BASELINE SKILLS GAP ANALYSIS

A Consolidated Curriculum Review Compendium

Modernised ND, NCE, BSc and HND Curricula, Identified Gaps, National Occupational Standards, and Transformation Pathways across Agronomy, Livestock, Fisheries and Aquaculture, and Forestry Programmes

APRIL, 2026

Table of Contents

Executive Summary 9
1.0 OCP-HND — HND Organic Crop Production 11
1.1 Curriculum Structure 11
HND I – Semester 1 11
HND I – Semester 2 11
HND II – Semester 3 12
HND II – Semester 4 12
1.2 Alignment with Identified Gaps 12
Gap 1: Organic Certification Pathways (Partial → Fully Strengthened) 12
Gap 2: Digital Marketing & E-Commerce (Absent → Fully Introduced) 13
Gap 3: Climate-Smart Organic Systems (Partial → Fully Integrated) 13
Gap 4: Agribusiness & Enterprise Development (Partial → Full System) 13
1.3 National Occupational Standards (NOS) Alignment 13
1.4 Key Priority Actions 14
1.4 Transformation Outcome 15
2.0 PHM-ND — ND Postharvest Management 15
2.1 Curriculum Structure 15
ND I – Semester 1 15
ND I – Semester 2 15
ND II – Semester 3 16
ND II – Semester 4 16
2.2 Alignment with Identified Gaps 17
Gap 1: Cold Chain & Controlled Atmosphere Storage (Absent → Fully Introduced) 17
Gap 2: Digital Supply Chain Management (Absent → Fully Integrated) 17
Gap 3: NAFDAC / SON / Postharvest Standards (Partial → Fully Strengthened) 17
Gap 4: Export-Grade Packaging Standards (Partial → Fully Developed) 18
2.3 National Occupational Standards (NOS) Alignment 18
2.4 Key Priority Actions 18
2.5 Transformation Outcome 19
3.0 PIE-ND — ND Produce Inspection & Export Management 19
3.1 Curriculum Structure 19
ND I – Semester 1 19
ND I – Semester 2 20
ND II – Semester 3 20
ND II – Semester 4 20
3.2 Alignment with Identified Gaps 21
Gap 1: AfCFTA Trade Provisions (Absent → Fully Integrated) 21
Gap 2: Digital Export Documentation Systems (Absent → Fully Introduced) 21

Gap 3: NAFDAC / SON Regulatory Alignment (Partial → Fully Updated) 21
Gap 4: Phytosanitary Standards (Partial → Full System) 21
3.3 National Occupational Standards (NOS) Alignment 22
3.4 Key Priority Actions 22
3.5 Transformation Outcome 23
4.0 HWR-ND — ND Hydrology & Water Resource Management 23
4.1 Curriculum Structure 23
ND I – Semester 1 23
ND I – Semester 2 24
ND II – Semester 3 24
ND II – Semester 4 24
4.2 Alignment with Identified Gaps 25
Gap 1: Climate Hydrology & Extreme Events (Partial → Fully Integrated) 25
Gap 2: Digital Water Monitoring Systems (Minimal → Fully Introduced) 25
Gap 3: Gender & Water Access (Absent → Fully Integrated) 25
Gap 4: Agri–Water Nexus (Minimal → Structured System) 26
4.3 National Occupational Standards (NOS) Alignment 26
4.4 Key Priority Actions 27
4.5 Transformation Outcome 27
5.0 IAT-ND — ND Irrigation Agronomy Technology 27
5.1 Curriculum Structure 27
ND I – Semester 1 27
ND I – Semester 2 28
ND II – Semester 3 28
ND II – Semester 4 28
5.2 Alignment with Identified Gaps 29
Gap 1: Smart Irrigation & IoT Sensors (Absent → Fully Addressed) 29
Gap 2: Climate Impact on Water Availability (Partial → Strengthened) 29
Gap 3: Agribusiness of Irrigation Enterprises (Absent → Introduced) 29
5.3 National Occupational Standards (NOS) Alignment 30
5.4 Key Priority Actions 30
5.5 Transformation Outcome 31
6.0 HRE-HND — HND Home & Rural Economics 32
6.1 Curriculum Structure 32
HND I – Semester 1 32
HND I – Semester 2 32
HND II – Semester 3 33
HND II – Semester 4 33
6.2 Alignment with Identified Gaps 33

Gap 1: Digital Agriculture (Absent → Fully Introduced) 33
Gap 2: Climate-Smart Agriculture (Absent → Fully Integrated) 34
Gap 3: Entrepreneurship (Minimal → Full Enterprise System) 34
Gap 4: One Health & Biosecurity (Minimal → Full System) 34
6.3 National Occupational Standards (NOS) Alignment 34
6.4 Key Priority Actions 35
6.5 Transformation Outcome 35
7.0 HRE-ND — ND Home & Rural Economics 36
7.1 Curriculum Structure 36
ND I – Semester 1 36
ND I – Semester 2 36
ND II – Semester 3 37
ND II – Semester 4 37
7.2 Alignment with Identified Gaps 37
Gap 1: Digital Agriculture (Absent → Introduced) 37
Gap 2: Climate-Smart Agriculture (Absent → Integrated) 38
Gap 3: Food Safety & Quality Assurance (Partial → Strengthened) 38
Gap 4: Entrepreneurship (Minimal → Structured) 38
Gap 5: Gender & Social Inclusion (Partial → Mainstreamed) 38
7.3 National Occupational Standards (NOS) Alignment 38
7.4 Key Priority Actions 39
7.5 Transformation Outcome 40
8.0 HOT-HND — HND Horticulture 40
8.1 Curriculum Structure 40
HND I – Semester 1 40
HND I – Semester 2 40
HND II – Semester 3 41
HND II – Semester 4 41
8.2 Alignment with Identified Gaps 41
Gap 1: Precision Horticulture Systems (Partial → Strengthened) 41
Gap 2: Post-Harvest Export Logistics (Partial → Strengthened) 42
Gap 3: Entrepreneurship & Innovation (Minimal → Introduced) 42
8.3 National Occupational Standards (NOS) Alignment 42
8.4 Key Priority Actions 43
8.5 Transformation Outcome 43
9.0 HOT-ND — ND Horticulture 43
9.1 Curriculum Structure 44
ND I – Semester 1 44
ND I – Semester 2 44

ND II – Semester 3 44
ND II – Semester 4 45
9.2 Alignment with Identified Gaps 45
Gap 1: Controlled Environment Agriculture (Partial → Strengthened) 45
Gap 2: Export Market Food Safety Standards (Partial → Strengthened) 45
Gap 3: Digital Marketing for Horticultural Produce (Absent → Introduced) 45
9.3 National Occupational Standards (NOS) Alignment 46
9.4 Key Priority Actions 46
9.5 Transformation Outcome 47
10.0 SSLT-HND — HND Soil Science & Land Technology 47
10.1 Curriculum Structure 47
HND I – Semester 1 47
HND I – Semester 2 47
HND II – Semester 3 48
HND II – Semester 4 48
10.2 Alignment with Identified Gaps 48
Gap 1: Digital Soil Mapping & Remote Sensing (Absent → Introduced) 48
Gap 2: Climate-Smart Soil Management (Partial → Strengthened) 49
Gap 3: Gender & Social Inclusion (Absent → Introduced) 49
10.3 National Occupational Standards (NOS) Alignment 49
10.4 Key Priority Actions 50
10.5 Transformation Outcome 50
11.0 CPT-HND — HND Crop Production Technology 50
11.1 Curriculum Structure 50
HND I – Semester 1 50
HND I – Semester 2 51
HND II – Semester 3 51
HND II – Semester 4 51
11.2 Alignment with Identified Gaps 52
Gap 1: Precision Crop Monitoring Technology (Absent → Introduced) 52
Gap 2: Climate Adaptation Agronomy (Partial → Strengthened) 52
Gap 3: Food Safety & HACCP (Minimal → Introduced) 52
11.3 National Occupational Standards (NOS) Alignment 53
11.4 Key Priority Actions 53
11.5 Transformation Outcome 54
12.0 ABM-HND — HND Agribusiness Management 54
12.1 Curriculum Structure 54
HND I – Semester 1 54
HND I – Semester 2 54

HND II – Semester 3 55
HND II – Semester 4 55
12.2 Alignment with Identified Gaps 55
Gap 1: Digital Agriculture Tools for Agribusiness (Absent → Introduced) 55
Gap 2: Gender & Social Inclusion (Absent → Introduced) 56
Gap 3: One Health & Supply Chain (Absent → Introduced) 56
12.3 National Occupational Standards (NOS) Alignment 56
12.4 Key Priority Actions 57
12.5 Transformation Outcome 57
13.0 AEM-HND — HND Agricultural Extension Management 58
13.1 Curriculum Structure 58
HND I – Semester 1 58
HND I – Semester 2 58
HND II – Semester 3 58
HND II – Semester 4 59
13.2 Alignment with Identified Gaps 59
Gap 1: Digital Extension Tools (Absent → Introduced) 59
Gap 2: Climate-Smart Agriculture Communication (Partial → Strengthened) 60
Gap 3: Gender-Responsive Extension (Partial → Strengthened) 60
13.3 National Occupational Standards (NOS) Alignment 60
13.4 Key Priority Actions 61
13.5 Transformation Outcome 61
14.0 GT-ND — ND General Agricultural Technology 61
Curriculum Structure 61
ND I – Semester 1 61
ND I – Semester 2 62
ND II – Semester 3 62
ND II – Semester 4 62
14.1 Alignment with Identified Gaps 63
Gap 1: Digital Agriculture & Precision Farming (Absent → Introduced) 63
Gap 2: Climate-Smart Agriculture (Absent → Introduced) 63
Gap 3: Entrepreneurship & Innovation (Absent → Introduced) 63
Gap 4: Gender & Social Inclusion (Absent → Introduced) 63
Gap 5: One Health & Biosecurity (Absent → Introduced) 63
14.2 National Occupational Standards (NOS) Alignment 64
14.3 Key Priority Actions 64
14.4 Transformation Outcome 65
15.0 OAT ND ND ORGANIC AGRICULTURAL TECHNOLOGY 65
15.1 Curriculum Structure 65

ND I – Semester 1 65
ND I – Semester 2 65
ND II – Semester 3 66
ND II – Semester 4 66
15.2 Alignment with Identified Gaps 66
Gap 1: Digital Agriculture & Precision Farming (Absent → Introduced) 66
Gap 2: Climate-Smart Agriculture (Absent → Introduced) 67
Gap 3: AGRIBUSINESS & EXPORT CHANNELS (PARTIAL → FULL SYSTEM) 67
15.3 National Occupational Standards (NOS) Alignment 67
Certification & Compliance NOS 67
Climate-Smart Organic NOS 67
Agribusiness NOS 67
Digital Agriculture NOS 68
Trade & AfCFTA NOS 68
15.4 Key Priority Actions 68
PRIORITY 1 (GLOBAL MARKET ACCESS) 68
PRIORITY 2 68
PRIORITY 3 68
15.5 Transformation Outcome 68
16.0 NCE Agronomy Panel Sub-committee (Crop and Agribusiness Option) 69
16.1 NCE Crop and Agribusiness Option 69
17.0 Livestock Ecology Skills-Gap Analysis 71
Table 1 — Animal Health & Production Programmes 71
Table 2 — Pasture & Range Management Programme 79
Table 3 — Veterinary Laboratory Technology Programmes 84
18.0 Fisheries & Aquaculture Skills-Gap Analysis 91
Table 1 — ND Fisheries Technology (2022) 91
Table 2 — ND Oceanography and Fisheries Science (2017) 96
Table 3 — HND Fisheries Technology 101
Table 4 — Cross-cutting Gaps (ND, ND OFS and HND) 106
19.0 Livestock Skills-Gap Analysis vs NUC CCMAS 2023 110
20.0 Fisheries & Aquaculture Skills-Gap Analysis vs NUC CCMAS 2023 116
21.0 B.Agric. Agronomy — Skills Gap Analysis & Curriculum Reform Framework 131
21.1 Introduction & Scope 132
21.1.1 The Two Reform Ratios — 70/30 and 60/40 132
21.1.2 CCMAS 2023 Framework — Accurate Application 132
21.1.3 B.Agric. Programme Structure Under CCMAS 2023 133
21.2 Analytical Framework & Methodology 134
21.2.1 Gap Score Calculation 134

21.3 Consolidated Skills Gap Summary — All B.Agric. Courses 135
21.4 Comprehensive Assessment Form — B.Agric. Agronomy 179
21.5 New Course Module Register — B.Agric. Agronomy 180
22.0 Summary and Recommendations of Skills Gap Report on Forestry and Related Programmes 181
23.0 Agronomy Panel Sub-committee (NCE Crop and Agribusiness Option)..... 190

Executive Summary

Baseline Skills Gap Analysis: Agricultural Curricula Reform Compendium

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Purpose and Scope

This compendium presents a comprehensive baseline skills gap analysis and curriculum modernization framework for Nigerian agricultural education across all qualification levels ND, HND, NCE, B.Agric., and B.Sc. covering 24 programme areas under the regulatory oversight of NBTE and NUC (CCMAS 2023). The review was conducted by sector-specific sub-committees spanning Agronomy, Livestock, Fisheries & Aquaculture, and Forestry panels.

The Central Finding

Across every sector and qualification level reviewed, curricula are heavily skewed toward theoretical delivery estimated at less than 30% practical contact hours against reform targets of 60–70%. Five critical cross-cutting competency areas are **completely absent** from most programmes: digital agriculture and AI tools, agricultural robotics and drones, climate resilience and adaptation, export certification and trade standards, and food quality conformity (HACCP/GAP). This is not a marginal gap it represents a structural mismatch between what institutions currently produce and what Nigeria's agricultural economy requires.

Sector-by-Sector Gap Summary

Agronomy (ND, HND, B.Agric., NCE) Across 15 programmes including HND Organic Crop Production, HND Crop Production Technology, ND General Agricultural Technology, and B.Agric. Agronomy common critical gaps include the complete absence of precision farming tools (GPS, drones, remote sensing), climate-smart agronomy, pre-harvest food safety (HACCP/GAP), and digital marketing. The B.Agric. review, calibrated to NUC CCMAS 2023, identifies seven courses with CRITICAL gap scores (score = 4/4) where practical delivery is currently at 0%. Five new mandatory modules are proposed: AGR 315 (AI & Digital Farming), AGR 320 (Agricultural Robotics & Drones), AGR 325 (Climate Resilience), AGR 415 (Export Certification), and AGR 416 (Quality Conformity/HACCP). The NCE Agronomy panel further flags the complete absence of forestry content and grossly inadequate fisheries coverage under NCCE 2020.

Livestock (HND, ND, NCE, B.Sc.) Analysis of Animal Health Technology, Animal Production Technology, Pasture & Range Management, and Veterinary Laboratory Technology programmes identifies 25 discrete gaps at polytechnic level and 19 at university level. The most critical include: apiculture (nationally scored 1.87/5 the lowest across all roles); digital livestock farming (IoT collars, RFID, drone pasture monitoring entirely absent); cold chain management for animal products; computer-aided feed formulation; and climate-smart livestock practices. Artificial insemination content exists in some programmes but lacks species-

specific depth. Equipment maintenance is the lowest-scoring individual competency nationally (2.32/5). New NOS/NSQ trades proposed include Digital Livestock Farming Technician, Livestock Cold-Chain Operations, Swine Production, Apiculture/Queen Rearing Specialist, and Climate-Smart Livestock Production.

Fisheries & Aquaculture (ND, ND Oceanography, HND, B.Sc.) The review identifies systemic failures across all three polytechnic programmes and the B.Sc. Fisheries CCMAS. Daily farm management practical time is grossly inadequate (ND Fish Farm Practice: 1 CU/15 hours for an entire production cycle). Fish feed production which accounts for 60–70% of farm operating costs is not taught at ND level at all. Hatchery practice, mariculture, digital/precision aquaculture, HACCP/Codex compliance, and fish disease diagnostics are absent or superficially treated. The cross-cutting section recommends enforcing the 2+1+2 polytechnic model (ND + full-year industrial attachment + HND), tying graduation to measurable production outcomes (≥100 kg at ND; ≥500 kg with FCR benchmarks at HND), and registering nine new NOS/NSQ fisheries trades. The existing NSQ Aquaculture trade is capped at Levels 1–2, misaligned with HND graduate expectations.

Forestry, Wildlife & Wood Technology (ND, HND, B.Sc.) Carbon accounting, REDD+, GHG inventory, and voluntary carbon market competencies are entirely absent from all forestry programmes. Forest law and governance (CITES, CBD, Paris Agreement, FPIC) lacks any dedicated coverage. Biodiversity management tools conservation genetics, eDNA sampling, landscape connectivity modeling are not taught. Agroforestry systems have no dedicated course. Entrepreneurship is generic rather than forestry-specific, with no integration of carbon credit markets, NTFP value chains, or ecotourism business models. Mandatory lecturer recertification in Carbon & Climate, Forest Protection, and Forest Law & Governance within twelve months is recommended as a formal accreditation condition. Five new B.Sc. courses are proposed alongside substantial modernization of three existing ones.

Cross-Cutting Themes Requiring Immediate Action

Across all sectors, the following gaps recur with uniform urgency:
Digital agriculture and precision farming tools are absent from nearly every curriculum reviewed, yet represent the defining competency shift of the decade. Climate-smart agriculture — covering adaptation, resilience, and carbon accounting — receives only passing mention and zero practical delivery. Export certification, MRL compliance, phytosanitary standards, and AfCFTA trade integration are uniformly absent; leaving graduates unequipped for Nigeria's agricultural export ambitions. Food safety systems (HACCP, Codex Aliment Arius, NAFDAC/SON alignment) are partial at best. Gender and social inclusion is absent or minimal across the majority of programmes. One Health and biosecurity integration — critical given zoonotic disease risks is treated superficially across livestock, general agriculture, and rural economics programmes.
This compendium serves as the evidence base and proposed curriculum framework for the NBTE, NCCE and NUC Implementation Committee on Agricultural Curricula Review. Implementation will require coordinated action between NBTE, NUC, NCCE, Sector Skills

Councils, industry partners, and accreditation bodies to translate these recommendations into revalidated curricula, updated accreditation standards, and measurable graduate competency outcomes.

1.0 OCP-HND — HND Organic Crop Production

Level: Higher National Diploma (HND)
Upgrade: Undated → Modernized & Revalidated
Delivery Ratio: 70% Practical / 30% Theory

1.1 Curriculum Structure

HND I – Semester 1

Code	Course Title	CU	T/P Ratio
OCP 311	Advanced Principles of Organic Crop Production Systems	3	30/70
OCP 312	Organic Soil Fertility & Ecosystem Management	2	30/70
OCP 313	Organic Pest & Disease Management Systems	3	30/70
OCP 314	Regenerative Agriculture & Soil Health Systems	2	30/70
OCP 315	Postharvest Handling in Organic Crop Systems	2	30/70
OCP 316	Introduction to Organic Certification Systems	3	40/60
GNS 301	Technical Communication & Report Writing	2	60/40

HND I – Semester 2

Code	Course Title	CU	T/P Ratio
OCP 321	Organic Crop Production Economics & Farm Management	3	30/70
OCP 322	Integrated Organic Farming Systems (Crop-Livestock Linkage)	3	30/70
OCP 323	Climate-Smart Organic Agriculture Practices	3	30/70
OCP 324	Organic Seed Systems & Biodiversity Conservation	2	30/70
OCP 325	Research Methods in Organic Agriculture	2	40/60
OCP 326	Field Practical I (Organic Farm Systems Practice)	3	10/90

HND II – Semester 3

Code	Course Title	CU	T/P Ratio
OCP 411	Advanced Organic Crop Production Systems	3	30/70
OCP 412	ECOCERT, USDA-NOP & EU Organic Certification Systems	3	40/60
OCP 413	Organic Value Chain Development & Market Systems	3	30/70
OCP 414	Agroecology & Sustainable Farming Systems	2	30/70
OCP 415	Climate Resilience in Organic Crop Production	2	30/70
OCP 416	Organic Data Systems & Farm Record Management	2	30/70
OCP 417	Field Practical II (Certified Organic Farm Systems Practice)	3	10/90

HND II – Semester 4

Code	Course Title	CU	T/P Ratio
OCP 421	Digital Marketing of Organic Agricultural Products	3	20/80
OCP 422	Agribusiness & Enterprise Development for Organic Farming	3	30/70
OCP 423	Organic Export Markets & AfCFTA Trade Systems	2	40/60
OCP 424	Organic Branding, Packaging & Premium Market Access	2	20/80
OCP 425	Seminar: Global Trends in Organic Agriculture	2	40/60
OCP 426	Final Project (Organic Enterprise Development & Certification Pathway)	6	10/90
SIW 200	SIWES / Industrial Attachment (Certified Organic Farms & Export Firms)	6	0/100

1.2 Alignment with Identified Gaps

Gap 1: Organic Certification Pathways (Partial → Fully Strengthened)

New Courses Added

- OCP 316 — Introduction to Organic Certification Systems
- OCP 412 — ECOCERT, USDA-NOP & EU Organic Certification Systems

Practical Competencies

- Organic certification documentation
- Compliance with international organic standards

- Certification audit preparation
- Inspection readiness procedures
- Traceability systems for organic farms

Gap 2: Digital Marketing & E-Commerce (Absent → Fully Introduced)

New Courses Added

- OCP 421 — Digital Marketing of Organic Agricultural Products

Practical Competencies

- E-commerce platforms for organic products
- Social media branding strategies
- Online organic marketplaces
- Digital customer engagement systems
- Premium organic product positioning

Gap 3: Climate-Smart Organic Systems (Partial → Fully Integrated)

New Courses Added

- OCP 323 — Climate-Smart Organic Agriculture Practices
- OCP 415 — Climate Resilience in Organic Crop Production

Practical Competencies

- Regenerative soil management
- Climate adaptation in organic farming
- Water-efficient organic systems
- Biodiversity-based farming resilience
- Carbon-conscious farming practices

Gap 4: Agribusiness & Enterprise Development (Partial → Full System)

New Courses Added

- OCP 422 — Agribusiness & Enterprise Development for Organic Farming
- OCP 413 — Organic Value Chain Development

Practical Competencies

- Organic startup development
- Value chain structuring
- Cooperative organic farming models
- Export business planning
- Premium market positioning strategies

1.3 National Occupational Standards (NOS) Alignment

Organic Crop Production NOS

- Organic agronomy practices
- Soil fertility management
- Pest control in organic systems
- Composting and bio-input production

Certification & Compliance NOS

- ECOCERT certification procedures
- USDA-NOP compliance systems
- EU organic standards
- Farm audit documentation systems

Climate-Smart Agriculture NOS

- Regenerative agriculture systems
- Agroecological farming methods
- Climate adaptation strategies
- Biodiversity conservation farming

Agribusiness NOS

- Organic enterprise development
- Value chain systems
- Agribusiness planning
- Export-oriented production systems

Digital Agriculture NOS

- Digital marketing systems
- E-commerce agriculture platforms
- Farm data management systems
- Online branding strategies

Trade & AfCFTA NOS

- Organic export systems
- Regional trade integration
- International market compliance
- Cross-border agricultural trade

1.4 Key Priority Actions

Priority 1 — Critical / Immediate Action

- ECOCERT / USDA / EU certification integration
- Full traceability systems
- Inspection compliance frameworks

Priority 2

- Digital organic marketing ecosystems
- Export-oriented organic agribusiness systems
- AfCFTA integration for organic products

Priority 3

- AI-driven organic farming analytics (future expansion)
- Smart soil health monitoring systems
- Global organic brand development

1.4 Transformation Outcome

Old Model (Undated)	New Model (Reconstructed)
• Production-focused organic farming • Weak certification integration • No digital commercialization • Limited export readiness	• Fully certified organic production system • Global export-ready organic value chains • Digital organic agriculture ecosystem • Climate-resilient regenerative agriculture model • Premium market access framework

2.0 PHM-ND — ND Postharvest Management

Level: National Diploma (ND)
Upgrade: Undated → Modernized & Revalidated
Delivery Ratio: 70% Practical / 30% Theory

2.1 Curriculum Structure

ND I – Semester 1

Code	Course Title	CU	T/P Ratio
PHM 111	Introduction to Postharvest Systems & Food Supply Chains	3	40/60
PHM 112	Principles of Food Preservation & Storage Science	2	30/70
PHM 113	Postharvest Physiology of Agricultural Produce	2	40/60
PHM 114	Packaging Materials & Basic Handling Techniques	2	30/70
PHM 115	Food Quality Inspection & Grading Systems	2	30/70
PHM 116	Introduction to Food Safety Standards (NAFDAC Basics)	2	40/60
GNS 101	Communication Skills & Technical Writing	2	60/40

ND I – Semester 2

Code	Course Title	CU	T/P Ratio
PHM 121	Traditional Storage Systems & Rural Postharvest Practices	3	30/70

Code	Course Title	CU	T/P Ratio
PHM 122	Food Loss Reduction Techniques & Waste Minimization	2	30/70
PHM 123	Principles of Agro-Logistics & Distribution Systems	2	40/60
PHM 124	Postharvest Pest & Disease Control Systems	2	30/70
PHM 125	Introduction to Export Standards & Quality Compliance	3	40/60
PHM 126	Practical Postharvest Handling I (Field & Storage Practice)	3	10/90

ND II – Semester 3

Code	Course Title	CU	T/P Ratio
PHM 211	Advanced Postharvest Technology & Processing Systems	3	30/70
PHM 212	Cold Chain Logistics & Refrigeration Systems	3	20/80
PHM 213	Controlled Atmosphere Storage & Smart Warehousing	3	30/70
PHM 214	Food Safety Systems (HACCP, NAFDAC, SON Compliance)	3	30/70
PHM 215	Digital Supply Chain Management & Traceability Systems	2	30/70
PHM 216	Export Handling & International Quality Certification	2	40/60
PHM 217	Practical Postharvest Operations II (Cold Chain Systems)	3	10/90

ND II – Semester 4

Code	Course Title	CU	T/P Ratio
PHM 221	Food Logistics Economics & Supply Chain Optimization	2	40/60
PHM 222	Export Packaging Design & International Standards	3	20/80
PHM 223	NEPC Export Systems & Global Market Compliance	3	40/60
PHM 224	Digital Tracking, QR Coding & Traceability Systems	2	20/80
PHM 225	Seminar: Innovations in Postharvest Technology	2	40/60
PHM 226	Final Project (Cold Chain / Export Supply Chain	6	10/90

