoxin, pesticide residue, physical contamination) • Prioritise	Risk profile template, commodity hazard data, risk scoring matrix, computers, projector, FAO manuals/stats, smartphones, PPE.

		decisions			inspection areas based on risk scores • Present findings to class	
General Objective 2.0: Know ISO 17020 requirements to produce inspection body management						
4-5	2.1 Explain ISO 17020:2012 requirements. 2.2 Explain Type A, B, and C inspection body designations and their implications for Nigerian produce inspection services. 2.3 Describe ISO 17020 documentation hierarchy.	• Discuss ISO 17020:2012 requirements: independence, impartiality policy, management system, and technical requirements for inspection personnel • Discuss Type A, B, and C inspection body designations and their implications for Nigerian produce inspection services • Discuss ISO 17020 documentation hierarchy: quality manual, procedures, work instructions, forms, and records	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	• Conduct ISO 17020 gap assessment of a hypothetical inspection body • Identify non-conformities and draft a corrective action plan • Present gap assessment report to the class	Guide students to: • Conduct ISO 17020 gap assessment of a hypothetical inspection body • Identify non-conformities and draft a corrective action plan • Present gap assessment report to class	ISO 17020 gap assessment checklist, hypothetical inspection body scenario, CAP template smartphones, PPE.
General Objective 3.0: Know how to design official sampling plans and inspection protocols for produce export.						
6-7	3.1 Explain Codex	• Discuss Codex	Laptop	• Design an official	Guide students	Codex

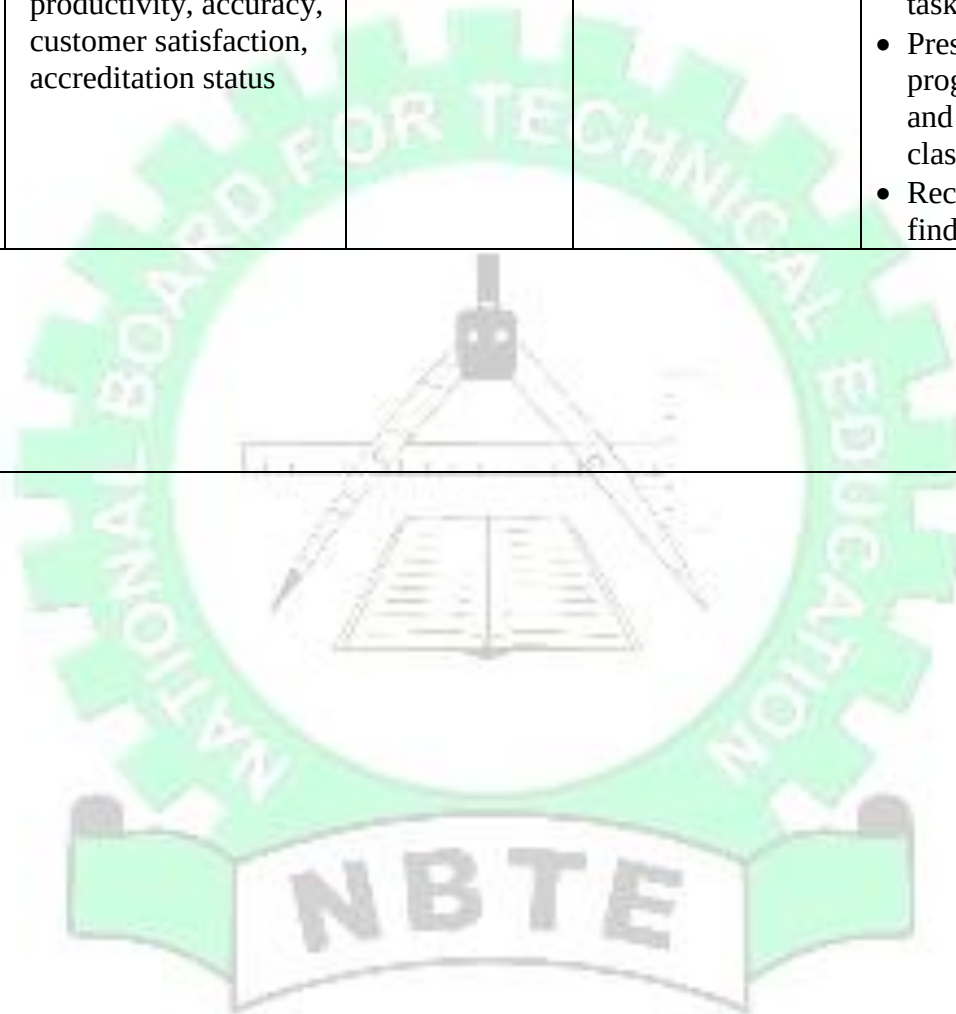
	CAC/GL 50 guidelines: representative sampling principles for heterogeneous produce lots 3.2 Describe sample size based on lot size, AQL, and inspection type (normal, tightened, reduced) 3.3 Explain stratified and probabilistic sampling plans for produce and container consignments	CAC/GL 50 guidelines: representative sampling principles for heterogeneous produce lots • Discuss sample size based on lot size, AQL, and inspection type (normal, tightened, reduced) • Discuss stratified and probabilistic sampling plans for produce and container consignments	computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, etc.	sampling plan for a 500-tonne produce export lot to the EU Specify: inspection level, AQL, increments, composite sample mass, and sub-sampling procedures • Determine sample size based on lot size, AQL, and inspection type (normal, tightened, reduced). • Execute plan on a simulated lot • Record findings	to: • Design an official sampling plan for a 500-tonne produce export lot to the EU - Specify: inspection level, AQL, increments, composite sample mass, and sub-sampling procedure • Determine sample size based on lot size, AQL, and inspection type (normal, tightened, reduced) • Execute plan on a simulated lot • Record findings	CAC/GL 50, sampling worksheets, grain probes, sample containers, calculators, smartphones, PPE, etc.
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General Objective 4.0: Know official inspection process meeting EU, US, and Gulf export market requirements						
8-9	4.1 Explain EU official inspection under Regulation (EU) 543/2011. 4.2 Explain USDA official grade standards. 4.3 Describe Gulf/UAE import inspection.	• Discuss EU official inspection under Regulation (EU) 543/2011: classification, tolerance levels, marking, and official check sampling • Discuss USDA official grade standards: certificates, grade designations, tolerance calculations for US-destined produce • Explain Gulf/UAE import inspection: municipality inspection, Halal verification, Arabic labelling compliance	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc	• Conduct official inspection of three produce lots to EU Regulation 543/2011 • Assign quality class, calculate tolerance percentages, and complete official inspection record • Simulate inspector-to-exporter compliance communication • Record findings	Guide students to: • Conduct official inspection of three produce lots to EU Regulation 543/2011 • Assign quality class, calculate tolerance percentages, and complete official inspection record • Simulate inspector-to-exporter compliance communication • Record findings	EU Regulation 543/2011 extracts, produce samples, official inspection record form, tolerance calculation worksheet smartphones.
General Objective 5.0: Understand management of official inspection documentation and digital certification systems						
10-11	5.1 Explain official document types.	• Describe official document types:	Laptop computers,	• Prepare a complete official	Guide students to:	Official document

	5.2 Explain digital certification systems. 5.3 Explain inspection report standards.	CHED, Phytosanitary Certificate, Certificate of Conformity, Certificate of Analysis, Certificate of Origin • Discuss digital certification systems: EU TRACES NT, IPPC ePhyto Hub, SON/NAQS electronic certification • Discuss inspection report standards: objectivity, mandatory data fields, chain of custody, and legal defensibility	smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc	documentation set for a produce export lot: inspection report, certificate of quality, and draft phytosanitary certificate • Verify all data fields for completeness and accuracy • Conduct mock document verification with a partner • Record findings	• Prepare a complete official documentation set for a produce export lot: inspection report, certificate of quality, and draft phytosanitary certificate • Verify all data fields for completeness and accuracy • Conduct mock document verification with a partner • Record findings	templates, produce inspection scenario data, document verification checklist, computers, smartphones, PPE.
General Objective 6.0: Understand how to manage non-conformance, disputes and appeals in official produce inspection						
12-13	6.1 Describe non-conformance management 6.2 Discuss dispute resolution.	• Explain non-conformance management: corrective action requests (CARs), root cause analysis	Laptop computers, smart board, Projector, Writing	• Analyse a provided export rejection dispute case: identify procedural failures and legal	Guide students to: • Analyse a provided export	Dispute case study handout, NCR template, root

	6.3 Discuss the inspector's role in providing legally defensible evidence in commercial trade disputes	methods, and preventive action requirements • Explain dispute resolution: re-inspection rights, split sample analysis, referee laboratory testing, and third-party mediation including arbitration panel • Explain the inspector's role in providing legally defensible evidence in commercial trade disputes	Materials, White board, Markers, Internet, Pictures, Videos, etc	issues • Draft a non-conformance investigation report with root cause and corrective actions • Present findings to a mock arbitration panel	rejection dispute case: identify procedural failures and legal issues • Draft a non-conformance investigation report with root cause and corrective actions • Present findings to a mock	cause analysis worksheet, role-play scenario cards Smartphones, PPE.
General Objective 7.0: Understand continuous improvement and inspector competence assessment systems						
14-15	7.1 Describe ISO 17020 internal audit and management review requirements for inspection body self-assessment. 7.2 Explain inspector competence assessment. 7.3 Explain performance indicators for official inspection bodies.	• Describe ISO 17020 internal audit and management review requirements for inspection body self-assessment • Discuss inspector competence assessment: technical matrices, proficiency testing programmes, witnessed inspections, and CPD requirements • Explain performance	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc	• Develop a 12-month internal audit schedule for a produce inspection body • Design an inspector competency assessment matrix covering all inspection task types • Present audit programme and matrix to class	Guide students to: • Develop a 12-month internal audit schedule for a produce inspection body • Design an inspector competency assessment matrix	Internal audit schedule template, competency matrix template, ISO 17020 reference, computers, smartphones, PPE.

		indicators for official inspection bodies: productivity, accuracy, customer satisfaction, accreditation status		• Record findings	covering all inspection task types • Present audit programme and matrix to class • Record findings	
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



INTERNATIONAL STANDARDISATION MANAGEMENT AND REGULATORY COMPLIANCE

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: INTERNATIONAL STANDARDISATION MANAGEMENT AND REGULATORY COMPLIANCE	COURSE CODE: PIE 322	CONTACT HOURS: 4 HOURS/WEEK
YEAR: I SEMESTER: II	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 of international standardisation architecture, multi-market regulatory compliance management, and tools to develop standards compliance programmes for agri-export Enterprises.		
GENERAL OBJECTIVES: At the end of this course, the students should be able to: 1.0 Understand the international standardisation architecture and WTO framework; 2.0 Know Codex Alimentarius standards to export compliance management; 3.0 Understand global food law and import requirements for Nigerian exporters; 4.0 Understand FSMA requirements for Nigerian exporters targeting the US market; 5.0 Understand a multi-market regulatory compliance programme; 6.0 Know GLOBAL G.A.P., BRC Issue 9, and FSSC 22000 certification schemes; 7.0 Understand regulatory compliance reporting and communication systems.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: INTERNATIONAL STANDARDISATION MANAGEMENT AND REGULATORY COMPLIANCE		COURSE CODE: PIE 322		CONTACT HOURS: 4 HOUR/WEEK		
		CREDIT UNIT: 4		THEORETICAL: 1 HOURS/WEEK		
YEAR: I SEMESTER: II		PRE-REQUISITE: -		PRACTICAL: 3 HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills of international standardisation architecture, multi-market regulatory compliance management, and tools to develop standards compliance programmes for agri-export Enterprises.						
General Objective 1.0: Understand the international standardisation architecture and WTO framework						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Describe three-tier standardisation structure. 1.2 Explain WTO TBT Agreement. 1.3 Explain Codex Alimentarius Commission as the authoritative reference for WTO, SPS dispute settlement	• Describe three-tier standardisation structure: ISO/IEC/ITU (global), CEN/CENELEC (regional), SON/NAFDAC (national) • Explain WTO TBT Agreement: member notification obligations and recognition of international standards • Discuss Codex Alimentarius Commission as the authoritative reference for WTO SPS dispute settlement	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	• Map international, regional, and Nigerian national standards for 3 produce quality parameters • Identify gaps and conflicts between standardisation levels • Present harmonisation recommendations to class	Guide students to: • Map international, regional, and Nigerian national standards for 3 produce quality parameters • Identify gaps and conflicts between standardisation levels • Present harmonisation	Standards mapping template, ISO/Codex/SON comparison worksheet, internet, computers, smartphones, PPE.

					recommendations to class	
General Objective 2.0: Know Codex Alimentarius standards to export compliance management						
4-5	2.1 Describe Codex standard development. 2.2 Explain Codex General Principles of Food Hygiene (CXC 1-1969 rev 2023) applied to produce export operations 2.3 Explain Codex maximum limits for mycotoxins in groundnuts and cereals versus EU limits	• Discuss Codex standard development: elaboration by commodity committees, adoption procedure, acceptance mechanisms • Discuss Codex General Principles of Food Hygiene (CXC 1-1969 rev 2023) applied to produce export operations • Discuss Codex maximum limits for mycotoxins in groundnuts and cereals versus EU limits	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	• Access Codex database and retrieve standards for 3 Nigerian export commodities • Compare Codex MRL/ML to EU equivalents and create a compliance gap table • Recommend risk mitigation for highest-risk commodity • Present findings	Guide students to: • Access Codex database and retrieve standards for 3 Nigerian export commodities • Compare Codex MRL/ML to EU equivalents and create a compliance gap table • Recommend risk mitigation for highest-risk	Codex Alimentarius online database, EU standards extracts, compliance gap template, computers, internet, smartphones, PPE.
General Objective 3.0: Understand global food law and import requirements for Nigerian exporters						
6-7	3.1 Explain EU General Food Law (EC 178/2002). 3.2 Describe EU Border Control Post (BCP)	• Discuss EU General Food Law (EC 178/2002): safety principles, traceability obligations, RASFF,	Laptop computers, smart board, Projector, Writing	• Simulate a documentary check for a produce consignment arriving at an EU	Guide students to: • Simulate a documentary check for	Blank CHED-PP form, produce export scenario data,

	procedures. 3.3 Describe EU Organic Regulation (EU 2018/848) equivalence framework for Nigerian organic produce export	emergency measures • Discuss EU Border Control Post (BCP) procedures: documentary checks, identity checks, physical checks, CHED requirements • Discuss EU Organic Regulation (EU 2018/848) equivalence framework for Nigerian organic produce export	Materials, White board, Markers, Internet, Pictures, etc.	BCP • Complete a CHED-PP form and identify compliance deficiencies • Draft a corrective action response • Record findings	a produce consignment arriving at an EU BCP • Complete a CHED-PP form and identify compliance deficiencies • Draft a corrective action response • Record findings	EU BCP procedure checklist, computers, smartphones, PPE.
General Objective 4.0: Understand FSMA requirements for Nigerian exporters targeting the US market						
8-9	4.1 Describe FSMA FSVP. 4.2 Explain FSMA Produce Safety Rule (21 CFR 112). 4.3 Explain FDA Import Alert 99-35 for aflatoxin and DWPE detention implications for Nigerian exporters	• Explain FSMA FSVP: importer obligations, supplier verification, corrective action procedures, and records requirements • Discuss FSMA Produce Safety Rule (21 CFR 112): agricultural water requirements, biological soil amendments, worker hygiene standards • Discuss FDA Import Alert 99-35 for	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	• Review a Nigerian exporter FDA DWPE detention case study • Identify FSMA non-conformances and root causes • Develop corrective action plan to lift detention • Present findings	Guide students to: • Review a Nigerian exporter FDA DWPE detention case study • Identify FSMA non-conformances and root causes • Develop corrective	FDA Import Alert case study, FSMA compliance checklist, corrective action plan template, smartphones, PPE.

		aflatoxin and DWPE detention implications for Nigerian exporters			action plan to lift detention	
					• Present findings	
General Objective 5.0: Understand a multi-market regulatory compliance programme						
10-11	5.1 Describe compliance programme components. 5.2 Explain compliance management software for multi-market regulatory tracking and alert systems 5.3 Explain how AfCFTA simplification measures affect regulatory compliance burden for intra-African produce trade	• Explain compliance programme components: regulatory intelligence, compliance calendar, gap assessment, training, internal audit, management review • Explain compliance management software for multi-market regulatory tracking and alert systems • Discuss how AfCFTA simplification measures affect regulatory compliance burden for intra-African produce trade	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	• Develop a 12-month regulatory compliance calendar for a Nigerian exporter selling to EU, US, and UAE markets - Include: regulatory events, testing schedules, certification renewals, audit dates for all three markets • Present calendar with justification • Report findings	Guide students to: • Develop a 12-month regulatory compliance calendar for a Nigerian exporter selling to EU, US, and UAE markets - Include: regulatory events, testing schedules, certification renewals, audit dates for all three markets • Present calendar with justification • Report findings	Compliance calendar template, EU/US/UAE requirement summaries, computers, internet, smartphones, PPE.

General Objective 6.0: Know GLOBAL G.A.P., BRC Issue 9, and FSSC 22000 certification schemes						
12-13	6.1 Describe GLOBAL G.A.P. IFA standard: scope, control points, compliance criteria, audit process, and certification benefits for Nigerian exporters 6.2 Explain BRC Issue 9. 6.3 Explain FSSC 22000 Version 6 certification requirements and GFSI recognition status	• Describe GLOBAL G.A.P. IFA standard: scope, control points, compliance criteria, audit process, and certification benefits for Nigerian exporters • Discuss BRC Issue 9: fundamental requirements, audit types (announced/unannounced), and grading system (AA–D) • Discuss FSSC 22000 Version 6 certification requirements and GFSI recognition status	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc	• Conduct a GLOBAL G.A.P. IFA compliance assessment for a hypothetical Nigerian produce farm • Identify critical, major, and minor non-conformances • Prepare a pre-audit corrective action report • Present findings	Guide students to: • Conduct a GLOBAL G.A.P. IFA compliance assessment for a hypothetical Nigerian sesame farm • Identify Critical, Major, and Minor non-conformances • Prepare a pre-audit corrective action report • Present findings	GLOBAL G.A.P. IFA checklist (printed), hypothetical farm scenario description, corrective action report template, smartphones, PPE.
General Objective 7.0: Understand regulatory compliance reporting and communication systems						
14-15	7.1 Describe regulatory compliance reporting. 7.2 Explain buyer compliance communication.	• Describe regulatory compliance reporting: management reports, regulatory body notifications, third-party	Laptop computers, smart board, Projector, Writing	• Prepare a supplier compliance declaration for a Nigerian produce exporter supplying	Guide students to: • Prepare a supplier compliance	Compliance declaration template, compliance summary

	7.3 Explain regulatory breach communication.	audit report management • Discuss buyer compliance communication: supplier declarations, audit summaries, MRL test result letters • Discuss regulatory breach communication: notifications, recall communications, regulatory authority engagement protocols	Materials, White board, Markers, Internet Pictures Videos etc	an EU buyer • Draft compliance summary covering MRL testing, GLOBAL G.A.P. status, and NAQS inspection records • Present as a formal supplier compliance briefing • Record findings	declaration for a Nigerian Produce exporter supplying an EU buyer • Draft compliance summary covering MRL testing, GLOBALG. A.P. status, and NAQS inspection records • Present as a formal supplier compliance briefing • Record findings	report template, sesame exporter scenario, computers, smartphones, PPE.
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

MYCOTOXIN ANALYTICS, HPLC AND AFLATOXIN MITIGATION SYSTEMS

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: MYCOTOXIN ANALYTICS, HPLC AND AFLATOXIN MITIGATION SYSTEMS	COURSE CODE: PIE 323	CONTACT HOURS: 4 HOURS/WEEK
YEAR: I SEMESTER: II	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 mycotoxin analysis using HPLC and LC-MS/MS, aflatoxin mitigation across the value chain, and mycotoxin control programme management for export produce operations.		
GENERAL OBJECTIVES: At the end of this course, the students should be able to: 1.0 Understand toxicology and regulatory significance of mycotoxins in export commodities; 2.0 Know EU-compliant sampling procedures for mycotoxin analysis; 3.0 Know HPLC-FLD for aflatoxin determination in agricultural produce; 4.0 Know LC-MS/MS for multi-mycotoxin analysis in export commodities; 5.0 Understand a comprehensive aflatoxin mitigation programme across the value chain; 6.0 Know mycotoxin laboratory management under ISO 17025 accreditation; 7.0 Know mycotoxin compliance knowledge to export market entry decisions.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: MYCOTOXIN ANALYTICS, HPLC AND AFLATOXIN MITIGATION SYSTEMS		COURSE CODE: PIE 323		CONTACT HOURS: 4 HOURS/WEEK		
		CREDIT UNIT: 4		THEORETICAL: 1 HOURS/WEEK		
YEAR: I SEMESTER: II		PRE-REQUISITE: -		PRACTICAL: 3 HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in mycotoxin analysis using HPLC and LC-MS/MS, aflatoxin mitigation across the value chain, and mycotoxin control programme management for export produce operations.						
General Objective 1.0: Understand toxicology and regulatory significance of mycotoxins in export commodities						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain aflatoxin B1and fumonisins toxicity. 1.2 Explain regulatory limits for aflatoxins, fumonisins, OTA, and DON across EU, Codex, US, and African markets 1.3 Describe economic costs of mycotoxin contamination.	• Discuss aflatoxin B1 and fumonisins toxicity: DNA adduct formation, hepatocellular carcinoma risk, immunosuppression — IARC Group 1 classification • Discuss regulatory limits for aflatoxins, fumonisins, OTA, and DON across EU, Codex, US, and African markets • Explain economic costs of mycotoxin contamination: RASFF rejections, market exclusion, and export	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	• Analyse 5 years of RASFF notifications for mycotoxin-related Nigerian produce rejections • Calculate rejection frequency distribution by hazard type and commodity • Estimate financial exposure and develop risk prioritisation matrix • Present findings	Guide students to: • Analyse 5 years of RASFF notifications for mycotoxin-related Nigerian produce rejections • Calculate rejection frequency distribution by hazard type and commodity	RASFF data extraction (provided), frequency analysis worksheet, financial exposure template, computers, smartphones, PPE.

		revenue losses for Nigeria			• Estimate financial exposure and develop risk prioritisation matrix • Present findings	
General Objective 2.0: Know EU-compliant sampling procedures for mycotoxin analysis						
4-5	2.1 Explain mycotoxin sampling uncertainty. 2.2 Describe EU Regulation (EC) 401/2006 sampling for aflatoxins in produce. 2.3 Explain critical importance of representative sampling and consequences of inadequate sampling	• Discuss mycotoxin sampling uncertainty: contributions from sampling heterogeneity, sample preparation, and analytical measurement • Describe EU Regulation (EC) 401/2006 sampling for aflatoxins in groundnuts and maize: lot size-dependent plans • Discuss critical importance of representative sampling and consequences of inadequate sampling	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc	• Execute EU 401/2006-compliant sampling for a simulated 25-tonne produce lot • Calculate increments, aggregate sample mass, and laboratory sub-sample • Document sampling and complete chain of custody • Record findings	Guide students to: • Execute EU 401/2006-compliant sampling for a simulated 25-tonne produce lot • Calculate increments, aggregate sample mass, and laboratory sub-sample • Document sampling and complete chain of	EU 401/2006 reference, grain probes, sample containers, riffle divider, chain of custody forms, weighing balance, smartphones, PPE.

					custody • Record findings	
General Objective 3.0: Know HPLC-FLD for aflatoxin determination in agricultural produce						
6-7	3.1 Describe HPLC-FLD method. 3.2 Explain immunoaffinity column (IAC) cleanup. 3.3 Describe post-column derivatisation (KOBRA cell or PHRED photochemical reactor) for B1 and G1 fluorescence enhancement	• Explain HPLC-FLD method: methanol: water extraction, IAC cleanup, mobile phase, fluorescence wavelengths, calibration • Discuss immunoaffinity column (IAC) cleanup: conditioning, sample loading, washing, and elution steps • Discuss post-column derivatisation (KOBRA cell or PHRED photochemical reactor) for B1 and G1 fluorescence enhancement	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc	• Prepare groundnut extract using methanol: water extraction and IAC cleanup • Run HPLC-FLD analysis and construct calibration curve • Calculate aflatoxin concentrations and compare to EU Maximum Limit Standards (MLs) • Prepare laboratory analytical report • Record findings	Guide students to: • Prepare groundnut extract using methanol: water extraction and IAC cleanup. • Run HPLC-FLD analysis and construct a calibration curve. • Calculate aflatoxin concentrations and compare to EU Maximum Limit Standards (MLs). • Prepare a laboratory analytical	HPLC-FLD system, IAC columns, groundnut samples, methanol, aflatoxin calibration standards, lab coats, gloves, PPE, smartphones.

					report. • Record findings.	
General Objective 4.0: Know LC-MS/MS for multi-mycotoxin analysis in export commodities						
8-9	4.1 Describe LC-MS/MS multi-mycotoxin method. 4.2 Explain isotope-labelled internal standards. 4.3 Explain method validation per SANTE/12682/2019.	• Explain LC-MS/MS multi-mycotoxin method: QuEChERS extraction, MRM transitions for aflatoxins, fumonisins, OTA, DON, ZEA • Discuss isotope-labelled internal standards: ¹³C-labelled standards for recovery correction and accurate quantification • Discuss method validation per SANTE/12682/2019: matrix-matched calibration, apparent recovery, repeatability, within-lab reproducibility	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc	• Interpret provided LC-MS/MS chromatogram data for a produce sample analysed for 6 mycotoxins • Calculate concentrations using calibration curves • Compare results to Codex and EU regulatory limits • Issue multi-mycotoxin compliance report • Record findings	Guide students to: • Interpret provided LC-MS/MS chromatogram data for a produce sample analysed for 6 mycotoxins • Calculate concentration s using calibration curves • Compare results to Codex and EU regulatory limits • Issue multi-mycotoxin compliance report • Record findings	LC-MS/MS chromatogram data sets (provided), calibration curves, Codex/EU ML tables, compliance report template, PPE, smartphones.

General Objective 5.0: Understand a comprehensive aflatoxin mitigation programme across the value chain						
10-11	5.1 Explain pre-harvest mitigation. 5.2 Describe post-harvest mitigation. 5.3 Explain commercial optical sorting technology.	• Discuss pre-harvest mitigation: Aflasafe biological control, mycotoxin-resistant varieties, climate-smart drought management • Describe post-harvest mitigation: rapid drying to <10% MC, UV fluorescence sorting, ozone treatment, biocontrol agents • Discuss commercial optical sorting technology: SORTEX/SATAKE UV fluorescence sorting and AI-powered optical sorting platforms	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc	• Design a complete aflatoxin mitigation programme for a groundnut, sesame, etc, export facility • Practice Aflasafe application at farm, rapid drying protocol, UV/AI sorting specification, HPLC-FLD testing, and rejection management • Present with expected contamination reduction estimates • Record findings	Guide students to: • Design a complete aflatoxin mitigation programme for a groundnut export facility • Practice Aflasafe at farm, rapid drying protocol, UV/AI sorting specification, HPLC-FLD testing, and rejection management • Present with expected contamination reduction estimates • Record findings	Mitigation programme template, Aflasafe data sheets, optical sorting specs, contamination reduction data, computers, PPE, smartphones.
General Objective 6.0: Know mycotoxin laboratory management under ISO 17025 accreditation						

12-13	6.1 Describe ISO/IEC 17025:2017 requirements for mycotoxin testing laboratories. 6.2 Explain proficiency testing. 6.3 Explain chain of custody requirements from field sampling through laboratory analysis to export compliance certificate	• Explain ISO/IEC 17025:2017 requirements for mycotoxin testing laboratories: technical competence, impartiality, consistent operation, accreditation scope • Discuss proficiency testing: FAPAS, BIPEA, GENAS — performance evaluation using z-scores and acceptance criteria • Discuss chain of custody requirements from field sampling through laboratory analysis to export compliance certificate	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	• Complete a full chain of custody documentation set for groundnut aflatoxin analysis from field to export certificate • Verify all fields and identify documentation gaps • Conduct peer verification review • Record findings	Guide students to: • Complete a full chain of custody documentation set for groundnut aflatoxin analysis from field to export certificate • Verify all fields and identify documentation gaps • Conduct peer verification review • Record findings	Chain of custody forms, sampling records, lab reports, export certificate template, PPE, smartphones.
General Objective 7.0: Know mycotoxin compliance knowledge to export market entry decisions						
14-15	7.1 Explain export market selection based on mycotoxin regulatory risk. 7.2 Describe how exporters leverage low mycotoxin levels as a	• Discuss export market selection based on mycotoxin regulatory risk: EU strict limits versus Middle East versus Asian market requirements	Laptop Computers, smart board, Projector, Writing Materials, White board,	• Develop market entry recommendation for a Nigerian groundnut exporter with aflatoxin at 3-5 ppb	Guide students to: • Develop market entry recommendation for a Nigerian	Market mycotoxin limit tables, market entry recommendation template, computers,

	competitive differentiator through traceability and testing certification 7.3 Explain NAQS, NAFDAC, and SON roles in enforcing mycotoxin limits at export inspection points	• Discuss how exporters leverage low mycotoxin levels as a competitive differentiator through traceability and testing certification • Discuss NAQS, NAFDAC, and SON roles in enforcing mycotoxin limits at export inspection points	Markers, Internet etc	• Evaluate EU (4 ppb ML), US (20 ppb), UAE (10 ppb), and AfCFTA market compliance • Recommend market entry sequence and testing protocol • Present as a business advisory report • Record findings	groundnut exporter with aflatoxin at 3-5 ppb • Evaluate EU (4 ppb ML), US (20 ppb), UAE (10 ppb), and AfCFTA market compliance • Recommend market entry sequence and testing protocol • Present as a business advisory report • Record findings	projector, internet, PPE, smartphones.
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

FOOD SAFETY AUDITING, ISO 22000 AND CERTIFICATION MANAGEMENT

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: FOOD SAFETY AUDITING, ISO 22000 AND CERTIFICATION MANAGEMENT	COURSE CODE: PIE 324	CONTACT HOURS: 4 HOURS/WEEK
YEAR: I SEMESTER: II	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 food safety management system design, ISO 22000 implementation, BRC lead auditing, and certification process management for produce export operations.		
GENERAL OBJECTIVES: At the end of this course, the student should be able to: 1.0 Understand ISO 22000:2018 food safety management system requirements; 2.0 Know HACCP plans for produce inspection and export facility operations; 3.0 Know BRC Global Standard for Food Safety Issue 9 to produce operations; 4.0 Understand lead auditor competencies for food safety management system audits; 5.0 Know food safety corrective action and verification systems; 6.0 Understand certification body requirements and manage ISO 22000 certification processes; 7.0 Know food fraud prevention and allergen management in export operations.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: FOOD SAFETY AUDITING, ISO 22000 AND CERTIFICATION MANAGEMENT				COURSE CODE: PIE 324		CONTACT HOURS: 4 HOURS/WEEK
				CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II				PRE-REQUISITE: -		PRACTICAL: 3 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in food safety management system design, ISO 22000 implementation, BRC lead auditing, and certification process management for produce export operations.						
General Objective 1.0: Understand ISO 22000:2018 food safety management system requirements						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain ISO 22000:2018 Annex SL HLS. 1.2 Explain prerequisite programme (PRP) requirements. 1.3 Describe HACCP integration.	• Discuss ISO 22000:2018 Annex SL HLS: PDCA cycle, context analysis, interested parties, scope, risk-based thinking • Discuss prerequisite programme (PRP) requirements: infrastructure, cleaning, pest control, training, allergen management • Discuss HACCP integration: hazard analysis, CCP/OPRP designation, monitoring, corrective action, control measure validation	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	• Conduct ISO 22000:2018 gap assessment for a hypothetical sesame processing facility • Classify gaps by clause: critical (8), significant (6/7), minor (4/5) • Prioritise corrective actions and estimate implementation timeline • Present gap assessment report	Guide students to: • Conduct ISO 22000:2018 gap assessment for a hypothetical sesame processing facility • Classify gaps by clause: critical (8), significant (6/7), minor (4/5) • Prioritise corrective	ISO 22000:2018 gap assessment checklist, hypothetical sesame processing scenario, corrective action matrix, smartphones, PPE.

					actions and estimate implementation timeline • Present gap assessment report	
General Objective 2.0: Know HACCP plans for produce inspection and export facility operations						
4-5	2.1 Describe HACCP plan development. 2.2 Explain critical limit setting. 2.3 Explain HACCP plan review triggers.	- Describe HACCP plan development: flow diagram verification, comprehensive hazard analysis (biological, chemical, physical, radiological), and CCP determination using a decision tree - Discuss critical limit setting: scientific basis, regulatory requirements, operational limits versus critical limits, and monitoring frequency - Discuss HACCP plan review triggers: process changes, new hazards, regulatory updates, and corrective action trends	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	- Develop a complete HACCP plan for a fresh produce packing and export operation Include: product description, flow diagram, hazard analysis, CCPs, monitoring plan, corrective actions, verification schedule - Present the plan to the class	Guide students to: - Develop a complete HACCP plan for a fresh produce packing and export operation, including product description, flow diagram, hazard analysis, CCPs, monitoring plan, corrective actions, and verification schedule; - Present and	HACCP plan templates, product description forms, hazard analysis worksheets, CCP determination forms, smartphones, PPE.

					defend the plan to class; • Record findings	
General Objective 3.0: Know BRC Global Standard for Food Safety Issue 9 to produce operations						
6-7	3.1 Explain BRC Issue 9. 3.2 Describe BRC audit types. 3.3 Describe BRC grading.	• Discuss BRC Issue 9: Fundamental requirements, Senior Management Commitment, Food Safety Plan, Site Standards, Product and Process Control, Personnel • Describe BRC audit types: announced, unannounced, partial unannounced — and strategic implications for Nigerian export facilities • Analyse BRC grading: AA, A, B, C, D criteria, Critical non-conformances, and re-audit processes	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, etc.	• Conduct a BRC Issue 9 mock audit of a simulated produce packing facility. • Identify Critical, Major, and Minor non-conformances • Prepare complete audit report with corrective actions • Simulate closing meeting • Record findings	Guide students to: • Conduct a BRC Issue 9 mock audit of a simulated produce packing facility - Identify Critical, Major, and Minor non-conformances • Prepare complete audit report with corrective actions • Simulate closing meeting • Record findings	BRC Issue 9 audit checklist, hypothetical facility scenario, non-conformance guide, audit report template, smartphones, PPE.
General Objective 4.0: Understand lead auditor competencies for food safety management system audits						

8-9	4.1 Describe food safety auditing principles per ISO 19011:2018. 4.2 Explain audit programme management. 4.3 Explain all audit phases.	- Describe food safety auditing principles per ISO 19011:2018: objectivity, evidence-based findings, confidentiality, risk-based approach, auditor independence - Discuss audit programme management: scheduling, resource allocation, scope and criteria, auditor qualification, team composition - Describe all audit phases: preparation, opening meeting, document review, facility walkthrough, interviews, closing meeting, report finalisation	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	- Lead a complete food safety audit of a simulated produce export facility as lead auditor - Execute all phases from preparation to final report issuance - Issue a complete classified audit report - Facilitate post-audit debrief - Record findings	Guide students to: - Lead a complete food safety audit of a simulated produce export facility as lead auditor - Execute all phases from preparation to final report issuance - Issue a complete classified audit report - Facilitate post-audit debrief - Record findings	Audit programme template, audit report template, simulated facility QMS documentation, role-play scripts, smartphones, PPE.
General Objective 5.0: Know food safety corrective action and verification systems						
10-11	5.1 Describe ISO 22000 Clause 10 corrective action. 5.2 Explain HACCP verification activities. 5.3 Explain food safety	Describe ISO 22000 Clause 10 corrective action: 5-Why and Fishbone root cause analysis, corrective action plan	Laptop computers, smart board, Projector, Writing Materials,	Investigate a provided food safety incident (aflatoxin exceedance in sesame export lot)	Guide students to: Investigate a provided food safety incident	Food safety incident scenario, 5-Why worksheet, corrective action plan template, verification schedule template,

	incident investigation.	development, effectiveness verification • Discuss HACCP verification activities: plan validation, verification schedule, internal audits, calibration verification • Discuss food safety incident investigation: classification, containment, root cause, corrective actions, regulatory notification	White board, Markers, Internet, Pictures, Videos, etc.	• Conduct root cause analysis using 5-Why methodology • Develop corrective action plan with verification schedule • Present findings to class • Record findings	(aflatoxin exceedance in sesame export lot) • Conduct root cause analysis using 5-Why methodology • Develop corrective action plan with verification schedule • Present findings to class • Record findings	smartphones, PPE.
General Objective 6.0: Understand certification body requirements and manage ISO 22000 certification processes						
12-13	6.1 Describe ISO/IEC 17021-1. 6.2 Explain GFSI benchmarking. 6.3 Explain certificate management.	• Describe ISO/IEC 17021-1:2015 requirements for certification bodies: impartiality, competence, consistency for food safety certification • Discuss GFSI benchmarking: scheme owner requirements, benchmarked scheme	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	• Develop a certification preparation plan for a Nigerian sesame exporter seeking ISO 22000 certification Include: gap assessment, implementation milestones, internal audit schedule, pre-	Guide students to: • Develop a certification preparation plan for a Nigerian sesame exporter seeking ISO 22000 certification	Certification preparation plan template, gap assessment tool, budget estimation worksheet, certification body criteria, smartphones, PPE.

		recognition list, buyer recognition implications • Discuss certificate management: maintenance audits, validity periods, scope extensions, suspension and withdrawal		cert readiness review, certification body selection • Present plan with timeline and budget • Record findings	Include: gap assessment, implementation milestones, internal audit schedule, pre-cert readiness review, certification body selection • Present plan with timeline and budget • Record findings	
General Objective 7.0: Know food fraud prevention and allergen management in export operations						
14-15	7.1 Describe FFVA using SSAFE tool. 7.2 Explain allergen management for export. 7.3 Explain authenticity testing.	• Describe FFVA using SSAFE tool: economic motivation analysis, opportunity assessment, control effectiveness evaluation (PAS 96:2017) • Discuss allergen management for export: EU FIR (EU 1169/2011), US FALCPA requirements, allergen cross-contact prevention	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	• Conduct food fraud vulnerability assessment for a Nigerian sesame export operation using SSAFE online tool • Identify top 3 fraud vulnerabilities. • Design mitigation strategies • Prepare a food defence plan summary	Guide students to: • Conduct food fraud vulnerability assessment for a Nigerian sesame export operation using SSAFE online tool • Identify top 3 fraud vulnerabilities	SSAFE FFVA tool (online), sesame export scenario, mitigation strategy template, food defence plan template, smartphones, PPE.