Code	Course Title	CU	T/P Ratio
	Design)		
SIW 200	SIWES / Industrial Attachment (Food Processing & Export Firms)	6	0/100

2.2 Alignment with Identified Gaps

Gap 1: Cold Chain & Controlled Atmosphere Storage (Absent → Fully Introduced)

New Courses Added

- PHM 212 — Cold Chain Logistics & Refrigeration Systems
- PHM 213 — Controlled Atmosphere Storage & Smart Warehousing

Practical Competencies

- Refrigerated storage systems operation
- Cold room management
- Temperature-controlled logistics
- Humidity and atmosphere control systems
- Postharvest spoilage reduction techniques

Gap 2: Digital Supply Chain Management (Absent → Fully Integrated)

New Courses Added

- PHM 215 — Digital Supply Chain Management & Traceability Systems
- PHM 224 — Digital Tracking, QR Coding & Traceability Systems

Practical Competencies

- QR-based product tracking systems
- Digital logistics platforms
- Farm-to-market traceability systems
- Supply chain data analytics
- Warehouse inventory digitization

Gap 3: NAFDAC / SON / Postharvest Standards (Partial → Fully Strengthened)

New Courses Added

- PHM 116 — Food Safety Standards (NAFDAC Basics)
- PHM 214 — Food Safety Systems (HACCP, NAFDAC, SON)
- PHM 216 — Export Handling & Certification

Practical Competencies

- HACCP compliance systems
- NAFDAC inspection readiness
- SON packaging standards
- Export certification documentation
- Hygiene and safety protocols

Gap 4: Export-Grade Packaging Standards (Partial → Fully Developed)

New Courses Added

- PHM 222 — Export Packaging Design & International Standards
- PHM 125 — Export Standards & Quality Compliance

Practical Competencies

- International packaging design
- Export-grade labeling systems
- Moisture-proof packaging methods
- Quality grading for export markets
- NEPC export readiness systems

2.3 National Occupational Standards (NOS) Alignment

Postharvest Handling NOS

- Produce handling and grading
- Storage systems operation
- Spoilage control techniques
- Packaging and labeling systems

Cold Chain Logistics NOS

- Refrigeration systems management
- Controlled atmosphere storage
- Temperature monitoring systems
- Cold logistics operations

Food Safety NOS

- HACCP implementation
- NAFDAC compliance systems
- SON packaging standards
- Hygiene and contamination control

Digital Supply Chain NOS

- QR traceability systems
- Digital logistics platforms
- Warehouse management systems
- Data-driven supply chain operations

Export & Trade NOS

- NEPC export compliance
- International packaging standards
- Global food market systems
- Trade documentation processes

2.4 Key Priority Actions

Priority 1 — Critical / Immediate Action

- Cold chain infrastructure systems
- Controlled atmosphere storage technologies
- Digital traceability systems

Priority 2

- Export packaging standardization
- NEPC compliance integration
- Digital logistics platforms

Priority 3

- AI-based supply chain forecasting (future upgrade)
- National food logistics data systems
- Smart warehouse automation expansion

2.5 Transformation Outcome

Old Model (Undated)	New Model (Reconstructed)
• Traditional storage methods • Manual handling systems • Weak export integration • No digital traceability • No cold chain structure	• Smart cold chain logistics ecosystem • Digital supply chain management system • Export-compliant postharvest framework • NAFDAC/SON/NEPC-aligned quality system • Fully traceable food distribution network

3.0 PIE-ND — ND Produce Inspection & Export Management

Level: National Diploma (ND)
Upgrade: Undated → Modernized & Revalidated
Delivery Ratio: 70% Practical / 30% Theory

3.1 Curriculum Structure

ND I – Semester 1

Code	Course Title	CU	T/P Ratio
PIE 111	Principles of Produce Inspection & Quality Control	3	40/60
PIE 112	Introduction to Export Agriculture Systems	2	40/60
PIE 113	Agricultural Produce Standards & Grading Systems	2	30/70
PIE 114	Postharvest Quality Assurance Fundamentals	2	30/70
PIE 115	Basics of Phytosanitary Inspection Procedures	2	30/70
PIE 116	Introduction to Digital Trade & Export Documentation Systems	2	30/70
GNS 101	Communication Skills & Technical Writing	2	60/40

ND I – Semester 2

Code	Course Title	CU	T/P Ratio
PIE 121	Agricultural Export Commodities Inspection Systems	3	30/70
PIE 122	NAFDAC, SON & Quality Compliance Procedures	2	40/60
PIE 123	Export Documentation & Certification Processes	2	30/70
PIE 124	Laboratory Methods in Produce Inspection	3	20/80
PIE 125	Introduction to Trade Policy & Export Regulation	3	40/60
PIE 126	Practical Inspection Field Operations I	3	10/90

ND II – Semester 3

Code	Course Title	CU	T/P Ratio
PIE 211	Advanced Produce Inspection & Risk Analysis Systems	3	30/70
PIE 212	Phytosanitary Certification for Export Crops	3	30/70
PIE 213	Digital Export Documentation & Trade Platforms	3	20/80
PIE 214	AfCFTA Trade Framework & Non-Tariff Barrier Management	3	40/60
PIE 215	Food Safety Compliance & International Standards (Codex/NAFDAC/SON)	3	30/70
PIE 216	Inspection Technology (Sensors, Imaging & Lab Instruments)	2	20/80
PIE 217	Practical Export Inspection Operations II	3	10/90

ND II – Semester 4

Code	Course Title	CU	T/P Ratio
PIE 221	Export Market Systems & Global Commodity Trade	3	40/60
PIE 222	International Logistics & Cold Chain Export Compliance	3	30/70
PIE 223	Regulatory Intelligence in Export Agriculture (NAFDAC/SON/NEPC)	2	40/60
PIE 224	Digital Traceability & Blockchain in Export Systems	2	20/80
PIE 225	Seminar: Global Trends in Agricultural Trade & Inspection	2	40/60
PIE 226	Final Project (Export Inspection & Certification	6	10/90

Code	Course Title	CU	T/P Ratio
	System Design)		
SIW 200	SIWES / Industrial Attachment (NEPC, Customs, Export Firms)	6	0/100

3.2 Alignment with Identified Gaps

Gap 1: AfCFTA Trade Provisions (Absent → Fully Integrated)

New Courses Added

- PIE 214 — AfCFTA Trade Framework & Non-Tariff Barrier Management

Practical Competencies

- Regional trade compliance systems
- Tariff and non-tariff barrier analysis
- Intra-African export procedures
- Trade negotiation awareness
- Cross-border commodity movement systems

Gap 2: Digital Export Documentation Systems (Absent → Fully Introduced)

New Courses Added

- PIE 116 — Digital Trade & Export Documentation Systems
- PIE 213 — Digital Export Documentation & Trade Platforms

Practical Competencies

- Electronic export documentation systems
- Digital customs declaration platforms
- QR-coded export certification
- Blockchain-based traceability systems
- Automated inspection reporting tools

Gap 3: NAFDAC / SON Regulatory Alignment (Partial → Fully Updated)

New Courses Added

- PIE 122 — NAFDAC, SON & Quality Compliance Procedures
- PIE 215 — Food Safety Compliance & International Standards
- PIE 223 — Regulatory Intelligence in Export Agriculture

Practical Competencies

- Regulatory compliance audits
- Inspection protocol enforcement
- Codex Alimentarius alignment
- Export certification validation
- Compliance documentation systems

Gap 4: Phytosanitary Standards (Partial → Full System)

New Courses Added

- PIE 212 — Phytosanitary Certification for Export Crops
- PIE 115 — Basics of Phytosanitary Inspection Procedures

Practical Competencies

- Plant health inspection systems

- Pest and disease quarantine procedures
- Export crop certification standards
- Inspection sampling methods
- International phytosanitary compliance

3.3 National Occupational Standards (NOS) Alignment

Produce Inspection NOS

- Grading and sorting systems
- Quality inspection procedures
- Contamination detection systems
- Sampling and testing methods

Export Certification NOS

- Phytosanitary certification
- Export documentation systems
- Compliance auditing
- Regulatory inspection systems

Digital Trade NOS

- Electronic export documentation
- Blockchain traceability systems
- Digital customs systems
- Online trade platforms

AfCFTA Trade NOS

- Intra-African trade procedures
- Non-tariff barrier management
- Regional trade compliance
- Commodity export integration

Food Safety & Standards NOS

- NAFDAC compliance systems
- SON quality standards
- Codex Alimentarius compliance
- Food safety inspection protocols

Logistics & Export NOS

- Cold chain export systems
- International logistics management
- Supply chain traceability
- Export packaging compliance

3.4 Key Priority Actions

Priority 1 — Critical / Immediate Action

- AfCFTA integration into export inspection systems
- Digital export documentation platforms
- Updated NAFDAC/SON compliance frameworks

Priority 2

- Phytosanitary certification modernization
- Laboratory inspection technology expansion
- Trade intelligence systems

Priority 3

- Blockchain traceability for exports
- AI-based inspection forecasting (future upgrade)
- National export data system integration

3.5 Transformation Outcome

Old Model (Undated)	New Model (Reconstructed)
• Manual inspection systems • Pre-reform regulatory frameworks • Weak trade digitization • Limited AfCFTA awareness • Paper-based certification	• Digital export inspection ecosystem • AfCFTA-compliant trade framework • Real-time certification systems • Smart laboratory inspection technologies • Fully traceable export agriculture system

4.0 HWR-ND — ND Hydrology & Water Resource Management

Level: National Diploma (ND)
Upgrade: 2017 → Modernized & Revalidated
Delivery Ratio: 70% Practical / 30% Theory

4.1 Curriculum Structure

ND I – Semester 1

Code	Course Title	CU	T/P Ratio
HWR 111	Introduction to Hydrology & Water Cycle Systems	3	40/60
HWR 112	Principles of Water Resource Management	2	40/60
HWR 113	Surface Water Hydrology Basics	2	30/70
HWR 114	Groundwater Hydrology Fundamentals	2	30/70
HWR 115	Hydrometeorology & Climate Systems	2	40/60
HWR 116	Introduction to Digital Water Systems & ICT Tools	2	30/70
GNS 101	Communication Skills & Technical Writing	2	60/40

ND I – Semester 2

Code	Course Title	CU	T/P Ratio
HWR 121	Watershed Hydrology & Catchment Management	3	30/70
HWR 122	Water Quality Assessment & Pollution Control	2	30/70
HWR 123	Irrigation & Agricultural Water Use Systems	2	30/70
HWR 124	Hydrological Data Collection & Field Methods	2	20/80
HWR 125	Climate Variability & Water Resource Impacts	3	30/70
HWR 126	Practical Hydrology Field Work I (Catchment Observation)	3	10/90

ND II – Semester 3

Code	Course Title	CU	T/P Ratio
HWR 211	Advanced Watershed Management Systems	3	30/70
HWR 212	Groundwater Resource Assessment & Management	2	30/70
HWR 213	Climate Change Hydrology & Extreme Event Analysis	3	30/70
HWR 214	Hydrological Modelling & Simulation Basics	3	30/70
HWR 215	GIS & Remote Sensing for Water Resource Management	3	20/80
HWR 216	Integrated Water Resource Planning (Agri-Water Nexus)	2	30/70
HWR 217	Field Practical II (Hydrological Data Systems Practice)	3	10/90

ND II – Semester 4

Code	Course Title	CU	T/P Ratio
HWR 221	Water Governance, Policy & Institutional Frameworks	2	40/60
HWR 222	Digital Water Monitoring Systems (Sensors & IoT Applications)	3	20/80
HWR 223	Gender & Social Inclusion in Water Resource Management	2	40/60
HWR 224	Water Economics & Resource Valuation Systems	2	30/70
HWR 225	Seminar: Emerging Trends in Water Security & Climate Risk	2	40/60

Code	Course Title	CU	T/P Ratio
HWR 226	Final Project (Watershed Management / Water Systems Design)	6	10/90
SIW 200	SIWES / Industrial Attachment (Water Resource Institutions)	6	0/100

4.2 Alignment with Identified Gaps

Gap 1: Climate Hydrology & Extreme Events (Partial → Fully Integrated)

New Courses Added

- HWR 125 — Climate Variability & Water Resource Impacts
- HWR 213 — Climate Change Hydrology & Extreme Event Analysis
- HWR 225 — Emerging Water Security & Climate Risk Seminar

Practical Competencies

- Flood and drought risk modelling
- Rainfall variability analysis
- Extreme weather impact assessment
- Climate-resilient water planning
- Hydrological scenario simulation

Gap 2: Digital Water Monitoring Systems (Minimal → Fully Introduced)

New Courses Added

- HWR 116 — Digital Water Systems & ICT Tools
- HWR 222 — Digital Water Monitoring Systems (IoT & Sensors)
- HWR 215 — GIS & Remote Sensing for Water Management

Practical Competencies

- IoT-based water level monitoring
- Sensor-driven hydrological data collection
- GIS watershed mapping
- Remote sensing for water bodies
- Digital hydrological dashboards

Gap 3: Gender & Water Access (Absent → Fully Integrated)

New Courses Added

- HWR 223 — Gender & Social Inclusion in Water Resource Management

Practical Competencies

- Equitable water allocation systems
- Gender analysis in water access
- Community water governance participation
- Inclusive irrigation/water planning
- Social equity in water infrastructure

Gap 4: Agri–Water Nexus (Minimal → Structured System)

New Courses Added

- HWR 123 — Irrigation & Agricultural Water Use Systems
- HWR 216 — Integrated Water Resource Planning (Agri-Water Nexus)

Practical Competencies

- Agricultural water demand planning
- Irrigation-water balance systems
- Farm water efficiency models
- Watershed-to-farm linkage systems
- Sustainable agri-water allocation

4.3 National Occupational Standards (NOS) Alignment

Hydrology NOS

- Surface water monitoring
- Groundwater assessment
- Hydrological data collection
- Watershed analysis

Climate Hydrology NOS

- Flood risk assessment
- Drought modelling
- Climate impact analysis
- Extreme event prediction

Digital Water Systems NOS

- IoT water monitoring
- GIS watershed mapping
- Remote sensing applications
- Hydrological data systems

Water Governance NOS

- Water policy frameworks
- Institutional water management
- Resource allocation systems
- Regulatory compliance systems

Agri-Water Nexus NOS

- Irrigation water planning
- Agricultural water efficiency
- Watershed-farm integration
- Sustainable water use systems

Gender & Water NOS

- Equitable water access systems
- Gender-inclusive governance
- Community participation frameworks

- Social equity in water management

4.4 Key Priority Actions

Priority 1 — Critical / Immediate Action

- Digital water monitoring systems (IoT + sensors)
- Climate hydrology & extreme event modelling
- Agri-water nexus integration

Priority 2

- GIS watershed management expansion
- Water governance modernization
- Water data systems & analytics

Priority 3

- Gender inclusion in water systems
- Water economics & valuation systems
- AI-based hydrological forecasting (future upgrade)

4.5 Transformation Outcome

Old Model (2017)	New Model (Reconstructed)
• Traditional hydrology science • Manual data collection systems • Weak climate integration • No gender dimension • Minimal digital tools	• Smart hydrology systems • Digital water monitoring networks • Climate-resilient water resource planning • Integrated agri-water systems • Gender-inclusive water governance • Data-driven watershed management

5.0 IAT-ND — ND Irrigation Agronomy Technology

Level: National Diploma (ND)
Upgrade: 2021 → Modernized & Revalidated
Delivery Ratio: 70% Practical / 30% Theory

5.1 Curriculum Structure

ND I – Semester 1

Code	Course Title	CU	T/P Ratio
IAT 111	Principles of Irrigation Agronomy	3	30/70
IAT 112	Soil–Water–Plant Relationships	2	30/70
IAT 113	Introduction to Irrigation Systems	2	30/70
IAT 114	Crop Water Requirements & Scheduling Basics	2	30/70
IAT 115	Farm Hydraulics & Water Flow Principles	2	40/60
IAT 116	Introduction to Digital Agriculture & Smart Irrigation Concepts	2	30/70

Code	Course Title	CU	T/P Ratio
GNS 101	Use of English & Communication Skills	2	60/40

ND I – Semester 2

Code	Course Title	CU	T/P Ratio
IAT 121	Surface, Sprinkler & Drip Irrigation Systems	3	20/80
IAT 122	Irrigation Scheduling & Water Management Practices	2	30/70
IAT 123	Soil Moisture Measurement & Field Techniques	2	20/80
IAT 124	Smart Irrigation Systems (IoT, Sensors & Automation Basics)	3	20/80
IAT 125	Climate Change & Water Resource Planning	3	30/70
IAT 126	Practical Irrigation Installation & Field Operations I	3	10/90

ND II – Semester 3

Code	Course Title	CU	T/P Ratio
IAT 211	Advanced Irrigation Design & System Engineering	3	30/70
IAT 212	Precision Irrigation & Sensor-Based Water Management	3	20/80
IAT 213	Irrigation Agronomy & Crop Production Integration	2	30/70
IAT 214	Climate-Smart Irrigation Systems & Drought Management	3	30/70
IAT 215	Digital Water Monitoring Systems (GIS, Remote Sensing Intro)	2	30/70
IAT 216	Irrigation Maintenance, Repair & Automation Systems	2	20/80
IAT 217	Practical Irrigation Operations II (System Deployment Practice)	3	10/90

ND II – Semester 4

Code	Course Title	CU	T/P Ratio
IAT 221	Irrigation Enterprise Economics & Farm Water Business Models	2	30/70
IAT 222	Water Resource Governance & Policy in Agriculture	2	40/60

Code	Course Title	CU	T/P Ratio
IAT 223	Agribusiness of Irrigation Systems & Service Delivery	3	20/80
IAT 224	Climate Risk Analysis in Irrigation Planning	3	30/70
IAT 225	Seminar: Innovations in Irrigation Agronomy	2	40/60
IAT 226	Final Project (Smart Irrigation System Design & Implementation)	6	10/90
SIW 200	SIWES / Industrial Attachment (Irrigation Enterprises)	6	0/100

5.2 Alignment with Identified Gaps

Gap 1: Smart Irrigation & IoT Sensors (Absent → Fully Addressed)

New Courses Added

- IAT 116 — Digital Agriculture & Smart Irrigation Concepts
- IAT 124 — Smart Irrigation Systems (IoT, Sensors & Automation)
- IAT 212 — Precision Irrigation & Sensor-Based Water Management

Practical Competencies

- Soil moisture sensors usage
- Automated irrigation control systems
- IoT-based irrigation scheduling
- Smart fertigation systems
- Real-time water monitoring dashboards

Gap 2: Climate Impact on Water Availability (Partial → Strengthened)

New Courses Added

- IAT 125 — Climate Change & Water Resource Planning
- IAT 214 — Climate-Smart Irrigation Systems & Drought Management
- IAT 224 — Climate Risk Analysis in Irrigation Planning

Practical Competencies

- Drought forecasting application
- Rainfall variability adaptation strategies
- Water conservation techniques
- Irrigation planning under climate scenarios
- Watershed management basics

Gap 3: Agribusiness of Irrigation Enterprises (Absent → Introduced)

New Courses Added

- IAT 221 — Irrigation Enterprise Economics
- IAT 223 — Agribusiness of Irrigation Systems

Practical Competencies

- Irrigation service business models
- Water supply enterprise management
- Irrigation equipment maintenance services
- Cost-benefit analysis of irrigation systems
- Irrigation consultancy services

5.3 National Occupational Standards (NOS) Alignment

Irrigation Systems NOS

- Drip irrigation installation
- Sprinkler system operation
- Surface irrigation management
- System maintenance & repair

Smart Agriculture NOS

- IoT irrigation systems
- Sensor-based water management
- Automated irrigation control
- Digital water monitoring systems

Climate-Smart Agriculture NOS

- Drought adaptation strategies
- Water conservation systems
- Climate-resilient irrigation planning
- Environmental water management

Agribusiness NOS

- Irrigation enterprise development
- Water service business management
- Irrigation consultancy services
- Value chain irrigation systems

Water Resource Management NOS

- Watershed management
- Water allocation systems
- Irrigation policy frameworks
- Sustainable water use practices

5.4 Key Priority Actions

Priority 1 — Critical / Immediate Action

- Smart irrigation systems (IoT + sensors)
- Climate-smart irrigation planning
- Digital water management systems

Priority 2

- Irrigation agribusiness development
- Water enterprise models
- Precision irrigation scaling

Priority 3

- GIS + remote sensing integration (advanced stage)
- AI-based irrigation forecasting (future expansion)
- National irrigation data systems

5.5 Transformation Outcome

Old Model (2021)	New Model (Reconstructed)
• Basic irrigation science • Manual field operations • Weak climate integration • No agribusiness component	• Smart IoT-enabled irrigation systems • Climate-resilient water management • Irrigation agribusiness development • Digital water monitoring networks

6.0 HRE-HND — HND Home & Rural Economics

Level: Higher National Diploma (HND)

Upgrade: 2002 → Modernized & Revalidated

Delivery Ratio: 70% Practical / 30% Theory

This reform restructures the programme into a Rural Enterprise, Food Systems & Development Economics HND, ensuring clear progression beyond ND level. The 2002 curriculum was largely a repetition of ND content with minimal advancement into enterprise systems, food systems governance, digital rural transformation, and climate-resilient livelihoods.

6.1 Curriculum Structure

HND I – Semester 1

Code	Course Title	CU	T/P Ratio
HRE 311	Advanced Rural Livelihood Systems & Development Economics	3	40/60
HRE 312	Nutrition Security & Public Health Systems	2	40/60
HRE 313	Rural Enterprise Development & Value Chain Systems	3	30/70
HRE 314	Advanced Food Science, Processing & Quality Assurance	2	30/70
HRE 315	Digital Agriculture & Rural ICT Systems	3	30/70
HRE 316	Food Safety Systems (HACCP + NAFDAC + Quality Standards)	3	30/70
GNS 301	Technical Communication & Report Writing	2	60/40

HND I – Semester 2

Code	Course Title	CU	T/P Ratio
HRE 321	Rural Development Policy & Institutional Systems	2	40/60
HRE 322	Rural Entrepreneurship & Agribusiness Management	3	20/80
HRE 323	Climate-Smart Rural Systems & Environmental Adaptation	3	30/70
HRE 324	Gender & Social Inclusion in Rural Development	2	40/60
HRE 325	Research Methods in Rural Development & Food Systems	2	40/60
HRE 326	Rural Enterprise Incubation Lab I (Startup Simulation)	3	10/90

Code	Course Title	CU	T/P Ratio
HRE 327	Field Practical I (Community Enterprise & Value Chain Practice)	3	10/90

HND II – Semester 3

Code	Course Title	CU	T/P Ratio
HRE 411	Rural Food Systems & Supply Chain Management	3	30/70
HRE 412	Applied Nutrition Security & Food Systems Governance	2	40/60
HRE 413	Rural Innovation, SMEs & Agribusiness Startups	3	20/80
HRE 414	One Health, Biosecurity & Rural Food Safety Systems	3	30/70
HRE 415	Digital Market Systems for Rural Enterprises	2	30/70
HRE 416	Applied Data & Impact Evaluation in Rural Development	2	40/60
HRE 417	Enterprise Incubation Practical II (Field Startup Lab)	3	10/90

HND II – Semester 4

Code	Course Title	CU	T/P Ratio
HRE 421	Food Systems Governance & Policy Analysis	2	40/60
HRE 422	Rural Marketing, Branding & Value Chain Development	2	30/70
HRE 423	Financial Inclusion & Rural Microenterprise Systems	2	30/70
HRE 424	Seminar & Case Studies in Rural Transformation	2	40/60
HRE 425	Final Project (Rural Enterprise / Food Systems Innovation)	6	20/80
SIW 400	SIWES / Industrial Attachment (Rural Development Practice)	6	0/100

6.2 Alignment with Identified Gaps

Gap 1: Digital Agriculture (Absent → Fully Introduced)

New Courses Added

- HRE 315 — Digital Agriculture & Rural ICT Systems
- HRE 415 — Digital Market Systems for Rural Enterprises

Practical Competencies

- Digital farm and enterprise records
- Mobile advisory systems

- Rural e-commerce platforms
- ICT-based extension services
- Data-driven rural decision systems

Gap 2: Climate-Smart Agriculture (Absent → Fully Integrated)

New Courses Added

- HRE 323 — Climate-Smart Rural Systems

Practical Competencies

- Climate risk adaptation planning
- Sustainable rural resource use
- Resilience-based livelihood systems
- Environmental management in rural areas

Gap 3: Entrepreneurship (Minimal → Full Enterprise System)

New Courses Added

- HRE 313 — Rural Enterprise Development
- HRE 322 — Rural Entrepreneurship & Agribusiness
- HRE 413 — Rural Innovation & Startups
- HRE 326 & 417 — Enterprise Incubation Labs

Practical Competencies

- Startup development
- Agribusiness modelling
- Value chain scaling
- Investment pitching
- Cooperative enterprise systems

Gap 4: One Health & Biosecurity (Minimal → Full System)

New Courses Added

- HRE 414 — One Health, Biosecurity & Food Safety Systems

Practical Competencies

- Zoonotic disease awareness
- Food contamination control
- Rural sanitation systems
- Safe food handling standards
- Integrated farm health systems

6.3 National Occupational Standards (NOS) Alignment

Rural Livelihood NOS

- Rural development systems
- Household economy transformation
- Community livelihood structuring

Digital Agriculture NOS

- ICT4Ag systems
- Digital extension services
- Rural data systems
- E-market platforms

Food Safety NOS

- HACCP compliance

- NAFDAC food safety systems
- Traceability systems
- Quality assurance protocols

Climate-Smart NOS

- Adaptation systems
- Resource efficiency
- Environmental sustainability
- Resilience planning

Agribusiness NOS

- Enterprise development
- Value chain systems
- Startup incubation
- Financial inclusion

One Health NOS

- Biosecurity systems
- Zoonotic risk control
- Food hygiene systems
- Environmental health linkages

Gender & Inclusion NOS

- Inclusive rural development
- Gender-responsive planning
- Youth participation systems
- Equitable resource access

6.4 Key Priority Actions

Priority 1 — Critical / Immediate Action

- Digital Agriculture integration
- Climate-Smart Rural Systems
- One Health & Biosecurity systems

Priority 2

- Enterprise incubation strengthening
- Rural data systems and analytics
- Value chain development expansion