		• Discuss authenticity testing: IRMS for origin verification, DNA barcoding for species authentication, NMR fingerprinting		• Present the findings	and design mitigation strategies • Prepare a food defence plan summary • Present and defend findings • Record findings	
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

FUMIGATION, PHYTOSANITARY OPERATIONS AND OTHER REGULATORY COMPLIANCE

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: FUMIGATION, PHYTOSANITARY OPERATIONS AND OTHER REGULATORY COMPLIANCE	COURSE CODE: PIE 325	CONTACT HOURS: 4 HOURS/WEEK
YEAR: I SEMESTER: II	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 commercial fumigation management, IPPC phytosanitary compliance, quarantine pest risk analysis, and digital phytosanitary operations for international export markets.		
GENERAL OBJECTIVES: At the end of this course, the students should be able to: 1.0 Understand fumigant chemistry and large-scale resistance management; 2.0 Know regulatory compliant phytosanitary operations for export certification; 3.0 Understand pest risk analysis for quarantine pest management; 4.0 Understand International Plant Protection Convention Electronic Phytosanitary Certificate (IPPC e-Phyto) system and digital phytosanitary certificate management; 5.0 Know phytosanitary interception response and market access negotiation; 6.0 Understand wood packaging material regulatory compliance; 7.0 Know a phytosanitary compliance programme for a produce export organization.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: FUMIGATION, PHYTOSANITARY OPERATIONS AND OTHER REGULATORY COMPLIANCE			COURSE CODE: PIE 325		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE: -		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in commercial fumigation management, IPPC phytosanitary compliance, quarantine pest risk analysis, and digital phytosanitary operations for international export markets.						
General Objective 1.0: Understand fumigant chemistry and large-scale resistance management						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain phosphine behaviour at commercial scale. 1.2 Explain sulfuryl fluoride mode of action 1.3 Describe Ethanedinitrile (EDN) and methyl bromide controlled use and regulatory phase out implications 1.4 Explain safe handling and disposal of used containers	- Discuss phosphine behaviour at commercial scale: gas stratification, sorption effects, and CT product requirements - Discuss sulfuryl fluoride mode of action - Explain Ethanedinitrile (EDN) and methyl bromide controlled use and regulatory phase out implications - Discuss safe handling and	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	- Calculate CT product for commercial phosphine fumigation of a 1,000-tonne grain silo - Determine whether standard dosage achieves resistance-defeating CT (≥900 ppm·h) - Modify fumigation plan to achieve full compliance - Record all calculations with	Guide students to: - Calculate CT product for commercial phosphine fumigation of a 1,000-tonne grain silo - Determine whether standard dosage achieves resistance-defeating CT (≥900	Fumigation calculation worksheets, silo dimension data, phosphine CT requirement tables, calculators, computers Materials safety data sheet (MSDS), Smartphones, PPE.

		disposal of used containers		- justifications - Document findings	- ppm·h) - Modify fumigation plan to achieve full compliance - Record all calculations with justifications - Document findings	
General Objective 2.0: Know regulatory compliant phytosanitary operations for export certification						
4-5	2.1 Describe NAQS Enterprisesal structure, mandate, and official inspection procedures 2.2 Explain NAQS pre-export inspection protocol: - Commodity-specific checklists, - Sample collection - Phytosanitary certificate issuance 2.3 Explain phytosanitary certificate data requirements under International Standard for phytosanitary measures ISPM 12 for EU, US, and Gulf destination markets	- Explain NAQS Enterprisesal structure, mandate, and official inspection procedures - Discuss NAQS pre-export inspection protocol: - Commodity-specific checklists, - Sample collection - Phytosanitary certificate issuance - Discuss phytosanitary	NAQS operational manual, ISPM 12 standard, phytosanitary certificate samples, projector, etc.	- Complete a full phytosanitary certification documentation set for a 20-tonne produce consignment to the EU - Include: pre-export inspection checklist, fumigation treatment record, completed Phytosanitary Certificate (PC) with all mandatory fields - Verify PC	Guide students to: - Complete a full phytosanitary certification documentation set for a 20-tonne produce consignment to the EU - Include: pre-export inspection checklist, fumigation treatment	NAQS inspection checklist, fumigation treatment record form, blank PC template, ISPM 12 reference, computers, Smartphones, PPE.

		certificate data requirements under ISPM 12 for EU, US, and Gulf destination markets		- completeness against ISPM 12 - Record findings	- record, completed Phytosanitary Certificate (PC) with all mandatory fields - Verify against ISPM 12 requirements - Conduct peer verification review - Record findings	
General Objective 3.0: Understand pest risk analysis (PRA) for quarantine pest management						
6-7	3.1 Describe ISPM 11 framework: i. Initiation ii. Pest categorization, iii. Pathway analysis iv. Risk assessment v. Risk management option selection 3.2 Explain economic and environmental consequences in PRA: i. Direct losses ii. Market exclusion	- Explain ISPM 11 framework: i. Initiation ii. Pest categorization, iii. Pathway analysis iv. Risk assessment v. Risk management option selection - Discuss economic and environmental consequences in PRA:	ISPM 11 standard, EPPO Decision Support Scheme guide, PRA template, projector, Computer, White board, Markers, etc.	- Conduct a simplified PRA for <i>Prostephanus truncatus</i> as a quarantine pest in EU-destined Nigerian produce - Complete all PRA stages: pathway analysis, pest categorization, risk assessment, risk management	Guide students to: Conduct a simplified PRA for <i>Prostephanus truncatus</i> as a quarantine pest in EU-destined Nigerian produce	PRA template (ISPM 11-based), EPPO database access, <i>Prostephanus truncatus</i> pest data, computers, internet, Smartphones, PPE.

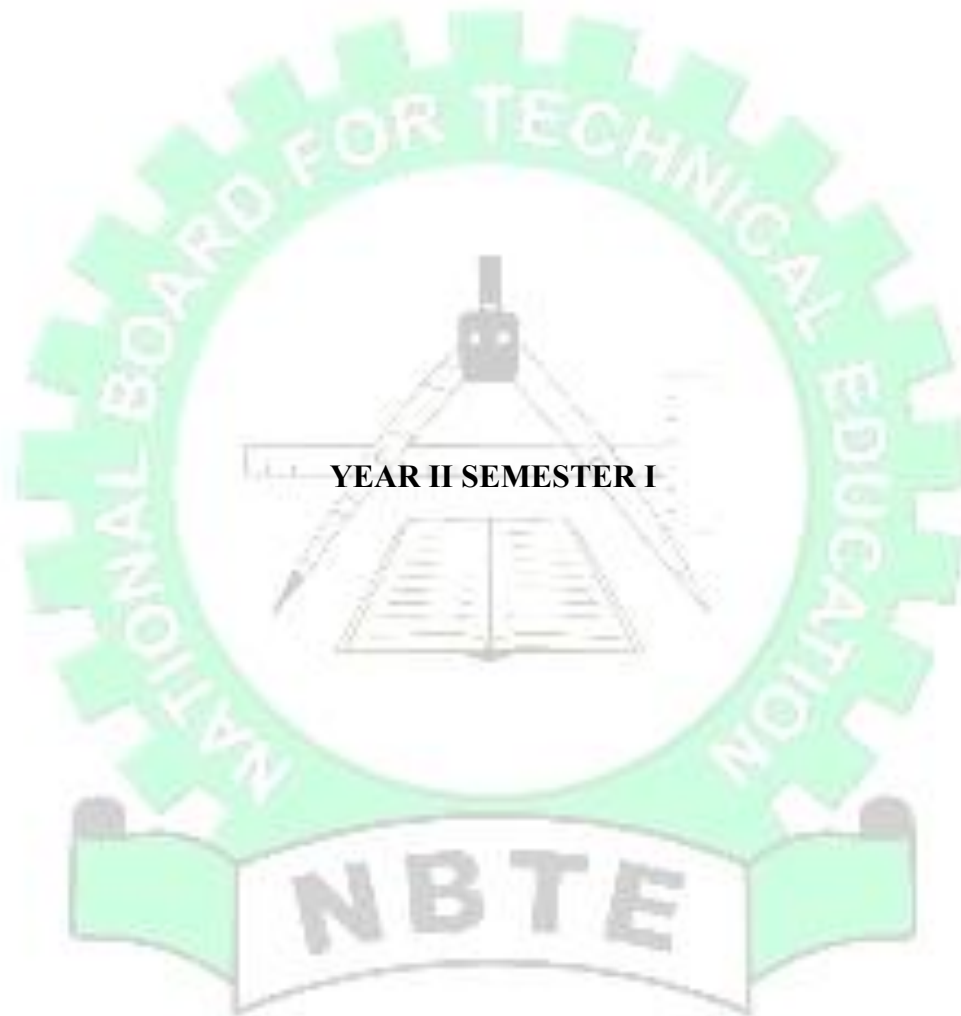
	costs iii. Control costs iv. Eradication feasibility 3.3 Explain EPPO Decision Support Scheme	i. Direct losses ii. Market exclusion costs iii. Control costs iv. Eradication feasibility • Explain EPPO Decision Support Scheme		options • Present PRA findings to class	• Complete all PRA stages: pathway analysis, pest categorization, risk assessment, risk management options • Present PRA findings to class • Record findings	
General Objective 4.0: Understand International Plant Protection Convention Electronic Phytosanitary Certificate (IPPC e-Phyto) system and digital phytosanitary certificate management.						
8-9	4.1 Describe the IPPC ePhyto Solution and benefits for Nigerian exporters 4.2 Explain ePhyto adoption by key markets. 4.3 Explain NAQS digital readiness for ePhyto.	• Explain the IPPC ePhyto Solution and benefits for Nigerian exporters • Discuss ePhyto adoption by key markets: EU, US (USDA APHIS), UAE • Discuss NAQS digital readiness for ePhyto: - Current paper-based	IPPC ePhyto system overview, TRACES NT guide, NAQS digital readiness assessment, projector, Computer	• Navigate the IPPC ePhyto Hub portal and simulate submission of an ePhyto certificate for Nigerian produce to the EU • Complete all data fields and identify differences from paper PC format • Draft a briefing	Guide students to: • Navigate the IPPC ePhyto Hub portal and simulate submission of an ePhyto certificate for Nigerian produce to the EU • Complete all	IPPC ePhyto portal access, ePhyto simulation interface, paper PC for comparison, computers, internet, Smartphones, PPE.

		systems - Planned digitisation - International technical assistance needs		note recommending NAQS ePhyto implementation steps • Record findings	data fields and identify differences from paper PC format • Draft a briefing note recommending NAQS ePhyto implementation steps • Record finding	
General Objective 5.0: Know phytosanitary interception response and market access negotiation						
10-11	5.1 Describe phytosanitary interception response. 5.2 Explain market access negotiation with importing NPPOs 5.3 Explain bilateral phytosanitary agreements	• Explain phytosanitary interception response: receiving EUROPHYT findings - Notification - Classifying - Selecting corrective actions • Explain market access negotiation with importing NPPOs • Describe bilateral phytosanitary	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	• Analyse 3 provided phytosanitary interception notifications for Nigerian produce. • Identify the pest/issue. • Recommend appropriate corrective action • Draft an NPPO-to-NPPO communication • Present findings to class	Guide students to: • Analyse 3 provided phytosanitary interception notifications for Nigerian produce, for each: - Identify the pest/issue, Recommend appropriate corrective	EUROPHYT interception notifications (provided), corrective action guide, NPPO communication template, Computers Smart board Projector, Writing Materials White board Markers, Smartphones,

		agreements		Record findings	action ii. Draft an NPPO-to-NPPO communication - Facilitate presentations - Present findings to class - Record findings	PPE.
General Objective 6.0: Understand wood packaging material regulatory compliance						
12-13	6.1 Describe regulatory requirements for wood packaging materials and technical specifications 6.2 Explain wood packaging materials audit procedures i. Supplier approval ii. Batch certification iii. Mark verification 6.3 Explain consequences of non-compliance of wood packaging materials: i. Detention ii. Destruction iii. Port refusal iv. Reputational damage	- Explain regulatory requirements for wood packaging materials and technical specifications - Describe wood packaging materials audit procedures i. Supplier approval ii. Batch certification iii. Mark verification - Explain consequences of non-compliance of wood packaging materials: i. Detention ii. Destruction	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc	- Inspect 5 wood packaging material samples for regulatory compliance - Verify treatment marks - Check heat treatment certificates - Assess physical condition - Classify each as compliant or non-compliant for ISPM - Prepare wood	Guide students to: - Inspect 5 wood packaging material samples for regulatory compliance i. Verify treatment marks ii. Check heat treatment certificates iii. Assess physical condition - Classify each	wood packaging material samples (marked and unmarked), ISPM 15mark reference card, wood packaging material compliance inspection form ISPM 15 standard, ISPM 15mark specifications

		iii. Port refusal iv. Reputational damage		packaging materials compliance inspection report Record findings	as compliant or non-compliant for ISPM - Prepare wood packaging materials compliance inspection report - Record findings	, wood packaging material audit checklist, projector, hand lens/magnifier, wood moisture meter, measuring callipers, digital camera Smartphones, PPE.
General Objective 7.0: Know a phytosanitary compliance programme for a produce export enterprise						
14-15	7.1 Describe components of a produce exporter's phytosanitary compliance programme 7.2 Explain GLOBAL GAP certification's contribution to phytosanitary compliance: - Farm records - Traceability systems - Producer database management 7.3 Explain continuous improvement: interception trend of phytosanitary compliance programme	- Describe components of a produce exporter's phytosanitary compliance programme - Discuss GLOBAL GAP certification's contribution to phytosanitary compliance: - Farm records - Traceability systems - Producer database management	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	- Develop a phytosanitary compliance programme for a produce organization with 200 farmers supplying 500 tonnes/year to EU, include: - Farmer inspection - Pre-export testing - Fumigation management	Guide students to: - Develop a phytosanitary compliance programme for a produce enterprise with 200 farmers supplying 500 tonnes/year to EU include: - Farmer inspection - Pre-export testing	Compliance programme template, farmer inspection form, pre-export testing plan template, computers, projector, Smartphones, PPE.

		Discuss continuous improvement: interception trend of phytosanitary compliance programme		iii. PC documentation Annual review - Present the programme - Record findings	iii. Fumigation management iv. PC documentation v. Annual review - Present and defend programme - Record findings	
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



EXPORT DOCUMENTATION, LETTERS OF CREDIT AND DIGITAL TRADE SYSTEMS

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: EXPORT DOCUMENTATION, LETTERS OF CREDIT AND DIGITAL TRADE SYSTEMS	COURSE CODE: PIE 411	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 managing export documentation systems, processing Letters of Credit, applying digital trade platforms and conducting export costing for global agri-export Enterprises.		
GENERAL OBJECTIVES: At the end of this course, the students should be able to: 1.0 Know complete export documentation requirements for global agricultural produce 2.0 Understand letters of Credit and manage export financing instruments 3.0 Understand Incoterms 2020 and international trade contract terms 4.0 Know digital export documentation for customs systems 5.0 Understand export shipping and freight management procedures 6.0 Understand export pricing, costing and profitability analysis 7.0 Understand a complete export operation management plan for an agri-export organization		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: EXPORT DOCUMENTATION, LETTERS OF CREDIT AND DIGITAL TRADE SYSTEMS			COURSE CODE: PIE 411		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 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 in managing export documentation systems, processing Letters of Credit, applying digital trade platforms and conducting export costing for global agri-export Enterprises.						
General Objective 1.0: Know complete export documentation requirements for global agricultural produce						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain the complete export documentation set: i. Commercial Invoice ii. Packing List iii. Certificate of Origin iv. Phytosanitary Certificate v. Certificate of Analysis, vi. NAFDAC/SON Certificates, vii. Fumigation Certificate viii. Bill of Lading 1.2 Explain market-specific requirements for: EU, US, UAE	• Explain complete export documentation set: i. Commercial Invoice ii. Packing List iii. Certificate of Origin iv. Phytosanitary Certificate v. Certificate of Analysis, vi. NAFDAC/SON Certificates, vii. Fumigation Certificate viii. Bill of Lading • Explain market-	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	• Prepare a complete export documentation set for a simulated 20-tonne produce export to Germany and EU Country • Verify all 8 documents for accuracy and consistency • Conduct document verification review with a partner • Record findings	Guide students to: • Prepare a complete export documentation set for a simulated 20-tonne produce export to Germany • Verify all 8 documents for accuracy and consistency • Conduct	Blank export document templates, produce export scenario data, document verification checklist Sample export documentation sets, market-specific requirement tables, projector,

	(Certificate of Conformity, Arabic labelling etc) 1.3 Explain consequences of documentation errors: i. Customs holds ii. Demurrage financing delays iii. Buyer relationship damage	- specific requirements for: EU, US, UAE (Certificate of Conformity, Arabic labelling etc) - Explain consequences of documentation errors: i. Customs holds ii. Demurrage financing delays iii. Buyer relationship damage			- document verification review with a partner - Record findings	internet, Smartphones, PPE.
General Objective 2.0: Understand letters of Credit and manage export financing instruments						
3-4	2.1 Explain letters of Credit types. 2.2 Explain Uniform Customs and Practice (UCP 600) requirements. 2.3 Explain common L/C discrepancies in Nigerian agri-exports.	- Describe letters of Credit types: i. Irrevocable ii. Confirmed iii. Sight iv. Usance v. Revolving letters of Credit vi. risk implications for Nigerian exporters - Discuss Uniform Customs and Practice (UCP 600) requirements: i. Document compliance	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	- Examine a provided L/C for produce export: i. Identify required documents ii. Deadlines iii. Special conditions - Check provided shipping documents for discrepancies against L/C terms - Draft a discrepancy notification and recommend	Guide students to: - Examine a provided L/C for produce export: i. Identify required documents - Deadlines - Special conditions - Check provided	Sample L/C document, shipping document set, UCP 600 discrepancy checklist, notification letter template Sample Letters of Credit, UCP 600 summary guide, discrepancy case studies,

		standards ii. Examination period iii. Discrepancy management iv. Payment procedures • Explain common L/C discrepancies in Nigerian agri-exports: i. Late presentation ii. Document inconsistency iii. Short shipment iv. Insurance gaps		corrective actions • Record findings	shipping documents for discrepancies against L/C terms • Draft a discrepancy notification and recommend corrective actions • Record findings	projector, Smartphones, PPE.
General Objective 3.0: Understand Incoterms 2020 and international trade contract terms						
5-6	3.1 Explain all Incoterms 2020 rules and risk transfer points 3.2 Explain Incoterms selection impact on exporter obligations 3.3 Describe Incoterms dispute scenarios	• Discuss all Incoterms 2020 rules and risk transfer points • Discuss Incoterms selection impact on exporter obligations • Explain Incoterms dispute scenarios	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures	• Conduct a simulated export contract negotiation for Nigerian produce using role-play • Assign Incoterms, agree on price, payment terms, and quality specifications • Document agreed contract terms and present negotiation	Guide students to: • Conduct a simulated export contract negotiation for Nigerian produce using role-play • Assign Incoterms, agree on price,	Negotiation role-play scenario cards, export contract template, Incoterms 2020 reference Incoterms 2020 reference guide, risk transfer diagrams,

				- outcomes - Record findings	- payment terms, and quality specifications - Document agreed contract terms and present negotiation outcomes - Record findings	dispute case studies, projector, Smartphones, PPE.
General Objective 4.0: Know digital export documentation for customs systems						
7-8	4.1 Describe Nigeria's Single Window system: NICIS II electronic customs declaration: i. Form M requirement ii. Pre-shipment inspection for agri-exports 4.2 Explain digital Certificate of Origin: i. NEPC e-CO platform ii. Nigeria Customs e-Form M, iii. AfCFTA digital origin certification	- Explain Nigeria's Single Window system: NICIS II electronic customs declaration: i. Form M requirement ii. Pre-shipment inspection for agri-exports - Discuss digital Certificate of Origin: NEPC e-CO platform i. Nigeria Customs e-Form M, ii. AfCFTA digital origin certification	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	- Navigate NEPC e-CO platform and simulate an e-CO application for a produce export to Europe - Complete all data fields - Identify required supporting documents - Prepare a digital documentation readiness checklist for Nigerian exporters	Guide students to: - Navigate NEPC e-CO platform and simulate an e-CO application for a produce export to Europe - Complete all data fields - Identify required supporting	NEPC e-CO platform access, sesame export scenario data, digital documentation checklist template, computers, internet NICIS II user guide, NEPC e-CO platform overview,

	4.3 Explain global trade digitalisation: i. ICC Digital Standards Initiative ii. MLETR iii. WCO SAFE Framework	Discuss global trade digitalisation: i. ICC Digital Standards Initiative ii. MLETR iii. WCO SAFE Framework		Record findings	- documents - Prepare a digital documentation readiness checklist for Nigerian exporters - Record findings	ICC DSI description, projector, internet, Smartphones, PPE.
General Objective 5.0: Understand export shipping and freight management procedures						
9-10	5.1 Describe container shipping: i. Container booking ii. Stuffing and sealing iii. Bill of Lading types (OBL, Seaway B/L, Express B/L) iv. Safety of Life at Sea Verified Gross Margin v. SOLAS VGM compliance 5.2 Explain freight forwarder selection: i. Scope of services ii. Tariff negotiation, Booking platform capabilities	- Explain container shipping: i. Container booking ii. Stuffing and sealing iii. Bill of Lading types (OBL, Seaway B/L, Express B/L) iv. Safety of Life at Sea Verified Gross Margin v. SOLAS VGM compliance - Discuss freight forwarder selection: ➤ Scope of services ➤ Tariff negotiation, Booking platform capabilities ➤ Liability - Describe air freight	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	- Complete a container booking simulation: i. prepare booking instruction ii. Draft B/L, iii. Calculate VGM, iv. Verify SOLAS compliance - Prepare an Air Waybill for a fresh produce consignment meeting IATA PCR requirements - Record findings	Guide students to: - Complete a container booking simulation: i. Prepare booking instruction ii. Draft B/L, iii. Calculate VGM, iv. Verify SOLAS compliance - Prepare an Air Waybill for a fresh produce consignment	Container booking form, Draft B/L template, VGM calculation worksheet, Air Waybill template, IATA PCR reference Container shipping guide, SOLAS VGM requirements, IATA PCR overview, projector,

	iii. Liability 5.3 Explain air freight for fresh produce: i. IATA Perishable Cargo Regulations (PCR) ii. Time-temperature requirements iii. Carriage condition classifications	for fresh produce: ➤ IATA Perishable Cargo Regulations (PCR) ➤ Time-temperature requirements ➤ Carriage condition classifications			meeting IATA PCR requirements • Record findings	Smartphones, PPE.
General Objective 6.0: Understand export pricing, costing and profitability analysis						
11-12	6.1 Describe all export costing components: i. Production cost ii. Value addition iii. Domestic logistics Documentation fees Inspection fees iv. Freight v. Insurance vi. Bank charges vii. Export levies 6.2 Explain export price calculation under Incoterms: building Free on Board (FOB), Cost and Freight (CFR) and Cost, Insurance and Freight (CIF) prices step by step from farm-gate	• Explain all export costing components: ➤ Production cost ➤ Value addition ➤ Domestic logistics Documentation fees Inspection fees ➤ Freight ➤ Insurance ➤ Bank charges ➤ Export levies • Discuss export price calculation under Incoterms: building Free on Board (FOB), Cost and Freight (CFR) and Cost, Insurance and Freight (CIF) prices	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc	• Calculate FOB, CFR (Rotterdam), and CIF export prices for a 20-tonne produce consignment from provided cost data • Analyse export profitability and • Identify top 2 cost reduction opportunities • Present financial analysis to class • Record findings	Guide students to: • Calculate FOB, CFR (Rotterdam), and CIF export prices for a 20-tonne produce consignment from provided cost data • Analyse export profitability and • Identify top 2 cost	Export costing worksheets, produce cost data set, calculators, computers, Export costing template, Incoterms price build-up worksheets, profitability template, projector, Smartphones, PPE.