Priority 3

- Gender mainstreaming across enterprise courses
- Rural innovation ecosystems
- Digital extension system expansion

6.5 Transformation Outcome

Old Model (2002)	New Model (Reconstructed)
• Repetition of ND content • Weak enterprise systems • No digital agriculture • Pre-NAFDAC food safety logic	• Rural enterprise ecosystem development • Digital agriculture integration • Climate-resilient rural systems • Food systems governance • One Health compliance framework

	• Startup incubation model

7.0 HRE-ND — ND Home & Rural Economics

Level: National Diploma (ND)
Upgrade: 2002 → Modernized & Revalidated
Delivery Ratio: 70% Practical / 30% Theory

7.1 Curriculum Structure

ND I – Semester 1

Code	Course Title	CU	T/P Ratio
HRE 111	Introduction to Rural Livelihood Systems	3	40/60
HRE 112	Family Resource & Socio-Economic Management	2	30/70
HRE 113	Fundamentals of Food Science & Human Nutrition	2	30/70
HRE 114	Clothing, Textile & Household Production Systems	2	20/80
HRE 115	Rural Sociology & Community Development Systems	2	40/60
HRE 116	Introduction to Digital Literacy for Rural Development	2	30/70
GNS 101	Use of English & Communication Skills	2	60/40

ND I – Semester 2

Code	Course Title	CU	T/P Ratio
HRE 121	Food Processing & Preservation Technologies	3	20/80
HRE 122	Household Economics & Resource Management Systems	2	30/70
HRE 123	Basic Agricultural Production for Rural Households	2	30/70
HRE 124	Food Safety, Hygiene & NAFDAC Compliance Basics	3	30/70
HRE 125	Climate-Smart Rural Livelihood Practices	2	30/70
HRE 126	Practical Rural Livelihood Operations I (Community Field Practice)	3	10/90

ND II – Semester 3

Code	Course Title	CU	T/P Ratio
HRE 211	Advanced Rural Livelihood Systems & Development Economics	3	40/60
HRE 212	Applied Nutrition Security & Community Health Systems	2	40/60
HRE 213	Rural Enterprise Development & Micro-Value Chains	3	30/70
HRE 214	Advanced Food Processing & Quality Assurance Systems	2	30/70
HRE 215	Digital Rural Economy Systems & ICT Applications	3	30/70
HRE 216	Advanced Food Safety Systems (HACCP + NAFDAC Compliance)	3	30/70
HRE 217	Rural Practical Operations II (Enterprise Value Chain Practice)	3	10/90

ND II – Semester 4

Code	Course Title	CU	T/P Ratio
HRE 221	Rural Development Policy & Institutional Systems	2	40/60
HRE 222	Rural Entrepreneurship & Agribusiness Foundations	3	20/80
HRE 223	Climate-Smart Rural Systems & Environmental Adaptation	3	30/70
HRE 224	Gender & Social Inclusion in Rural Development	2	40/60
HRE 225	Applied Research Methods in Rural Development	2	40/60
HRE 226	Rural Enterprise Innovation Project (Startup Simulation Lab)	3	10/90
SIW 200	SIWES / Industrial Attachment (Rural Development Practice)	6	0/100

7.2 Alignment with Identified Gaps

Gap 1: Digital Agriculture (Absent → Introduced)

New Courses Added

- HRE 116 — Introduction to Digital Literacy for Rural Development
- HRE 215 — Digital Rural Economy Systems & ICT Applications

Practical Competencies

- Mobile advisory systems
- Digital farm/household records

- E-extension tools
- Rural ICT communication systems

Gap 2: Climate-Smart Agriculture (Absent → Integrated)

New Courses Added

- HRE 125 — Climate-Smart Rural Livelihood Practices
- HRE 223 — Climate-Smart Rural Systems & Environmental Adaptation

Practical Competencies

- Climate adaptation strategies
- Drought/flood resilience practices
- Sustainable rural resource management
- Environmental risk planning

Gap 3: Food Safety & Quality Assurance (Partial → Strengthened)

New Courses Added

- HRE 124 — Food Safety, Hygiene & NAFDAC Compliance Basics
- HRE 216 — Advanced Food Safety Systems (HACCP + NAFDAC)

Practical Competencies

- Hygienic food handling
- Contamination prevention
- HACCP principles
- Safe processing and storage standards

Gap 4: Entrepreneurship (Minimal → Structured)

New Courses Added

- HRE 213 — Rural Enterprise Development
- HRE 222 — Rural Entrepreneurship & Agribusiness Foundations
- HRE 226 — Rural Enterprise Innovation Project

Practical Competencies

- Rural micro-enterprises
- Value chain development
- Startup simulation lab
- Agribusiness planning

Gap 5: Gender & Social Inclusion (Partial → Mainstreamed)

New Courses Added

- HRE 224 — Gender & Social Inclusion in Rural Development

Practical Competencies

- Women/youth inclusion strategies
- Equitable resource access
- Participatory rural development
- Inclusive livelihood systems

7.3 National Occupational Standards (NOS) Alignment

Rural Livelihood NOS

- Household resource management
- Rural production systems
- Community livelihood systems

Digital Rural Systems NOS
- ICT4Ag tools usage
- Mobile advisory systems
- Rural digital record systems
- E-extension communication

Food Safety & Quality NOS
- HACCP principles
- NAFDAC compliance systems
- Hygienic processing
- Contamination control

Climate-Smart Livelihood NOS
- Adaptation strategies
- Sustainable rural systems
- Resilience planning
- Environmental protection

Rural Entrepreneurship NOS
- Micro-enterprise development
- Agribusiness planning
- Value chain participation
- Startup incubation

Gender & Inclusion NOS
- Inclusive rural development
- Gender-sensitive planning
- Youth participation systems
- Equitable livelihood access

7.4 Key Priority Actions

Priority 1 — Critical / Immediate Action
- Digital Rural Systems integration
- Climate-Smart Rural Livelihoods
- Food Safety (HACCP + NAFDAC full strengthening)

Priority 2
- Rural Entrepreneurship expansion
- Value chain development systems
- Digital rural data systems

Priority 3
- Gender mainstreaming across all field courses
- Rural innovation and startup incubation scaling
- Community-based digital extension systems

7.5 Transformation Outcome

Old Model (2002)	New Model (Reconstructed)
• Household-focused traditional curriculum • Minimal enterprise content • No digital agriculture • Limited food safety coverage	• Integrated rural enterprise development • Digital rural economy systems • Climate-smart livelihood practices • Structured food safety framework • Gender-inclusive programming

8.0 HOT-HND — HND Horticulture

Level: Higher National Diploma (HND)
Upgrade: Undated → Modernized & Revalidated
Delivery Ratio: 70% Practical / 30% Theory

8.1 Curriculum Structure

HND I – Semester 1

Code	Course Title	CU	T/P Ratio
HTH 411	Advanced Fruit & Vegetable Production Systems	3	30/70
HTH 412	Horticultural Crop Physiology & Productivity	2	40/60
HTH 413	Advanced Nursery & Propagation Technologies	2	20/80
HTH 414	Protected Cultivation Systems (Greenhouse Basics)	2	30/70
HTH 415	Post-Harvest Handling & Value Chain Systems	2	30/70
HTH 416	Precision Horticulture Systems (Sensors, IoT & Smart Irrigation)	3	20/80
GNS 401	Communication & Technical Reporting	2	60/40

HND I – Semester 2

Code	Course Title	CU	T/P Ratio
HTH 421	Advanced Pest & Disease Management in Horticulture	2	30/70
HTH 422	Irrigation Design & Water Efficiency Systems	2	30/70
HTH 423	Soil-less Cultivation (Hydroponics Introduction)	2	20/80
HTH 424	Smart Greenhouse & Controlled Environment Agriculture	3	20/80
HTH 425	Horticultural Research Methods & Experimental Design	2	40/60

Code	Course Title	CU	T/P Ratio
HTH 426	Digital Horticulture Data Systems & Crop Monitoring	3	20/80
HTH 427	Field Practical I (Protected & Open Field Systems)	3	10/90

HND II – Semester 3

Code	Course Title	CU	T/P Ratio
HTH 511	Advanced Vegetable Production & Protected Systems	2	30/70
HTH 512	Advanced Fruit Production & Orchard Technology	2	30/70
HTH 513	Horticultural Biotechnology & Seed Systems	2	40/60
HTH 514	Phytosanitary Standards & Export Certification Systems	3	30/70
HTH 515	Cold Chain Logistics & Export Post-Harvest Systems	3	20/80
HTH 516	Horticultural Business Management & Agrifinance	2	30/70
HTH 517	Field Practical II (Export-Oriented Production Systems)	3	10/90

HND II – Semester 4

Code	Course Title	CU	T/P Ratio
HTH 521	Climate-Smart Horticulture & Resource Efficiency	3	30/70
HTH 522	Landscaping, Urban & Commercial Horticulture Systems	2	30/70
HTH 523	Horticultural Entrepreneurship & Startup Innovation Lab	3	20/80
HTH 524	Horticultural Product Branding, Packaging & Export Marketing	2	20/80
HTH 525	Seminar & Case Studies in Horticultural Development	2	40/60
HTH 526	Project	6	20/80
SIW 500	SIWES / Industrial Attachment	6	0/100

8.2 Alignment with Identified Gaps

Gap 1: Precision Horticulture Systems (Partial → Strengthened)

New Courses Added

- HTH 416 — Precision Horticulture Systems
- HTH 424 — Smart Greenhouse & Controlled Environment Agriculture

- HTH 426 — Digital Crop Monitoring Systems

Practical Competencies

- Sensor-based irrigation (smart fertigation)
- Greenhouse climate automation
- Drone scouting of horticultural farms
- Hydroponic system scaling
- IoT-based crop monitoring dashboards

Gap 2: Post-Harvest Export Logistics (Partial → Strengthened)

New Courses Added

- HTH 514 — Phytosanitary Standards & Export Certification Systems
- HTH 515 — Cold Chain Logistics & Export Post-Harvest Systems

Practical Competencies

- Export certification documentation
- GLOBALG.A.P compliance procedures
- Cold chain storage and transport systems
- Traceability systems (QR/barcode tracking)
- Packaging for international markets
- Quality grading and inspection protocols

Gap 3: Entrepreneurship & Innovation (Minimal → Introduced)

New Courses Added

- HTH 523 — Horticultural Entrepreneurship & Startup Innovation Lab
- HTH 524 — Branding, Packaging & Export Marketing

Practical Competencies

- Horticulture startup business plans
- Agritech innovation pitching
- Investor-ready proposals
- Product branding and packaging design
- E-commerce horticulture sales channels
- Value chain scaling models

8.3 National Occupational Standards (NOS) Alignment

Advanced Horticulture NOS

- Protected cultivation systems
- Fruit and vegetable production systems
- Nursery and propagation technologies
- Pest and disease management

Precision Agriculture NOS (New Priority Area)

- IoT-based greenhouse monitoring
- Sensor-driven irrigation systems
- Drone crop monitoring
- Digital horticulture data management
- Hydroponic system operations

Export & Phytosanitary Compliance NOS

- Phytosanitary certification procedures

- Export documentation systems
- Cold chain logistics management
- GLOBALG.A.P compliance
- Traceability and quality assurance

Horticultural Entrepreneurship NOS

- Agribusiness startup development
- Value chain innovation
- Horticulture marketing and branding
- Agritech business models

Controlled Environment Agriculture NOS

- Hydroponics systems management
- Greenhouse automation systems
- Vertical farming operations

8.4 Key Priority Actions

Priority 1 — Critical / Immediate Action

- Precision horticulture systems integration (IoT, sensors, drones)
- Smart greenhouse automation systems

Priority 2

- Export certification + cold chain logistics full integration
- Traceability systems for horticultural produce

Priority 3

- Agritech entrepreneurship and startup incubation lab
- Digital branding and horticulture e-commerce scaling

8.5 Transformation Outcome

Old Model (Undated)	New Model (Reconstructed)
• Traditional production focus • Weak export integration • No precision systems • Minimal entrepreneurship	• Precision IoT horticulture system • Export-ready certified supply chains • Smart greenhouse production • Entrepreneurship and startup incubation • Digital crop monitoring platform

9.0 HOT-ND — ND Horticulture

Level: National Diploma (ND)
Upgrade: Undated → Modernized & Revalidated
Delivery Ratio: 70% Practical / 30% Theory

9.1 Curriculum Structure

ND I – Semester 1

Code	Course Title	CU	T/P Ratio
HOT 111	Principles of Horticultural Crop Production	3	30/70
HOT 112	Nursery Management & Propagation Techniques	2	20/80
HOT 113	Soil & Plant Nutrition for Horticulture	2	30/70
HOT 114	Vegetable Crop Production I	2	30/70
HOT 115	Fruit Crop Production I	2	30/70
HOT 116	Ornamental Horticulture & Landscaping	2	30/70
GNS 101	Communication Skills	2	60/40

ND I – Semester 2

Code	Course Title	CU	T/P Ratio
HOT 121	Vegetable Crop Production II	3	30/70
HOT 122	Fruit Crop Production II	3	30/70
HOT 123	Irrigation & Water Management in Horticulture	2	30/70
HOT 124	Post-Harvest Handling of Horticultural Crops	2	30/70
HOT 125	Pest & Disease Management in Horticulture	2	30/70
HOT 126	Introduction to Controlled Environment Agriculture	3	20/80
HOT 127	Field Practical I (Horticultural Production Systems)	3	10/90

ND II – Semester 3

Code	Course Title	CU	T/P Ratio
HOT 211	Advanced Vegetable Production Systems	2	30/70
HOT 212	Advanced Fruit Production & Orchard Management	2	30/70
HOT 213	Horticultural Crop Physiology	2	40/60
HOT 214	Horticultural Business Management	2	30/70
HOT 215	Hydroponics, Vertical Farming & Greenhouse Technology	3	20/80
HOT 216	Digital Marketing & Agribusiness E-Commerce for Horticulture	3	20/80
HOT 217	Field Practical II (Controlled Production Systems)	3	10/90

ND II – Semester 4

Code	Course Title	CU	T/P Ratio
HOT 221	Post-Harvest Technology & Value Addition	2	30/70
HOT 222	Horticultural Crop Protection (Advanced IPM)	2	30/70
HOT 223	Export Standards, Food Safety & GLOBALG.A.P Compliance	3	30/70
HOT 224	Landscaping Design & Urban Horticulture	2	30/70
HOT 225	Seminar & Case Studies in Horticulture	2	40/60
HOT 226	Project	6	20/80
SIW 200	SIWES / Industrial Attachment	6	0/100

9.2 Alignment with Identified Gaps

Gap 1: Controlled Environment Agriculture (Partial → Strengthened)

New Courses Added

- HOT 126 — Introduction to Controlled Environment Agriculture
- HOT 215 — Hydroponics, Vertical Farming & Greenhouse Technology

Practical Competencies

- Hydroponic nutrient solution preparation
- Greenhouse climate control operations
- Vertical farming system setup
- Fertigation system management
- Urban horticulture production units

Gap 2: Export Market Food Safety Standards (Partial → Strengthened)

New Courses Added

- HOT 223 — Export Standards, Food Safety & GLOBALG.A.P Compliance

Practical Competencies

- GLOBALG.A.P certification requirements
- Pesticide residue monitoring practices
- Cold chain handling procedures
- Traceability system setup (batch/QR coding)
- Export packaging standards compliance
- SON/NES horticultural export alignment

Gap 3: Digital Marketing for Horticultural Produce (Absent → Introduced)

New Courses Added

- HOT 216 — Digital Marketing & Agribusiness E-Commerce for Horticulture

Practical Competencies

- Online produce selling platforms

- Social media marketing for perishables
- Price tracking and demand analytics
- Logistics coordination apps
- Branding and packaging for digital markets
- Customer relationship management (CRM)

9.3 National Occupational Standards (NOS) Alignment

Horticultural Production NOS

- Fruit and vegetable production
- Nursery and propagation systems
- Pest and disease management
- Irrigation and post-harvest handling

Controlled Environment Agriculture NOS

- Hydroponic production systems
- Greenhouse management operations
- Vertical farming technologies
- Fertigation and climate control systems

Food Safety & Export Compliance NOS

- GLOBALG.A.P implementation
- Traceability systems
- Cold chain management
- Export packaging standards
- Pesticide residue control

Digital Agribusiness & Marketing NOS

- Agribusiness e-commerce operations
- Digital marketing strategies
- Online supply chain coordination
- Farm-to-market digital platforms

Urban Horticulture NOS

- Landscaping systems
- Urban food production systems
- Green infrastructure development

9.4 Key Priority Actions

Priority 1 — Critical / Immediate Action

- Hydroponics, vertical farming, and greenhouse systems integration
- Controlled environment agriculture practical labs

Priority 2

- Export-grade horticultural food safety systems (GLOBALG.A.P alignment)
- Traceability and cold chain systems

Priority 3

- Digital marketing and agribusiness e-commerce platforms
- Branding and online horticulture trade systems

9.5 Transformation Outcome

Old Model (Undated)	New Model (Reconstructed)
• Traditional open-field horticulture • Manual production systems • Weak export food safety standards • No digital marketing	• Controlled environment agriculture (hydroponics, greenhouse) • Export-grade GLOBALG.A.P-compliant systems • Digital marketing and e-commerce platform • Urban horticulture integration

10.0 SSLT-HND — HND Soil Science & Land Technology

Level: Higher National Diploma (HND)
Upgrade: Undated → Modernized & Revalidated
Delivery Ratio: 70% Practical / 30% Theory

10.1 Curriculum Structure

HND I – Semester 1

Code	Course Title	CU	T/P Ratio
SSL 311	Soil Physics & Environmental Properties	3	30/70
SSL 312	Soil Chemistry & Nutrient Dynamics	3	30/70
SSL 313	Soil Fertility & Plant Nutrition	2	30/70
SSL 314	Pedology & Soil Formation Processes	2	40/60
SSL 315	Land Surveying & Land Use Principles	2	30/70
SSL 316	Introduction to GIS & Digital Soil Mapping	3	20/80
GNS 301	Communication Skills	2	60/40

HND I – Semester 2

Code	Course Title	CU	T/P Ratio
SSL 321	Soil Conservation & Erosion Control	2	30/70
SSL 322	Land Evaluation & Capability Classification	3	30/70
SSL 323	Irrigation, Drainage & Water Management	2	30/70
SSL 324	Remote Sensing for Soil & Land Resources	3	20/80
SSL 325	Soil Survey Methods & Field Mapping Techniques	2	20/80

Code	Course Title	CU	T/P Ratio
SSL 326	Research Methods in Soil Science	2	40/60
SSL 327	Field Practical I (Soil Survey & Sampling Techniques)	3	10/90

HND II – Semester 3

Code	Course Title	CU	T/P Ratio
SSL 411	Soil Mineralogy & Advanced Soil Chemistry	2	40/60
SSL 412	Soil Degradation & Rehabilitation Techniques	2	30/70
SSL 413	Land Degradation Assessment & Restoration	2	30/70
SSL 414	Soil Fertility Management Systems	2	30/70
SSL 415	Climate-Smart Soil Management & Carbon Sequestration	3	30/70
SSL 416	Soil Data Analysis & Geo-statistics	2	30/70
SSL 417	Field Practical II (GIS Soil Mapping & Land Evaluation)	3	10/90

HND II – Semester 4

Code	Course Title	CU	T/P Ratio
SSL 421	Land Use Planning & Environmental Impact Assessment	3	30/70
SSL 422	Soil and Water Conservation Engineering	2	30/70
SSL 423	Soil Resource Economics & Land Valuation	2	40/60
SSL 424	Gender & Socio-Economic Dimensions of Land Use	2	40/60
SSL 425	Seminar & Case Studies in Soil and Land Management	2	40/60
SSL 426	Project	6	20/80
SIW 400	SIWES / Industrial Attachment	6	0/100

10.2 Alignment with Identified Gaps

Gap 1: Digital Soil Mapping & Remote Sensing (Absent → Introduced)

New Courses Added

- SSL 316 — GIS & Digital Soil Mapping
- SSL 324 — Remote Sensing for Soil & Land Resources
- SSL 416 — Geo-statistics & Soil Data Analysis

Practical Competencies

- Soil mapping using GIS software

- Satellite soil moisture interpretation
- Drone-assisted land survey
- Digital elevation modeling (DEM)
- Spatial nutrient mapping
- Soil fertility zoning

Gap 2: Climate-Smart Soil Management (Partial → Strengthened)

New Courses Added

- SSL 415 — Climate-Smart Soil Management & Carbon Sequestration
- SSL 413 — Land Degradation Restoration

Practical Competencies

- Soil carbon measurement techniques
- Erosion control field structures
- Drought-resilient soil management
- Flood-affected soil rehabilitation
- NDC-aligned land restoration practices

Gap 3: Gender & Social Inclusion (Absent → Introduced)

New Courses Added

- SSL 424 — Gender & Socio-Economic Dimensions of Land Use

Practical Competencies

- Land access equity mapping
- Participatory land use planning
- Gender-disaggregated land ownership analysis
- Community land governance engagement
- Youth inclusion in land management planning

10.3 National Occupational Standards (NOS) Alignment

Soil Science NOS

- Soil sampling and analysis
- Soil fertility management
- Erosion control techniques
- Land evaluation procedures

Digital Soil Mapping & GIS NOS (New Priority Area)

- GIS soil mapping operations
- Remote sensing interpretation for soils
- Spatial data analysis
- Drone-based land survey
- Digital terrain analysis

Climate-Smart Soil Management NOS

- Soil carbon sequestration
- Climate-resilient soil systems
- Land degradation neutrality (LDN) practices
- Ecosystem restoration methods

Land Use Planning NOS

- Land capability classification
- Land evaluation systems
- Environmental impact assessment

Gender & Land Governance NOS

- Participatory land planning
- Inclusive land access systems
- Socio-economic land analysis
- Community land governance frameworks

10.4 Key Priority Actions

Priority 1 — Critical / Immediate Action

- GIS & Digital Soil Mapping integration (core modernization need)
- Remote sensing soil analysis systems

Priority 2

- Climate-smart soil management (carbon, resilience, degradation control)

Priority 3

- Gender and socio-economic inclusion in land governance

10.5 Transformation Outcome

Old Model (Undated)	New Model (Reconstructed)
• Manual soil sampling & lab analysis • Traditional land evaluation • Weak climate integration • No digital mapping • No gender dimension	• GIS-integrated digital soil mapping • Remote sensing land analysis • Climate-smart soil carbon management • Gender-inclusive land governance • Geo-statistical soil data systems

11.0 CPT-HND — HND Crop Production Technology

Level: Higher National Diploma (HND)
Upgrade: Undated → Modernized & Revalidated
Delivery Ratio: 70% Practical / 30% Theory

11.1 Curriculum Structure

HND I – Semester 1

Code	Course Title	CU	T/P Ratio
CPT 311	Advanced Crop Production Principles	3	30/70
CPT 312	Soil Fertility & Crop Nutrition Management	3	30/70
CPT 313	Weed Science & Weed Control Techniques	2	30/70
CPT 314	Crop Protection & Pest Management	2	30/70

Code	Course Title	CU	T/P Ratio
CPT 315	Seed Technology & Variety Development	2	30/70
CPT 316	Precision Crop Monitoring Tools (GPS, Sensors & Field Mapping)	3	30/70
GNS 301	Business Communication	2	60/40

HND I – Semester 2

Code	Course Title	CU	T/P Ratio
CPT 321	Irrigation & Water Management for Crop Production	2	30/70
CPT 322	Cropping Systems & Sustainable Agronomy	2	30/70
CPT 323	Plant Breeding & Crop Improvement	2	40/60
CPT 324	Climate-Resilient Agronomy & Stress Management	3	30/70
CPT 325	Remote Sensing & Satellite Crop Monitoring	3	20/80
CPT 326	Research Methods & Experimental Design	2	40/60
CPT 327	Field Practical I (Crop Trials & Demonstration Plots)	3	10/90

HND II – Semester 3

Code	Course Title	CU	T/P Ratio
CPT 411	Advanced Crop Physiology & Yield Improvement	2	40/60
CPT 412	Integrated Pest Management (IPM) in Crop Systems	2	30/70
CPT 413	Post-Planting Crop Management & Mechanization	2	30/70
CPT 414	Fertilizer Formulation & Nutrient Scheduling	2	30/70
CPT 415	Pre-Harvest Food Safety, GAP & HACCP Systems	3	30/70
CPT 416	Farm Data Analytics & Crop Yield Forecasting	2	30/70
CPT 417	Field Practical II (Precision Monitoring & Crop Protection Trials)	3	10/90

HND II – Semester 4

Code	Course Title	CU	T/P Ratio
CPT 421	Crop Production Economics & Farm Business Planning	2	30/70
CPT 422	Climate-Smart Cropping Systems & Sustainable Land Use	3	30/70

Code	Course Title	CU	T/P Ratio
CPT 423	Seed Certification & Quality Control	2	30/70
CPT 424	Export Crop Production & Quality Standards	2	30/70
CPT 425	Seminar & Case Studies in Crop Production	2	40/60
CPT 426	Project	6	20/80
SIW 400	SIWES / Industrial Attachment	6	0/100

11.2 Alignment with Identified Gaps

Gap 1: Precision Crop Monitoring Technology (Absent → Introduced)

New Courses Added

- CPT 316 — Precision Crop Monitoring Tools
- CPT 325 — Remote Sensing & Satellite Crop Monitoring
- CPT 416 — Farm Data Analytics & Yield Forecasting

Practical Competencies

- Drone scouting demonstrations
- NDVI crop health mapping
- Soil moisture sensor reading
- GPS farm boundary mapping
- Yield estimation field methods
- Pest detection using digital tools

Gap 2: Climate Adaptation Agronomy (Partial → Strengthened)

New Courses Added

- CPT 324 — Climate-Resilient Agronomy & Stress Management
- CPT 422 — Climate-Smart Cropping Systems & Land Use

Practical Competencies

- Drought tolerant crop trials
- Heat stress mitigation practices
- Climate-based planting calendar design
- Mulching, irrigation scheduling, soil moisture conservation
- Climate-driven pest and disease forecasting

Gap 3: Food Safety & HACCP (Minimal → Introduced)

New Courses Added

- CPT 415 — Pre-Harvest Food Safety, GAP & HACCP Systems
- CPT 424 — Export Crop Production & Quality Standards

Practical Competencies

- Pesticide residue compliance awareness
- Safe agrochemical storage and application
- Water quality management for irrigation
- Traceability records at farm level
- Contamination risk assessment (soil, manure, water)