	cost 6.3 Explain export profitability: - Margin calculation - Break-even analysis - Currency risk impact - Payment term effects on cash flow	step by step from farm-gate cost - Discuss export profitability: ➤ Margin calculation ➤ Break-even analysis ➤ Currency risk impact ➤ Payment term effects on cash flow			reduction opportunities - Present financial analysis to class - Record findings	
General Objectives 7.0: Understand a complete export operation management plan for an agri-export organization						
13-15	7.1 Describe the export operation management cycle: - Procurement - Processing - Quality control Documentation - Shipping - Payment collection - Post-shipment review 7.2 Explain export operation risk management: - Quality - Documentation - Payment, logistics	- Explain the export operation management cycle: ➤ Procurement ➤ Processing ➤ Quality control Documentation ➤ Shipping ➤ Payment collection ➤ Post-shipment review - Discuss export operation risk management: ➤ Quality ➤ Documentation ➤ Payment, logistics - Regulatory risks with	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc	Develop a complete export operation management plan for a hypothetical 100-tonne/year produce business, include: Procurement plan, Quality control, Documentation management, Shipping calendar, Payment management, KPI dashboard	Guide students to: Develop a complete export operation management plan for a hypothetical 100-tonne/year produce business, include: Procurement plan, Quality control,	Export operation plan template, procurement planning tools, KPI tracking template, computers, projector Export operation flowchart, risk management matrix, KPI dashboard

	Regulatory risks with mitigation strategies 7.3 Explain export operation KPIs: i. Fill rate ii. On-time delivery - Document accuracy rate - Payment days iii. Shipment rejection rate	mitigation strategies • Discuss export operation KPIs: ➤ Fill rate ➤ On-time delivery - Document accuracy rate - Payment days ➤ Shipment rejection rate		• Present the plan	Documentation on management , Shipping calendar, Payment management KPI dashboard • Present and defend plan • Record findings	examples, Smartphones, PPE.
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

SUPPLY CHAIN MANAGEMENT, AGRI-LOGISTICS AND EXPORT OPERATIONS

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: SUPPLY CHAIN MANAGEMENT, AGRI-LOGISTICS AND EXPORT OPERATIONS	COURSE CODE: PIE 412	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 agricultural supply chain management, agri-logistics design, export operations management and digital supply chain platforms for global agri-export Enterprises.		
GENERAL OBJECTIVES: At the end of this course, the student should be able to: 1.0 Know agricultural supply chain management frameworks; 2.0 Understand warehouse and storage facility layouts for produce export operations; 3.0 Know multimodal transport management for agricultural export consignments; 4.0 Understand smallholder aggregation systems for export supply chain integration; 5.0 Understand supply chain digitalisation and Enterprise Resource Planning systems to agri-export operations; 6.0 Know reverse logistics and produce waste management in export operations; Understand a comprehensive supply chain management strategy for agri-export organization.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: SUPPLY CHAIN MANAGEMENT, AGRI-LOGISTICS AND EXPORT OPERATIONS			COURSE CODE: PIE 413		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 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 in agricultural supply chain management, agri-logistics design, export operations management and digital supply chain platforms for global agri-export Enterprises.						
General Objective 1.0: Know agricultural supply chain management frameworks						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain Supply Chain Operations Reference (SCOR) Model. 1.2 Describe demand-driven Supply Chain Management (SCM). 1.3 Describe supply chain resilience.	- Discuss Supply Chain Operations Reference (SCOR) Model: (Plan, Source, Make, Deliver, Return, Enable) applied to agricultural export supply chains - Explain demand-driven Supply Chain Management (SCM): Sales and Operation Planning (SandOP), demand-forecasting methods, Economic Order Quantity (EOQ) inventory	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc.	- Apply SCOR Model to map the supply chain for a Nigerian produce export business from farm to EU customer - Identify top 3 performance gaps from provided data - Recommend improvement interventions for each gap - Record and present findings	Guide students to: - Apply SCOR Model to map the supply chain for a Nigerian produce export business from farm to EU customer - Identify top 3 performance gaps from provided	SCOR Model mapping template, sesame supply chain data, performance gap analysis worksheet, computers SCOR Model diagrams, SandOP framework, inventory management worksheets, Smartphones, PPE.

		optimisation, and safety stock management Discuss supply chain resilience: risk identification, vulnerability assessment, disruption response, and adaptive capacity			data - Recommend improvement interventions for each gap - Record and present findings	
General Objective 2.0: Understand warehouse and storage facility layouts for produce export operations						
3-4	2.1 Explain warehouse design for produce storage. 2.2 Describe Warehouse Management System (WMS) functions. 2.3 Explain warehouse performance metrics.	- Discuss warehouse design for produce storage: Product flow patterns Storage zone design, Cold room placement, Traffic separation, British Retail Consortium (BRC/GLOBAL GAP) facility requirements - Explain Warehouse Management System (WMS) functions: - Receipt - Put-away - Pick, Pack, Ship, - FIFO/FEFO compliance, - Inventory cycle	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	- Design a warehouse layout for a 500-tonne produce export facility: - Receiving dock - Dry storage - Cold room Fumigation chamber Quality inspection - Dispatch dock - Ensure layout meets BRC site standards - Present and justify design - Record findings	Guide students to: - Design a warehouse layout for a 500-tonne produce export facility: - Receiving dock - Dry storage - Cold room Fumigation chamber Quality inspection	Warehouse layout design template, BRC site standards reference, graph paper or CAD software, computers Warehouse design case studies, WMS feature comparison, facility layout diagrams, projector, Smartphones, PPE.

		- counting - Discuss warehouse performance metrics: - Space utilisation - Inventory accuracy - Order fulfilment rate - Damage rate			iv. Dispatch dock - Ensure layout meets BRC site standards - Present and justify design - Record findings	
General Objective 3.0: Know multimodal transport management for agricultural export consignments						
5-6	3.1 Explain transport mode selection. 3.2 Describe Nigerian port operations. 3.3 Explain logistics bottlenecks. 3.4 Explain mitigation strategies.	- Discuss transport mode selection: Road, Sea Full Container Load and Less than Container Load (FCL vs LCL), air- International Air Transport Association (IATA) and Perishable Cargo Regulations (PCR), inland waterway — based on cost, speed, and produce type - Explain Nigerian port operations: Apapa, Tin Can, Onne — terminal operations, Port	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, etc.	- Develop a logistics plan for exporting 20 tonnes of fresh fruit from any known State to Rotterdam via Apapa Port - Specify transport modes, transit times, temperature management, port operations sequence, documentation timeline - Calculate total logistics cost and	Guide students to: - Develop a logistics plan for exporting 20 tonnes of fresh fruit from any known State to Rotterdam via Apapa Port - Specify transport modes, transit times, temperature management	Logistics plan template, transport cost data, port operations timeline, critical path calculation worksheet, computers Transport mode comparison matrix, Nigerian port operations guide, bottleneck data,

		health, Customs examination, Container handling - Discuss logistics bottlenecks: Port congestion, Document delays, Container shortage, Phytosanitary turnaround - Discuss mitigation strategies		critical path Record findings	, port operations sequence, documentation timeline - Calculate total logistics cost and critical path - Record findings	projector, Smartphones, PPE.
General Objective 4.0: Understand smallholder aggregation systems for export supply chain integration						
7-8	4.1 Explain smallholder aggregation models: - Cooperative system, - Lead farmer/aggregator model - Contract farming scheme Nucleus estate-outgrower model 4.2 Explain traceability for smallholder produce. 4.3 Explain digital farmer management platforms: - e-farmer registration - Yield forecasting - Payment digitisation	- Discuss smallholder aggregation models: - Cooperative system - Lead farmer/aggregator model - Contract farming scheme Nucleus estate-outgrower model - Describe traceability for smallholder produce: GLOBAL G.A.P. Option 2 Group Certification, Simplified AfCFTA traceability - Discuss digital	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	- Design a smallholder aggregation programme for 200 produce farmers supplying 100 tonnes/year, specify: - Registration; - Traceability; - Input supply; - Quality monitoring; - Payment system certification pathway; - Simulate the design - Visit to port, ware	- Simulate and design a smallholder aggregation programme for 200 produce farmers supplying 100 tonnes/year, specify: - Registration on - Traceability - Input supply - Quality	Aggregation programme template, farmer registration form, traceability design template, computers, projector Aggregation model comparison, GLOBALG.A.P. Option 2 guide, digital farmer platform

		farmer management platforms: ➤ e-farmer registration Mobile advisory ➤ Yield forecasting ➤ Payment digitisation		houses and inspection agencies. • Record findings	v. monitoring Payment system certification pathway • Present and defend programme • Invite an industry expert to train students on the process • Visit to port, warehouses and inspection agencies • Record findings	examples, Smartphones, PPE.
General Objective 5.0: Understand supply chain digitalisation and Enterprise Resource Planning systems to agri-export operations						
9-11	5.1 Explain Enterprise Resource Planning (ERP) systems for agri-export: i. Procurement ii. Inventory iii. Production planning iv. Quality control v. Sales orders	• Discuss Enterprise Resource Planning (ERP) systems for agri-export: ➤ Procurement ➤ Inventory ➤ Production planning	Laptop computers, smart board, Projector, Writing Materials, White board, Markers,	• Map the digital transformation journey for a Nigerian produce exporter from paper-based to digital Supply Chain	Guide students to: • Map the digital transformation journey for a Nigerian	Digital transformation roadmap template, digital tool comparison matrix, ROI calculation

	vi. Financial reporting 5.2 Describe supply chain visibility platforms: i. Real-time shipment tracking ii. Exception management iii. Predictive Expected Time of Arrival (ETA) 5.3 Explain digital compliance tools for trade document management and ethical supply chain compliance.	➤ Quality control ➤ Sales orders ➤ Financial reporting • Explain supply chain visibility platforms: ➤ Real-time shipment tracking ➤ Exception management ➤ Predictive Expected Time of Arrival (ETA) • Discuss digital compliance tools for trade document management and ethical supply chain compliance.	Internet Pictures Videos etc.	Management (SCM) • Identify pain points, select digital tools for each function, estimate costs and ROI • Present digital transformation roadmap • Record findings	produce exporter from paper-based to digital Supply Chain Management (SCM) • Identify pain points, select digital tools for each function, estimate costs and ROI • Present digital transformation roadmap • Record findings	worksheet, computers ERP system comparison, visibility platform demonstrations, digital compliance tool overviews, projector, Smartphones, PPE.
General Objective 6.0: Know reverse logistics and produce waste management in export operations						
12-13	6.1 Describe reverse logistics in agri-export: i. Rejected consignment management ii. Disposal options iii. Cost recovery strategies 6.2 Explain produce waste valorisation.	• Discuss reverse logistics in agri-export: ➤ Rejected consignment management ➤ Disposal options ➤ Cost recovery	Laptop computers, smart board, Projector, Writing Materials, White board, Markers,	• Develop a reverse logistics and waste management plan for a sesame operation with 5% expected rejection rate	Guide students to: • Develop a reverse logistics and waste management plan for a	Reverse logistics plan template, waste valorisation cost data, produce rejection

	6.3 Explain EU sustainability regulations.	• strategies • Discuss produce waste valorisation: Converting rejects to processed products contributing to circular economy • Discuss EU sustainability regulations: Cooperate Sustainability Due Diligence Directive (CSDDD) and European Union Deforestation Regulation (EUDR) deforestation-free supply chain requirements for Nigerian exporters	Internet Pictures Videos etc.	• Specify rejection handling, disposal options, cost implications, and waste valorisation opportunity • Present and justify plan • Record findings	sesame operation with 5% expected rejection rate • Specify rejection handling, disposal options, cost implications, and waste valorisation opportunity • Present and justify plan • Record findings	scenario, computers Reverse logistics case studies, waste valorisation options, EU CSDDD/EU DR overviews, projector Smartphones, PPE.
General Objective 7.0: Understand a comprehensive supply chain management strategy for an agri-export organization						
14-15	7.1 Describe strategic SCM: - Network design - Make-or-buy decisions - Supplier development programmes - Strategic partnerships 7.2 Explain supply chain sustainability: - Environmental and social KPIs	• Explain strategic SCM: ➢ Network design ➢ Make-or-buy decisions ➢ Supplier development programmes ➢ Strategic partnerships • Discuss supply chain	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures	• Develop a 3-year SCM strategy for a hypothetical 500-tonne/year Nigerian agri-export business, include: ➢ Network design	Guide students to: • Develop a 3-year SCM strategy for a hypothetical 500-tonne/year Nigerian	SCM strategy template, network design worksheet, KPI scorecard template, computers, projector,

	ii. SDG alignment for agri-export businesses 7.3 Explain emerging SCM trends: i. AI forecasting ii. Autonomous logistics iii. Drone procurement iv. Predictive quality monitoring	sustainability: ➤ Environmental and social KPIs ➤ SDG alignment for agri-export businesses • Discuss emerging SCM trends: ➤ AI forecasting ➤ Autonomous logistics ➤ Drone procurement ➤ Predictive quality monitoring	Videos etc	➤ Supplier development ➤ Digitalisation ➤ Roadmap ➤ Sustainability commitments ➤ KPI scorecard • Present and defend strategy • Record findings	agri-export business, include: ➤ Network design ➤ Supplier development ➤ Digitalisation ➤ Roadmap ➤ Sustainability commitments ➤ KPI scorecard • Present and defend strategy • Record findings	internet SCM strategy frameworks, sustainability KPI guides, emerging trends research, Smartphones, PPE.
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

INTERNATIONAL TRADE LAW, WTO/SPS AND AFCFTA MARKET ACCESS

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: INTERNATIONAL TRADE LAW, WTO/SPS AND AFCFTA MARKET ACCESS	COURSE CODE: PIE 413	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 of the international trade law framework governing agricultural exports: World Trade Enterprises (WTO) agreements, AfCFTA Protocol on Trade in Goods, bilateral agreements and legal rights of global agri-exporters.		
GENERAL OBJECTIVES: At the end of this course, the students should be able to: 1.0 Understand World Trade Enterprises framework governing international agricultural trade; 2.0 Know AfCFTA trade protocols and implications for agri-exports; 3.0 Understand EU-Nigeria trade framework and Economic Partnership Agreement (EPA) provisions; 4.0 Know Nigerian export control regulations and international sanctions compliance; 5.0 Understand trade dispute resolution mechanisms for agri-export commodities; 6.0 Understand intellectual property rights in agricultural trade, geographical indications and plant variety protection; 7.0 Understand market access strategy for global agricultural exports.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: INTERNATIONAL TRADE LAW, WTO/SPS AND AFCFTA MARKET ACCESS		COURSE CODE: PIE 413		CONTACT HOURS: 4 HOURS/WEEK		
		CREDIT UNIT: 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 of the international trade law framework governing agricultural exports: World Trade Enterprises (WTO) agreements, AfCFTA Protocol on Trade in Goods, bilateral agreements and legal rights of global agri-exporters.						
General Objective 1.0: Understand World Trade Enterprises framework governing international agricultural trade						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain WTO Agreement on Agriculture (AoA): i. Market access (tariff reduction Quotas (TRQs)) ii. Domestic support disciplines iii. Export competition rules 1.2 Explain WTO SPS Agreement: i. Use of international standards ii. Science-based measures iii. Precautionary principle	• Discuss WTO Agreement on Agriculture (AoA): ➤ Market access (tariff reduction Quotas (TRQs)) ➤ Domestic support disciplines ➤ Export competition rules • Describe WTO SPS Agreement: ➤ Use of international standards ➤ Science-based measures ➤ Precautionary	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet, etc.	• Examine a WTO SPS dispute involving a developing country agricultural exporter • Analyse disputed measure, SPS provisions, panel/Appellate Board (AB) ruling, and outcome • Present as case study with lessons for Nigerian exporters	Guide students to: • Examine a WTO SPS dispute involving a developing country agricultural exporter • Analyse disputed measure, SPS provisions, panel/Appellate Board (AB) ruling,	WTO dispute database access, SPS case study analysis template, computers, internet WTO AoA and SPS summaries, SPS dispute cases, TBT-SPS comparison, projector, Smartphones, PPE.

	iv. Dispute settlement 1.3 Explain WTO Technical Barriers to Trade (TBT) Agreement and its interface with SPS for produce certification and labelling requirements	- principle ➤ Dispute settlement - Describe WTO Technical Barriers to Trade (TBT) Agreement and its interface with SPS for produce certification and labelling requirements		Record findings	- and outcome • Present as case study with lessons for Nigerian exporters • Record findings	
General Objective 2.0: Know AfCFTA trade protocols and implications for agri-exports						
3-4	2.1 Discuss AfCFTA Protocol on Trade in Goods: - Tariff liberalisation schedules - Rules of origin - Non-Tariff Barriers (NTB) elimination - Safeguard provisions 2.2 Describe AfCFTA Annex on SPS measures: - Alignment with WTO SPS - Equivalence - Mutual recognition - Capacity building 2.3 Explain Nigerian strategic commodities	- Discuss AfCFTA Protocol on Trade in Goods: ➤ Tariff liberalisation schedules ➤ Rules of origin ➤ Non-Tariff Barriers (NTB) elimination - Safeguard provisions - Explain AfCFTA Annex on SPS measures: ➤ Alignment with WTO SPS, ➤ Equivalence ➤ Mutual recognition ➤ Capacity building - Discuss Nigerian strategic	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc.	- Explore 3 Nigerian commodities with significant AfCFTA market potential - Analyse: ➤ Trade volumes ➤ Tariff elimination timeline ➤ Rules of origin ➤ SPS compliance barriers - Present AfCFTA market opportunity report - Record findings	Guide students to: - Explore 3 Nigerian commodities with significant AfCFTA market potential - Exemplify: - Trade volumes - Tariff elimination on timeline - Rules of origin	AfCFTA portal access, ITC Trade Map, AfCFTA tariff schedule, computers, AfCFTA Protocol text, Nigerian AfCFTA tariff schedule, SPS Annex, projector, internet, Smartphones, PPE.

	under AfCFTA: i. Comparative advantage products ii. Tariff elimination timelines iii. Market access gains	commodities under AfCFTA: i. Comparative advantage products ii. Tariff elimination timelines iii. Market access gains			iv. SPS compliance barriers • Present AfCFTA market opportunity report • Record findings	
General Objective 3.0: Understand EU-Nigeria trade framework and Economic Partnership Agreement (EPA) provisions						
5-6	3.1 Describe EU-West Africa EPA: i. Provisions affecting Nigerian agri-exports, ii. Sensitive product exclusions, iii. Market Access Regulation 3.2 Explain EU Generalised Scheme of Preferences (GSP): i. Current status for Nigeria Product coverage ii. Tariff preferences iii. Graduation provisions 3.3 Explain EU Carbon Border Adjustment Mechanisms (CBAM)	• Explain EU-West Africa EPA: i. Provisions affecting Nigerian agri-exports, ii. Sensitive product exclusions, iii. Market Access Regulation • Discuss EU Generalised Scheme of Preferences (GSP): i. Current status for Nigeria Product coverage ii. Tariff preferences iii. Graduation provisions • Discuss EU Carbon	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures, etc.	• Calculate tariff preference benefit for Nigerian produce under EU GSP and Most Favored Nation (MFN) tariff rate • Determine annual export earnings gain from GSP preference • Analyse EUDR compliance requirements and recommend a supply chain due diligence system • Record findings	Guide students to: • Calculate tariff preference benefit for Nigerian produce under EU GSP and Most Favored Nation (MFN) tariff rate • Determine annual export earnings gain from	EU GSP tariff schedule, EU EUDR requirements, calculation worksheets, computers, internet EU EPA summary, EU GSP guide for Nigeria, EU CBAM/EUDR overviews, projector, Smartphones, PPE.