11.3 National Occupational Standards (NOS) Alignment

Crop Production NOS

- Land preparation and planting
- Fertilizer and soil amendment application
- Irrigation practices
- Harvesting and handling

Precision Agriculture / Digital Crop Monitoring NOS

- GPS mapping and farm boundary setting
- Remote sensing interpretation
- Drone crop scouting support
- Sensor-based soil moisture monitoring
- Yield mapping and crop forecasting

Climate Adaptation Agronomy NOS

- Drought and heat stress crop management
- Climate-resilient variety selection
- Soil moisture conservation systems
- Climate-smart cropping systems

Food Safety & HACCP / GAP NOS

- Safe pesticide handling and compliance
- Good Agricultural Practices implementation
- Farm-level HACCP risk assessment
- Traceability record keeping
- Pre-harvest contamination prevention

Seed Technology NOS

- Seed multiplication and certification
- Quality control and storage

11.4 Key Priority Actions

Priority 1 — Critical / Immediate Action

- Remote sensing & satellite crop monitoring (major missing technology)
- Precision crop monitoring tools integration

Priority 2

- Climate-resilient agronomy (drought, heat, pests)
- Resilient variety selection and cropping calendars

Priority 3

- Pre-harvest food safety (GAP + HACCP compliance)
- Traceability and residue management

11.5 Transformation Outcome

Old Model (Undated)	New Model (Reconstructed)
• Traditional crop agronomy • Manual field monitoring • Weak climate-smart integration • Minimal food safety content	• Precision digital crop monitoring • Remote sensing & satellite agronomy • Climate-resilient crop management systems • Pre-harvest food safety & HACCP framework

12.0 ABM-HND — HND Agribusiness Management

Level: Higher National Diploma (HND)
Upgrade: Undated → Modernized & Revalidated
Delivery Ratio: 70% Practical / 30% Theory

12.1 Curriculum Structure

HND I – Semester 1

Code	Course Title	CU	T/P Ratio
ABM 311	Agribusiness Management Principles	3	30/70
ABM 312	Agricultural Marketing & Consumer Behaviour	2	30/70
ABM 313	Agricultural Finance & Investment Analysis	2	40/60
ABM 314	Cooperative & Enterprise Development	2	30/70
ABM 315	Value Chain Analysis & Development	3	30/70
ABM 316	Digital Agribusiness Tools & E-Commerce	2	30/70
GNS 301	Business Communication	2	60/40

HND I – Semester 2

Code	Course Title	CU	T/P Ratio
ABM 321	Agricultural Policy & Rural Development	2	50/50
ABM 322	Agribusiness Accounting & Costing	2	30/70
ABM 323	Farm Business Planning & Feasibility Studies	3	30/70
ABM 324	Agricultural Commodity Trading & Price Analysis	2	30/70
ABM 325	Gender & Social Inclusion in Agribusiness	2	40/60
ABM 326	Agritech Entrepreneurship & Innovation Lab	3	20/80
ABM 327	Practical Agribusiness Enterprise I	3	10/90

HND II – Semester 3

Code	Course Title	CU	T/P Ratio
ABM 411	Strategic Agribusiness Management	3	30/70
ABM 412	Logistics, Storage & Supply Chain Management	2	30/70
ABM 413	Agricultural Project Planning & Management	2	30/70
ABM 414	Export Trade, Standards & Quality Assurance	2	30/70
ABM 415	Food Safety, Traceability & One Health in Supply Chains	3	30/70
ABM 416	Digital Market Systems & Agribusiness Data Analytics	2	30/70
ABM 417	Research Methods in Agribusiness	2	50/50

HND II – Semester 4

Code	Course Title	CU	T/P Ratio
ABM 421	Agribusiness Risk Management & Insurance	2	30/70
ABM 422	SME Growth, Branding & Agro-processing Management	3	30/70
ABM 423	Business Negotiation & Contract Management	2	40/60
ABM 424	Agricultural Innovation & Investment Pitching	2	20/80
ABM 425	Practical Agribusiness Enterprise II	3	10/90
ABM 426	Seminar & Case Studies in Agribusiness	2	40/60
ABM 427	Project	6	20/80

12.2 Alignment with Identified Gaps

Gap 1: Digital Agriculture Tools for Agribusiness (Absent → Introduced)

New Courses Added

- ABM 316 — Digital Agribusiness Tools & E-Commerce
- ABM 416 — Digital Market Systems & Agribusiness Data Analytics
- ABM 326 — Agritech Entrepreneurship & Innovation Lab

Practical Competencies

- Online produce listing and e-commerce operations
- POS, digital payments, USSD/fintech
- Inventory tracking tools
- Agritech marketplace platforms
- Commodity pricing dashboards

- Customer database & CRM systems

Gap 2: Gender & Social Inclusion (Absent → Introduced)

New Courses Added

- ABM 325 — Gender & Social Inclusion in Agribusiness

Practical Competencies

- Gender-responsive value chain mapping
- Inclusive cooperative formation models
- Women/youth access to finance strategies
- Labour equity and enterprise participation assessment

Gap 3: One Health & Supply Chain (Absent → Introduced)

New Courses Added

- ABM 415 — Food Safety, Traceability & One Health in Supply Chains

Practical Competencies

- HACCP basics
- Food hygiene standards
- Cold chain monitoring
- Contamination risk mapping
- Pesticide residue awareness
- Livestock-product safety linkages
- Traceability (QR/barcode, batch systems)

12.3 National Occupational Standards (NOS) Alignment

Agribusiness Management NOS

- Business planning and enterprise operations
- Cooperative management
- Farm enterprise costing and accounting
- Market analysis and pricing

Digital Agribusiness / Agritech NOS (New Key Area)

- Agribusiness e-commerce operations
- Digital payment systems for agribusiness
- Digital inventory and supply chain tools
- Online marketing and customer engagement
- Agribusiness data reporting

Gender & Social Inclusion NOS

- Inclusive value chain facilitation
- Cooperative development for women/youth
- Social impact assessment in agribusiness

Food Safety & Traceability NOS (One Health Area)

- Food safety compliance practices
- Traceability systems operations
- Storage and cold chain management
- Hygiene and contamination prevention
- Livestock-to-consumer risk management

Agricultural Logistics & Supply Chain NOS

- Storage management
- Transport planning
- Distribution coordination
- Quality assurance checks

12.4 Key Priority Actions

Priority 1 — Critical / Immediate Action

- Digital Agribusiness Tools & E-Commerce
- Agritech Entrepreneurship & Innovation Lab
- Food Traceability & Safety

Priority 2

- Gender-responsive value chain analysis
- Agribusiness data analytics
- Research methods improvement

Priority 3

- Export compliance and international standards integration

12.5 Transformation Outcome

Old Model (Undated)	New Model (Reconstructed)
• Traditional agribusiness management • No digital tools • Weak gender inclusion • No food safety/traceability component	• Digital agribusiness ecosystem • Agritech entrepreneurship & innovation lab • Gender-responsive value chain systems • One Health food traceability framework

13.0 AEM-HND — HND Agricultural Extension Management

Level: Higher National Diploma (HND)
Upgrade: Undated → Modernized & Revalidated
Delivery Ratio: 70% Practical / 30% Theory

13.1 Curriculum Structure

HND I – Semester 1

Code	Course Title	CU	T/P Ratio
AEM 311	Principles of Agricultural Extension	3	30/70
AEM 312	Rural Sociology & Community Development	2	40/60
AEM 313	Communication Skills for Extension Agents	2	30/70
AEM 314	Agricultural Programme Planning & Implementation	3	30/70
AEM 315	Cooperative Development & Group Dynamics	2	30/70
AEM 316	ICT4Ag & Digital Extension Systems	3	30/70
GNS 301	Business Communication	2	60/40

HND I – Semester 2

Code	Course Title	CU	T/P Ratio
AEM 321	Agricultural Extension Teaching Methods	2	30/70
AEM 322	Monitoring & Evaluation of Extension Programmes	2	30/70
AEM 323	Agricultural Innovation Dissemination Systems	2	30/70
AEM 324	Climate Change Communication & Adaptation Advisory	3	30/70
AEM 325	Gender-Responsive Extension & Social Inclusion	2	40/60
AEM 326	Research Methods & Data Collection for Extension	2	40/60
AEM 327	Field Practical I (Community Diagnosis & Demonstration)	3	10/90

HND II – Semester 3

Code	Course Title	CU	T/P Ratio
AEM 411	Agricultural Policy, Institutions & Rural Development	2	40/60
AEM 412	Participatory Rural Appraisal (PRA) Techniques	2	20/80

Code	Course Title	CU	T/P Ratio
AEM 413	Extension Administration & Leadership	2	30/70
AEM 414	Farm Business Advisory & Agripreneurship Support	3	30/70
AEM 415	Mobile Advisory Systems & Digital Content Development	3	20/80
AEM 416	Applied Statistics for Extension Research	2	40/60
AEM 417	Field Practical II (Participatory Extension Practice)	3	10/90

HND II – Semester 4

Code	Course Title	CU	T/P Ratio
AEM 421	Extension Programme Evaluation & Impact Assessment	2	30/70
AEM 422	Conflict Management & Farmer Organization Support	2	30/70
AEM 423	Agricultural Information Systems & Knowledge Management	2	30/70
AEM 424	Participatory Gender Analysis & Inclusive Field Practice	2	20/80
AEM 425	Seminar & Case Studies in Extension Management	2	40/60
AEM 426	Project	6	20/80
SIW 400	SIWES / Industrial Attachment	6	0/100

13.2 Alignment with Identified Gaps

Gap 1: Digital Extension Tools (Absent → Introduced)

New Courses Added

- AEM 316 — ICT4Ag & Digital Extension Systems
- AEM 415 — Mobile Advisory Systems & Digital Content Development
- AEM 423 — Agricultural Information Systems

Practical Competencies

- SMS/USSD advisory design
- WhatsApp advisory groups management
- Digital farmer registration
- KoboCollect/ODK survey tools
- E-extension video/audio content production
- Radio extension integrated with mobile feedback

Gap 2: Climate-Smart Agriculture Communication (Partial → Strengthened)

New Courses Added

- AEM 324 — Climate Change Communication & Adaptation Advisory

Practical Competencies

- Community climate risk messaging
- Early warning advisory dissemination
- Adaptation campaign planning
- Extension messages for drought, flooding, pests, heat stress

Gap 3: Gender-Responsive Extension (Partial → Strengthened)

New Courses Added

- AEM 325 — Gender-Responsive Extension & Social Inclusion
- AEM 424 — Participatory Gender Analysis & Inclusive Field Practice

Practical Competencies

- Gender analysis tools (Harvard framework, activity profile mapping)
- Women/youth advisory inclusion plans
- Gender-responsive demonstration farm selection
- Inclusive extension workplan design

13.3 National Occupational Standards (NOS) Alignment

Agricultural Extension Service NOS

- Extension planning and delivery
- Farmer group facilitation
- Demonstration and field day organization
- Advisory reporting and documentation

ICT4Ag / Digital Extension NOS (New Area)

- Mobile advisory system operation
- Digital extension content creation
- E-extension data collection and reporting
- Digital farmer profiling and database management
- Use of ICT tools for market advisory

Climate Change Communication NOS

- CSA advisory communication
- Climate risk messaging
- Adaptation extension planning
- Resilience communication systems

Gender & Inclusion NOS

- Participatory gender analysis
- Inclusive extension programming
- Women/youth cooperative facilitation
- Inclusive access to inputs and services

Rural Development & PRA NOS

- Community entry and engagement
- Stakeholder mapping
- PRA tools application
- Participatory planning facilitation

13.4 Key Priority Actions

Priority 1 — Critical / Immediate Action

- ICT4Ag / Mobile advisory systems (major missing area)
- Digital farmer engagement platforms

Priority 2

- Climate change communication expanded into extension campaigns
- Early warning advisory dissemination methods

Priority 3

- Participatory gender analysis fully integrated into field practice

13.5 Transformation Outcome

Old Model (Undated)	New Model (Reconstructed)
• Traditional face-to-face extension delivery • Weak digital tools • Limited climate communication • Minimal gender integration	• Digital ICT4Ag extension ecosystem • Mobile advisory systems deployment • Climate-smart adaptation communications • Gender-responsive participatory extension

14.0 GT-ND — ND General Agricultural Technology

Level: National Diploma (ND)
Upgrade: 2009 → Modernized & Revalidated
Delivery Ratio: 70% Practical / 30% Theory

Curriculum Structure

ND I – Semester 1

Code	Course Title	CU	T/P Ratio
AGT 111	Principles of Crop Production	3	30/70
AGT 112	Introduction to Soil Science	2	30/70
AGT 113	Introduction to Animal Production	2	30/70
AGT 114	Agricultural Botany & Plant Physiology	2	40/60

Code	Course Title	CU	T/P Ratio
AGT 115	Farm Tools, Equipment & Workshop Practice	2	20/80
AGT 116	Introduction to Agricultural Economics	2	40/60
GNS 101	Use of English & Communication Skills	2	60/40

ND I – Semester 2

Code	Course Title	CU	T/P Ratio
AGT 121	Annual Crop Production	3	30/70
AGT 122	Introduction to Crop Protection	2	30/70
AGT 123	Farm Records & Accounts	2	30/70
AGT 124	Soil Fertility & Fertilizer Application	2	30/70
AGT 125	Agricultural Extension & Rural Sociology	2	40/60
AGT 126	Practical Farm Operations I (School Farm Practice)	3	10/90

ND II – Semester 3

Code	Course Title	CU	T/P Ratio
AGT 211	Perennial Crop Production	3	30/70
AGT 212	Livestock Production (Poultry & Ruminants)	3	30/70
AGT 213	Agricultural Mechanization & Tractor Operations	2	20/80
AGT 214	Climate-Smart Agriculture & Sustainable Farming	3	30/70
AGT 215	Digital Agriculture & Precision Farming (GPS, Sensors, Drones Intro)	2	30/70
AGT 216	One Health, Biosecurity & Farm Hygiene	2	30/70
AGT 217	Practical Farm Operations II (Crop/Livestock Unit Practice)	3	10/90

ND II – Semester 4

Code	Course Title	CU	T/P Ratio
AGT 221	Irrigation & Water Management	2	30/70
AGT 222	Post-Harvest Technology & Storage	2	30/70
AGT 223	Agripreneurship, Innovation & Value Chain Development	3	30/70
AGT 224	Gender & Social Inclusion in Agriculture	2	40/60
AGT 225	Integrated Pest Management (IPM)	2	30/70

Code	Course Title	CU	T/P Ratio
AGT 226	Project (Crop/Livestock Demonstration Enterprise)	4	10/90
SIW 200	SIWES / Industrial Attachment	6	0/100

14.1 Alignment with Identified Gaps

Gap 1: Digital Agriculture & Precision Farming (Absent → Introduced)

New Courses Added

- AGT 215 — Digital Agriculture & Precision Farming

Practical Competencies

- Farm apps and e-extension tools
- GPS farm mapping
- Drone demonstration practices
- Digital farm record keeping
- Basic farm data analytics

Gap 2: Climate-Smart Agriculture (Absent → Introduced)

New Courses Added

- AGT 214 — Climate-Smart Agriculture & Sustainable Farming

Practical Competencies

- Climate risk mitigation
- Conservation agriculture
- Water harvesting
- Agroforestry integration
- Resilient crop trials

Gap 3: Entrepreneurship & Innovation (Absent → Introduced)

New Courses Added

- AGT 223 — Agripreneurship, Innovation & Value Chain Development

Practical Competencies

- Business plan writing
- Agribusiness pitching
- Packaging and branding
- Cooperative model development

Gap 4: Gender & Social Inclusion (Absent → Introduced)

New Courses Added

- AGT 224 — Gender & Social Inclusion in Agriculture

Practical Competencies

- Field extension engagement
- Women/youth inclusion strategies
- Community mobilization

Gap 5: One Health & Biosecurity (Absent → Introduced)

New Courses Added

- AGT 216 — One Health, Biosecurity & Farm Hygiene

Practical Competencies

- Farm sanitation protocols
- Disease control systems
- Zoonotic prevention
- Safe handling of agrochemicals

14.2 National Occupational Standards (NOS) Alignment

Crop Production NOS

- Land preparation, planting, fertilizer application, irrigation, harvesting

Livestock Production NOS

- Poultry operations, feeding, housing, vaccination routines

Farm Mechanization NOS

- Tractor operation, maintenance, implement usage

Digital Agriculture NOS (Key New Work Area)

- GPS field mapping
- Drone-assisted monitoring
- Digital farm record keeping
- Smart irrigation systems
- Basic farm data analytics

Climate-Smart Agriculture NOS (Key New Work Area)

- Conservation agriculture
- Climate adaptation practices
- Soil carbon practices
- Water conservation and resilience systems

Agripreneurship NOS

- Enterprise planning
- Value chain management
- Market linkage development
- Cooperative formation

One Health & Biosecurity NOS

- Farm hygiene systems
- Animal health surveillance
- Food safety handling
- Waste disposal and sanitation

Gender & Inclusion NOS

- Inclusive extension delivery
- Gender-responsive project planning
- Youth inclusion in agribusiness

14.3 Key Priority Actions

Priority 1 — Critical / Immediate Action

- Digital Agriculture & Precision Farming
- Climate Smart Agriculture
- One Health & Biosecurity

Priority 2

- Agripreneurship & Innovation
- Post-harvest value addition
- Farm Data Analytics & GIS

Priority 3

- Gender and Social Inclusion integration
- Extension and enterprise course integration

14.4 Transformation Outcome

Old Model (2009)	New Model (Reconstructed)
• Traditional crop and animal production • Manual farm operations • No digital agriculture • No entrepreneurship • No gender or One Health content	• Digital precision farming integrated • Climate-smart sustainable agriculture • Agripreneurship & innovation ecosystem • One Health biosecurity framework • Gender and social inclusion institutionalized

15.0 OAT ND ND ORGANIC AGRICULTURAL TECHNOLOGY

Level: National Diploma (ND)
Upgrade: 2023 → Modernized & Revalidated
Delivery Ratio: 70% Practical / 30% Theory

15.1 Curriculum Structure

ND I – Semester 1

Code	Course Title	CU	T/P Ratio
OAT 111	Principles of Organic Agriculture Systems	3	30/70
OAT 112	Soil Fertility Management in Organic Farming	2	30/70
OAT 113	Organic Crop Production Systems	3	30/70
OAT 114	Composting & Biofertilizer Production Techniques	2	20/80
OAT 115	Pest & Disease Management in Organic Systems	2	30/70
OAT 116	Introduction to Climate-Smart & Sustainable Agriculture	2	40/60
GNS 101	Communication Skills & Technical Writing	2	60/40

ND I – Semester 2

Code	Course Title	CU	T/P Ratio
OAT 121	Organic Livestock & Integrated Farming Systems	3	30/70
OAT 122	Water Management in Organic Farming Systems	2	30/70
OAT 123	Post-Harvest Handling of Organic Produce	2	30/70
OAT 124	Organic Certification Principles & Standards	3	40/60

Code	Course Title	CU	T/P Ratio
OAT 125	Soil Health, Microbiology & Ecosystem Balance	3	30/70
OAT 126	Practical Organic Farm Operations I	3	10/90

ND II – Semester 3

Code	Course Title	CU	T/P Ratio
OAT 211	Advanced Organic Crop Production Systems	3	30/70
OAT 212	Organic Value Chain Development & Processing	2	30/70
OAT 213	Sustainable Agroforestry & Regenerative Agriculture	3	30/70
OAT 214	Organic Certification Systems (EU, USDA, Global Organic Standards)	3	40/60
OAT 215	Climate Resilience in Organic Agriculture	2	30/70
OAT 216	Organic Data Systems & Farm Record Keeping	2	30/70
OAT 217	Practical Organic Farm Operations II	3	10/90

ND II – Semester 4

Code	Course Title	CU	T/P Ratio
OAT 221	Digital Marketing of Organic Agricultural Products	3	20/80
OAT 222	Agribusiness & Export Channels for Organic Produce	3	30/70
OAT 223	AfCFTA & International Organic Trade Systems	2	40/60
OAT 224	Organic Entrepreneurship & Green Startup Innovation	3	20/80
OAT 225	Seminar: Global Trends in Organic Agriculture	2	40/60
OAT 226	Final Project (Organic Farm Enterprise Development)	6	10/90
SIW 200	SIWES / Industrial Attachment (Organic Farms & Certification Bodies)	6	0/100

15.2 Alignment with Identified Gaps

Gap 1: Digital Agriculture & Precision Farming (Absent → Introduced)

New Courses Added

- OAT 221 — Digital Marketing of Organic Agricultural Products

Practical Competencies

- e-commerce platforms for organic produce
- social media branding for organic farms

- digital customer engagement systems
- online organic product marketplaces
- farm-to-consumer digital sales channels

Gap 2: Climate-Smart Agriculture (Absent → Introduced)

New Courses Added

- OAT 214 — Organic Certification Systems (EU, USDA, Global Organic Standards)
- OAT 124 — Organic Certification Principles & Standards

Practical Competencies

- organic certification documentation
- compliance with EU/USDA organic standards
- farm inspection readiness procedures
- certification audit preparation
- traceability systems for organic export

Gap 3: AGRIBUSINESS & EXPORT CHANNELS (PARTIAL → FULL SYSTEM)

New Courses Added

- OAT 222 — Agribusiness & Export Channels for Organic Produce
- OAT 223 — AfCFTA & International Organic Trade Systems

Practical Competencies

- export documentation for organic goods
- regional trade integration (AfCFTA)
- value chain export structuring
- international buyer linkage systems
- organic supply chain logistics

15.3 National Occupational Standards (NOS) Alignment

Organic Production NOS

- organic crop production systems
- soil fertility management
- pest control in organic systems
- composting and biofertilizers

Certification & Compliance NOS

- organic certification procedures
- international organic standards (EU/USDA)
- farm audit compliance systems
- traceability documentation

Climate-Smart Organic NOS

- regenerative agriculture systems
- agroforestry integration
- climate adaptation in organic farming
- ecosystem-based farming systems

Agribusiness NOS

- organic value chain development
- export market systems
- agribusiness planning
- startup development

Digital Agriculture NOS

- digital marketing systems
- e-commerce agriculture platforms
- farm data record systems
- online branding systems

Trade & AfCFTA NOS

- cross-border agricultural trade
- export logistics systems
- international market compliance
- **regional value chain integration**

15.4 Key Priority Actions

PRIORITY 1 (GLOBAL MARKET ACCESS)

- Organic certification systems (EU, USDA, Global standards)
- Export readiness & compliance systems
- Traceability and audit systems

PRIORITY 2

- Digital marketing & e-commerce expansion
- AfCFTA integration for organic products
- Agribusiness scaling models

PRIORITY 3

- Organic startup incubation systems
- AI-assisted organic farming analytics (future expansion)
- **Global organic branding systems**

15.5 Transformation Outcome

Old Model (2023)	New Model (Reconstructed)
• TStrong production focus • Limited global market integration • Weak digital commercialization • Partial certification awareness	• Globally compliant organic agriculture system • Export-ready organic value chains • Digital organic marketing ecosystems • Certified premium market access framework • Climate-resilient regenerative agriculture system

16.0 NCE Agronomy Panel Sub-committee (Crop and Agribusiness Option)

16.1 NCE Crop and Agribusiness Option

S/N	Subject Clusters	Existing Curriculum (NCCE 2020)	Skill Gap Identified	Remark
1	Crop Production I & II	Six (6) courses covered the subject cluster from principle and practice of crop production.	- Key practical activities on focus areas are lacking, - modern crop production techniques like greenhouse not available, -Equipment, tools and facilities are obsolesce. - No exposure to irrigation and irrigation facilities	To be reviewed
2	Soil Science and Land Management	Two (2) courses covering introductory and soil fertility management in the entire period of the study	- Two courses in the subject cluster are inadequate for the specialist, - Soil laboratory practices, soil field test and practices are not taking cared up. -land management practices for the specialist are inadequate	To be reviewed
3	Horticulture and Vegetable Production	AGC324 is the only horticultural course in the course of study.	-specialist are not exposed to various horticultural and vegetable crop practices from seed health practices, sowing, nursery bed preparation, transplanting, management practices to harvesting and post-harvest management practices.	To be reviewed
4	Pest and Disease Management	AGC222 & AGC322 are the two (2) courses that is limited to theoretical aspects of crop pest and disease management	- No practical field identification of these crop pest and diseases, - Inadequate laboratory equipment to train students diagnostic, treatment and control of these diseases.	
5	Agricultural Economics, Management and Accounts	The subject cluster has enough courses ten (10) courses within the course of study.	- many courses that are theoretically based, - absent of the modern value chain practice - lack of exposure to modern marketing system, cooperative visits and market surveys.	To be reviewed to accommodate practical training
6	Agricultural Extension and Rural	Only AGE122 which is an introductory aspect of the	-limited coverage of extension and rural sociology knowledge	

	Development	knowledge of extension and rural settings is in the current NCE Agric curriculum.	- training may exclude vital knowledge on communication channels. -	
7	SIWES, Field trip, Field Practical's	- 16 Weeks Industrial SIWES, - 1 CU field practical - I time field trip visit to agro-allied industry	- very limited highly organized industries with modern facilities for the SIWES - students on SIWES lack capacity to meet serious industries demands.	
Fishery Panel				
8	Fisheries and Aquaculture	AGA 222; Introduction to fisheries and aquaculture, only 1CU, course without practical.	-The only fishery related course the curriculum covered - practical are not covered	To be reviwed
Forestry Panel				
9	Forestry, Silviculture,	Absent	The entire NCCE/NCE 2020 minimum standard has not covered any forestry related course	To be reviewed to accommodate aspect of forestry

17.0 Livestock Ecology Skills-Gap Analysis

Table 1 — Animal Health & Production Programmes

HND Animal Health Technology (2002) • HND Animal Production Technology (2005) • ND Animal Health & Production Technology (2005)

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
1	**Artificial Insemination (AI) in poultry breeder birds —** Absent. Existing AI content is species-general only, with no dedicated poultry breeder AI protocol.	**ANH 442** **APT 312** **AHP 123**	Introduce a dedicated module on AI in avian species. Allocate 2 CU with practical demonstration at the institutional poultry unit. Cover semen collection, evaluation, insemination devices, timing and biosecurity protocols.	**NEW Poultry Artificial Insemination Technician** ***Levels 2, 3 & 4*** *• Sector 5.2 Animal Husbandry* **EXTEND Poultry Production** ***Extend to Level 4 (add AI unit)*** *• Sector 5.2 Animal Husbandry*	**30 : 70** *Theory : Practical*
2	**Feed formulation software (Allix, AFOS, Best Mix, Excel) —** Absent. Nutrition courses remain entirely manual.	**APT 441** **APT 322** **AHP 125** **COM 311**	Revise nutrition courses to include a minimum of 15 practical hours on computer-aided feed formulation. Acquire institutional licences for Allix or AFOS, or develop Excel-based least-cost templates. Integrate with Relevant Computer Packages.	**NEW Computer-Aided Feed Formulation Technician** ***Levels 3 & 4*** *• Sector 5.1 Agriculture/Agro-Processing* **EXTEND Feed Production** ***Extend to Level 3 (digital module)*** *• Sector 5.1 Agriculture/Agro-Processing*	**30 : 70** *Theory : Practical*
3	**Practical AI, semen collection, oestrus synchronisation and pregnancy diagnosis (cattle, swine, small ruminants) —** Partial in	**ANH 442** **ANH 436** **APT 442** **APT 445** **AHP 216**	Upgrade ANH 442 to include species-specific protocols for cattle, sheep/goat and swine, with rectal-palpation and ultrasound pregnancy diagnosis. In HND APT, create a new reproductive-technology unit within APT 442 and APT 445.	**NEW Ruminant & Swine Artificial Insemination Technician** ***Levels 2, 3 & 4*** *• Sector 5.2 Animal Husbandry*	**20 : 80** *Theory : Practical*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	HND AHT via ANH 442; absent in HND APT and ND AHPT.			**EXTEND Beef Cattle Production & Dairy Cattle Production** ***Extend to Level 3 (AI & pregnancy diagnosis units)*** • *Sector 5.2 Animal Husbandry*	
4	**Piglet management — iron dextran, fostering, castration, assisted farrowing** — Partial in APT 434 and AHP 212; absent in HND AHT.	**APT 434 AHP 212 ANH 442**	Expand APT 434 and AHP 212 with operational protocols: iron supplementation schedules, cross-fostering, elastration and surgical castration, neonatal thermoregulation and assisted farrowing.	**NEW Swine (Pig) Production** ***Levels 1, 2 & 3*** • *Sector 5.2 Animal Husbandry (currently missing)*	**20 : 80** *Theory : Practical*
5	**Swine Finishing & Marketing including social media channels** — Absent. Skills-Gap score 2.39/5 (High Gap).	**APT 434 AHP 212 ANH 436**	Introduce 'Swine Finishing, Marketing & Digital Commerce' in APT 434, AHP 212 and as a unit under ANH 436. Cover BCS for finishing, live-weight/carcass pricing, social-media marketing and e-commerce logistics.	**NEW Swine (Pig) Production** ***Add Level 4 with finishing & digital-marketing unit*** • *Sector 5.2 Animal Husbandry*	**40 : 60** *Theory : Practical*
6	**Cold chain & storage management for milk, meat, eggs and vaccines** — Absent. Existing courses reference storage generically but do not address cold-chain as a system.	**APT 444 AHP 222**	Add a dedicated unit 'Cold Chain Management of Animal Products' within APT 444 and AHP 222 — minimum 15 theory + 30 practical hours. Cover refrigeration chain, temperature data-logging, transport refrigeration, last-mile cold-chain, vaccine cold-chain, HACCP.	**NEW Livestock Cold-Chain & Storage Operations** ***Levels 2, 3 & 4*** • *Sector 5.2 Animal Husbandry / Agro-Processing*	**30 : 70** *Theory : Practical*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
7	**Modern dairy husbandry and milking technology —** Partial via APT 445 and dairy sections of ANH 436; machine-milking and automation missing.	**APT 445** **ANH 436** **AHP 125**	Upgrade to include machine milking, automated calf feeders, parlour-hygiene protocols, somatic-cell-count monitoring and robotic-milking concepts. Sign MoUs with commercial dairy farms for practical placement.	**EXTEND Dairy Cattle Production** ***Extend from Levels 1–2 to Levels 3, 4 & 5 (parlour automation, SCC)*** • *Sector 5.2 Animal Husbandry*	**20 : 80** *Theory : Practical*
8	**Climate-smart livestock and dairy production —** Absent. No current course integrates climate adaptation into husbandry planning.	**APT 442** **APT 445** **AHP 217**	Introduce a transversal topic 'Climate-Smart Livestock Production'. Cover heat-stress mitigation, water-use efficiency, low-emission diets, shade/cooling design, climate-resilient breeds, and pasture-based carbon accounting.	**NEW Climate-Smart Livestock Production** ***Levels 3 & 4*** • *Sector 5.2 Animal Husbandry* **EXTEND Add climate-smart unit to all existing AH trades** ***Cross-cutting***	**50 : 50** *Theory : Practical*
9	**Feedlot operations — stock selection, weight monitoring, body-condition scoring —** Partial in APT 442 and beef/cattle sections of ANH 436 and AHP 211, mainly theoretical.	**APT 442** **ANH 436** **AHP 211**	Convert theoretical treatment into structured practicals: feedlot-entry selection criteria, weekly weight-gain monitoring, BCS charts, daily feed-intake logging, and break-even finishing-period calculation.	**NEW Feedlot Operations (Beef Cattle Finishing)** ***Levels 2 & 3*** • *Sector 5.2 Animal Husbandry* **EXTEND Beef Cattle Production** ***Extend from Levels 1–2 to Level 3 & 4*** • *Sector 5.2 Animal Husbandry*	**30 : 70** *Theory : Practical*
10	**Value addition to agricultural residues and**	**APT 441** **AHP 121**	Add a dedicated module 'Crop Residue & By-Product Utilisation'. Cover urea-	**EXTEND Feed Production** ***Extend from Levels 1–2 to Levels***	**30 : 70** *Theory :*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	agro-industrial by-products — Absent or weakly partial. Nutrition courses cite residues without processing depth.		treatment of straws, molasses-urea blocks, brewers' dried grains, PKC, and silage from residues. Provide practical production and cost-benefit analysis.	***3 & 4 (residue treatment, UMMB, silage)*** • *Sector 5.1 Agriculture/Agro-Processing*	*Practical*
11	**Beef processing — meat cuts, butchery and abattoir operations** — Partial in APT 444 and AHP 222. Practical infrastructure inadequate.	**APT 444** **AHP 222**	Expand APT 444 and AHP 222 to include structured carcass-cutting labs, modern butchery protocols, halal slaughter procedures, meat-grade labelling, and retail-cut merchandising. Partner with slaughterhouses for placement.	**NEW Meat Processing and Butchery (Abattoir Operator)** ***Levels 1, 2, 3 & 4*** • *Agro-Processing*	**20 : 80** *Theory : Practical*
12	**Apiary management, hive construction, honey processing, bee disease/pest control, queen rearing, bee nutrition** — Entirely absent. Queen Rearing scored 1.68/5 — lowest nationally. Apiary overall 1.87/5 (Critical Gap).	**NEW** *'Intro. to Apiculture & Hive Products' (2 CU, all three)*	Introduce a new compulsory course in all three programmes. Modules: hive types (Langstroth, KTB, top-bar), colony management, seasonal feeding, Varroa/hive-beetle control, queen rearing, honey extraction and packaging. Establish an institutional demo apiary with at least 10 colonies.	**EXTEND Bee Keeping Practice** ***Extend from Levels 1–3 to Levels 4 & 5 (queen rearing, commercial apiary mgmt, honey processing)*** • *Sector 5.1 Agriculture/Agro-Processing* **NEW Queen Rearing & Bee Breeding Specialist** ***Levels 3 & 4 (spin-out trade)*** • *Sector 5.1 Agriculture/Agro-Processing*	**20 : 80** *Theory : Practical*
13	**Livestock by-product processing (leather, bone meal, tallow, blood meal)**	**APT 435** **APT 444** **AHP 222**	Expand APT 435 into a full pathway 'Leather, Bone Meal & Rendered Products Technology' and replicate modules in APT	**NEW Livestock By-Product Processing (Tanning, Rendering)**	**30 : 70** *Theory : Practical*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	— Weak. APT 435 covers only primary curing; absent from HND AHT and ND AHPT.		444 and AHP 222. Cover tanning, fleshing, splitting and finishing; bone-meal; tallow rendering; blood-meal.	***Levels 2, 3 & 4*** • *Agro-Processing / Leather* **EXISTING NTC/ANTC Leather Works** ***Link to existing craft trade*** • *Textile Trades*	
14	**Digital Livestock Farming — robotics, automation, remote sensing, GPS tracking, IoT sensors —** Absent from all three curricula. FGD identifies as emerging priority.	**COM 311** **COM 101** **NEW** *'Digital Livestock Farming' (2 CU)*	Introduce a new 2-CU module, modernising existing computer courses. Cover livestock IoT collars, GPS geo-fencing, automated feeders/waterers, drone pasture monitoring, RFID ear-tag mgmt, and farm-management software.	**NEW Smart / Digital Livestock Farming Technician** ***Levels 2, 3 & 4*** • *Sector 5.2 Animal Husbandry* **EXISTING NTC Smart Agriculture** ***Links to existing NTC craft trade*** • *Agriculture Trades*	**40 : 60** *Theory : Practical*
15	**Entrepreneurship as a standalone livestock value chain —** Partial: generic entrepreneurship embedded in AGR 303 and general studies, not livestock-specific.	**AGR 303** **NEW** *'Livestock Enterprise Development' (2 CU)*	Elevate entrepreneurship to a standalone 2-CU course. Cover livestock-specific business-plan canvassing, agribusiness finance, livestock insurance, cooperative formation, off-take contracts, agri-digital marketing.	**NEW Livestock Enterprise Management** ***Levels 3 & 4*** • *Sector 5.2 Animal Husbandry*	**40 : 60** *Theory : Practical*
16	**Hatchery biosecurity — conceptual, structural, operational, digital**	**APT 433** **ANH 436** **AHP 125**	Upgrade APT 433 and equivalents to include commercial-scale hatchery layout, HVAC, disinfection zoning, footbaths, all-in/all-out	**NEW Commercial Hatchery Operations & Biosecurity** ***Levels 2, 3 & 4*** • *Sector 5.2*	**30 : 70** *Theory : Practical*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	dimensions — Partial in APT 433; limited structural and digital depth elsewhere.		flow, digital egg-weight scales, and automated hatcher controls. Require a hatchery-design drawing assignment.	*Animal Husbandry* **EXTEND Quality Assurance in Poultry** ***Extend from Levels 3–4 to Level 5 (hatchery QA)*** • *Sector 5.2 Animal Husbandry*	
17	**Egg management — fumigation, grading and transportation chain —** Partial in APT 433; absent in HND AHT and ND AHPT.	**APT 433** **ANH 436** **AHP 125**	Add a practical module 'Commercial Egg Handling' covering fumigation chambers, electronic candling, weight-grading machines, palletising for export, and cold-chain transportation of table eggs.	**EXTEND Poultry Production** ***Extend to Level 4 (add egg-handling unit)*** • *Sector 5.2 Animal Husbandry*	**30 : 70** *Theory : Practical*
18	**Feedmill operation, management and quality control —** Partial in APT 441; absent in ND AHPT.	**APT 441** **AHP 125**	Convert APT 441 into a two-part course — theory plus a 'Feedmill Operations' practical — covering mill layout, mixing technology, pellet-quality control, mycotoxin screening, bagging/storage and operator safety.	**NEW Feed Mill Operations & Quality Control** ***Levels 2, 3 & 4*** • *Sector 5.1 Agriculture/Agro-Processing* **EXTEND Feed Production** ***Extend from Levels 1–2 to Levels 3 & 4*** • *Sector 5.1 Agriculture/Agro-Processing*	**30 : 70** *Theory : Practical*
19	**Farm machinery & equipment — tractors, feed mills, balers, forage harvesters, precision**	**APT 311** **NEW** *Equivalent in HND AHT & ND AHPT*	Revise APT 311 and introduce equivalents covering modern fodder-harvesting equipment (chopper-baler, mower-conditioner), GPS-guided tractors, automatic	**EXTEND Agricultural Equipment Operations** ***Extend from Levels 1–3 to Levels 4 & 5 (precision equipment)*** •	**20 : 80** *Theory : Practical*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	equipment — Partial via APT 311; absent in HND AHT and ND AHPT.		feed wagons, and preventive-maintenance schedules.	*Sector 5.1 Agriculture/Agro-Processing* **EXTEND Agricultural Equipment Mechanics** ***Extend to Level 4 (livestock-equipment focus)*** • *Sector 5.1 Agriculture/Agro-Processing*	
20	**Processing equipment maintenance —** Partial in APT 444; absent elsewhere. Scored 2.32/5 — lowest nationally.	**APT 444** **AHP 222**	Introduce a cross-cutting unit 'Preventive Maintenance of Processing Equipment' covering abattoir machinery, pasteurisers, chillers, mixers, vacuum packaging machines; log-sheet discipline, spare-part inventory and basic fault-finding.	**NEW Livestock Processing Equipment Maintenance Technician** ***Levels 2 & 3*** • *Agro-Processing / Engineering*	**20 : 80** *Theory : Practical*
21	**Livestock logistics as a sub-value chain —** Absent across all three programmes.	**AGR 303** **NEW** *'Livestock Logistics & Cold-Chain Transport' (1 CU)*	Add a 1-CU topic covering live-animal transport welfare standards, route planning, temperature-controlled vehicles, and digital freight-tracking.	**NEW Livestock Logistics & Transport Operator** ***Levels 2 & 3*** • *Transport / Agro-Processing*	**40 : 60** *Theory : Practical*
22	**Practical / demonstration training infrastructure —** Weak. 92% of respondents prefer practical training yet institutional farms remain sub-standard.	**SIWES Accreditation**	Incorporate a 'Minimum Practical Infrastructure Standard' specifying required demonstration units for accreditation: dairy parlour, modern piggery, commercial layer pen, feedlot pen, abattoir, apiary and forage field. Require SIWES at commercial	**EXISTING Leverage all existing AH & AG trades as competency assessment benchmarks for SIWES and graduate outputs** ***NSQ Assessment Centre***	**10 : 90** *On-Farm Practical-Heavy*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
			livestock enterprises.	***accreditation for each institution***	
23	**Extension service linkage for livestock —** Weak. 44% of respondents lack extension-service access.	**AGR 302** **AGR 402**	Strengthen AGR 302 and AGR 402 to embed livestock-specific extension delivery: farmer-training methodologies, mobile-phone-based extension (SMS/WhatsApp), agricultural radio/TV broadcasting, and participatory rural appraisal for livestock keepers.	**NEW Agricultural / Livestock Extension Services Delivery** ***Levels 3 & 4*** • *Sector 5.1 Agriculture/Agro-Processing / Sector 5.2 Animal Husbandry*	**40 : 60** *Theory : Practical*
24	**Animal handling, welfare and modern biosecurity standards —** Partial via Clinical Techniques; lacks contemporary WOAH (OIE) welfare codes.	**ANH 432 / 442** **AHP 216 / 224**	Modernise Clinical Techniques courses to incorporate current welfare codes (five-domains model), low-stress handling (Temple Grandin designs), restraint technology and biosecurity zoning. Add welfare-assessment practicals as coursework.	**NEW Animal Welfare & Humane Handling** ***Levels 2 & 3 (cross-cutting)*** • *Sector 5.2 Animal Husbandry* **EXTEND Animal Husbandry (Livestock Farming)** ***Add welfare & biosecurity unit to Levels 2 & 3*** • *Sector 5.2 Animal Husbandry*	**20 : 80** *Theory : Practical*
25	**Neonatal care for small ruminants (lamb/kid care) —** Partial via ANH 436 Sec 11; absent from HND APT and ND AHPT. National score 2.98/5.	**APT 323** **AHP 211** **ANH 436**	Introduce dedicated neonatal-care practicals in APT 323 and AHP 211. Cover colostrum management, hypothermia treatment, navel dipping, neonatal feeding and vaccination schedules.	**NEW Sheep & Goat (Small Ruminant) Production** ***Levels 1, 2 & 3*** • *Sector 5.2 Animal Husbandry (currently missing)*	**20 : 80** *Theory : Practical*

Table 2 — Pasture & Range Management Programme

HND Pasture & Range Management (2006)

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
1	**Feed formulation software —** Absent. PRM 322 remains entirely manual; no computer-aided least-cost formulation taught.	**PRM 322** **COM 311/321**	Revise PRM 322 to include ≥ 15 practical hours on computer-aided ration balancing software. Integrate with Computer Application I & II. Introduce least-cost-formulation assignments using forage-based rations typical of Nigerian rangelands.	**NEW Computer-Aided Feed Formulation Technician (Forage-based)** ***Levels 3 & 4*** • *Sector 5.1 Agriculture/Agro-Processing*	**30 : 70** *Theory : Practical*
2	**Practical AI and reproductive management for dairy and beef cattle on pasture —** Absent. PRM programme does not cover reproductive technology in grazing animals.	**PRM 322** **NEW** *'Reproductive Mgmt of Range Livestock' (2 CU)*	Introduce a new 2-CU module within PRM 322 or as a new Year-II course. Cover heat detection in pasture-based herds, controlled-breeding seasons, AI techniques, and pregnancy diagnosis via rectal palpation and ultrasound.	**NEW Ruminant Artificial Insemination Technician (Pasture-based)** ***Levels 2, 3 & 4*** • *Sector 5.2 Animal Husbandry*	**20 : 80** *Theory : Practical*
3	**Digital livestock farming — GPS/GIS rangeland monitoring, remote sensing (NDVI), virtual fencing, drone pasture assessment —** Absent. Computer Applications cover only	**COM 311/321** **PRM 421**	Modernise Computer Application I & II into 'Digital Tools for Pasture & Range Management'. Add GIS (QGIS, ArcGIS), NDVI-based pasture biomass monitoring, drone-based range monitoring, GPS livestock collars, virtual fencing. Link with PRM 421.	**NEW Digital Pasture & Range Monitoring Technician (GIS/Drone/NDVI)** ***Levels 3 & 4*** • *Sector 5.1 Agriculture/Agro-Processing*	**30 : 70** *Theory : Practical*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	generic ICT skills.				
4	**Cold-chain and modern storage of forage products (hay, silage, pellets) —** Partial. PRM 413 covers traditional hay/silage but not modern packaging, storage or supply-chain.	**PRM 413**	Expand PRM 413 to include baled-hay wrapping, vacuum-packed silage, pelleted-forage production, modern silo technology, moisture monitoring, and the commercial forage supply chain (B2B delivery to dairies and feedlots).	**NEW Commercial Hay & Silage Production and Storage** *Levels 2, 3 & 4 • Sector 5.1 Agriculture/Agro-Processing* **EXTEND Pasture Cultivation** *Extend from Levels 1–3 to Levels 4 & 5 (post-harvest) • Sector 5.1 Agriculture/Agro-Processing*	**30 : 70** *Theory : Practical*
5	**Apiary management as an integrated rangeland enterprise —** Absent. Rangelands are ideal for apiculture yet no apiary content exists.	**NEW** *'Apiculture on Rangelands' (2 CU)*	Introduce a new 2-CU course covering hive placement on forage stands, pollination services for fodder legumes, honey production from rangeland flora, and integration of bees into range-livestock enterprises. Establish a demo apiary.	**EXTEND Bee Keeping Practice** *Extend from Levels 1–3 to Levels 4 & 5 (range-based apiary, pollination services) • Sector 5.1 Agriculture/Agro-Processing*	**20 : 80** *Theory : Practical*
6	**Livestock entrepreneurship and value-chain enterprise development —** Partial (single topic under PRM 424).	**PRM 424** **NEW** *'Pasture/Forage/Range Enterprise Development' (3 CU)*	Separate entrepreneurship from PRM 424 Project and create a standalone 3-CU course covering commercial hay/silage business models, fodder-bank enterprise, grazing-lease contracts, ranching business plans,	**NEW Forage & Range Enterprise Management** *Levels 3 & 4 • Sector 5.1 Agriculture/Agro-Processing*	**40 : 60** *Theory : Practical*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
			digital marketing.		
7	**Modern precision forage production** — Partial. AET 222 and PRM 321 are currently conventional.	**AET 222** **PRM 321**	Revise AET 222 and PRM 321 to include precision-agriculture content for forage: drip-fertigation, variable-rate seeding, yield-mapping of fodder plots, sensor-based soil-moisture management, and decision-support apps for planting-date selection.	**EXTEND Pasture Cultivation** ***Extend to Level 4 (precision forage)*** • *Sector 5.1 Agriculture/Agro-Processing* **EXTEND Crop Production (Cereal/Legume)** ***Extend to Level 4 (precision-agriculture units)*** • *Sector 5.1 Agriculture/Agro-Processing*	**30 : 70** *Theory : Practical*
8	**Feedlot operations as an applied use of pasture/forage outputs** — Partial in PRM 412 with primarily theoretical treatment.	**PRM 412**	Add a dedicated 'Feedlot Nutrition & Finishing' unit within PRM 412 covering transition diets from pasture to feedlot, BCS, daily-gain targets, feedlot-pen design and integration with pasture-based backgrounding.	**NEW Feedlot Operations (Beef Cattle Finishing)** ***Levels 2 & 3*** • *Sector 5.2 Animal Husbandry*	**30 : 70** *Theory : Practical*
9	**Value addition to crop residues and agro-industrial by-products** — Present (PRM 423) but lacks modern treatments and commercial-scale	**PRM 423**	Strengthen PRM 423 by adding urea-molasses block making, bulk ammoniation, brewers'-dried-grain ensiling, commercial mycotoxin screening and cost-benefit analysis. Add practical on production and marketing of treated residues.	**EXTEND Feed Production** ***Extend from Levels 1–2 to Levels 3 & 4 (UMMB, ammoniation, BDG)*** • *Sector 5.1 Agriculture/Agro-Processing*	**30 : 70** *Theory : Practical*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	content.				
10	**Climate-smart pasture and range practices —** Partial. CPT 313 treats climate as a static factor; no adaptation content.	**CPT 313** **PRM 324**	Revise CPT 313 and integrate with PRM 324 to cover drought-tolerant species, silvopasture, agroforestry, rotational grazing for carbon sequestration, flood-resilient fodder species, early-warning systems, carbon-credit/monetisation.	**NEW Climate-Smart Pasture & Range Management** ***Levels 3 & 4*** • *Sector 5.1 Agriculture/Agro-Processing*	**40 : 60** *Theory : Practical*
11	**Animal-based by-product processing (leather, bone meal, tallow from range livestock) —** Absent.	**PRM 412** **NEW** *'Range Livestock By-Products' module*	Introduce a new module within PRM 412 covering hide and skin recovery, on-ranch primary curing, bone-meal production from mortality, and the leather value chain. Arrange site visits to tanneries and rendering plants.	**NEW Livestock By-Product Processing (Tanning, Rendering)** ***Levels 2, 3 & 4*** • *Agro-Processing / Leather*	**30 : 70** *Theory : Practical*
12	**Modern livestock breed identification, welfare standards and handling for pasture-based systems —** Partial. PRM 322 touches husbandry superficially.	**PRM 322**	Upgrade PRM 322 to include modern welfare standards (five-domains model), low-stress handling designs, identification of tropically-adapted breeds (White Fulani, Sokoto Gudali, Red Sokoto goat, Yankasa sheep), and selection indices.	**EXTEND Animal Husbandry (Livestock Farming)** ***Extend from Levels 1–3 to Level 4 (welfare, breed selection)*** • *Sector 5.2 Animal Husbandry*	**30 : 70** *Theory : Practical*
13	**Livestock health and biosecurity on rangelands (tick-borne diseases, helminthosis,**	**PRM 411** **NEW** *'Range Livestock Health' (2 CU)*	Introduce a new 2-CU course covering tick-borne disease management, strategic deworming using FEC protocols, FAMACHA scoring, mobile	**NEW Community Animal Health Worker (Range/Pastoral)** ***Levels 2 & 3*** • *Sector 5.2*	**30 : 70** *Theory : Practical*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	zoonoses) — Absent as dedicated topic; only light reference in PRM 411.		veterinary-service logistics, and zoonotic-disease surveillance on rangelands.	*Animal Husbandry*	
14	**Cold-chain and commercial processing of pasture-fed livestock products —** Absent.	**PRM 412**	Add a unit 'Pasture-to-Plate Value Chain' in PRM 412 covering grass-fed milk premium markets, grass-fed-beef certification, cold-chain logistics from range to abattoir, and consumer-facing labelling. Require a value-chain mapping assignment.	**NEW Grass-Fed Livestock Products Processing & Marketing** ***Levels 3 & 4*** • *Agro-Processing*	**40 : 60** *Theory : Practical*
15	**Practical demonstration infrastructure for modern pasture-livestock systems —** Partial. PRM 414 Horse Riding is strongest existing hands-on component but narrow.	**Accreditation**	Mandate a 'Minimum Demonstration Infrastructure': established forage bank, baling/silage facility, fenced rotational-grazing demo, demo apiary, and linkages with commercial ranches for SIWES. Tie these to accreditation criteria.	**EXISTING Use NSQ Assessment Centre accreditation process for infrastructure benchmarking** ***Cross-cutting***	**10 : 90** *On-Range Practical-Heavy*
16	**Farm machinery & precision equipment for forage production —** Partial via AES 413.	**AES 413**	Modernise AES 413 to emphasise forage-specific machinery: disc mowers, mower-conditioners, rotary rakes, round/square balers, bale wrappers, forage harvesters, preventive-maintenance. Annual practical operation on institutional	**EXTEND Agricultural Equipment Operations & Mechanics** ***Extend from Levels 1–3 to Levels 4 & 5 (forage-machinery specialism)*** • *Sector 5.1 Agriculture/Agro-*	**20 : 80** *Theory : Practical*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
			forage fields.	*Processing*	
17	**Extension service delivery for pasture/forage technology transfer** — Partial via AEM 446 Rural Sociology.	**AEM 446**	Strengthen AEM 446 to embed livestock-extension-specific tools: mobile extension apps, WhatsApp-based pastoralist advisories, radio-based forage-technology broadcasts, participatory rangeland-monitoring methodologies.	**NEW Pasture & Range Extension Services** ***Levels 3 & 4*** • *Sector 5.1 Agriculture/Agro-Processing*	**40 : 60** *Theory : Practical*
18	**Integration of pasture programme with modern livestock husbandry** — Weak. Focus on forage production with limited animal-side integration.	**NEW** *Capstone 'Forage–Livestock Systems Design'* **PRM 425**	Introduce an integrative capstone unit requiring students to design a pasture-based dairy, beef or small-ruminant enterprise — linking PRM 322, PRM 412, PRM 413 and the new Reproductive Management module. Place alongside PRM 425 Project.	**NEW Integrated Pasture–Livestock Systems Manager** ***Level 5 (capstone)*** • *Sector 5.2 Animal Husbandry / Sector 5.1 Agriculture/Agro-Processing*	**30 : 70** *Theory : Practical*