	and EUDR deforestation regulation implications for Nigerian agricultural exporters	Border Adjustment Mechanisms (CBAM) and EUDR deforestation regulation implications for Nigerian agricultural exporters			- GSP preference - Analyse EUDR compliance requirements and recommend a supply chain due diligence system - Record findings	
General Objective 4.0: Know Nigerian export control regulations and international sanctions compliance						
7-8	4.1 Describe Nigerian export licensing: i. Export Prohibition List ii. NEPC registration iii. CBN export proceeds repatriation obligations 4.2 Explain international sanctions affecting Nigerian agri-trade. 4.3 Explain Anti Money Laundering /Combating Financial Terrorism (AML/CFT) obligations for agri-export payment	- Explain Nigerian export licensing: i. Export Prohibition List ii. NEPC registration iii. CBN export proceeds repatriation obligations - Discuss international sanctions affecting Nigerian agri-trade: UN, EU, and US Office of Foreign Assets Control (OFAC) sanctions and screening	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	- Navigate NEPC portal and complete mock registration for a new produce organization - Check provided buyer list against OFAC specially designated nationals (SDN) list for sanctions compliance - Prepare AML compliance checklist for Nigerian agri-	Guide students to: - Navigate NEPC portal and complete mock registration for a new produce organization - Check provided buyer list against OFAC specially	NEPC portal access, OFAC SDN List access, AML compliance checklist template, computers, internet Nigeria Export Prohibition List, CBN export repatriation guide, OFAC

	systems	- requirements - Discuss Anti Money Laundering /Combating Financial Terrorism (AML/CFT) obligations for agri-export payment systems		- export business - Record findings	- designated nationals (SDN) list for sanctions compliance - Prepare AML compliance checklist for Nigerian agri-export business - Record findings	sanctions overview, Smartphones, PPE.
General Objective 5.0: Understand trade dispute resolution mechanisms for agri-export commodities						
9-11	5.1 Explain WTO Dispute Settlement Understanding (DSU): - Consultations panel proceedings - Appellate Body review - Developing country special provisions 5.2 Explain non-WTO mechanisms: - ICC International Court of Arbitration, - AfCFTA dispute	- Discuss WTO Dispute Settlement Understanding (DSU): - Consultations panel proceedings - Appellate Body review - Developing country special provisions - Describe non-WTO mechanisms: - ICC International Court of Arbitration, - AfCFTA dispute settlement	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc	- Analyse a provided trade dispute between a Nigerian produce exporter and an EU importer over quality non-conformance - Identify legal issues, applicable contract terms, dispute resolution options - Draft dispute notification letter and recommend	Guide students to: - Analyse a provided trade dispute between a Nigerian produce exporter and a EU importer over quality non-conformance - Identify legal issues,	Dispute scenario case study, trade contract template, dispute notification template, resolution guide WTO DSU summary, ICC arbitration overview, AfCFTA

	settlement iii. Bilateral negotiation and mediation 5.3 Explain practical dispute scenarios: i. Border rejection ii. Quality claims iii. Payment disputes iv. Regulatory discrimination complaints	iii. bilateral negotiation and mediation • Discuss practical dispute scenarios: i. Border rejection ii. Quality claims iii. Payment disputes iv. Regulatory discrimination complaints		resolution pathway • Record findings	applicable contract terms, dispute resolution options • Draft dispute notification letter and recommend resolution pathway • Record findings	dispute settlement guide, projector, Smartphones, PPE.
General Objective 6.0: Understand intellectual property rights in agricultural trade: Geographical Indications and plant variety protection						
12-13	6.1 Describe Geographical Indications (GI) for Nigerian agricultural products: i. World Intellectual Property Organization (WIPO) registration ii. Marketing premium iii. Protection against imitation 6.2 Explain plant variety protection (PVP) under International Union for the Protection of New Varieties of Plants (UPOV):	• Explain Geographical Indications (GI) for Nigerian agricultural products: i. World Intellectual Property Organization (WIPO) registration ii. Marketing premium iii. Protection against imitation • Discuss plant variety protection (PVP)	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc	• Identify one Nigerian agricultural product with GI registration potential • Prepare preliminary GI strategy: uniqueness criteria, geographic area, production rules, producer group, expected premium	Guide students to: • Identify one Nigerian agricultural product with GI registration potential • Prepare preliminary GI strategy: uniqueness criteria, geographic area,	WIPO GI application guide, GI strategy template, Nigerian agricultural product data, computers, internet WIPO GI registration guide, UPOV convention summary, Nigerian GI

	i. Breeders' rights ii. Farmer privilege exemptions iii. Implications for Nigerian seed systems 6.3 Explain how GI and PVP rights create trade barriers or competitive opportunities for Nigerian exporters	under International Union for the Protection of New Varieties of Plants (UPOV): i. Breeders' rights ii. Farmer privilege exemptions iii. Implications for Nigerian seed systems • Discuss how GI and PVP rights create trade barriers or competitive opportunities for Nigerian exporters		• Present as a business development case • Record findings	production rules, producer group, expected premium • Present as a business development case • Record findings	case studies, Smartphones, PPE.
General Objective 7.0: Understand market access strategy for Nigerian agricultural exports						
14-15	7.1 Explain market access strategy components: i. Regulatory landscape analysis ii. Preferential trade agreement utilisation iii. Compliance investment prioritisation iv. Stakeholder engagement plan 7.2 Explain PPP models	• Describe market access strategy components: ➤ Regulatory landscape analysis ➤ Preferential trade agreement utilisation ➤ Compliance investment prioritisation ➤ Stakeholder engagement plan	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	• Develop a market access strategy for one Nigerian commodity targeting a new export market, cover: ➤ Regulatory requirements ➤ Compliance investment ➤ PPP engagement	Guide students to: • Develop a market access strategy for one Nigerian commodity targeting a new export market, cover: ➤ Regulator	Market access strategy template, target market regulatory summary, PPP engagement plan, computers, internet Market

	for market access. 7.3 Describe how Nigerian diplomatic capital accelerates phytosanitary market access.	• Discuss PPP models for market access: government-industry working groups: National Commodity Associations, NEPC, NAQS, and industry associations • Explain how Nigerian diplomatic capital accelerates phytosanitary market access: bilateral equivalence negotiations and IPPC commitment compliance		➤ Diplomatic utilisation ➤ Implementation timeline • Present and defend strategy • Record findings	➤ Compliance investment ➤ PPP engagement ➤ Diplomatic utilisation ➤ Implementation timeline • Present and defend strategy • Record findings	y requirements access strategy framework, PPP model examples, IPPC capacity guide, projector, Smartphones, PPE.
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

MARKET INTELLIGENCE, AGRI-EXPORT BUSINESS DEVELOPMENT AND NEGOTIATIONS

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: MARKET INTELLIGENCE, AGRI-EXPORT BUSINESS DEVELOPMENT AND NEGOTIATIONS	COURSE CODE: PIE 414	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 agri-export market intelligence, business development strategy, buyer relationship management, export negotiation and agri-export business development.		
GENERAL OBJECTIVES: At the end of this course, the students should be able to: 1.0 Understand novel market intelligence systems for agri-export; 2.0 Understand buyer identification and prospecting systems for agri-export; 3.0 Know export product branding and differentiation strategies; 4.0 Understand export negotiation skills and trade contract management; 5.0 Understand trade fair strategy and buyer relationship management for agri-export; 6.0 Know agri-export business plan and enterprise development framework; - Understand digital marketing and e-commerce for agri-export market development;		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: MARKET INTELLIGENCE, AGRI-EXPORT BUSINESS DEVELOPMENT AND NEGOTIATIONS		COURSE CODE: PIE 414		CONTACT HOURS: 4 HOURS/WEEK		
		CREDIT UNIT: 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 in agri-export market intelligence, business development strategy, buyer relationship management, export negotiation and agri-export business development.						
General Objective 1.0: Understand novel market intelligence systems for agri-export						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain market intelligence sources. 1.2 Outline primary intelligence methods. 1.3 Explain intelligence dissemination.	- Discuss market intelligence sources: International Trade Centre (ITC) Trade Map, United Nations Commodity Trade Statistics Database (COMTRADE)etc - Explain primary intelligence methods: i. Trade fair intelligence gathering ii. Buyer surveys	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc.	- Obtain ITC Trade Map and COMTRADE to develop a market profile for Nigerian produce targeting Asia and Arab buyers, include: ➤ Import volumes, ➤ Price trends ➤ Competitive suppliers ➤ Seasonal patterns	Guide students to: - Obtain ITC Trade Map and COMTRAD E to develop a market profile for Nigerian produce targeting Asia and Arab buyers, include: ➤ Import	ITC Trade Map access, COMTRADE, market profile template, computers, internet ITC Trade Map, Tridge, Euromonitor overview, market intelligence template, projector, Smartphones, PPE.

		iii. Competitive benchmarking iv. Social media monitoring • Discuss intelligence dissemination: ➤ market intelligence reports ➤ buyer briefs ➤ Opportunity bulletins		➤ Quality specifications • Present as a buyer-ready market brief • Record findings	volumes ➤ Price trends ➤ Competitive suppliers ➤ Seasonal patterns ➤ Quality specifications • Present as a buyer-ready market brief • Record findings	
General Objective 2.0: Understand buyer identification and prospecting systems for agri-export						
3-4	2.1 Describe buyer identification channels: i. B2B platforms (Alibaba, Kompass, etc.) ii. Trade directories commodity exchanges iii. Trade fair contacts 2.2 Explain buyer qualification criteria: i. Financial stability import ii. Track record iii. Distribution capacity	• Explain buyer identification channels: i. B2B platforms (Alibaba, Kompass, etc) ii. Trade directories commodity exchanges iii. Trade fair contacts • Discuss valuate buyer qualification criteria: i. Financial stability import ii. Track record iii. Distribution	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	• Identify 5 potential EU buyers for Nigerian produce using B2B platforms and importer databases • Qualify each against a provided checklist • Draft a cold outreach email to the highest-ranked buyer	Guide students to: • Identify 5 potential EU buyers for Nigerian produce using B2B platforms and importer databases • Qualify each against a provided checklist	B2B platform access, buyer qualification checklist, cold outreach email template, computers B2B platform guides, buyer qualification framework, prospecting communication examples Register premium service on those platforms (eg Alibaba, Trade Kompass, etc.) Smartphones, PPE.

	iv. Certification requirements v. Payment preferences 2.3 Explain buyer prospecting communication: i. Cold outreach strategies ii. LinkedIn B2B engagement iii. Trade fair follow-up protocols	capacity iv. Certification requirements v. Payment preferences 2.4 Discuss buyer prospecting communication: i. Cold outreach strategies ii. LinkedIn B2B engagement iii. Trade fair follow-up protocols		- Carry out exercise on the platforms of Alibaba, Trade Kompass etc - Record findings	- Draft a cold outreach email to the highest-ranked buyer - Carry out exercise on the platforms of Alibaba, Trade Kompass etc. - Record findings	
General Objective 3.0: Know export product branding and differentiation strategies						
5-6	3.1 Explain agricultural product branding. 3.2 Explain product differentiation strategies. 3.3 Describe digital brand building.	Discuss agricultural product branding: i. Origin branding, ii. Certification branding (Organic, Fair Trade, etc.) iii. Sustainability iv. Storytelling for	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet	Develop a branding and differentiation strategy for a Nigerian produce exporter targeting EU premium market, specify: Brand name,	Guide students to: Develop a branding and differentiation strategy for a Nigerian produce	Brand strategy template, certification pathway guides, digital marketing plan template, computers Branding case studies, certification label examples, digital marketing strategy guides,

		premium market positioning - Describe product differentiation strategies: Speciality variety promotion, Traceability transparency, Climate-smart farming certification - Discuss digital brand building: Company website, LinkedIn, Instagram, YouTube crop tour videos for international buyer trust	Pictures, etc.	Certification pathway, Unique Selling Position (USP), Digital marketing channels, Expected price premium - Present to class - Record findings	exporter targeting EU premium market, specify: Brand name, Certification pathway, Unique Selling Position (USP), Digital marketing channels, Expected price premium - Present to class - Record findings	Smartphones, PPE.
General Objective 4.0: Understand export negotiation skills and trade contract management						
7-8	4.1 Explain Best Alternative for a Negotiated Agreement (BATNA) and Zone of Possible Agreement (ZOPA) preparation concepts 4.2 Explain negotiation tactics and closing	- Discuss BATNA and ZOPA preparation concepts - Discuss negotiation tactics and closing techniques - Discuss contract management principles	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	Conduct a structured negotiation simulation for a produce export contract between a Nigerian exporter and foreign importer	Guide students to: Conduct a structured negotiation simulation for a produce export	Negotiation role-play scenario cards, BATNA worksheet, contract template, projector BATNA/ZOPA worksheets, negotiation tactics guide, contract management framework, Smartphones, PPE.

	techniques 4.3 Describe contract management principles			• Apply BATNA, anchor opening position, negotiate price, quality, payment, and delivery • Document agreed contract terms • Record findings	contract between a Nigerian exporter and foreign importer • Apply BATNA, anchor opening position, negotiate price, quality, payment, and delivery • Document agreed contract terms • Record findings	
General Objective 5.0: Understand trade fair strategy and buyer relationship management for agri-export						
9-10	5.1 Explain agricultural trade fair strategy 5.2 Explain buyer relationship management 5.3 Describe Customer Relationship Management (CRM)	• Discuss agricultural trade fair strategy • Discuss buyer relationship management • Describe CRM systems for agri-export	Laptop computers, smart board, Projector, Writing Materials, White board, Markers,	• Develop a trade fair participation strategy for known food trade show targeting EU produce buyers, include: Pre-show	Guide students to: • Develop a trade fair participation strategy for known food trade show	Trade fair strategy template, booth design guide, follow-up protocol template, budget worksheet Trade fair selection criteria, BRM framework, CRM system

	systems for agri-export		Internet Pictures Videos, etc.	preparation, Booth concept, Lead generation targets, Follow-up protocol, Budget estimate • Present to class • Record findings	targeting EU produce buyers include: Pre- show preparation, Booth concept, Lead generation targets, Follow-up protocol, Budget estimate • Present to class • Record findings	comparison, projector, Smartphones, PPE.
General Objective 6.0: Know agri-export business plan and enterprise development framework						
11-13	6.1 Explain agri-export business plan structure 6.2 Explain business model canvas 6.3 Describe investment readiness requirements	• Discuss agri-export business plan structure • Discuss business model canvas • Describe investment readiness requirements	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	• Develop a comprehensive agri-export business plan for a Nigerian Produce enterprise: 100 tonnes/year to EU organic market include: Market analysis, Supply chain,	Guide students to: • Develop a comprehensive agri-export business plan for a Nigerian Produce enterprise: 100	Business plan template, financial projection worksheets, investor pitch deck template, computers, projector Business plan template, business model canvas, investor pitch deck examples, Smartphones, PPE.

				Certification pathway, 3-year financial projections, funding strategy • Present as investor pitch • Record findings	tonnes/year to EU organic market include: Market analysis, Supply chain, Certification pathway, 3-year financial projections, funding strategy • Present as investor pitch • Record findings	
General Objective 7.0: Understand digital marketing and e-commerce for agri-export market development						
14-15	7.1 Explain B2B digital marketing for agri-export 7.2 Explain agri-export e-commerce platforms 7.3 Describe digital marketing Return on Investment (ROI) measurement	• Explain B2B digital marketing for agri-export • Describe agri-export e-commerce platforms • Discuss digital marketing Return on Investment ROI	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet	• Develop a digital marketing plan for a Nigerian produce exporter targeting EU and Asian buyers, include: LinkedIn strategy, Alibaba International	Guide students to: • Develop a digital marketing plan for a Nigerian produce exporter	B2B platform access, buyer qualification checklist, cold outreach email template, computers B2B platform guides, buyer qualification framework, prospecting communication examples

		measurement	Pictures Videos etc.	Station listing, Email marketing sequence, Performance KPIs • Present plan • Record findings	targeting EU and Asian buyers include: LinkedIn strategy, Alibaba International Station listing, Email marketing sequence, Performance KPIs • Present plan • Record findings	Register premium service on those platforms (eg Alibaba, Trade Kompas, etc.), Smartphones, PPE.
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



QUALITY MANAGEMENT SYSTEMS IN AGRICULTURAL PRODUCE EXPORT

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: QUALITY MANAGEMENT SYSTEMS IN AGRICULTURAL PRODUCE EXPORT	COURSE CODE: PIE 421	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 knowledge and skills in designing, implementing and auditing integrated QMS combining ISO 17020 inspection body accreditation, British Retail Consortium (BRC), Global Standards and GLOBAL G.A.P. for produce inspection and export Enterprises.		
GENERAL OBJECTIVES: At the end of this course, the student should be able to: 1.0 Understand integrated Quality Management System (QMS) for a produce inspection and export enterprise; 2.0 Know QMS internal audit and management review processes; 3.0 Understand GLOBALG.A.P. producer group certification programmes for export supply; 4.0 Understand customer complaints, feedback and continual improvement systems; 5.0 Understand calibration, measurement traceability and equipment management; 6.0 Understand knowledge, training and competence systems for inspection operations; 7.0 Know QMS accreditation processes and surveillance audit management.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: QUALITY MANAGEMENT SYSTEMS IN AGRICULTURAL PRODUCE EXPORT		COURSE CODE: PIE 421		CONTACT HOURS: 4 HOUR/WEEK		
		CREDIT UNIT: 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 knowledge and skills in designing, implementing and auditing integrated QMS combining ISO 17020 inspection body accreditation, British Retail Consortium (BRC), Global Standards and GLOBAL G.A.P. for produce inspection and export Enterprises.						
General Objective 1.0: Understand integrated Quality Management System (QMS) for a produce inspection and export organization						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain integrated Quality Management System architecture 1.2 Explain documentation hierarchy without duplication 1.3 Describe audit burden reduction benefits	- Discuss integrated Quality Management System architecture - Discuss documentation hierarchy without duplication - Describe audit burden reduction benefits	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc.	- Design an integrated QMS framework for a hypothetical produce inspection and export organization - Map how ISO 17020 and ISO 22000 share documentation and processes - Present QMS framework to class - Record findings	- Design an integrated QMS framework for a hypothetical produce inspection and export enterprise - Map how ISO 17020 and ISO 22000 share documentati on and processes	Integrated QMS framework template, ISO 17020/22000 shared element worksheet, computers, projector ISO 17020/22000/9001 comparison diagram, integrated QMS

					• Present QMS framework to class • Record findings	framework template, projector, Smartphones, PPE.
General Objective 2.0: Know Quality Management System (QMS) internal audit and management review processes						
3-4	2.1 Explain internal audit programme design 2.2 Explain audit report classification and structure 2.3 Describe management review process	• Discuss internal audit programme design • Discuss audit report classification and structure • Describe management review process	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	• Plan a comprehensive QMS internal audit of a simulated produce inspection body against ISO 17020 • Report a complete classified audit report • Carry out a mock management review meeting using the audit data • Record findings	Guide students to: • Plan and lead a comprehensive QMS internal audit of a simulated produce inspection body against ISO 17020 • Issue a complete classified audit report • Facilitate a mock management review meeting using the audit data • Record	Internal audit checklist, simulated facility QMS documentation, audit report template, management review agenda Internal audit programme template, audit report template, management review agenda, projector, Smartphones, PPE.

					findings	
General Objective 3.0: Understand GLOBAL G.A.P. producer group certification programmes for export supply						
5-6	3.1 Explain GLOBAL G.A.P. IFA V6 structure and pathways 3.2 Explain producer group management requirements 3.3 Describe risk-based inspection protocols	• Discuss GLOBAL G.A.P. IFA V6 structure and pathways • Discuss producer group management requirements • Describe risk-based inspection protocols	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures, etc.	• Design a GLOBAL G.A.P. Option 2 group certification programme for 150 produce farmers in a known State, include: ➤ QMS manual, ➤ Internal auditor Training plan, ➤ Inspection schedule, ➤ Corrective action system, ➤ Database registration procedure • Present programme • Record findings	Guide students to: • Design a GLOBAL G.A.P. Option 2 group certification programme for 150 produce farmers in a known State, include: ➤ QMS manual, ➤ Internal auditor Training plan, ➤ Inspection schedule, ➤ Corrective action system, ➤ Database registration procedure • Present programme	GLOBALG. A.P. Option 2 guide, QMS manual template, internal audit training plan, computers, projector GLOBAL G.A.P. IFA V6 standard, group certification guide, risk-based inspection protocol, projector Smartphones, PPE.

					Record findings	
General Objective 4.0: Understand customer complaints, feedback and continual improvement systems						
7-8	4.1 Explain customer complaint management procedures 4.2 Explain continual improvement tools 4.3 Describe QMS performance data use for strategic improvement	- Discuss customer complaint management procedures - Discuss continual improvement tools - Describe QMS performance data use for strategic improvement	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	- Investigate a provided customer complaint about an incorrect inspection certificate for produce - Conduct root cause analysis using 5-Why and Fishbone diagram - Develop corrective action plan with verification schedule and customer response letter - Record findings	Guide students to: - Investigate a provided customer complaint about an incorrect inspection certificate for produce - Conduct root cause analysis using 5-Why and Fishbone diagram - Develop corrective action plan with verification schedule and customer response letter - Record findings	Customer complaint form, 5-Why worksheet, Fishbone template, corrective action plan template Complaint management flowchart, PDCA improvement tools, KPI dashboard examples, projector, Smartphones, PPE.