Table 3 — Veterinary Laboratory Technology Programmes

HND Veterinary Laboratory Technology (2018) • ND Veterinary Laboratory Technology (2018)

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
1	**Livestock production competencies entirely absent** — Skills-Gap scorecard: 2% coverage. Diplomates cannot	**NEW** *'Livestock Production Systems for Lab Technologists' (2 CU, Year 1)*	Introduce a new foundation course in Year 1 of both HND VLT and ND VLT. Cover species-specific husbandry, farm biosecurity, and the role of the veterinary laboratory in supporting commercial livestock enterprises.	**NEW Veterinary Laboratory Assistant (Livestock-Aware)** ***Levels 2, 3 & 4*** • *Health / Sector 5.2 Animal Husbandry*	**40 : 60** *Theory : Practical*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	meaningfully support livestock-farm work.				
2	**Feed & nutrition with no contextual linkage to laboratory diagnostics —** Partial via VLT 321 but isolated theory; absent at ND level.	**VLT 321** **NEW** *Equivalent in ND VLT*	Expand VLT 321 to include laboratory analysis of feed (proximate, mycotoxin, urea), diet-related clinical-pathology panels, and intro to feed-formulation software for interpreting nutrition-related lab results.	**NEW Feed & Forage Analysis Laboratory Technician** ***Levels 3 & 4*** • *Sector 5.1 Agriculture/Agro-Processing*	**30 : 70** *Theory : Practical*
3	**Apiary/bee pathology and hive-disease diagnostics —** Absent. VLT 416 does not cover apiary parasites (Varroa, Nosema, AFB, EFB).	**VLT 416** **VLT 211**	Introduce 'Apiculture Pathology' unit within VLT 416 and VLT 211. Cover hive inspection for disease, Varroa mite monitoring, Nosema microscopy, AFB ropiness test, chalkbrood diagnosis. Equip lab with bee-disease reference slides and a model hive.	**EXTEND Bee Keeping Practice** ***Add Level 4 unit on apiary pathology & diagnostics*** • *Sector 5.1 Agriculture/Agro-Processing*	**30 : 70** *Theory : Practical*
4	**Poultry disease diagnostics and hatchery biosecurity laboratory support —** Partial; hatchery-specific diagnostic workflows missing.	**VLT 324** **VLT 417 / VLT 421**	Add 'Hatchery & Poultry Diagnostic Support' covering egg-borne pathogen screening (Salmonella), Marek's PCR, Newcastle/IB/Avian-Influenza serological surveillance, hatchery sanitation-swab protocols.	**EXTEND Quality Assurance in Poultry** ***Extend from Levels 3–4 to Level 5 (hatchery diagnostics)*** • *Sector 5.2 Animal Husbandry* **NEW Poultry Disease Diagnostic Technician** ***Levels 3 & 4*** • *Health / Sector 5.2 Animal Husbandry*	**30 : 70** *Theory : Practical*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
5	**Swine disease diagnostic workflow (ASF, CSF, PRRS)** — Absent as species-specific content.	**VLT 324** **VLT 417 / VLT 421**	Introduce swine-specific content covering ASF molecular diagnosis (PCR), biosecurity zone mapping, and outbreak-investigation sampling. Link to national ASF surveillance protocols.	**NEW Swine Health Diagnostic Technician** ***Levels 3 & 4*** • *Health / Sector 5.2 Animal Husbandry*	**30 : 70** *Theory : Practical*
6	**Dairy reproduction diagnostics — progesterone assays, pregnancy testing, semen quality** — Absent. No course addresses reproductive-diagnostic support for dairy enterprises.	**VLT 311** **VLT 124**	Add 'Reproductive Diagnostics' practical module within VLT 311 and VLT 124. Cover milk-progesterone tests, bovine PAG ELISAs, semen morphology/motility evaluation, and hormone-assay interpretation.	**NEW Dairy Reproduction Diagnostic Technician** ***Level 3*** • *Health / Sector 5.2 Animal Husbandry*	**30 : 70** *Theory : Practical*
7	**Animal handling and welfare for live-animal sample collection** — Partial via VLT 114 and VLT 125 (ND VLT); not repeated at HND level.	**VLT 114 / VLT 125** **NEW** *'Advanced Live-Animal Sampling' (HND VLT)*	Extend animal-handling content into HND VLT by adding a new module focusing on humane restraint for blood/faecal/milk/urine/biopsy sampling; species-specific venipuncture sites; welfare assessment prior to sampling.	**NEW Animal Welfare & Sampling Technician** ***Levels 2 & 3*** • *Sector 5.2 Animal Husbandry / Health*	**20 : 80** *Theory : Practical*
8	**Digital laboratory technologies — LIMS, automated PCR, ELISA readers, digital microscopy** — Absent. VLT 411 is generic and	**VLT 411**	Modernise VLT 411 to include LIMS, automated real-time qPCR, automated ELISA readers, digital slide scanning, cloud-based result reporting. Replicate essentials in ND VLT.	**NEW Digital Veterinary Laboratory Technician** ***Levels 3 & 4*** • *Health*	**30 : 70** *Theory : Practical*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	dated.				
9	**Cold-chain management for samples, vaccines and biologics** — Absent. Both curricula cover sterilisation but not cold chain.	**VLT 322** **VLT 124**	Introduce 'Cold-Chain Management in Veterinary Laboratories' covering sample transport (dry ice, liquid-nitrogen vapour, cold-pack logistics), vaccine storage, ultra-low-temperature freezer management, cold-chain audit protocols.	**NEW Veterinary Cold-Chain & Sample Logistics Technician** ***Levels 2 & 3*** • *Health*	**30 : 70** *Theory : Practical*
10	**Zoonotic disease surveillance and One Health** — Absent as integrated concept.	**NEW** *'One Health Surveillance' (1 CU)*	Add a 1-CU module covering zoonotic disease pathways (rabies, brucellosis, anthrax, Lassa, avian influenza), inter-agency reporting (veterinary–public health), outbreak-sampling protocols and digital surveillance platforms.	**NEW One Health Surveillance Assistant** ***Levels 3 & 4*** • *Health / Sector 5.2 Animal Husbandry*	**50 : 50** *Theory : Practical*
11	**Toxicology applied to livestock feed contamination and agricultural residues** — Partial via VLT 325; absent in ND VLT.	**VLT 325** **NEW** *'Basic Toxicology' (ND VLT)*	Upgrade VLT 325 to include applied toxicology: aflatoxin screening, pesticide residues in meat/milk/eggs, heavy metals in forage, and prosecution-grade sample handling for agro-chemical poisoning cases.	**NEW Veterinary Toxicology Laboratory Technician** ***Level 3*** • *Health*	**30 : 70** *Theory : Practical*
12	**Laboratory entrepreneurship — setting up a private veterinary laboratory** — Absent. Entrepreneurship only in general studies with	**NEW** *'Veterinary Laboratory Entrepreneurship' (2 CU, final semester)*	Introduce a final-semester 2-CU course covering business-plan development for a private vet-lab SME, regulatory licensing, pricing, QMS setup, client-sample logistics, digital marketing.	**NEW Veterinary Laboratory Enterprise Management** ***Level 4*** • *Health*	**40 : 60** *Theory : Practical*

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	no lab-specific content.				
13	**Field diagnostics and point-of-care (POC) testing —** Absent.	**VLT 322** **NEW** *Stand-alone unit (ND VLT)*	Add 'Point-of-Care Veterinary Diagnostics' covering lateral-flow tests, portable PCR (e.g. Biomeme), handheld blood analysers, mastitis-CMT kits, ketone/pH strips, field-sampling kits.	**NEW Field / Point-of-Care Veterinary Diagnostics Technician** ***Levels 2 & 3*** • *Health*	**20 : 80** *Theory : Practical*
14	**Small-ruminant health diagnostics (PPR, CCPP, helminthosis) —** Partial via VLT 324 and VLT 416.	**VLT 324 / VLT 416** **VLT 121**	Strengthen these with dedicated content on PPR/CCPP ELISA and PCR diagnostics, FAMACHA eye-colour scoring for anaemia, faecal-egg counts (FEC), McMaster counting technique.	**NEW Small Ruminant Disease Diagnostic Technician** ***Levels 3 & 4*** • *Health / Sector 5.2 Animal Husbandry*	**30 : 70** *Theory : Practical*
15	**Digital Livestock Farming — remote-sensing disease surveillance, IoT health monitoring —** Absent.	**VLT 411** **NEW** *'Digital & Remote Veterinary Surveillance' (1 CU)*	Introduce a new 1-CU module covering IoT rumen-bolus data, accelerometer-based sickness detection, satellite surveillance of disease outbreaks, mobile-app-based disease reporting.	**NEW Digital Livestock Disease Surveillance Technician** ***Levels 3 & 4*** • *Health / Sector 5.2 Animal Husbandry*	**40 : 60** *Theory : Practical*
16	**Meat inspection and abattoir laboratory support —** Partial via VLT 412 (Pathology option); not covered at ND level.	**VLT 412** **NEW** *Condensed version (ND VLT)*	Add 'Meat Inspection Laboratory Practice' to VLT 412 and introduce a condensed version in ND VLT. Cover ante- and post-mortem inspection protocols, Trichinella testing, TB-lesion identification, condemnation documentation, slaughterhouse-sample flow.	**NEW Meat Inspection Technician (Abattoir)** ***Levels 2 & 3*** • *Agro-Processing / Health*	**20 : 80** *Theory : Practical*
17	**Equipment maintenance**	**VLT 411**	Upgrade VLT 411 to include preventive-	**NEW Veterinary Laboratory**	**20 : 80**

S/N	Gap Identified	Course Code(s) to Revise / Create	Recommendation for Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	— Partial via VLT 411; lacks hands-on depth. 2.32/5 — lowest nationally.		maintenance schedules for microscopes, centrifuges, autoclaves, haematology analysers, incubators, spectrophotometers. Practicals on calibration, fuse-replacement, first-line fault-finding. Introduce logbook as assessed coursework.	**Equipment Maintenance Technician** ***Levels 2 & 3*** • *Engineering / Health*	*Theory : Practical*
18	**Demonstration practical infrastructure and livestock-farm linkages** — Absent from both curricula's accreditation specifications.	**VLT 425 VLT 224 Accreditation**	Add a clause requiring each institution to establish either (a) a functional teaching veterinary diagnostic laboratory serving a commercial-livestock-farm catchment, or (b) an MoU with at least two commercial livestock enterprises for SIWES/clinical posting.	**EXISTING Accredit institutions as NSQ Assessment Centres for Health-sector livestock diagnostic trades** ***Cross-cutting accreditation***	**10 : 90** *Clinical-Posting Practical-Heavy*
19	**Climate-smart livestock-health monitoring (emerging and re-emerging diseases)** — Absent.	**VLT 324 VLT 417 / VLT 421**	Introduce a cross-cutting unit 'Climate-Driven Disease Emergence'. Cover vector shifts, Rift Valley Fever, anthrax re-emergence, heat-stress pathologies, drought-driven nutritional diseases.	**EXTEND Add climate-adaptation units to existing diagnostic trades (One Health link)** ***Cross-cutting*** • *Health*	**50 : 50** *Theory : Practical*
20	**Leather/by-product testing and quality control** — Absent.	**VLT 325 VLT 122**	Add 'Testing of Livestock By-Products' within VLT 325 covering hide/skin pre-tanning quality tests, microbial contamination of rendered products, residue screening. Introductory coverage in ND VLT via VLT 122.	**NEW Livestock By-Product Quality Assurance Technician** ***Level 3*** • *Agro-Processing / Leather*	**30 : 70** *Theory : Practical*

Strategic note for curriculum integration with the NSQF: The curriculum review team is encouraged to align the revised ND/HND curricula with these NOS/NSQ trades will enable dual certification (academic + vocational) for graduates, increase their employability (as flagged in the

Skills-Gap Report), and allow the institutions themselves to seek NSQ Assessment Centre accreditation — a direct response to the 92% practical-training preference and the 2–26% coverage scores identified in the baseline Skills Gap Analysis.

Key:

AHP - ND Animal Health and Production Technology

APT – HND Animal Production Technology

ANH – HND Animal Health Technology

VLT- Veterinary Laboratory Technology

PRM- Pasture and Range Management

18.0 Fisheries & Aquaculture Skills-Gap Analysis

Table 1 — ND Fisheries Technology (2022)

Foundational freshwater-aquaculture gaps and recommendations for the National Diploma in Fisheries Technology

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
1	**Daily farm management skill absent.** **FIT 121** Fish Farm Practice is only 1 CU (15 hrs) — grossly inadequate for the production-cycle exposure required by the Skills-Gap Report (Operational Skills, major deficit).	Expand **FIT 121** from **1 CU to 4 CU**. Restructure as a production-cycle-based module where each student takes full responsibility for one pond/tank throughout a stocking-to-harvest cycle. Daily duties: water quality monitoring, feeding, stocking-density checks, growth sampling, record keeping. Logbook assessment.	**EXTEND Fish Farming Activity** *Currently Levels 1, 2 & 3 — add Level 4 • 5.2 Animal Husbandry (EXISTING NSQF)* **NEW Fish Farm Management** *Proposed NOS #6 • Levels 1 & 2 • 5.2 Animal Husbandry*	**10 : 90** *Theory : Practical*
2	**Basic aquaculture too theoretical.** **FIT 123** Basic Aquaculture runs at 2-0-2 contact pattern; students complete the course without producing any fish themselves.	Convert **FIT 123** to **50% practical delivery** at the institutional fish farm. Include pond stocking, fingerling handling, basic feeding regime, water-parameter testing. **Exit competency**: each student raises ≥ 50 fingerlings to table size as assessed coursework.	**EXISTING Aquaculture** *Currently Levels 1 & 2 • 5.2 Animal Husbandry* **EXTEND Aquaculture** *Add Level 3 (graduate-level) • 5.2 Animal Husbandry*	**20 : 80** *Theory : Practical*
3	**Basic fish feed production absent from ND level.** Feed cost is 60–70% of production cost; feed formulation is both a Technical Skill (§5.1) and Practical Technical Skill (§3.5). Neither **FIT 123** nor any other ND course teaches feed production.	Introduce a **new 3-CU course ~FIT 126~ Basic Fish Feed Production** (or expand **FIT 123**). Cover ingredient identification (soybean cake, fish meal, groundnut cake, maize bran, palm kernel cake, brewers' dried grains), ratio calculation, mixing, manual hand-pelleter use, drying, feed-quality tests. Establish a pilot feed-mixing bench.	**NEW Fish Feed Production** *Proposed NOS #1 • Levels 1 & 2 • 5.1 Agriculture/Agro-Processing or 5.2 AH*	**20 : 80** *Theory : Practical*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
4	**Basic hatchery and fingerling production missing.** The Skills-Gap Report flags 'Hatchery and fingerling production' as a critical Practical Technical Skill. ND curriculum has no dedicated hatchery course; **FIT 123** touches it lightly.	Introduce a **new 3-CU course ~FIT 125~ Basic Fish Hatchery Practice** (2-0-3). Cover broodstock selection, hormone injection (basic HCG / ovaprim), egg incubation in McDonald jars, fry-to-fingerling rearing, sex-reversal of tilapia, fry transport. Establish demo hatchery with ≥ 5 incubation units.	**NEW Fish Breeding & Hatchery Management** ***Proposed NOS #3*** • ***Levels 1 & 2*** • *5.2 Animal Husbandry*	**20 : 80** *Theory : Practical*
5	**Practical fish processing weak.** **FIT 212** Fish Processing and Storage Technology exists but delivery is predominantly lectures; students lack competency in smoking, salting, drying, hygienic handling.	Restructure **FIT 212** to include **≥ 30 practical hours (50:50 theory-practical)**. Cover traditional and modern smoking kilns (Chorkor, Altona), salting, sun- and mechanical drying, chilling, hygienic gutting, packaging, HACCP principles, and Codex basics. Each student produces 5 kg each of smoked and dried fish product.	**NEW Fish Processing and Value Addition** ***Proposed NOS #2*** • ***Levels 1 & 2*** • *Agro-Processing*	**20 : 80** *Theory : Practical*
6	**Swimming and diving skills not formally taught.** Listed as a Technical Skill (§5.1) required for free-range marine and inshore fisheries work, but no ND course covers water safety.	Introduce a **new 1-CU course ~FIT 127~ Water Safety, Swimming and Basic Diving** (or as a dedicated practical block inside **FIT 213** Navigation and Seamanship). Cover floatation, basic swimming strokes, free-diving basics, use of lifejackets, rescue techniques. Partner with institutional / community swimming pool; certify competence.	**NEW Cross-cutting safety unit — prerequisite for** ***Proposed NOS #4*** • ***Levels 1 & 2*** • *5.2 AH / Maritime*	**10 : 90** *Theory : Practical*
7	**Fishing gear knowledge too theoretical.** **FIT 124** and **FIT 214** Fishing Gear and Craft Technology I & II are lecture-heavy; most	Restructure **FIT 124** and **FIT 214** to **70% practical delivery**. **Exit competency**: each student constructs at least one complete gear (cast net, gill net or fish trap) and demonstrates net-mending and knot-tying	**NEW Fishing Gear and Craft** ***Proposed NOS #4*** • ***Levels 1 & 2*** • *5.2 AH / Maritime*	**20 : 80** *Theory : Practical*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	students graduate without constructing a single complete gear.	(bowline, sheet bend, fisherman's knot) on assessed coursework.		
8	**Practical Fishing (~FIT 216~ / ~FIT 223~) not linked to commercial operations.** Institution-based practicals do not expose students to artisanal fishing vessels, trawlers or research vessels.	Mandate that **FIT 216** and **FIT 223** include **at least 2 weeks aboard a commercial artisanal fishing boat or institutional research vessel**. Each institution to sign MoU with local fishing cooperatives. Assessed by skipper's competence report + student log.	**NEW Fishing Gear and Craft** ***Proposed NOS #4*** • ***Levels 2 & 3 (practical-fishing strand)*** • *5.2 AH / Maritime*	**10 : 90** *Theory : Practical*
9	**Pond management too theoretical.** **FIT 221** Pond Management runs 2 hrs theory / 2 hrs practical but practical time does not include full pond construction.	Upgrade **FIT 221** to include **pond staking, clearing, embankment construction, inlet/outlet pipe installation, liming, fertilisation and harvesting** as hands-on work. Each student participates in complete construction of at least one demonstration pond or in refurbishment of an existing pond.	**NEW Fish Farm Design and Construction** ***Proposed NOS #7*** • ***Levels 1 & 2*** • *5.2 AH / Construction*	**30 : 70** *Theory : Practical*
10	**Computer Application in Fisheries (~FIT 217~) is generic ICT** — no aquaculture-specific software; disconnected from sector digital tools and real production records.	Revise **FIT 217** to include **entry-level aquaculture farm-management tools**: Excel-based templates for pond records, feeding schedules and FCR calculations; introductory use of platforms such as AquaManager or eFishery; water quality data logging; basic GPS use. Drop duplicative generic-ICT content.	**NEW Digital Aquaculture (sub-unit of)** ***Proposed NOS #6*** • ***Levels 1 & 2 (digital strand)*** • *5.2 Animal Husbandry*	**30 : 70** *Theory : Practical*
11	**Generic entrepreneurship not linked to fish-farm economics.** **EDD 126** Introduction to Entrepreneurship is subject-agnostic; no fish-farm costing, no	Revise **EDD 126** delivery for Fisheries students to include **sector-specific case studies**: cost of a 1,000-fish pond cycle; break-even analysis for catfish and tilapia; fingerling market prices; table-size fish pricing per state; feed-cost sensitivity (60–70% of	**NEW Fish Farm Management (business strand)** ***Proposed NOS #6*** • ***Level 2 (foundation)*** • *5.2 Animal*	**40 : 60** *Theory : Practical*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	FCR-based economics, no Nigerian feed-cost reality.	total). Introduce **FCR economics concept at ND level** so graduates enter HND with basic literacy.	*Husbandry*	
12	**Record keeping not formally taught.** Listed in §5.4 Behavioural Skills as neglected. Without records, graduates cannot compute FCR, mortality, cost per kg, or demonstrate productivity.	Introduce **'Fish Farm Record Keeping'** as a structured practical module inside **FIT 121** and **FIT 224**. Cover input records (feed, fingerlings, labour), production records (biomass, sampling), financial records, and daily log books. Logbook discipline is assessed throughout SIWES.	**NEW Cross-cutting behavioural / record-keeping unit within** ***Proposed NOS #6*** • ***Levels 1 & 2*** • *5.2 Animal Husbandry*	**30 : 70** *Theory : Practical*
13	**Electronic-meter handling weak.** 'Operate and maintain electronic meters and equipment' is listed as a Technical Skill (§5.1). Students cannot confidently operate DO, pH, NH_3, conductivity meters.	Within **FIT 215** Aquatic Ecology and **FIT 221** Pond Management, require each student to **demonstrate handling, calibration and maintenance** of: DO meter, pH meter, handheld multi-parameter probe, thermometer, ammonia test kit, refractometer. Equipment-competency checklist is part of exit assessment.	**NEW Cross-cutting technical unit — baseline for all 9 fisheries trades** ***Levels 1 & 2*** • *5.2 Animal Husbandry*	**20 : 80** *Theory : Practical*
14	**Crisis response not taught.** Oxygen depletion, disease outbreak, feed failure listed as Operational Skills gap (§3.5). No ND course currently covers emergency farm response.	Introduce **'Emergency Response on Fish Farms'** as a unit within **FIT 221** Pond Management. Cover oxygen-crash response (paddle-wheel/emergency aeration), mortality-spike investigation, disease-outbreak triage, emergency pond drainage, power-outage drills. Include annual simulation exercise.	**NEW Crisis-response sub-unit cross-cutting all 9 fisheries trades** ***Proposed NOS #6*** • ***Level 2*** • *5.2 Animal Husbandry*	**30 : 70** *Theory : Practical*
15	**SIWES is short and poorly placed.** Current ND SIWES is 3–4 months between Year 1 and Year 2 — insufficient for a full production cycle. Report recommends 6–12	**Extend SIWES to 6 months minimum** for ND Fisheries. Place students in **commercial farms only** — no institutional farms accepted. Require production-cycle logbook with measurable outputs (fingerlings stocked, biomass harvested, FCR	**EXISTING SIWES attached to EXISTING Aquaculture & Fish Farming Activity trades** ***Assessment of Levels 2 & 3*** • *5.2 Animal Husbandry*	**5 : 95** *SIWES Industry-Based*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	months (§8.1).	achieved, survival rate). NBTE to publish minimum placement-farm criteria.		

Table 2 — ND Oceanography and Fisheries Science (2017)

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
1	**Mariculture entirely absent despite the programme's dual Oceanography-Fisheries identity and Maritime Academy Oron collaboration.** Marine Biology (**OFS 212**) and Chemical Oceanography (**OFS 122**) provide foundation, but no seaweed, oyster, mussel, shrimp or brackish-water culture practicals. This is the single biggest missed opportunity of the OFS curriculum.	Introduce a **new 3-CU course ~OFS 222~ Introduction to Mariculture** (1-0-3). Cover seaweed farming (Eucheuma, Gracilaria), oyster culture (rack, long-line), shrimp semi-intensive culture, cage culture in brackish water, coastal mariculture economics and site selection. Partner with NIOMR and Maritime Academy Oron for practicum.	**NEW Mariculture Technology (entry-level)** ***Levels 1, 2 & 3*** • *5.2 Animal Husbandry / Maritime*	**30 : 70** *Theory : Practical*
2	**Aquaculture production competency shallow.** OFS programme objective (v) requires graduates to 'assist in layout, construction and development of fish ponds/farms', but only one course **FIT 123** Basic Aquaculture (4 CH, shared with ND Fisheries Tech) delivers aquaculture. Practical aquaculture competence is therefore weak.	Deliver **FIT 123** to OFS students with ≥ **50% practical content** at the institutional fish farm or mariculture unit. Add **brackish-water fish culture** as an OFS-specific content strand (complementing freshwater focus of ND Fisheries Tech). Each student stocks and manages ≥ 50 fingerlings to table size as assessed coursework.	**EXISTING Aquaculture** ***Currently Levels 1 & 2*** • *5.2 Animal Husbandry* **EXTEND Aquaculture** ***Add Level 3 (graduate-level)*** • *5.2 Animal Husbandry*	**20 : 80** *Theory : Practical*
3	**No dedicated hatchery / fingerling-production course.** Same gap as ND Fisheries Tech but	Introduce a **new 2-CU course ~OFS 124~ Introduction to Fish Hatchery Practice** (1-0-3). Cover freshwater finfish spawning (induced with	**NEW Fish Breeding & Hatchery Management** ***Proposed NOS #3*** • ***Levels 1***	**20 : 80** *Theory : Practical*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	even more acute here because OFS graduates are expected to handle marine as well as freshwater species.	HCG / ovaprim), basic marine-finfish hatchery principles, egg incubation, fry-to-fingerling rearing. Establish demo hatchery or MoU with nearby commercial hatchery.	***& 2 (freshwater + marine bridge)*** • *5.2 Animal Husbandry*	
4	**Fish feed production missing.** Same as ND Fisheries Tech — feed formulation is not taught despite its 60–70% share of production costs. OFS-context gap: marine-ingredient-based feeds (fish meal, shrimp meal) are specifically relevant to the programme's marine focus.	Introduce a **basic feed-production topic** within **FIT 123** Basic Aquaculture or as a new **OFS 125** course. Include **marine-ingredient-based feeds** (fish meal, shrimp meal, crab-waste meal) and alternative proteins (black soldier fly, azolla). Provide pilot feed-mixing bench.	**NEW Fish Feed Production** ***Proposed NOS #1*** • ***Levels 1 & 2 (marine-ingredient strand)*** • *5.1 Agriculture/Agro-Processing*	**20 : 80** *Theory : Practical*
5	**Oceanographic instrumentation needs modernisation. OFS 211** Oceanographic Instrumentation has strong fundamentals but lacks modern autonomous instruments — CTD rosettes, Niskin bottle sampling, ADCPs (Acoustic Doppler Current Profilers), Argo floats, moored buoys, satellite remote-sensing data interpretation.	Modernise **OFS 211** to include **CTD rosette deployment and data analysis, Niskin bottle sampling, current-meter use, ADCPs, introduction to Argo profiling floats and moored buoys, and satellite remote-sensing integration**. Partner with NIMR / NIOMR for instrument access. Each student conducts one instrument-deployment practical.	**NEW Digital Oceanography Technician (cross-cutting)** ***Levels 2, 3 & 4*** • *Maritime / Environmental*	**30 : 70** *Theory : Practical*
6	**GIS and Remote Sensing (~OFS 221~) not linked to fisheries applications.** Delivered as generic	Revise **OFS 221** to include **applied fisheries GIS/RS**: habitat mapping, chlorophyll-a analysis for fishing-zone prediction, sea-surface-temperature	**NEW Digital Marine & Fisheries Monitoring Technician**	**30 : 70** *Theory : Practical*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	GIS/RS; not tied to fisheries management, habitat mapping or fishing-zone prediction.	(SST)-based fish-aggregation forecasts, IUU (illegal, unreported, unregulated) fishing satellite monitoring, and mariculture site-selection. Use open tools (QGIS, Google Earth Engine) and NASA / ESA datasets.	***Levels 3 & 4*** • *Maritime / 5.2 Animal Husbandry*	
7	**Marine Environmental Pollution course (~OFS 214~) strong on pollution types but weak on enforcement, MARPOL compliance, oil-spill response and fisheries impact assessment.**	Expand **OFS 214** with **MARPOL (International Convention for the Prevention of Pollution from Ships) compliance, oil-spill-response protocols, fisheries impact assessment, Environmental Impact Assessment (EIA) procedures for aquaculture and coastal developments**, and interfaces with NIMASA, NESREA and NAFDAC. Include one oil-spill simulation drill per session.	**NEW Marine Environmental Monitoring Technician** ***Levels 3 & 4*** • *Maritime / Environmental*	**40 : 60** *Theory : Practical*
8	**Marine Biology (~OFS 212~) is biology-focused but not production-linked.** Weak on commercial-fisheries species identification, broodstock biology and larval biology for mariculture.	Strengthen **OFS 212** with **commercial-fisheries species identification** (priority Nigerian catches: sardinella, tuna species, croaker, sole, shrimp, lobster), **broodstock biology** (age-at-maturity, reproductive seasonality), **larval biology** (for hatchery and mariculture), and introductory **stock assessment concepts** (CPUE, length-frequency, maximum sustainable yield).	**EXTEND Foundational within Fish Farming Activity** ***Levels 2 & 3 (biology strand)*** • *5.2 Animal Husbandry*	**30 : 70** *Theory : Practical*
9	**Basic Safety at Sea (~MCM 110~) listed as a zero-unit / zero-hour course** — essentially a placeholder. OFS graduates are expected to work at sea but do not complete certified STCW Basic Safety Training.	**Upgrade ~MCM 110~ from 0 CU to a full 2-CU course** delivering **STCW-compliant Basic Safety Training** — Personal Survival Techniques, Fire Prevention and Fire Fighting, Elementary First Aid, and Personal Safety and Social Responsibility. Certificate issued by Maritime Academy Oron; this	**NEW Maritime Safety Technician (STCW-aligned)** ***Levels 1 & 2*** • *Maritime*	**10 : 90** *Theory : Practical*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
		becomes a **prerequisite for all sea-going practicals** and SIWES embarkation.		
10	**No stand-alone fishing gear / craft course.** OFS has **FIT 216** Practical Fishing but no preceding gear-construction course (unlike ND Fisheries Tech which has **FIT 124** and **FIT 214**).	Introduce a **new 3-CU course ~OFS 213~ Fishing Gear and Craft Technology for Marine Fisheries** (1-0-3). Cover gill nets, drift nets, long-lines, purse seines, fish traps and fish-aggregating devices in marine contexts. **Exit competency**: each student constructs at least one complete marine-context gear.	**NEW Fishing Gear and Craft (marine strand)** ***Proposed NOS #4*** • ***Levels 1, 2 & 3*** • *5.2 AH / Maritime*	**20 : 80** *Theory : Practical*
11	**Outboard engine maintenance missing entirely.** OFS has no engine-maintenance course, yet graduates are expected to operate sea-going craft. Artisanal fishing in Nigeria is 85% outboard-driven.	Introduce a **new 2-CU course ~OFS 223~ Marine Engine Basics** (1-0-2). Cover outboard engine types (2-stroke, 4-stroke, 15–40 HP), routine maintenance, troubleshooting, fuel-system servicing, cooling-system flushing, propeller servicing. **Exit competency**: each student disassembles and reassembles a 15 HP outboard.	**NEW Marine Engine Technician (Artisanal Fishing)** ***Level 2 (entry)*** • *Automotive-Marine cross-over*	**20 : 80** *Theory : Practical*
12	**Fisheries and Blue Economy enterprise content too generic.** **EED 126** Introduction to Entrepreneurship and **EED 216** Practice of Entrepreneurship are subject-agnostic; do not touch marine-sector business opportunities.	Revise **EED 126** and **EED 216** for OFS students to include **Blue Economy enterprise opportunities**: commercial mariculture, eco-tourism and recreational fishing, marine-science consultancy, hydrographic-survey services, fishing cooperatives, port-waste management, coastal waste-recycling enterprises. Each student develops a marine-enterprise business plan.	**NEW Blue Economy Enterprise Management** ***Levels 2 & 3*** • *Maritime / 5.2 AH*	**40 : 60** *Theory : Practical*
13	**SIWES placement does not match the dual Oceanography-Fisheries focus.** The standard 3–4 month	**Extend SIWES to 6 months minimum** and require each OFS student to complete: **≥ 2 months at a marine-science institution** (NIOMR, Nigerian Navy	**EXISTING SIWES-anchored assessment across Aquaculture and Fish**	**5 : 95** *SIWES Industry-Based*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	SIWES is typically fisheries-farm-only; OFS students need exposure to both marine-science institutions and commercial aquaculture.	Hydrographic Office, NIMASA, Institute of Oceanography at the University of Calabar) plus **≥ 2 months at a commercial fish-farm or mariculture operation**. Log-book assessed jointly.	**Farming Activity** ***Levels 2 & 3 progression*** • *5.2 Animal Husbandry*	
14	**Climate-ocean linkage / Blue-Economy concepts missing.** Despite oceanography focus, the curriculum does not address ocean-climate coupling (El Niño / La Niña, sea-level rise, ocean acidification) or blue-carbon ecosystems (mangroves, seagrasses) — central to future-proofing Nigerian fisheries.	Introduce a **new cross-cutting unit 'Ocean–Climate Linkage and Blue Economy'** integrated within **OFS 121** Physical Oceanography and **OFS 214**. Cover El Niño / La Niña effects on Nigerian fisheries, ocean acidification, sea-level rise, blue-carbon ecosystems (mangroves, seagrasses, salt marshes), sustainable blue-economy principles, carbon-monetisation.	**NEW Climate-Smart Marine Science Technician (cross-cutting)** ***Levels 3 & 4*** • *Maritime / Environmental*	**50 : 50** *Theory : Practical*
15	**Fish processing (~FIT 212~) not tailored to marine products for OFS students.** Delivery typically freshwater-fish-focused; no tuna-canning, shrimp-processing, shellfish-depuration or marine-product hygiene content.	When delivering **FIT 212** to OFS students, include **marine-product-specific content**: introductory tuna processing and canning, shrimp processing and cold-chain, shellfish depuration and hygiene, introductory fish-oil extraction. Align with the Codex chapter for fishery products.	**NEW Fish Processing and Value Addition (marine strand)** ***Proposed NOS #2*** • ***Levels 2 & 3*** • *Agro-Processing*	**30 : 70** *Theory : Practical*

Table 3 — HND Fisheries Technology

Gaps and recommendations for the Higher National Diploma in Fisheries Technology

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
1	**Fish nutrition lacks commercial-scale feed production and software.** **FIT 321** Fish Nutrition is lecture-heavy; no computer-aided least-cost formulation and no pilot-scale feed production.	Expand **FIT 321** to include **computer-aided feed formulation** (Allix, Best-Mix, Excel-based least-cost formulation). Add a commercial feed-industry visit and **pilot-scale feed production practicum**: mixing, pelleting, drying and quality-control testing (moisture, water-stability, pellet durability). Each student produces 5 kg of fish feed.	**NEW Fish Feed Production** ***Proposed NOS #1*** • ***Levels 3 & 4 (commercial/QC strand)*** • *5.1 Ag/Agro-Processing*	**30 : 70** *Theory : Practical*
2	**Advanced hatchery & broodstock genetics shallow.** **FIT 445** Fish Breeding and Biotechnology covers principles but lacks commercial-scale hatchery operations, broodstock management and modern genetic-selection tools.	Strengthen **FIT 445** with hands-on practicals on: **HCG / ovaprim-induced spawning at commercial scale**, egg-incubation systems (McDonald jars, flow-through), fry-to-fingerling production, tilapia sex-reversal, broodstock nutrition, basic genetic-selection indices and PCR-based sex identification. Mandatory hatchery-visit and internship with a commercial hatchery.	**NEW Fish Breeding & Hatchery Management** ***Proposed NOS #3*** • ***Levels 3 & 4*** • *5.2 Animal Husbandry*	**20 : 80** *Theory : Practical*
3	**Fish processing — value-addition and Codex compliance gap.** **FIT 432** Fish Processing and Preservation Technology covers basics but weak on value-added products and export-grade Codex / HACCP compliance.	Restructure **FIT 432** to include **value-added products** (fish cutlets, fish sausages, fish burgers, smoked fillets for export) and **full HACCP / Codex Alimentarius protocols**: sanitary design, sanitation standard operating procedures (SSOPs), traceability, export-quality packaging, quality-management-system (QMS) set-up. ≥ 30 hours practical in functional processing unit.	**NEW Fish Processing and Value Addition** ***Proposed NOS #2*** • ***Levels 3 & 4*** • *Agro-Processing*	**30 : 70** *Theory : Practical*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
4	**Fish-disease diagnostics too theoretical.** **FIT 431** Fish Diseases is lecture-heavy; lacks PCR-based diagnostics, structured necropsy, water-borne pathogen screening and antibiotic/chemotherapeutic application.	Upgrade **FIT 431** to include **hands-on necropsy, microscopy-based parasite identification, bacterial isolation and sensitivity testing, water-borne pathogen screening, vaccine handling**, and correct antibiotic/chemotherapy dosing. Each student conducts at least 5 full disease-investigation cases with written diagnostic reports.	**NEW Fish Health Diagnostic Technician (sub-trade of)** ***Proposed NOS #6*** • ***Level 4*** • *Health / 5.2 Animal Husbandry*	**20 : 80** *Theory : Practical*
5	**Fish-farm engineering still conventional.** **FIT 323** Fish Farm Engineering and Management covers earth-pond design but lacks RAS (Recirculating Aquaculture Systems), biofloc technology, raceway design and modern tank systems.	Modernise **FIT 323** to include **RAS fundamentals** (biofilters, foam-fractionators, oxygen cones, ultraviolet disinfection), **biofloc protocols**, raceway construction, and tarpaulin-pond technology. **Exit competency**: each student produces an engineering drawing-package for a 10,000-fish-capacity farm — site plan, pond layout, water-flow diagram and bill of quantities.	**NEW Fish Farm Design and Construction** ***Proposed NOS #7*** • ***Levels 3 & 4*** • *5.2 AH / Construction*	**30 : 70** *Theory : Practical*
6	**Advanced fishing gear — trawling and mechanised gear absent.** **FIT 324** Advanced Fishing Gear and Craft Technology covers designs of gill / cast / seine / trap nets but omits commercial trawling systems, longlines, purse seines and modern acoustic aids.	Expand **FIT 324** to include **bottom-trawl and mid-water-trawl design**, **longline systems**, **purse-seine design**, **fish-aggregating devices (FADs)**, **acoustic fish-finders** and **electronic log-book systems**. Mandatory site visit to a commercial trawler.	**NEW Fishing Gear and Craft** ***Proposed NOS #4*** • ***Levels 3 & 4 (industrial strand)*** • *5.2 AH / Maritime*	**30 : 70** *Theory : Practical*
7	**Nautical / maritime training weak — low student interest in trawler work.** **FIT 433** Nautical Knowledge	Upgrade **FIT 433** to include **STCW-F fundamentals** (Standards of Training, Certification and Watchkeeping for Fishing-vessel personnel), celestial	**NEW Trawler & Industrial Fishing Operations (sub-trade of)**	**20 : 80** *Theory : Practical*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	plus the §3.6 perception problem: trawler operations viewed as low-status; students prefer merchant-vessel careers. HND graduates not trawler-ready.	and GPS navigation, AIS, ECDIS basics, VHF maritime communications, survival and sea-safety drills. **Mandatory 2-week embarkation on a commercial trawler** under industry MoU. Introduce career-pathway counselling to reframe trawler work as a high-value maritime specialism.	***Proposed NOS #4*** • ***Levels 3, 4 & 5*** • *Maritime / 5.2 Animal Husbandry*	
8	**Inboard / outboard engine maintenance under-practical. FIT 325** has limited practical time; students cannot troubleshoot or repair a 15–40 HP outboard engine independently.	Restructure **FIT 325** to **20 : 80 theory-practical**. **Exit competency**: each student disassembles and reassembles at least one 15–40 HP outboard engine and diagnoses-plus-rectifies three common faults (fuel, ignition, cooling). Link with existing NBTE Motorcycle Repair and Auto-Mechanic craft trades for shared bench time.	**NEW Marine Engine Technician (Artisanal Fishing)** ***Levels 2 & 3*** • *Automotive-Marine cross-over* **EXISTING Automobile Mechanic (levers only; not marine)** ***Currently Levels 1, 2 & 3*** • *5.3 Automotive*	**20 : 80** *Theory : Practical*
9	**Fisheries business and cooperatives too generic. FIT 326** is only 2 CU (30 hrs, 2-0-0); purely theoretical; treats cost and profitability superficially. Business Skills are flagged as the **Critical Gap** in the report (§3.5 B).	Restructure **FIT 326** as a **4-CU course (combined theory and practical)**. **Exit competency**: each student develops a viable business plan for a commercial fish farm (≥ ₦500,000 investment) — capital budget, FCR-based cost model, break-even analysis, market channels, cash-flow projection, risk analysis. External investor panel assesses plans.	**NEW Fish Farm Management (enterprise strand)** ***Proposed NOS #6*** • ***Levels 3 & 4*** • *5.2 Animal Husbandry*	**40 : 60** *Theory : Practical*
10	**Integrated fish farming still theoretical. FIT 434** Integrated Fish Farming is lecture-based; most	Mandate each institution to establish a **live integrated system** (fish-crop, fish-livestock, fish-rice, or aquaponic unit). **FIT 434** delivery to be 60%	**NEW Aquaponics and Integrated Aquaculture** ***Proposed NOS #9*** • ***Levels 3***	**30 : 70** *Theory : Practical*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	institutions have no functional integrated system.	practical at this facility, with **measured production outputs** (kg fish / kg crop / cropping cycles per annum).	*& 4 • 5.2 Animal Husbandry / 5.1 Agriculture*	
11	**Ornamental fishery narrow. FIT 315** / **FIT 317** Ornamental Fishery and Aquarium Technology covers aquarium construction but is weak on commercial breeding of ornamental species, export markets and aquascaping business.	Expand **FIT 315** to include **commercial breeding of priority species** (guppy, molly, platy, cichlids, goldfish, koi), aquascaping design, CITES regulations, ornamental export value chain, pricing and logistics. Each student develops an ornamental-production business plan.	**NEW Ornamental Fisheries** ***Proposed NOS #5 • Levels 2, 3 & 4 • 5.2 Animal Husbandry***	**30 : 70** *Theory : Practical*
12	**Mariculture entirely absent.** Mariculture — seaweed, oyster, mussel, shrimp and crab culture — flagged as an Emerging Skill (§3.5). HND has oceanography (**FIT 322**) but no mariculture.	Introduce a **new 3-CU course ~FIT 448~ Mariculture Technology** covering seaweed farming (Eucheuma, Gracilaria), oyster culture (rack, long-line), mussel culture, shrimp culture (semi-intensive), crab fattening and cage culture in brackish water. Partner with NIOMR, Federal College of Fisheries and Marine Technology Lagos and coastal research stations for practicum.	**NEW Mariculture Technology (new sub-trade)** ***Levels 3 & 4 • 5.2 Animal Husbandry / Maritime***	**30 : 70** *Theory : Practical*
13	**Climate-smart aquaculture absent.** Flagged as Emerging Skill; not addressed in any current course.	Introduce a **cross-cutting unit 'Climate-Smart Aquaculture'** within **FIT 443** Fish Farm Management. Cover water-efficient production, biofloc for water recycling, solar-powered aerators, drought-resilient species selection, climate risk assessment, and greenhouse-gas footprint of fish farming. Include a climate-adaptation case study for each Nigerian agro-ecological zone.	**NEW Climate-Smart Aquaculture Technician (cross-cutting)** ***Levels 3 & 4 • 5.2 Animal Husbandry***	**50 : 50** *Theory : Practical*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
14	**Digital and precision aquaculture absent.** Flagged as Emerging Skill; **FIT 313** Computer Application in Fisheries at HND level mirrors ND generic ICT content.	Introduce a **new 2-CU module 'Digital and Precision Aquaculture'** within **FIT 313**. Cover **IoT water-quality sensors, automated feeders, farm-management software (AquaManager, eFishery, Excel-based dashboards), drone pond monitoring, satellite harmful-algal-bloom alerting, AI-based fish biomass estimation**.	**NEW Digital Aquaculture Technician (cross-cutting trade)** *Levels 3 & 4 • 5.2 Animal Husbandry*	**40 : 60** *Theory : Practical*
15	**Non-food fish products and innovation absent.** The 9 proposed NOS trades include 'Non-food fish products'. HND curriculum does not address fish-skin leather, fish-bone calcium, fish oil, fish gelatine or pharmaceutical extracts.	Introduce a **new topic 'Non-Food Fish Products'** within **FIT 432** Fish Processing (or as a short stand-alone course). Cover fish-skin leather processing, fish-bone meal production, fish-oil extraction (crude and refined), fish-meal production, fish-collagen / gelatine extraction, and cosmetic and pharmaceutical applications.	**NEW Non-Food Fish Products and Innovation** *Proposed NOS #8 • Levels 3 & 4 • Agro-Processing / Leather*	**30 : 70** *Theory : Practical*
16	**HND Project research-oriented, not enterprise-oriented. FIT 447** Graduates leave with dissertation experience but no commercial production experience.	Restructure **FIT 447** so that **50% of students do Enterprise Projects** — actual fish-production / processing enterprise with measurable production and revenue targets. Students accountable for profit, loss and repayable seed capital; investor panel assesses. The other 50% retain research focus.	**NEW Fish Farm Management (capstone)** *Proposed NOS #6 • Level 5 (capstone assessment) • 5.2 Animal Husbandry*	**10 : 90** *Theory : Practical*

Table 4 — Cross-cutting Gaps (ND, ND OFS and HND)

System-level, infrastructure and NSQF-policy gaps applicable equally to all three fisheries programmes

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
1	**Commercial-scale teaching farms lacking.** §3.4 of the Report: most institutions lack functional hatcheries, feed-production units and commercial-scale fish farms. Training is demonstration-based, not production-based.	Adopt as an **NBTE accreditation requirement** that every fisheries programme institution operate a commercial teaching farm capable of **≥ 10,000 kg annual fish production**, with a functional hatchery producing ≥ 100,000 fingerlings per annum and a pilot feed mill. Non-compliance → deferred accreditation.	**EXISTING Accredit institutions as NSQ Assessment Centres for Aquaculture and Fish Farming Activity trades** *Cross-cutting • 5.2 Animal Husbandry*	**0 : 100** *Infrastructure Requirement*
2	**Industry immersion / SIWES duration insufficient.** §8.1 recommends 6–12 months of structured placement; §9 proposes enforcement of the Polytechnic **2 ND + 1 industrial attachment + 2 HND** model.	**Enforce the 2 + 1 + 2 polytechnic model**: 2-year ND + full 1-year industrial attachment + 2-year HND. During the 1-year attachment, each student manages one complete production cycle in a commercial farm. NBTE to publish minimum placement-farm standards (production volume, record-keeping, supervisor qualification).	**EXISTING Industry-based assessment of all NSQF trades via the 1-year attachment** *Levels 2 to 5 progression • All 9 proposed fisheries trades*	**5 : 95** *Industrial Attachment*
3	**Industry professionals rarely engaged as adjunct lecturers.** §3.7: weak industry-academia linkages.	**Mandate each institution to engage at least 3 industry professionals** (commercial fish farmers, processors, hatchery operators, trawler captains) as adjunct lecturers delivering ≥ 20% of practical content in relevant HND courses. Publish adjunct register as part of accreditation evidence.	**EXISTING Industry-Academia Framework — underpins all 9 trades** *All levels • Cross-sector*	**n/a : n/a** *Staffing Policy*
4	**Competency-based certification missing.** §8.4 — graduation should be tied to measurable production outcomes, not lecture attendance.	Introduce **exit competency assessment**: ND graduates demonstrate production of **≥ 100 kg of fish** from stocking to harvest, with survival rate > 70%; HND graduates demonstrate **≥ 500 kg** with FCR <	**EXISTING NSQ-style competency assessment applied as graduation requirement**	**0 : 100** *Outcome-Based*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
		1.8 (catfish) or < 1.5 (tilapia). Failure to meet benchmarks → repeat production cycle.	***ND = Level 3–4 / HND = Level 5*** • *All 9 trades*	
5	**Crisis-management drills absent.** §8.5 flags oxygen depletion, disease outbreak and feed failure as untrained-for scenarios.	Institute **annual simulation drills** on each institutional fish farm covering: oxygen-crash response, disease-outbreak triage, feed-failure contingency, power-outage response and pond-breach response. All ND and HND students must participate; unfit students cannot graduate.	**NEW Cross-cutting crisis-response unit within** ***Proposed NOS #6*** • ***Levels 3 & 4*** • *5.2 Animal Husbandry*	**10 : 90** *Theory : Practical*
6	**Curriculum not localised for Nigerian realities.** §6 & §8.8 — graduates trained for ideal conditions (60–70% feed cost, unstable power, volatile markets) not Nigerian constraints.	Every course revision must include **at least one Nigerian-context case study** covering: feed-cost challenge (alternative protein — maggots, azolla, black soldier-fly larvae); solar and biogas power options for pumps and aerators; market volatility (NAFDAC, pricing, cold-chain); currency risk in imported inputs. Content co-developed with existing Nigerian commercial farms.	**NEW Cross-cutting localisation content — mandatory across all 9 proposed trades** ***All levels*** • *5.2 AH / Agro-Processing*	**30 : 70** *Theory : Practical*
7	**Behavioural skills (discipline, teamwork, communication, risk management) not formally assessed.** §5.4 lists behavioural skills as the neglected competence layer.	Introduce a **Behavioural Competency Scorecard** assessed during SIWES, industrial attachment and final semester. Score against: punctuality, teamwork, communication, workplace discipline, record-keeping compliance, risk awareness. Minimum passing score is a graduation requirement.	**NEW Cross-cutting behavioural assessment within all fisheries trades** ***All levels*** • *5.2 Animal Husbandry*	**n/a : n/a** *Assessment Framework*
8	**Fish marketing and value chain not a formal module.** §3.5 flags marketing as a Practical Technical Skill gap. No dedicated course at	Create a cross-cutting **'Fish Marketing and Value Chain'** 2-CU module — delivered in the final semester of each programme. Cover **digital marketing platforms** (WhatsApp Business,	**NEW Fish Marketing (sub-trade within)** ***Proposed NOS #6*** • ***Levels 2, 3 & 4*** • *5.2 Animal Husbandry*	**40 : 60** *Theory : Practical*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	either ND or HND level.	Facebook Marketplace, Instagram, TikTok), cold-chain logistics, export requirements, commodity pricing mechanisms, aggregator / off-taker models and value-chain financing.	**NEW Links to Fish Processing and Value Addition** ***Proposed NOS #2*** • ***Marketing strand*** • *Agro-Processing*	
9	**Codex food-safety and hygiene not formally taught.** §3.5 flags Codex food safety as a Practical Technical Skill gap. Neither ND **FIT 212** nor HND **FIT 432** address it to export-compliance depth.	Introduce **'Fish Food Safety and Codex Standards'** as a 2-CU stand-alone course at HND level (or a strong unit within **FIT 432**). Cover HACCP, Codex Alimentarius, EU fish-export requirements, traceability systems, sanitation, personal hygiene, cold chain. Align with NAFDAC fish-product regulations.	**NEW Food-Safety strand central to** ***Proposed NOS #2*** • ***Levels 3, 4 & 5*** • *Agro-Processing / Health*	**40 : 60** *Theory : Practical*
10	**Existing NSQ 'Aquaculture' trade is stuck at Levels 1–2 and 'Fish Farming Activity' at 1–3** — misaligned with ND / HND graduate expectations. An HND graduate's NSQ competency ceiling is below the role expected in industry.	Formally petition NBTE and the Sector Skills Council to **extend the Aquaculture trade from Levels 1–2 to Levels 3, 4 & 5**, and **extend Fish Farming Activity from Levels 1–3 to Levels 4 & 5**. Align ND graduate exit to NSQ Level 4, HND graduate exit to NSQ Level 5. Enables dual certification (academic + vocational).	**EXTEND Aquaculture** ***Currently Levels 1 & 2 — add Levels 3, 4 & 5*** • *5.2 Animal Husbandry* **EXTEND Fish Farming Activity** ***Currently Levels 1, 2 & 3 — add Levels 4 & 5*** • *5.2 Animal Husbandry*	**n/a : n/a** *NSQF Policy Action*
11	**The 9 proposed NOS / NSQ trades in fisheries are not yet registered.** These trades collectively close the ND / HND	Convene a **Fisheries Sector Skills Council workshop** (70% industry / 30% academia per NBTE guidelines) to draft National Occupational Standards for all 9 proposed trades: **(1) Fish Feed Production;**	**NEW All 9 proposed fisheries trades — to be developed and registered** ***Levels 1 to 5 graduated across***	**n/a : n/a** *Sector Skills Council*

S/N	Gap Identified	Recommendations for the Curriculum Review Team	NOS / NSQ Trade(s) to Develop or Extend	Theory : Practical Ratio
	skills-gap but require Sector Skills Council development.	**(2) Fish Processing and Value Addition; (3) Fish Breeding and Hatchery Management; (4) Fishing Gear and Craft; (5) Ornamental Fisheries; (6) Fish Farm Management; (7) Fish Farm Design and Construction; (8) Non-Food Fish Products and Innovation; (9) Aquaponic and Integrated Aquaculture**. Sequence as P1 (trades 1, 3, 6), P2 (trades 2, 4, 7), P3 (trades 5, 8, 9).	***trades*** *• Primarily 5.2 Animal Husbandry; spill-over to Agro-Processing & Maritime*	
12	**Extension and community engagement weak.** **AGT 230** Agricultural Extension and Rural Sociology is generic; not fish-specific. Gap-report §8.7 calls for farmer-training capacity.	Create a **fisheries-extension specialism** within **AGT 230** or as a new **FIT 229** course (ND) and **FIT 329** / **FIT 429** (HND). Field visits to cooperatives, digital extension (WhatsApp groups, SMS alerts for fish farmers), radio-based fish-farming broadcasts, participatory rural appraisal with fishing communities.	**NEW Fisheries Extension Services Delivery (sub-trade)** ***Levels 3 & 4*** *• 5.2 Animal Husbandry*	**40 : 60** *Theory : Practical*

Strategic note for curriculum review: The Skills-Gap Report's closing message — 'Aquaculture is a business of precision and discipline. Any curriculum that does not produce graduates capable of running a profitable fish farm is incomplete' — frames the purpose of every recommendation here. The review team is encouraged to adopt three cross-cutting shifts: (i) enforce a 2 + 1 + 2 polytechnic model with a full year of industrial attachment on commercial fish farms; (ii) tie graduation to measurable production outcomes (≥ 100 kg at ND, ≥ 500 kg at HND, with FCR and survival-rate benchmarks); and (iii) work with the Sector Skills Council to register the 9 proposed fisheries NOS/NSQ trades and extend the existing Aquaculture and Fish Farming Activity trades to Levels 4 and 5 — enabling dual academic-plus-vocational certification for every graduate and accrediting each fisheries polytechnic as an NSQ Assessment Centre.