General Objective 5.0: Understand calibration, measurement traceability and equipment management						
9-10	5.1 Explain metrological traceability requirements 5.2 Explain equipment management systems 5.3 Describe calibration failure impacts on inspection reliability	- Discuss metrological traceability requirements - Discuss equipment management systems - Describe calibration failure impacts on inspection reliability	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc.	- Audit calibration records for a simulated inspection laboratory - Identify equipment overdue for calibration or with invalid certificates - Develop an equipment management improvement plan with calibration schedule - Record findings	Guide students to: - Audit calibration records for a simulated inspection laboratory - Identify equipment overdue for calibration or with invalid certificates - Develop an equipment management improvement plan with calibration schedule - Record findings	Equipment register template, calibration records (provided), overdue calibration worksheet, improvement plan template ISO 17025 calibration requirements, equipment register template, calibration requirements, equipment register template, calibration schedule, projector, Smartphones, PPE.
General Objective 6.0: Understand knowledge, training and competence systems for inspection operations						
11-13	6.1 Explain knowledge management systems	Discuss knowledge management systems	Laptop computers,	Conduct a training needs	Guide students to:	TNA template,

	6.2 Explain training needs analysis methodology 6.3 Describe succession planning and workforce development	- Analyse training needs analysis methodology - Describe succession planning and workforce development	smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc.	analysis for inspection staff of a hypothetical produce inspection body - Identify competency gaps and design a 12-month training programme with effectiveness measures - Present to class - Record findings	- Conduct a training needs analysis for inspection staff of a hypothetical produce inspection body - Identify competency gaps and design a 12-month training programme with effectiveness measures - Present to class - Record findings	competency gap analysis worksheet, training programme design template, computers, projector Knowledge management guide, evaluation framework, Smartphones, PPE.
General Objective 7.0: Know QMS accreditation processes and surveillance audit management						
14-15	7.1 Explain ISO 17020 accreditation through NiNAS 7.2 Explain surveillance audit management 7.3 Describe the business	- Discuss ISO 17020 accreditation through NiNAS - Discuss surveillance audit management - Describe the business	Laptop computers, smart board, Projector, Writing Materials,	Prepare an accreditation readiness review for a hypothetical inspection body seeking ISO	Guide students to: Prepare an accreditation readiness review for a	NiNAS accreditation guide, mock surveillance audit checklist, pre-

	case for accreditation	case for accreditation	White board, Markers, Internet Pictures Videos etc.	17020 NiNAS accreditation • Conduct mock surveillance audit. • Identify preparedness gaps, develop pre-accreditation action plan • Present readiness report • Record findings	hypothetical inspection body seeking ISO 17020 NiNAS accreditation • Conduct mock surveillance audit, identify preparedness gaps, develop pre-accreditation action plan • Present readiness report • Record findings	accreditation action plan template, computers business case data, projector, Smartphones, PPE.
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

PRODUCE INSPECTION, STATISTICAL PROCESS CONTROL AND OFFICIAL CERTIFICATION

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: PRODUCE INSPECTION, STATISTICAL PROCESS CONTROL AND OFFICIAL CERTIFICATION	COURSE CODE: PIE 422	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 the students with knowledge and skills in produce inspection, sampling and statistical analysis, produce quality certification and inspection data management systems		
GENERAL OBJECTIVES: At the end of this course, the student should be able to: 1.0 Know statistical principles in produce inspection and sampling; 2.0 Understand produce probe sampling applicable to global standards; 3.0 Know produce quality determination methods for export grading; 4.0 Understand produce inspection data management and reporting systems; 5.0 Know official produce inspection certificate systems for international trade; 6.0 Understand fumigation compliance verification and post-fumigation inspection; 7.0 Understand a comprehensive produce inspection quality assurance (QA) programme for an export facility.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: PRODUCE INSPECTION, STATISTICAL PROCESS CONTROL AND OFFICIAL CERTIFICATION			COURSE CODE: PIE 422		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 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 the students with knowledge and skills in produce inspection, sampling and statistical analysis, produce quality certification and inspection data management systems						
General Objective 1.0: Know statistical principles in produce inspection and sampling						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain Type I and II errors in produce inspection 1.2 Explain Operating Characteristic (OC) curve construction and interpretation 1.3 Explain Bayesian updating in inspection decisions	• Discuss Type I and II errors in Produce inspection • Discuss OC curve construction and interpretation • Discuss Bayesian updating in inspection decisions	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	• Construct an OC curve for a grain sampling plan using provided lot size and AQL data • Determine probability of accepting a borderline-quality lot • Adjust sampling plan to achieve specified maximum consumer's risk • Record findings	Guide students to: • Construct an OC curve for a grain sampling plan using provided lot size and AQL data • Determine probability of accepting a borderline-quality lot • Adjust sampling plan to achieve	OC curve construction worksheet, sampling plan data, calculators, computers Type I/II error illustrations, OC curve data, Bayesian updating examples, projector, Smartphones, PPE.

					specified maximum consumer's risk • Record findings	
General Objective 2.0: Understand grain probe sampling applicable to applicable to global standards						
3-4	2.1 Explain ISO 6644 and ISO 13690 sampling requirements 2.2 Explain Grain Inspection, Packers and Stockyards administration (GIPSA) official sampling procedures 2.3 Explain automated digital probe systems	• Discuss ISO 6644 and ISO 13690 sampling requirements • Discuss GIPSA official sampling procedures • Describe automated digital probe systems	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc.	• Conduct ISO 6644-compliant sampling of a simulated 50-tonne produce lot using digital probe • Calculate required increments, composite sample mass, laboratory sub-sample • Complete electronic sampling record with full chain of custody • Record findings	Guide students to: • Conduct ISO 6644-compliant sampling of a simulated 50-tonne produce lot using digital probe • Calculate required increments, composite sample mass, laboratory sub-sample • Complete electronic sampling record with full chain of custody	Digital grain probe, grain samples, ISO 6644 reference, electronic sampling record forms, computers ISO 6644/13690 standards, GIPSA sampling procedures, automated probe specifications, projector, Smartphones, PPE.

					Record findings	
General Objective 3.0: Know produce quality determination methods for export grading						
5-7	3.1 Explain Single Kernel characterization System (SKCS) for grain quality characterization 3.2 Explain NIR calibration for produce quality parameters 3.3 Explain parameter interaction effects on grading	- Discuss SKCS for grain quality characterization - Discuss NIR calibration for grain quality parameters - Describe parameter interaction effects on grading	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures, etc.	- Determine quality parameters for 3 export produce samples such as: moisture, test weight, broken kernels, foreign matter, heat-damaged kernels, dockage - Apply NIR for moisture and protein. - Compare to reference method - Assign official grade designation for each sample - Record findings	Guide students to: - Determine quality parameters for 3 export produce samples: moisture, test weight, broken kernels, foreign matter, heat-damaged kernels, dockage - Apply NIR for moisture and protein; compare to reference method - Assign official grade designation for each sample	Grain moisture meter, chondrometer, sieves, NIR device, grain samples, grade table, worksheets, Boerner/riffle sample divider, dockage tester, sample pans, analytical balance, hot-air drying oven (reference moisture) SKCS instrument overview, NIR calibration data, parameter interaction tables, projector, Smartphones, PPE.

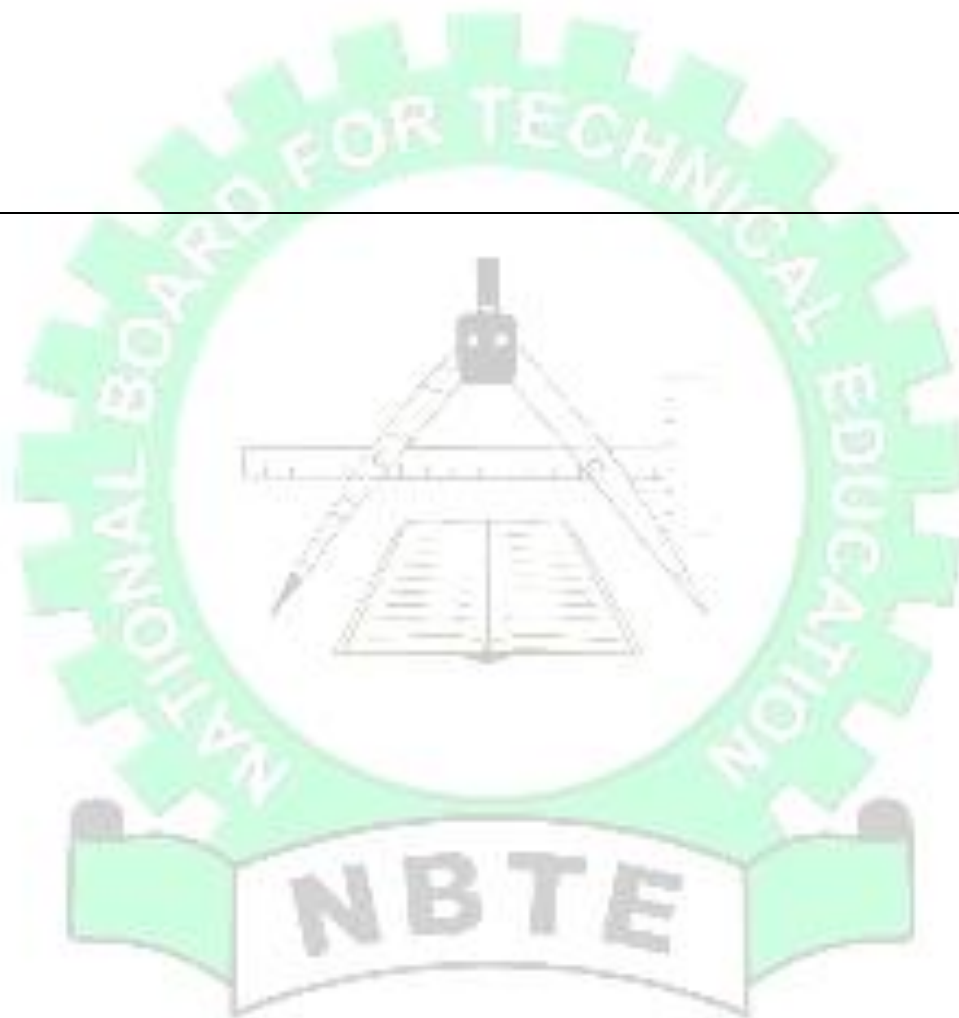
					Record findings	
General Objective 4.0: Understand produce inspection data management and reporting systems						
8-9	4.1 Explain produce inspection LIMS functionality 4.2 Explain SPC control charts for produce inspection 4.3 Describe produce quality trend reporting	- Discuss produce inspection LIMS functionality - Discuss Statistical Process Control (SPC) control charts for produce inspection - Describe produce quality trend reporting	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	- Use provided produce inspection data (3-month dataset, 50 lots) to construct moisture content control charts - Identify out-of-control signals and investigate potential causes - Prepare a produce quality trend report - Record findings	Guide students to: - Use provided produce inspection data (3-month dataset, 50 lots) to construct moisture content control charts - Identify out-of-control signals and investigate potential causes - Prepare a produce quality trend report - Record findings	produce inspection dataset (provided), control chart templates, trend report template, computers, spreadsheet projector interactive board software (LIMS), Smartphones, PPE.
General Objective 5.0: Know produce inspection certificate systems for international trade						

10-11	5.1 Explain produce certificate requirements across markets 5.2 Describe electronic certificate systems 5.3 Explain certificate dispute procedures	• Discuss produce certificate requirements across markets • Discuss electronic certificate systems • Describe certificate dispute procedures	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc.	• Prepare produce inspection certificates in three formats for the same produce sample data: Nigeria, EU, and GIPSA US format • Identify format differences and data field requirements • Conduct mock certificate verification exercise • Record findings	Guide students to: • Prepare produce inspection certificates in three formats for the same produce sample data: Nigerian, EU, and GIPSA US format • Identify format differences and data field requirements • Conduct mock certificate verification exercise • Record findings	certificate templates for 3 markets, produce inspection scenario data, verification checklist, computers dispute procedure guide, Smartphones, PPE.
General Objective 6.0: Understand fumigation compliance verification and post-fumigation inspection						
12-13	6.1 Explain produce inspector's role in fumigation verification	• Discuss produce inspector's role in fumigation	Laptop computers, smart board,	• Calibrate and operate a portable phosphine	Guide students to: • Calibrate	Portable phosphine detector,

	6.2 Describe portable phosphine detector operation 6.3 Explain fumigation-inspection-phytosanitary certificate linkage	verification • Discuss portable phosphine detector operation • Describe fumigation-inspection-phytosanitary certificate linkage	Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc.	electrochemical detector in a simulated sealed store. • Operate phosphine detector • Record phosphine concentrations at 24h and 72h intervals • Complete fumigation compliance verification record and issue ventilation clearance certificate • Record findings	and operate a portable phosphine electrochemical detector in a simulated sealed store • Record phosphine concentrations at 24h and 72h intervals • Complete fumigation compliance verification record and issue ventilation clearance certificate • Record findings	simulated sealed storage, compliance verification record, ventilation clearance certificate template, phosphine calibration gas and span check kit, gas sampling tubes/probes and gas-tight sampling line, gas-detector tubes, fume extraction/ventilation, personal phosphine gas-monitor badges, full PPE (gloves, respirator) specifications, fumigation compliance procedure, certificate linkage
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						flowchart, Smartphones.
General Objective 7.0: Understand a comprehensive produce inspection QA programme for an export facility						
14-15	7.1 Explain produce inspection Quality Assurance (QA) programme components 7.2 Explain inspector proficiency assessment methods 7.3 Describe produce inspection data for business intelligence	• Discuss produce inspection QA programme components • Discuss inspector proficiency assessment methods • Discuss produce inspection data for business intelligence	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos, etc.	• Develop a comprehensive produce inspection QA programme for a 1,000-tonne produce export facility, include: intake sampling, in-storage monitoring, pre-export testing, inspector proficiency programme, data management system • Present the QA programme	Guide students to: • Develop a comprehensive produce inspection QA programme for a 1,000-tonne produce export facility, include: intake sampling, in-storage monitoring, pre-export testing, inspector proficiency programme, data management system • Present and defend programme	QA programme template, proficiency assessment template, data management system design worksheet, computers business intelligence report examples, Smartphones, PPE.

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



DIGITAL AGRICULTURE, PRECISION INSPECTION AND BLOCKCHAIN TRACEABILITY

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: DIGITAL AGRICULTURE, PRECISION INSPECTION AND BLOCKCHAIN TRACEABILITY	COURSE CODE: PIE 423	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 the student with knowledge and skills in digital agriculture technologies, precision inspection systems, blockchain traceability, and digital tools for global agri-export quality assurance and supply chain management.		
GENERAL OBJECTIVES: At the end of this course, the students should be able to: 1.0 Understand precision agricultural technologies for export supply chain quality management; 2.0 Know blockchain-based traceability systems for agri-export supply chains; 3.0 Know IoT systems for real-time produce quality monitoring; 4.0 Understand AI-powered decision support systems for produce inspection management; 5.0 Understand the design of a digital export compliance management platform for an agri-export organizations; 6.0 Understand digital supply chain risk management and resilience systems; 7.0 Understand future digital inspection technologies and professional adaptation strategies.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: DIGITAL AGRICULTURE, PRECISION INSPECTION AND BLOCKCHAIN TRACEABILITY			COURSE CODE: PIE 423		CONTACT HOURS: 4 HOUR/WEEK	
			CREDIT UNIT: 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 the students with knowledge and skills in digital agriculture technologies, precision inspection systems, blockchain traceability, and digital tools for global agri-export quality assurance and supply chain management.						
General Objective 1.0: Understand precision agricultural technologies for export supply chain quality management						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain precision agriculture technology stack 1.2 Describe Variable Rate Technology (VRT) applications for quality management 1.3 Describe farm-to-export data integration	- Discuss precision agriculture technology stack - Discuss VRT applications for quality management - Discuss farm-to-export data integration	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc.	- Analyse a provided drone NDVI dataset for a produce field to identify crop stress zones indicating quality variation - Correlate NDVI data with yield and moisture content at harvest - Recommend targeted quality management interventions - Record findings	Guide students to: - Analyse a provided drone NDVI dataset for a produce field to identify crop stress zones indicating quality variation - Correlate NDVI data with yield and moisture content at harvest	NDVI dataset (provided), quality correlation worksheet, intervention recommendation template, computers Precision ag technology diagrams, VRT application data, farm-export traceability models, projector,

					• Recommend targeted quality management interventions • Record findings	Smartphones, PPE.
General Objective 2.0: Know blockchain-based traceability systems for agri-export supply chains						
3-4	2.1 Explain blockchain platforms for agri-traceability 2.2 Describe smart contract applications 2.3 Explain regulatory acceptance of blockchain traceability	• Discuss blockchain platforms for agri-traceability • Explain smart contract applications • Describe regulatory acceptance of blockchain traceability	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc.	• Design a blockchain traceability system for a Nigerian produce export supply chain from farmer to EU customer, specify: platform, data entry points, data fields, smart contract triggers, and QR code consumer interface • Present system design • Record findings	Guide students to: • Design a blockchain traceability system for a Nigerian produce export supply chain from farmer to EU customer, Specify: platform, data entry points, data fields, smart contract triggers, and QR code consumer interface • Trip to	Blockchain system design template, cashew supply chain scenario, smart contract design worksheet, computers, EU DPP overview, projector, internet, Smartphones, PPE.

					airports, seaports, dry port, etc. • Present system design • Record findings	
General Objective 3.0: Know IoT systems for real-time produce quality monitoring						
5-6	3.1 Explain IoT sensor fusion for quality monitoring 3.2 Explain edge computing in agri-IoT 3.3 Explain predictive quality algorithms	• Discuss IoT sensor fusion for quality monitoring • Discuss edge computing in agri-IoT • Describe predictive quality algorithms	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures, etc.	• Configure a multi-sensor IoT network for a simulated produce cold storage: temperature, humidity, CO2 • Collect 5-day data and apply threshold-based anomaly detection rules • Visualize data on a dashboard and identify quality risk events • Record findings	Guide students to: • Configure a multi-sensor IoT network for a simulated produce cold storage: temperature, humidity, CO2 • Collect 5-day data and apply threshold-based anomaly detection rules • Visualize data on a dashboard	Multi-sensor IoT nodes, IoT platform access, data visualisation tool, cold storage simulation, computers, temperature/humidity/CO2 sensors, microcontroller/IoT gateway (e.g. ESP32/Raspberry Pi), jumper wires and breadboard, power supply/battery, Wi-Fi

					and identify quality risk events • Record findings	router IoT sensor fusion architecture, edge computing system diagrams, predictive quality model examples, projector, Smartphones, PPE.
General Objective 4.0: Understand AI-powered decision support systems for produce inspection management						
7-8	4.1 Explain AI Decision Support System (DSS) architecture for inspection management 4.2 Describe explainable AI requirements 4.3 Explain AI bias and model drift issues	• Discuss AI DSS architecture for inspection management • Describe explainable AI requirements • Describe AI bias and model drift issues	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc.	• Evaluate a provided AI inspection recommendation for a borderline-quality produce consignment • Drive the accept/reject recommendation • Analyse AI recommendation using expert judgment • Present the recorded findings	Guide students to: • Evaluate a provided AI inspection recommendation for a borderline-quality produce consignment • Drive the accept/reject recommendation • Challenge or validate AI	AI DSS decision output, SHAP explanation data, expert judgment worksheet, computers, projector model drift monitoring guides, Smartphones, PPE.

					recommenda tion using expert judgment Record and present findings	
General Objective 5.0: Understand the design of a digital export compliance management platform for an agri-export organization						
9-10	5.1 Explain digital compliance platform architecture 5.2 Describe Software-as-a-Service (SaaS) compliance platforms 5.3 Explain make-versus-buy decision framework	- Discuss digital compliance platform architecture - Discuss SaaS compliance platforms - Describe make-versus-buy decision framework	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc.	- Design a digital export compliance management system for a Nigerian produce organization - Specify: core modules, data fields, regulatory update mechanism, testing schedule integration, document management workflow - Present as a digital transformation proposal - Record findings	- Design a digital export compliance management system for a Nigerian produce organization - Specify: core modules, data fields, regulatory update mechanism, testing schedule integration, document management workflow - Present as a digital	System design template, compliance module specifications, regulatory update mechanism design, computers, SaaS platform comparison, make-vs-buy analysis framework, projector, Smartphones, PPE.

					transformati on proposal • Record findings	
General Objective 6.0: Understand digital supply chain risk management and resilience systems						
11-13	6.1 Explain digital supply chain risk monitoring 6.2 Explain supply chain digital twin technology 6.3 Describe RegTech for agri-export compliance	• Discuss digital supply chain risk monitoring • Discuss supply chain digital twin technology • Discuss RegTech for agri-export compliance	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc	• Use a supply chain risk monitoring simulation to identify top 3 risks for a Nigerian produce export operation • Develop scenario response plans for each risk using digital twin logic • Present risk management framework • Record findings	Guide students to: • Use a supply chain risk monitoring simulation to identify top 3 risks for a Nigerian produce export operation • Develop scenario response plans for each risk using digital twin logic • Present risk management framework • Record findings	Supply chain risk simulation, scenario response template, digital twin logic worksheet, computers Supply chain risk platform examples, digital twin concept, RegTech tools, projector, internet, Smartphones, PPE.
General Objective 7.0: Understand future digital inspection technologies and professional adaptation strategies						
14-15	7.1 Explain digital inspection technology convergence	• Discuss digital inspection	Laptop computers,	• Develop a 5-year personal digital	Guide students to:	Competency development

	trends 7.2 Explain quantum computing implications 7.3 Explain professional adaptation strategies	technology convergence trends • Discuss quantum computing implications • Describe professional adaptation strategies	smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc	competency roadmap as a produce inspection professional • Identify key skills per year, relevant certifications, and international networks to join • Present roadmap and receive peer feedback • Record findings	• Develop a 5-year personal digital competency roadmap as a produce inspection professional • Identify key skills per year, relevant certifications, and international networks to join • Present roadmap and receive peer feedback • Record findings	roadmap template, digital certification list, international network directory, computers Technology convergence research, quantum computing horizon analysis, professional development pathways, projector, Smartphones, PPE.
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

PRODUCE VALUE ADDITION, PROCESSING AND EXPORT ENTERPRISE DEVELOPMENT

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: PRODUCE VALUE ADDITION, PROCESSING AND EXPORT ENTERPRISE DEVELOPMENT	COURSE CODE: PIE 424	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 knowledge and skills in produce value addition technology, agro-processing enterprise development, export enterprise management and sustainable business models for Nigerian agricultural commodity processing and export.		
GENERAL OBJECTIVES: At the end of this course, the student should be able to: 1.0 Understand produce value addition technologies for export market development; 2.0 Understand HACCP and GMP principles to agro-processing operations; 3.0 Understand organic and fair-trade certification for processed export products; 4.0 Know the design agro-processing facility layout and production capacity planning; 5.0 Know how to develop a processed produce export enterprise business model; 6.0 Understand packaging, labelling and branding for processed export products; 7.0 Know how to develop a comprehensive plan for agro-processing and export organization.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: PRODUCE VALUE ADDITION, PROCESSING AND EXPORT ENTERPRISE DEVELOPMENT			COURSE CODE: PIE 424		CONTACT HOURS: 4 HOUR/WEEK	
			CREDIT UNIT: 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 knowledge and skills in produce value addition technology, agro-processing enterprise development, export enterprise management and sustainable business models for Nigerian agricultural commodity processing and export.						
General Objective 1.0: Understand produce value addition technologies for export market development						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain primary processing technologies for Nigerian commodities 1.2 Explain secondary processing value differentiation 1.3 Describe economic value addition multiplier	- Discuss primary processing technologies for Nigerian commodities - Describe secondary processing value differentiation - Discuss economic value addition multiplier	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	- Conduct cold press oil extraction from a sesame sample using a mini cold press machine - Measure oil yield, moisture content, and appearance of extracted oil - Calculate value addition (price/kg oil versus raw sesame) and determine profitability of processing versus raw export - Record findings	Guide students to: - Conduct cold press oil extraction from a sesame sample using a mini cold press machine - Measure oil yield, moisture content, and appearance of extracted oil	Mini cold press machine, sesame samples, weighing balance, moisture meter, oil quality assessment tools, worksheets filtration/settling unit, refractometer, Processing technology overviews,

					• Calculate value addition (price/kg oil versus raw sesame) and determine profitability of processing versus raw export • Record findings	value addition price comparison data, specialty commodity examples, projector, Smartphones, PPE.
General Objective 2.0: Understand HACCP and GMP principles to agro-processing operations						
4	2.1 Explain HACCP plan development for commodity processing 2.2 Explain GMP requirements for agro-processing 2.3 Describe HACCP-GMP integration for market access	• Discuss HACCP plan development for commodity processing • Discuss GMP requirements for agro-processing • Explain HACCP-GMP integration for market access	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc	• Develop a HACCP plan for a sesame oil cold press facility, include: product description, process flow, hazard analysis, CCPs, monitoring plan, corrective action log • Conduct a simulated GMP facility audit using provided checklist • Record findings	Guide students to: • Develop a HACCP plan for a sesame oil cold press facility, include: product description, process flow, hazard analysis, CCPs, monitoring plan,	HACCP plan templates, GMP audit checklist, sesame oil processing scenario, computers, projector HACCP template for processing, GMP guidelines, FSSC 22000 processing scope,

					- corrective action log - Conduct a simulated GMP facility audit using provided checklist - Record findings	projector, Smartphones, PPE.
General Objective 3.0: Understand organic and fair-trade certification for processed export products						
5-6	3.1 Explain global Organic Regulation for processed products 3.2 Describe Fair trade certification process 3.3 Discuss combined certification strategy	- Describe global Organic Regulation for processed products - Analyse Fair trade certification process - Describe combined certification strategy	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures	- Develop an organic certification roadmap for a Nigerian sesame oil producer targeting global market, include: input assessment, conversion period, certification body selection, annual audit requirements, expected price premium timeline - Present roadmap - Record findings	Guide students to: Develop an organic certification roadmap for a Nigerian sesame oil producer targeting global market, include: input assessment, conversion period, certification body selection, annual audit	Organic certification roadmap template, global Organic Regulation reference, certification body list, price premium data, computers EU Organic Regulation 2018/848, Fair trade standards overview, combined

					requirements , expected price premium timeline • Present roadmap • Record findings	certification case studies, projector, Smartphones, PPE.
General Objective 4.0: Know the design of agro-processing facility layout and production capacity planning						
7-8	4.1 Explain agro-processing facility design principles 4.2 Describe production capacity planning methods 4.3 Explain energy efficiency measures	• Discuss agro-processing facility design principles • Discuss production capacity planning methods • Describe energy efficiency measures	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc.	• Design a 1 tonne/day sesame oil cold press facility layout, include: receiving dock, cleaning, press area, filling and packaging, laboratory, cold storage, waste collection • Calculate daily throughput and identify bottlenecks • Record findings	Guide students to: • Design a 1 tonne/day sesame oil cold press facility layout, include: receiving dock, cleaning, press area, filling and packaging, laboratory, cold storage, waste collection • Calculate daily throughput	Facility layout design template, throughput calculation worksheet, BRC processing site standards, graph paper or CAD software Facility design examples, capacity planning worksheets, energy efficiency guides, projector,

					- and identify bottlenecks - Record findings	Smartphones, PPE.
General Objective 5.0: Know how to develop a processed produce export organization business model						
9-11	5.1 Describe business model transformation from commodity to value-added 5.2 Explain sourcing models for agro-processors 5.3 Explain export market positioning options	- Explain business model transformation from commodity to value-added - Describe sourcing models for agro-processors - Explain export market positioning options	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc	- Develop a business model canvas for a Nigerian sesame oil enterprise targeting EU specialty retail market, include: value proposition, customer segments, channels, key activities, resources, partnerships, revenue streams, cost structure - Present canvas - Record findings	Guide students to: - Develop a business model canvas for a Nigerian sesame oil enterprise targeting EU specialty retail market, include: value proposition, customer segments, channels, key activities, resources, partnerships, revenue streams, cost structure - Present	Business model canvas template, sesame oil enterprise scenario, market channel data, computers, projector Business model transformation examples, sourcing model comparison, export market channel analysis, projector, Smartphones, PPE.

					• canvas Record findings	
General Objective 6.0: Understand packaging, labelling and branding for processed export products						
12-13	6.1 Explain packaging requirements for processed export products 6.2 Describe EU FIR mandatory labelling requirements 6.3 Explain premium product branding principles	• Discuss packaging requirements for processed export products • Explain EU FIR mandatory labelling requirements • Describe premium product branding principles	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc.	• Design a compliant EU export label for a 500ml Nigerian cold-pressed sesame oil for German retail market, include all EU FIR mandatory particulars, nutrition declaration, Dates marking, Batch coding, allergens cautions, organic label, and QR-code traceability link • Verify label compliance against EU FIR checklist • Record findings	Guide students to: • Design a compliant EU export label for a 500ml Nigerian cold-pressed sesame oil for German retail market, include all EU FIR mandatory particulars, nutrition declaration, Dates marking, Batch coding, allergens cautions, organic label, and QR-code	EU FIR mandatory label checklist, blank label design template, sesame oil nutrition data, computers, projector EU FIR labelling requirements, food contact material compliance guide, premium packaging examples, projector, Smartphones, PPE.

					• traceability link • Verify label compliance against EU FIR checklist • Record findings	
General Objective 7.0: Know how to develop a comprehensive plan for agro-processing and export organization						
14-15	7.1 Explain organization development plan structure 7.2 Describe funding options for agro-processing 7.3 Explain key success factors	• Discuss organization development plan structure • Discuss funding options for agro-processing • Describe key success factors	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc.	• Develop a complete agro-processing organization plan for a sesame oil venture: 500 tonnes/year export to EU, include all plan components, 5-year financial projections, and funding strategy • Present as investor pitch • Record findings	Guide students to: • Develop a complete agro-processing organization plan for a sesame oil venture: 500 tonnes/year export to EU, include all plan components, 5-year financial projections, and funding strategy • Present as investor	organization plan template, financial projection worksheets, investor pitch deck template, computers, projector Enterprise development plan template, funding source guide, success factor analysis framework, projector, Smartphones, PPE.

					pitch Record findings	
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Course Assessment:

Course work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%

INTEGRATING ARTIFICIAL INTELLIGENCE IN EXPORT PROCESSES

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT		
COURSE TITLE: INTEGRATING ARTIFICIAL INTELLIGENCE IN EXPORT PROCESSES	COURSE CODE: PIE 425	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 the student with knowledge and skills to apply Artificial Intelligence (AI) tools to modern agricultural export processes — including inspection, grading, documentation, traceability, market intelligence and logistics		
GENERAL OBJECTIVES: At the end of this course, the students should be able to: 1.0 Understand the fundamental concepts of Artificial Intelligence and their relevance to export processes; 2.0 Know how to apply AI-based tools for produce inspection, grading and quality assurance; 3.0 Understand AI systems for export documentation, traceability and compliance management; 4.0 Know blockchain-AI traceability concepts and real time monitoring; 5.0 Know how to employ AI for market intelligence, demand forecasting and price prediction; 6.0 Understand how to apply AI tools to optimize export logistics and supply-chain operations.		

PROGRAMME: HIGHER NATIONAL DIPLOMA PRODUCE INSPECTION AND EXPORT MANAGEMENT						
COURSE TITLE: INTEGRATING ARTIFICIAL INTELLIGENCE IN EXPORT PROCESSES		COURSE CODE: PIE 425		CONTACT HOURS: 4 HOURS/WEEK		
		CREDIT UNIT: 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 the students with knowledge and skills to apply Artificial Intelligence (AI) tools to modern agricultural export processes — including inspection, grading, documentation, traceability, market intelligence and logistics						
General Objective 1.0: Understand the fundamental concepts of Artificial Intelligence and their relevance to export processes.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain types of AI use in Agri-export 1.2 Explains the followings: i. Machine learning, ii. Computer vision iii. Natural Language Processing (NLP) iv. Predictive analytics 1.3 Explain agricultural export value chain and where AI fits	• Discuss types of AI use in Agri-export • Discuss the followings: i. Machine learning, ii. Computer vision iii. Natural Language Processing (NLP) iv. Predictive analytics • Discuss agricultural export value chain and where AI fits	Laptop Computers, smart board, Projector, Writing Materials, White board, Markers, Internet etc.	• Identify points in the export chain where AI applies • Operate a basic AI demo tool and report observations • Supervises mapping exercise • Record findings	Guide students to: • Identify points in the export chain where AI applies • Operate a basic AI demo tool and report observations • Record findings	Computer lab Internet access Sample AI platform Slides, charts Internet AI demo tools, smartphones, PPE.
General Objective 2.0: Know how to apply AI-based tools for produce inspection, grading and quality assurance.						
4-5	2.1 Explain Computer-vision image recognition for defect detection, ripeness,	• Discuss Computer-vision image recognition for defect detection, ripeness,	Laptop computers, smart board, Projector,	• Capture/upload produce images and run AI grading • Compare AI output	Guide students to: • Capture/upload produce images and run AI	•Computer-vision software •Digital cameras Sample produce,

	size and quality grading 2.2 Describe AI-assisted detection of pests, mould and contamination 2.3 Explain differences between AI and manual inspection	- size and quality grading - Explain AI-assisted detection of pests, mould and contamination - Discuss differences between AI and manual inspection	Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	- with manual inspection - Document accuracy and discrepancies - Records findings	- grading - Compare AI output with manual inspection - Document accuracy and discrepancies - Records findings	- laboratory - Sample produce - Reference grading standards - Cameras/phones, smartphones, PPE.
General Objective 3.0: Understand AI systems for export documentation, traceability and compliance management.						
6-7	3.1 Explain AI/automation for invoices, packing lists, phytosanitary and origin certificates 3.2 Explain Checking documents against NAQS, NAFDAC, SON, Codex requirements 3.3 Describe AI dashboards and IoT data for traceability	- Discuss AI/automation for invoices, packing lists, phytosanitary and origin certificates - Discuss Checking documents against NAQS, NAFDAC, SON, Codex requirements - Discuss AI dashboards and IoT data for traceability	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet, Pictures, Videos, etc.	- Use AI tools to draft a full export document set - Check documents integrity from the AI values - Record findings	Guide students to: - Use AI tools to draft a full export document set - Cross-check documents against a compliance checklist - Correct errors and finalise - Check documents integrity from the AI values - Record findings	Document templates Regulatory references Computers Documentation/automation software Computer lab Compliance checklists, smartphones, PPE.
General Objective 4.0: Employ AI for market intelligence, demand forecasting and price prediction						
8-9	4.1 Explain AI for demand forecasting and price prediction 4.2 Describe buyer	- Discuss AI for demand forecasting and price prediction - Explain buyer	Laptop computers, smart board, Projector,	- Run forecasting tools on supplied datasets - Interpret	Guide students to: Run forecasting tools on supplied	AI analytics platform Datasets Computer lab Market datasets

	matching and market-trend analysis 4.3 Explain export opportunities	- matching and market-trend analysis - Discuss export opportunities	Writing Materials, White board, Markers, Internet Pictures Videos etc.	- price/demand predictions - Present an export-opportunity brief - Report findings	- datasets - Interpret price/demand predictions - Present an export-opportunity brief - Report findings	Forecasting tool Computer skit, smartphones, PPE.
General Objective 5.0: Know how to apply AI supported tools to optimise export logistics and supply-chain operations						
10-12	5.1 Explain AI for route optimisation and shipment tracking 5.2 Describe Inventory and risk prediction in the export supply chain 5.3 Explain Apps use to track for shipments, rails, road. etc.	- Discuss AI for route optimisation and shipment tracking - Discuss Inventory and risk prediction in the export supply chain - Discuss Apps use to track for shipments, rails and road	Laptop computers, smart board, Projector, Writing Materials, White board, Markers, Internet Pictures Videos etc	- Use AI to optimise routes and track shipments - Predict inventory needs and supply-chain risks - Document an optimised logistics plan - Record findings	Guide students to: - Use AI to optimise routes and track shipments - Predict inventory needs and supply-chain risks - Document an optimised logistics plan - Record findings	Route-optimization software Computer lab Scenario data Logistics tool Scenario brief Computers, smartphones, PPE.
General Objective 6.0: Understand how to apply AI tools to optimize export logistics and supply-chain operations.						
13-15	6.1 Explain responsible AI use, bias and data privacy 6.2 Describe Regulatory	Discuss responsible AI use, bias and data privacy	Laptop computers, smart board, Projector,	- Analyse ethical and data-security scenarios. - Carryout capstone	Guide students to: Examine ethical and data-security	Computer lab Presentation facilities Project datasets Case studies

	limits and data security 6.3 Explain Capstone project and review	• Discuss regulatory limits and data security • Discuss capstone project and review	Writing Materials, White board, Markers, Internet Pictures Videos etc	project. • Present the capstone AI-in-export project	scenarios • Complete and present the capstone AI-in-export project • Give and receive peer feedback • Report finding	Capstone brief Projector, smartphones, PPE.
Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

LIST OF MINIMUM RESOURCES / PHYSICAL FACILITIES

1.0 PRODUCE INSPECTION AND GRADING LABORATORY

For physical quality assessment, grading and sampling of agricultural commodities.

S/N	DESCRIPTION OF ITEM	QUANTITY
1	Produce grading tables	10
2	Inspection benches	10
3	Digital weighing balances (precision and platform types)	10
4	Analytical balance (0.001 g resolution)	5
5	Vernier callipers	10
6	Micrometer screw gauges	10
7	Digital grain/seed moisture meters	10
8	Grain sampling probes (manual and digital)	10
9	Seed counter	5
10	Sample dividers (riffle/Boerner type)	10
11	Sieves and sieve shaker	5
12	Grain dockage tester	5

S/N	DESCRIPTION OF ITEM	QUANTITY
13	Specific gravity / chondrometer (test-weight) apparatus	5
14	Bulk density apparatus	5
15	Texture analyser / penetrometer	5
16	Fruit firmness tester (penetrometer)	5
17	Refractometer (Brix meter)	10
18	Colorimeter	5
19	Colour charts and colour comparator	Various
20	Hand lenses and magnifying glasses	20
21	Digital microscope	5
22	Stereo (dissecting) microscope	5
23	Single Kernel Characterization System (SKCS)	1
24	Near-Infrared (NIR) grain analyser (portable)	2
25	Grading rings and size templates (per produce type)	2 sets
26	Grading containers (assorted)	2 sets

S/N	DESCRIPTION OF ITEM	QUANTITY
27	Produce defect identification charts	Various
28	Commodity grading standards manuals	Various
29	Digital camera	2
30	Personal protective equipment (PPE)	20 sets
31	Moisture analyzer	2

2.0 QUALITY CONTROL AND ANALYTICAL LABORATORY

For chemical and analytical quality evaluation and export certification testing.

S/N	DESCRIPTION OF ITEM	QUANTITY
1	Analytical balances	5
2	Hot-air drying oven	2
3	Muffle / electric furnace	1
4	Water bath	2
5	Kjeldahl protein determination apparatus	1
6	Soxhlet fat-extraction unit	1

S/N	DESCRIPTION OF ITEM	QUANTITY
7	pH meter (bench and portable)	10
8	Conductivity meter	2
9	UV-Visible spectrophotometer	1
10	Microplate reader	1
11	Moisture analyser	5
12	Water activity (aw) meter	2
13	Peroxide value / rancidity test kit	5
14	Desiccators	5
15	Laboratory glassware sets (pipettes, cuvettes, condensers, flasks)	Assorted
16	Micropipettes	10
17	Magnetic stirrers	5
18	Centrifuge	2
19	Distillation unit	1
20	Laboratory oven (sample drying)	1

S/N	DESCRIPTION OF ITEM	QUANTITY
21	High Performance Liquid Chromatograph (HPLC-FLD)	1
22	Gas Chromatograph (GC) / LC-MS-MS data station	1
23	Atomic Absorption Spectrophotometer (AAS)	1
24	Immunoaffinity (IAC) clean-up columns	Assorted
25	ELISA aflatoxin rapid test kit	2
26	ELISA fumonisin and OTA rapid test kits	2
27	Aflatoxin test kits and reader	2
28	UV lamp (365 nm) for aflatoxin fluorescence	1
29	QuEChERS extraction reagents	Assorted
30	Reagents (methanol, ascorbic acid, biuret, iodine, starch, citric acid, etc.)	Assorted
31	Personal Protective Equipment (PPE)	20 sets
32	First aid kit (chemical exposure)	2

3.0 PHYTOSANITARY AND PEST INSPECTION LABORATORY

For export phytosanitary inspection, quarantine pest and fumigation-verification training.

S/N	DESCRIPTION OF ITEM	QUANTITY
1.	Compound microscopes	5
2.	Stereo microscopes	5
3.	Insect collection / dissection kits	5
4.	Insect specimen cabinets and cages	5
5.	Insect incubator / environmental cabinet	1
6.	Pest and quarantine-pest identification charts	Various
7.	Plant disease diagnostic kits	5
8.	Seed health testing equipment	1
9.	Sample preservation equipment	2
10.	Assorted insect traps (pheromone, snap, sticky)	Assorted
11.	Exposure chambers (bioassay)	10
12.	Digital imaging system	1
13.	Fumigation demonstration / simulation chamber	2

S/N	DESCRIPTION OF ITEM	QUANTITY
14.	Portable phosphine electrochemical detector	5
15.	Phosphine calibration / span-check gas and kit	2
16.	Phosphine gas-detector tubes	Assorted
17.	Gas sampling tubes/probes and gas-tight sampling line	Assorted
18.	Personal phosphine gas-monitor badges	10
19.	Fume extraction / ventilation unit	1
20.	Sprayers	Assorted
21.	Biopesticide and essential-oil samples (neem, eucalyptus, pyrethrum)	Assorted
22.	Diatomaceous earth	3 kg
23.	Full PPE (respirator, gloves, coverall)	Assorted
24.	Autoclave	2
25.	Incubator	2
26.	Laminar flow cabinet	2

4.0 PACKAGING AND EXPORT HANDLING LABORATORY

For packaging, labelling, MAP and package-performance testing for export.

S/N	DESCRIPTION OF ITEM	QUANTITY
1	Vacuum packaging machine	2
2	Heat sealing machines	2
3	Shrink wrapping machine	1
4	Strapping machine	1
5	Labelling machine	1
6	Barcode/QR printer and scanner	2
7	Modified Atmosphere Packaging (MAP) kit and gas injection set	2
9	Gas permeability / water-vapour permeability tester	2
10	Packaging material testing kit	5
11	Carton compression / drop tester	5
12	Tensile tester	2
13	Palletizing demonstration unit	1
14	Packaging design software (workstation)	2

S/N	DESCRIPTION OF ITEM	QUANTITY
15	Training materials (cartons, sacks, crates, pallets, stretch film, cushioning)	Assorted
16	Time-Temperature Indicator (TTI)	Assorted
17	Active/MAP packaging samples and sachets	Assorted

5.0 POSTHARVEST AND STORAGE TECHNOLOGY LABORATORY

For storage, cold-chain, controlled/modified-atmosphere and shelf-life studies.

S/N	DESCRIPTION OF ITEM	QUANTITY
1.	Programmable temperature and humidity (climatic/stability) test chamber	1
2.	Shelf-life testing chamber	1
3.	Integrated sensor, alarm and reporting system	1
4.	Mini cold room	1
5.	Refrigerators	2
6.	Deep freezers	2
7.	Grain storage bins and racks	Assorted
8.	Hermetic storage bags (GrainPro cocoon type) and PICS	5

S/N	DESCRIPTION OF ITEM	QUANTITY
9.	Controlled / modified-atmosphere storage demonstration unit	1
10.	Cooling chamber / humidity chamber	2
11.	Ethylene/CO ₂ /O ₂ sensors or analyzer	10
12.	Calibrated digital thermometers	20
13.	Calibrated hygrometers	20
14.	Data loggers (temperature/RH, USB and IoT type)	50
15.	Infrared thermometers	5
16.	Solar dryer	1
17.	Mechanical / cabinet dryer	1
18.	Grain aeration unit	1
19.	Sun-drying trays (wire-mesh)	Assorted
20.	Voltage stabiliser / UPS (sized to chamber load)	2

6.0 EXPORT DOCUMENTATION AND ICT LABORATORY

For export documentation, trade-platform, data-analysis and digital-systems training.

S/N	DESCRIPTION OF ITEM	QUANTITY
1	Desktop computers	40
2	Laptops	5
3	Printers	2
4	Scanners	2
5	Photocopier	1
6	Multimedia projector	2
7	Interactive smart board	1
8	Internet connectivity (broadband)	1
9	IoT development kit (microcontroller/gateway: ESP32/Raspberry Pi, sensors, breadboard, wiring)	10 sets
10	Wi-Fi router / network gateway	2
11	Cloud / external storage drives	3
12	Software: MS Office, spreadsheet, statistical analysis (PCA/SPC)	Licences
13	Software: inventory/ERP, export documentation, customs-declaration simulation	Licences

S/N	DESCRIPTION OF ITEM	QUANTITY
14	Software: image analysis (ImageJ), LIMS, data-visualisation, blockchain/IoT platform access	Licences
15	Scientific calculators	20

7.0 COMMODITY PROCESSING AND VALUE-ADDITION WORKSHOP

For value-addition, agro-processing and quality-change demonstration.

S/N	DESCRIPTION OF ITEM	QUANTITY
1.	Mini cold-press oil expeller	1
2.	Oil filtration / settling unit	1
3.	Rice milling machine prototype	1
4.	Maize sheller	1
5.	Grain cleaner/destoner	1
6.	Hammer mill	1
7.	Cassava grater and press	1 each
8.	Garri fryer	1
9.	Fruit pulper	1

S/N	DESCRIPTION OF ITEM	QUANTITY
10.	Juice extractor	1
11.	Dryer	2
12.	Weighing balance (platform)	2
13.	Moisture meter	2
14.	Oil quality assessment tools	1 set
15.	Groundnut decorticator	1

8.0 EXPORT LOGISTICS DEMONSTRATION UNIT

For cargo handling, container, reefer and warehousing demonstration.

S/N	DESCRIPTION OF ITEM	QUANTITY
1.	500kg to 3tonnes weighing scale	1
2.	Pallet trucks	2
3.	Forklift trainer / simulator	1
4.	Container loading / reefer models	Assorted
5.	Cargo securing equipment	Assorted

S/N	DESCRIPTION OF ITEM	QUANTITY
6.	Warehouse racking systems	Assorted
7.	Wood and plastic pallets	Assorted
8.	Container loading simulator (easy cargo, cargo wiz, cargo planner, etc)	5 licenses
9.	VGM training software (flexsim logistics/flexsim city)	5 licenses

9.0 FIELD INSPECTION EQUIPMENT

Portable equipment for field and on-site inspection exercises.

S/N	DESCRIPTION OF ITEM	QUANTITY
1.	Sample collection kits and sampling bags	Assorted
2.	GPS receivers / trackers	5
3.	GPS-enabled tablets / smartphones	5
4.	Digital cameras	5
5.	Drones (2 types)	Assorted
6.	Portable moisture meters	5
7.	Infrared thermometers	5

S/N	DESCRIPTION OF ITEM	QUANTITY
8.	Hand lenses	20
9.	Personal protective equipment (PPE)	20 sets

10.0 AUDIO-VISUAL STUDIO

Doubles as seminar and training room.

S/N	DESCRIPTION OF ITEM	QUANTITY
1.	Interactive smart board	1
2.	Multimedia/overhead/slide projector	2 each
3.	Public address system	1
4.	Television set	2
5.	Cameras	5
6.	Display cabinets and boards	2
7.	Laptop (for presentation)	2
8.	Printer	1
9.	Scientific calculator sets	20

11.0 METEOROLOGICAL STATION

For climate, weather and agro-meteorological data training.

S/N	DESCRIPTION OF ITEM	QUANTITY
1.	Stevenson screen	1
2.	Maximum and minimum thermometer	2
3.	Digital thermometer	2
4.	Rain gauge	2
5.	Wind vane and anemometer	2 each
6.	Evaporimeter	2
7.	Hygrometers (digital and manual)	2
8.	Barometer	2
9.	Automated weather station	1
10.	Computer with NIMET data-analysis software	1

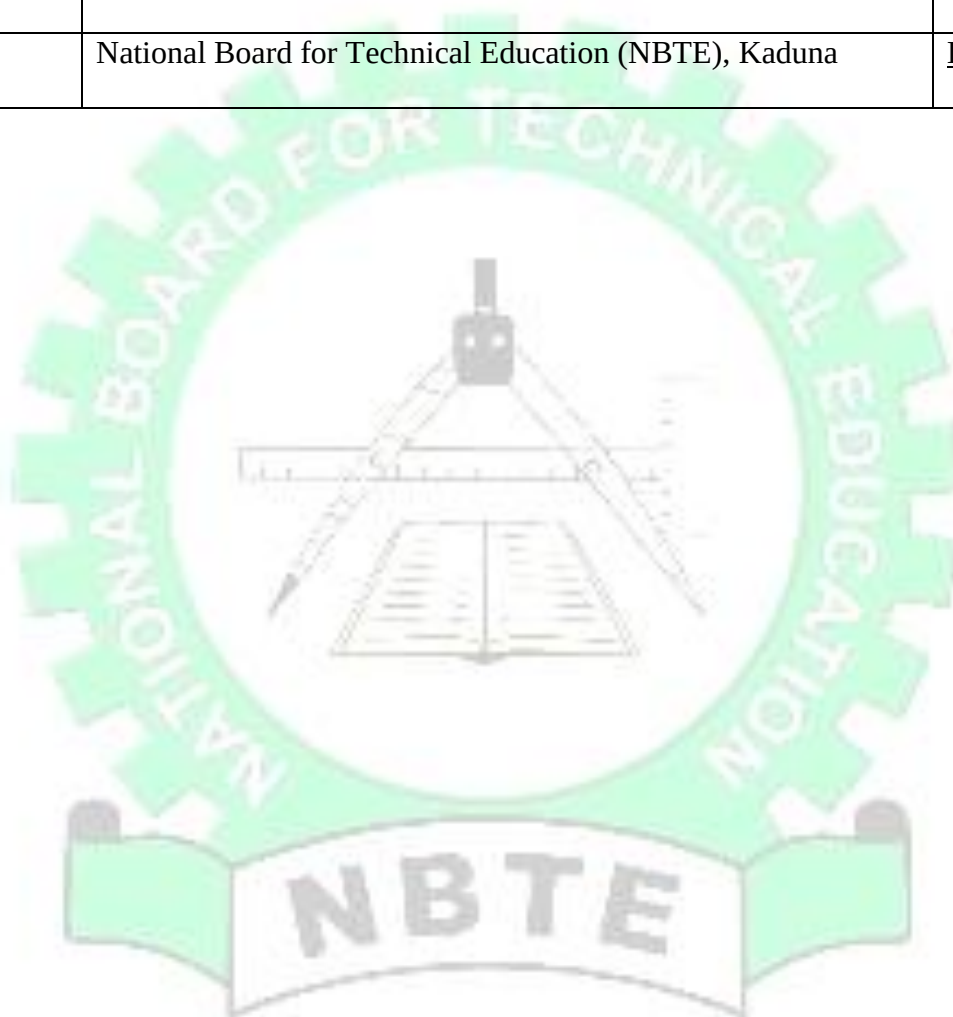
LIST OF PARTICIPANTS (PRE-CRITIQUE)

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.	Dr. Bashir Barau	Federal College of Agric. Produce Technology, (FCAPT), Kano	bashbarau2008@gmail.com
5.	Mr. 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.	Mr. 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.	Mr. Nsan Tiku Nsan	National Board for Technical Education (NBTE), Kaduna	Santoadaape2@gmail.com
12.	Mrs. Ramatu Adeiza	National Board for Technical Education (NBTE), Kaduna	ramatuishaq04@gamil.com
13.	Mrs. Rabi Sani	National Board for Technical Education (NBTE), Kaduna	rabohio1@gamil.com

LIST OF 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.	Mr. 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.	Dr. Bashir Barau	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	Sammorf Agro Consults Ltd. Ilorin, Kwara.	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	engroobello@gmail.com
11.	Mr. 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.	Mrs. Ramatu Adeiza	National Board for Technical Education (NBTE), Kaduna	ramatuishaq04@gmail.com
14.	Mal. Muhammad Aliyu Sani	National Board for Technical Education (NBTE), Kaduna	mzaleeyu@gmail.com

15.	Mrs. Hassana A. Enamusa	National Board for Technical Education (NBTE), Kaduna	hassanaennamusa@gmail.com
16.	Mr. Abdulrahman Idris	National Board for Technical Education (NBTE), Kaduna	Idrisabdulraham12@gmail.com



LIST OF ACRONYMS

LIST OF ACRONYMS	
ACRONYM	FULL MEANING
AfCFTA	African Continental Free Trade Area
AI	Artificial Intelligence
AML	Anti-Money Laundering
APHIS	Animal and Plant Health Inspection Service (USDA)
AQL	Acceptable Quality Level
ARS	Agricultural Research Service (USDA)
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ATP	Agreement on the International Carriage of Perishable Foodstuffs
AWS	Amazon Web Services
BATNA	Best Alternative to a Negotiated Agreement
BCP	Business Continuity Plan
BIPEA	Bureau Interprofessionnel d'Études Analytiques

LIST OF ACRONYMS

BRC	British Retail Consortium (Global Standard)
BRM	Business Relationship Management
CA	Controlled Atmosphere
CAAS	Computer-Aided Agricultural Systems
CAC	Codex Alimentarius Commission
CAD	Computer-Aided Design
CAP	Common Agricultural Policy (EU)
CBAM	Carbon Border Adjustment Mechanism (EU)
CBN	Central Bank of Nigeria
CCP	Critical Control Point
CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardisation
CFR	Cost and Freight
CFT	Combating the Financing of Terrorism

LIST OF ACRONYMS

CGPA	Cumulative Grade Point Average
CHED	Common Health Entry Document (EU)
CIELAB	International Commission on Illumination Colour Space
CIF	Cost, Insurance and Freight
CMOS	Complementary Metal-Oxide Semiconductor
CNN	Convolutional Neural Network
COMTRADE	United Nations Commodity Trade Statistics Database
COP	Conference of Parties
CPD	Continuing Professional Development
CRM	Customer Relationship Management
CSDDD	Corporate Sustainability Due Diligence Directive (EU)
CSRD	Corporate Sustainability Reporting Directive (EU)
CXC	Caribbean Examinations Council
DAC	Digital Analogue Converter

LIST OF ACRONYMS

DIDA	Digital Identity and Data Analytics
DNA	Deoxyribonucleic Acid
DON	Deoxynivalenol (Mycotoxin)
DPP	Digital Product Passport
DSS	Decision Support System
DSU	Dispute Settlement Understanding (WTO)
DWPE	Detention Without Physical Examination (FDA)
EAPHL	Export Agribusiness and Post-Harvest Laboratory
EC	European Commission / Electrical Conductivity
EDMS	Electronic Document Management System
ELISA	Enzyme-Linked Immunosorbent Assay
ENSO	El Niño-Southern Oscillation
EOQ	Economic Order Quantity
EPA	Environmental Protection Agency

LIST OF ACRONYMS

EPCIS	Electronic Product Code Information Services
EPPO	European and Mediterranean Plant Protection Organisation
ERP	Enterprise Resource Planning
ESG	Environmental, Social and Governance
EU	European Union
EUDR	EU Deforestation Regulation
EUROPHYT	European Union Notification System for Plant Health Interceptions
FALCPA	Food Allergen Labelling and Consumer Protection Act
FAO	Food and Agriculture Organisation of the United Nations
FAPAS	Food Analysis Performance Assessment Scheme
FAS	Free Alongside Ship / USDA Foreign Agricultural Service
FDA	Food and Drug Administration (USA)
FEFO	First Expired, First Out
FEWS	Famine Early Warning Systems Network

LIST OF ACRONYMS

FIFO	First In, First Out
FIR	Far Infrared
FMEA	Failure Mode and Effects Analysis
FOB	Free on Board
FSMA	Food Safety Modernisation Act (USA)
FSSC	Food Safety System Certification
FSVP	Foreign Supplier Verification Program (USA)
GABA	Gamma-Aminobutyric Acid
GAP	Good Agricultural Practice
GC	Gas Chromatography
GCC	Gulf Cooperation Council
GENAS	Global Export Notification and Alert System
GFSI	Global Food Safety Initiative
GI	Geographical Indication

LIST OF ACRONYMS

GIPSA	Grain Inspection, Packers and Stockyards Administration
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GLOBALG.A.P.	Global Good Agricultural Practice (Certification Standard)
GMP	Good Manufacturing Practice
GPS	Global Positioning System
GREEFA	Grading, Refrigeration, Electronics, Engineering, Fruit and Automation
GS1	Global Standards Organisation (Barcode/RFID)
GSP	Generalised System of Preferences
GVC	Global Value Chain
HACCP	Hazard Analysis and Critical Control Points
HILIC	Hydrophilic Interaction Liquid Chromatography
HLS	High Level Structure (ISO Management System Standard)
HOD	Head of Department
HPLC	High-Performance Liquid Chromatography

LIST OF ACRONYMS

HSV	Hue, Saturation and Value (Colour Model)
IAC	International Accreditation Council
IARC	International Agency for Research on Cancer
IATA	International Air Transport Association
ICC	International Chamber of Commerce / International Colour Consortium
ICT	Information and Communication Technology
IEC	International Electrotechnical Commission
IFA	International Fertiliser Association
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
IRAC	Insecticide Resistance Action Committee
IRCA	International Register of Certificated Auditors
IRM	Integrated Resistance Management
IRMS	Isotope Ratio Mass Spectrometry

LIST OF ACRONYMS

ISO	International Organisation for Standardisation
ISPM	International Standards for Phytosanitary Measures
ITC	International Trade Centre
ITU	International Telecommunication Union
KPI	Key Performance Indicator
LC	Liquid Chromatography / Less than Container Load
LC-MS	Liquid Chromatography–Mass Spectrometry
LC50	Lethal Concentration 50%
LCL	Less than Container Load
LD50	Lethal Dose 50%
LED	Light-Emitting Diode
LFI	Lateral Flow Immunoassay
LIMS	Laboratory Information Management System
LOD	Limit of Detection

LIST OF ACRONYMS

LOQ	Limit of Quantification
LTPD	Lot Tolerance Percent Defective
MAP	Modified Atmosphere Packaging
MC	Moisture Content
MCP	Methylcyclopropene
MFN	Most Favoured Nation
MIL	Military Standard (Sampling)
ML	Machine Learning
MLETR	Model Law on Electronic Transferable Records (UNCITRAL)
MPN	Most Probable Number
MRL	Maximum Residue Limit
MRM	Multiple Reaction Monitoring (Mass Spectrometry)
MSA	Measurement System Analysis
MSDS	Material Safety Data Sheet

LIST OF ACRONYMS

NAFDAC	National Agency for Food and Drug Administration and Control
NAQS	Nigerian Agricultural Quarantine Service
NBTE	National Board for Technical Education
NCR	Non-Conformance Report
NDVI	Normalised Difference Vegetation Index
NEPC	Nigerian Export Promotion Council
NEXIM	Nigerian Export-Import Bank
NFC	Near Field Communication
NICIS	Nigerian Customs Integrated System
NIMET	Nigerian Meteorological Agency
NIR	Near-Infrared (Spectroscopy)
NLP	Natural Language Processing
NMR	Nuclear Magnetic Resonance
NPPO	National Plant Protection Organisation

LIST OF ACRONYMS

NTB	Non-Tariff Barrier
OBL	Ocean Bill of Lading
OFAC	Office of Foreign Assets Control (USA)
OPRP	Operational Prerequisite Programme
OTA	Ochratoxin A (Mycotoxin)
PCA	Principal Component Analysis
PCR	Polymerase Chain Reaction
PDCA	Plan-Do-Check-Act
PICS	Purdue Improved Crop Storage
PIE	Produce Inspection and Export Management
PLS	Partial Least Squares
PLSR	Partial Least Squares Regression
PME	Pectin Methylesterase
PPE	Personal Protective Equipment

LIST OF ACRONYMS

PPP	Plant Protection Product
PRA	Pest Risk Analysis
PRP	Prerequisite Programme
PTI	Perishable Tracking Initiative
PVP	Plant Variety Protection
QA	Quality Assurance
QC	Quality Control
QMS	Quality Management System
QR	Quick Response (Code)
RASFF	Rapid Alert System for Food and Feed (EU)
RCA	Root Cause Analysis
RFID	Radio Frequency Identification
RGB	Red, Green, Blue (Colour Model)
RH	Relative Humidity

LIST OF ACRONYMS

RLU	Relative Light Units
ROI	Return on Investment
SCM	Supply Chain Management
SCOR	Supply Chain Operations Reference (Model)
SDG	Sustainable Development Goal
SHAP	SHapley Additive exPlanations
SKCS	Single Kernel Characterisation System
SOLAS	Safety of Life at Sea (Convention)
SON	Standards Organisation of Nigeria
SPC	Statistical Process Control
SPS	Sanitary and Phytosanitary (Measures)
TBT	Technical Barriers to Trade
TNA	Training Needs Analysis
TPA	Third Party Audit

LIST OF ACRONYMS

TRACES	Trade Control and Expert System (EU)
TTI	Time-Temperature Indicator
TVC	Total Viable Count
TVET	Technical and Vocational Education and Training
UCP	Uniform Customs and Practice for Documentary Credits
UN	United Nations
UPOV	International Union for the Protection of New Varieties of Plants
UPS	Uninterruptible Power Supply
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
USP	United States Pharmacopeia
UV	Ultraviolet
VCA	Value Chain Analysis
VGM	Verified Gross Mass

LIST OF ACRONYMS

VOC	Volatile Organic Compound
VRT	Variable Rate Technology
WCO	World Customs Organisation
WHO	World Health Organisation
WIPO	World Intellectual Property Organisation
WMS	Warehouse Management System
WTO	World Trade Organisation
ZEA	Zearalenone (Mycotoxin)
ZOPA	Zone of Possible Agreement