19.0 Livestock Skills-Gap Analysis vs NUC CCMAS 2023

B.Sc. Animal Science — Recommendations for the NUC Review Committee

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
1	**Poultry Value Chain** (Score 3.17 — Low-Moderate)	**ANS 304** Non-Ruminant Animal Production (2C); **AGR 204** Introduction to Animal Production (2C); content within **ANS 405**.	**Moderate**	Expand **ANS 304** from 2C to 3C and split into **ANS 304a** (Poultry) + **ANS 304b** (Swine & other Non-Ruminants). Add commercial-scale practicals: hatchery operations, biosecurity zoning, breeder AI, automated feeding/watering systems, layer/broiler management, egg handling and grading, poultry waste management. Mandatory commercial-poultry-farm internship.	**30 : 70** *Theory : Practical*
2	**Swine Value Chain** (2.58 — Moderate)	**ANS 304** Non-Ruminant (covers swine briefly); **ANS 408** Reproductive Physiology & AI (LH 15 + PH 45).	**Partial**	Create a dedicated **~ANS 304b~ Swine Production** module within the expanded **ANS 304**. Cover farrowing-house management, piglet management (iron dextran, fostering, castration, assisted farrowing), grower-finisher feeding, swine biosecurity (especially ASF protocols), swine carcass handling, and swine finishing & marketing including digital channels. Industry placement on commercial piggery is mandatory.	**20 : 80** *Theory : Practical*
3	**Dairy Value Chain** (2.89 — Moderate)	**ANS 305** Ruminant Animal Production (2C); **ANS 403** Animal Products Processing (PH 90) — includes dairy; no cold chain module.	**Partial**	Within **ANS 305** strengthen the dairy strand with **machine milking, automated calf feeders, parlour hygiene, somatic-cell-count monitoring, mastitis detection, milk quality testing**. Within **ANS 403** add a dedicated cold-chain unit (refrigeration logistics, temperature data-logging, vaccine cold-chain, HACCP compliance). Partner with commercial dairy operations for a full lactation-cycle practicum.	**20 : 80** *Theory : Practical*
4	**Beef Value Chain** (3.07 — Low-	**ANS 305** Ruminant Animal Production; **ANS 403** Animal	**Moderate**	Convert theoretical content in **ANS 305** into structured beef-specific practicals: **feedlot operations (entry**	**30 : 70** *Theory :*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
	Moderate)	Products Processing (covers meat cuts); **ANS 409** Pasture & Range.		**selection, BCS scoring, weekly weight monitoring, FCR computation, daily intake logging)**. In **ANS 403** add modern butchery, halal slaughter procedures, retail-cut merchandising and meat-grade labelling. Mandatory feedlot-visit reports; partnership with ≥ 1 commercial feedlot.	*Practical*
5	**Small Ruminants** (3.17 — Low-Moderate)	**ANS 305** Ruminant Animal Production — sheep & goats explicitly named; **ANS 405** Animal Husbandry.	**Moderate**	Strengthen sheep/goat practicals in **ANS 305** with **neonatal lamb/kid care** (colostrum, hypothermia treatment, navel dipping), **FAMACHA scoring** for anaemia, **faecal-egg counts (FEC)**, strategic deworming protocols, mobile small-ruminant veterinary services. Practicums on commercial small-ruminant farms. Address national score 2.98/5 for neonatal small-ruminant care.	**20 : 80** *Theory : Practical*
6	**Apiary Value Chain** (1.87 — CRITICAL)	No dedicated course in Animal Science. Appears only as one line inside **AGR 204**: "Bee-keeping (Apiculture), Animal Improvement".	**Weak**	Introduce a NEW standalone 2C course **~ANS 410~ Apiculture & Hive Products** in 4th year. Cover hive types (Langstroth, Kenyan Top-Bar, top-bar), colony management, seasonal feeding, **Varroa/hive-beetle control, queen rearing, honey processing & packaging, value-added bee products**. Establish institutional demonstration apiary (≥ 10 colonies). Directly addresses the 1.68/5 Queen Rearing role — lowest nationally.	**20 : 80** *Theory : Practical*
7	**Feed & Nutrition** (2.86 — Moderate)	**ANS 303** Principles of Nutrition & Biochemistry (2C); **ANS 309** Nigerian Feed & Feeding Stuffs (2C); **ANS**	**Moderate**	Modernise **ANS 309** and **ANS 402** to include **computer-aided feed formulation** using Allix, AFOS, Best-Mix or Excel-based least-cost templates. Add **commercial feedmill operations** (mill layout, mixing technology,	**30 : 70** *Theory : Practical*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
		402 Feed Production Technology (PH 90).		pellet quality control, mycotoxin screening). Pilot-scale feed production where each student produces ≥ 5 kg of feed and tests it on a target species.	
8	**Processing & Value Addition** (2.67 — Moderate)	**ANS 403** Animal Products, Processing, Handling & Marketing (2C, PH 90); additional coverage in B.Sc. Food Science and Technology.	**Partial**	Restructure **ANS 403** to include **full HACCP / Codex Alimentarius protocols**, structured carcass-cutting labs, value-added products (sausages, smoked products, cured meats, egg powder), modern butchery technology, retail-cut merchandising, export-quality packaging and traceability systems. Cross-list selected modules with B.Sc. Food Science and Technology to share processing-laboratory infrastructure.	**30 : 70** *Theory : Practical*
9	**CROSS-CUTTING: Digital Livestock Farming** (robotics, automation, remote sensing)	Absent from Animal Science. Generic references to AI, IoT, Blockchain in **ENT 312** Venture Creation — not applied to livestock.	**Absent**	Introduce a NEW 2C course **~ANS 411~ Digital Livestock Technology** covering livestock IoT collars, GPS geo-fencing, automated feeders/waterers, drone pasture monitoring, RFID ear-tag management, farm-management software (Farmbrite, DairyPlan, eFishery) and AI-vision biomass estimation. Cross-list with Computer Science / Agric Engineering to share laboratory and software-licence costs.	**40 : 60** *Theory : Practical*
10	**CROSS-CUTTING: Feed formulation software** (Allix, AFOS, Best Mix, Excel)	Absent — no named software. Only "linear programming" is mentioned in Agribusiness/Ag Economics courses (farm planning, not feed formulation).	**Absent**	Within **ANS 309** and **ANS 402**, allocate **≥ 15 practical hours** on computer-aided feed formulation. Acquire institutional Allix or AFOS licences (or develop Excel/Python-based least-cost optimisation templates). Each student formulates rations for at least three species (poultry, swine, dairy + small ruminants) and validates results in pilot feeding trials.	**30 : 70** *Theory : Practical*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
11	**CROSS-CUTTING: Cold chain management** (meat, milk, eggs)	Absent. **ANS 403** references "storage of meat, milk and poultry products" and "milk hygiene" — but cold chain as a system is not covered.	**Absent**	Add a dedicated unit **'Cold Chain Management of Animal Products'** within **ANS 403** — minimum 15 theory + 30 practical hours. Cover refrigeration/freezer chain, temperature data-logging, transport refrigeration, last-mile cold-chain for eggs/milk/meat, vaccine cold-chain, and HACCP / ISO 22000 standards. Industry visits to functional cold-chain operators required.	**30 : 70** *Theory : Practical*
12	**CROSS-CUTTING: Climate-smart livestock practices**	Absent in Animal Science. Some treatment in B.Sc. Water Resources Management & Agro-Meteorology but not applied to livestock.	**Absent**	Introduce a transversal topic **'Climate-Smart Livestock Production'** within **ANS 305**, **ANS 405** and **ANS 409**. Cover **heat-stress mitigation, water-use efficiency, low-emission diets, climate-resilient breed selection, shade/cooling design, pasture-based carbon accounting**. Where possible cross-list with Water Resources Management & Agro-Meteorology to leverage existing climate-modelling expertise.	**50 : 50** *Theory : Practical*
13	**CROSS-CUTTING: Practical / field-based training** (92% preference)	Fourth year of Animal Science is devoted to practical training (~ANS 402–408~ are all PH 90 courses); SIWES embedded. Strongest structural commitment.	**Moderate**	Maintain and **strengthen** the existing 4th-year practical commitment. Tie graduation to **measurable production outcomes** — student-managed flock or herd reaching market weight with documented FCR, survival rate and profit margin. NUC accreditation should require a **Minimum Practical Infrastructure Standard**: functional dairy parlour, modern piggery, commercial-scale poultry, feedlot pen, abattoir, apiary, forage field. Non-compliance → deferred accreditation.	**10 : 90** *On-Farm Practical-Heavy*
14	**CROSS-CUTTING: Entrepreneurship as a standalone**	**ENT 211** + **ENT 312** (generic); **ANS 402** Feed Production Technology and	**Partial**	Convert generic **ENT 211**/**ENT 312** coverage into a 2C **~ANS 412~ Livestock Enterprise Development** course in the final year. Cover livestock-specific business plans,	**40 : 60** *Theory : Practical*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
	livestock value chain	Entrepreneurship combines the two. Not a standalone pathway.		agribusiness finance, livestock insurance, cooperative formation, off-take contracts and agri-digital marketing. Each student develops a viable livestock SME plan (≥ ₦500,000 capital) with external investor-panel assessment.	
15	**CROSS-CUTTING: Leather processing** (standalone value chain)	Mentioned once in **ANS 403** learning outcomes: "hides and skin processing such as flaying, curing and tanning." No dedicated leather course.	**Weak**	Expand **ANS 403**'s flaying/curing/tanning content into a standalone unit **'Hides, Skins and Leather Value Chain'** (or a new 2C **ANS 413**). Cover wet-blue tanning, fleshing, splitting, finishing, leather-product manufacture, and tannery effluent management. Partner with a commercial tannery for placements (e.g. via Kano / Kaduna leather clusters).	**30 : 70** *Theory : Practical*
16	**CROSS-CUTTING: Extension service gap** (44% of respondents lack access)	Entire B.Sc. Agricultural Extension programme (~AGX 201–499~). Strong on paper; weak linkage to livestock-specific extension.	**Moderate**	Within the AGX programme, formally develop a **livestock-extension specialism**: farmer-training methodologies for livestock keepers, mobile-phone-based extension (SMS, WhatsApp), agricultural radio/TV broadcasting for livestock, participatory rural appraisal for pastoralists. Joint AGX/ANS final-year module to be co-taught with practising livestock-extension officers.	**40 : 60** *Theory : Practical*
17	**CROSS-CUTTING: Farm machinery & equipment operation** (tractors, feed mills, balers, forage harvesters)	Mentioned in **ANS 402** Feed Production Technology (feed mill equipment operation) — partial. Balers and forage harvesters not named.	**Partial**	Expand **ANS 402** to cover **modern fodder-harvesting equipment** (chopper-baler, mower-conditioner), GPS-guided tractors, automatic feed wagons, balers, forage harvesters and **preventive-maintenance schedules**. Mandatory equipment-maintenance logbook practical. Formalise partnership with the Department of Agricultural Engineering for shared workshop time.	**20 : 80** *Theory : Practical*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
18	**CROSS-CUTTING: Artificial Insemination** (across Poultry breeders, Dairy, Beef, Small Ruminants)	**ANS 408** Reproductive Physiology & AI (2C, LH 15 + PH 45) — strongest AI treatment. Covers semen collection & AI techniques, but limited to species-general treatment.	**Moderate**	Strengthen **ANS 408** into **species-specific AI streams**: avian AI (poultry breeders), bovine AI (dairy & beef), small-ruminant AI, and swine AI. Cover semen collection, evaluation, freezing, oestrus synchronisation, rectal-palpation and ultrasound pregnancy diagnosis. Hands-on training at university-affiliated commercial farms; certify a minimum number of successful AI procedures per student.	**20 : 80** *Theory : Practical*
19	**CROSS-CUTTING: Equipment maintenance** (lowest-scoring role, 2.32)	**ANS 402** Feed Production Technology references feed mill operation; no dedicated maintenance competency.	**Weak**	Introduce a cross-cutting unit '**Preventive Maintenance of Livestock & Processing Equipment**' within **ANS 402** and **ANS 403**. Cover abattoir machinery, pasteurisers, chillers, mixers, vacuum packaging machines, milking machines, automatic feeders, incubators. Include log-sheet discipline, spare-part inventory and basic electrical/mechanical fault-finding. Directly addresses the 2.32/5 score — lowest individual role nationally.	**20 : 80** *Theory : Practical*

Strategic note: Across the 19 recommendations, three new standalone courses are proposed (ANS 410 Apiculture & Hive Products; ANS 411 Digital Livestock Technology; ANS 412 Livestock Enterprise Development; with optional ANS 413 Hides, Skins and Leather Value Chain), and one structural split is proposed (ANS 304 → 304a Poultry + 304b Swine). The Review Committee is encouraged to coordinate with NBTE so that the revised B.Sc. Animal Science programme aligns to the same NOS/NSQ trades (Swine Production, Apiculture, Computer-Aided Feed Formulation, Livestock Cold-Chain Operations, Digital Livestock Farming, Climate-Smart Livestock Production, Livestock Enterprise Management) that the polytechnic programmes are working towards — enabling graduate progression and dual academic-plus-vocational certification.

20.0 Fisheries & Aquaculture Skills-Gap Analysis vs NUC CCMAS 2023

B.Sc. Fisheries and Aquaculture — Recommendations for the NUC Review Committee

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
1	**Daily farm management / Operational skills** (Major Operational Deficit — §3.5 A of Skills-Gap Report).	**FAA 307** Principles of Aquaculture (2C, LH 15 + PH 45); **FAA 399** SIWES (6C, PH 270) — strongest structural practical commitment in CCMAS.	**Moderate**	Within **FAA 307** require each student to manage one full production-cycle pond / tank as assessed coursework — daily water-quality monitoring, feeding, growth sampling, mortality logbook. Tie graduation to **measurable production outputs** (≥ 100 kg fish at degree-exit, FCR < 1.8 catfish or < 1.5 tilapia, survival > 70%). Strengthen **FAA 399** SIWES placement criteria so every student is hosted by a commercial producer (no institutional placements accepted).	**10 : 90** *Production-Cycle Assessment*
2	**Hatchery & fingerling production** (Critical Practical Technical Skill — §3.5 C).	**FAA 404** Fish Fry and Fingerlings Production; Hatchery Management (2C, LH 15 + PH 45) — explicitly named.	**Moderate**	**FAA 404** is the strongest existing CCMAS commitment to hatchery competence. Strengthen with **commercial-scale practicals**: HCG / ovaprim-induced spawning, McDonald-jar incubation systems (≥ 5 units), tilapia sex-reversal, fry-to-fingerling rearing, broodstock nutrition, basic genetic selection indices, **PCR-based sex identification**. Each institution must operate a functional demonstration hatchery (≥ 100,000 fingerlings/year) as accreditation requirement.	**20 : 80** *Theory : Practical*
3	**Fish feed production and computer-aided feed formulation** (Allix, AFOS, Best-Mix, Excel) — Skills-Gap §3.5 C and	**FAA 302** Fish Nutrition (2C, LH 15 + PH 45) — covers principles, feed classes, nutrient sources, formulation, but **no software named, no pilot-scale feed production**.	**Partial**	Modernise **FAA 302** to include **computer-aided least-cost feed formulation** (Allix, AFOS, Best-Mix or Excel-based linear-programming templates). Add a **pilot-scale feed production practicum**: ingredient sourcing (soybean cake, fish meal, GNC, palm-kernel cake, brewers' dried grains, alternative proteins — black	**30 : 70** *Theory : Practical*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
	Cross-Cutting; feed cost is 60–70% of total production cost.			soldier fly, azolla), mixing, hand-pelleting, drying, water-stability and pellet-durability testing. Each student produces ≥ 5 kg of feed and validates it in a 4-week feeding trial.	
4	**Fish processing, value addition and Codex / HACCP food safety** (Skills-Gap §3.5 C).	**FAA 401** Fish Processing, Handling, Utilization Technology, Storage and Control (2C, LH 15 + PH 45) — covers spoilage, handling, smoking, salting, drying. Good coverage of fundamentals.	**Partial**	Strengthen **FAA 401** with **value-added products** (fish sausages, cutlets, burgers, smoked fillets, fish gelatine, fish-bone calcium) and **full HACCP / Codex Alimentarius protocols** for fishery products: sanitary design, sanitation standard operating procedures (SSOPs), traceability systems, EU export-quality packaging. Cross-list with B.Sc. Food Science modules where available. Each student produces ≥ 5 kg of smoked and dried fish to grade-A specification.	**30 : 70** *Theory : Practical*
5	**Cold-chain management** for fish, fish products, vaccines and biologics — Skills-Gap §3.5 C; absent as a system from ND/HND curricula.	**FAA 401** references storage and control of fish products, but **cold-chain as a system is not addressed**.	**Weak**	Add a dedicated unit **'Cold-Chain Management of Fishery Products'** within **FAA 401** — minimum 15 theory + 30 practical hours. Cover **refrigeration / freezer chain, temperature data-logging (e.g. Tinytag, EasyLog), transport refrigeration, last-mile cold-chain for fresh and smoked fish**, vaccine cold-chain (Argulus, Streptococcus iniae), HACCP / ISO 22000. Industry visits to functional cold-chain operators (e.g. integrated catfish processors).	**30 : 70** *Theory : Practical*
6	**Mariculture** — seaweed, oyster, mussel, shrimp, crab culture (Skills-Gap §3.5 D Emerging	**FAA 307** Principles of Aquaculture mentions cultivable shellfish briefly; **FAA 305** Limnology and **FAA 306** Fisheries Ecology	**Weak**	Introduce a NEW 2C course **~FAA 309~ Mariculture Technology** in 300-level (LH 15 + PH 45). Cover **seaweed farming** (Eucheuma, Gracilaria), **oyster culture** (rack and long-line), mussel culture, semi-intensive shrimp culture, crab fattening, and brackish-	**30 : 70** *Theory : Practical*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
	Skills). Nigeria's 853-km coastline is under-utilised.	cover aquatic environments. **No mariculture-specific course.**		water cage culture. Partner with NIOMR, Maritime Academy of Nigeria Oron, and coastal research stations for practicum.	
7	**Climate-smart aquaculture** — water-recycling, biofloc, solar aeration, drought-resilient species, GHG footprinting (Skills-Gap §3.5 D Emerging Skills).	**FAA 407** Aquatic Environment Survey; Climate Change in Fisheries and Aquaculture (2C, LH 15 + PH 45) — explicitly named, addresses drivers and impacts of climate change.	**Moderate**	**FAA 407** provides a strong foundation but is currently observational/survey-focused. Strengthen with **adaptation practicals**: biofloc water-recycling system construction, **solar-powered aerator** installation, drought-resilient species selection (heterotic vs. inbred lines), salinity-tolerant tilapia for brackish water, **carbon-monetisation case studies** for African aquaculture, and ocean-acidification monitoring for mariculture sites.	**50 : 50** *Theory : Practical*
8	**Digital and precision aquaculture** — IoT water-quality sensors, automated feeders, drone monitoring, AI biomass estimation (Skills-Gap §3.5 D Emerging Skills).	**FAA 410** Information and Communications Technologies in Fisheries and Aquaculture (2C, LH 15 + PH 45) — mentions FAO Apps, **artificial intelligence** as emerging opportunity, value-chain analysis, software development. Excellent foundation but generic.	**Moderate**	**FAA 410** already gestures at AI and ICT — operationalise it. Add **hands-on digital aquaculture practicals**: IoT water-quality sensor deployment (DO, pH, NH_3 probes with cloud dashboards), automated feeder programming, **drone pond monitoring** with NDVI plant-health analysis, AI-vision biomass estimation (e.g. eFishery, Aquabyte demonstrations), satellite harmful-algal-bloom alerting. Each student configures one IoT sensor system.	**40 : 60** *Theory : Practical*
9	**Fishing gear technology — beyond theory; trawling, longlines, purse-seines, fish-**	**FAA 304** Fish Gear Design and Production (2C, LH 15 + PH 45) and **FAA 403** Fish Gear Design, Production, Use, & Maintenance; Pond	**Moderate**	Restructure **FAA 304** to **70% practical delivery**. Each student constructs at least one complete gear (cast net, gill net or fish trap) and demonstrates net-mending and knot-tying (bowline, sheet bend, fisherman's knot). In **FAA 403** expand to **bottom-trawl and mid-water-trawl**	**20 : 80** *Theory : Practical*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
	aggregating devices, acoustic fish-finders (Skills-Gap §3.5 D Emerging Skills).	Construction & Management (2C, LH 15 + PH 45) — covers theory, gear types and craft maintenance.		**design, longline systems, purse-seine design, fish-aggregating devices (FADs), and acoustic fish-finders**. Mandatory site visit to a commercial trawler.	
10	**Trawler operations and STCW maritime safety training** (Skills-Gap §3.6 Behavioural Gap — students perceive trawler work as low-status, prefer merchant-vessel careers).	**FAA 304** Fish Gear; **FAA 403** Pond/Gear Maintenance. **No STCW Basic Safety Training, no nautical/seamanship course, no career-pathway counselling.**	**Absent**	Introduce a NEW 2C course **~FAA 308b~ Nautical Knowledge and Seamanship for Industrial Fishing** (LH 15 + PH 45) covering **STCW-F fundamentals** (Standards of Training, Certification and Watchkeeping for Fishing-vessel personnel — IMO 1995/2022): GPS / AIS / ECDIS basics, VHF maritime communications, survival and sea-safety drills, celestial navigation. Mandatory **2-week embarkation on a commercial trawler** under industry MoU. Career-pathway counselling reframes trawler work as a recognised maritime specialism.	**20 : 80** *Theory : Practical*
11	**Apiary management** — Note: in fisheries context, this corresponds to **integrated aquaculture-apiculture** systems (rangeland-bee + fish-pond pollination services).	**No apiary content** in B.Sc. Fisheries and Aquaculture CCMAS — apiary appears only in B.Sc. Animal Science and Crop Production curricula.	**Absent**	Optional cross-listing: introduce a 1C **'Integrated Aquaculture–Apiculture'** elective module within **FAA 307** Principles of Aquaculture, covering bee-pond agroforestry systems, pollination services for fodder legumes used in fish-feed ingredients (e.g. soybean, *Leucaena*), and honey as a value-added farm enterprise. Lower priority than the other 18 gaps for B.Sc. Fisheries — primary apiary trade development belongs in B.Sc. Animal Science and the NSQ system.	**40 : 60** *Theory : Practical*
12	**Ornamental fisheries** — guppy, molly, koi,	**FAA 303** Ichthyology (Systematics) and **FAA 307**	**Absent**	Introduce a NEW 2C course **~FAA 408~ Ornamental Fisheries and Aquarium Technology** (LH 15 + PH 45).	**30 : 70** *Theory :*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
	goldfish, cichlid breeding; aquascaping; CITES export markets (Skills-Gap Cluster).	Principles of Aquaculture mention species classification but **no ornamental-fishery breeding or business course**.		Cover **commercial breeding of priority species** (guppy, molly, platy, cichlids, goldfish, koi), **aquascaping design**, CITES regulations, ornamental export value chain, pricing and air-freight logistics. Each student develops an ornamental-production business plan and breeds at least one species through a full reproductive cycle.	*Practical*
13	**Non-food fish products and innovation** — fish-skin leather, fish-bone calcium, fish oil, fish gelatine, collagen, pharmaceutical and cosmetic extracts (Proposed NSQ #8).	**No coverage** of non-food fish products in NUC CCMAS Fisheries.	**Absent**	Add a **'Non-Food Fish Products'** module within **FAA 401** Fish Processing (or as a new short stand-alone course). Cover **fish-skin leather processing, fish-bone meal, fish-oil extraction (crude and refined), fish-meal production, fish-collagen / gelatine extraction**, and cosmetic / pharmaceutical applications. Partner with a commercial leather goods company and a cosmetics SME for placements.	**30 : 70** *Theory : Practical*
14	**Aquaponic and integrated aquaculture** — fish + vegetables / fish + crops / fish + livestock (Proposed NSQ #9).	**FAA 307** Principles of Aquaculture covers basic aquaculture principles. **No integrated-system course**, no aquaponics.	**Weak**	Introduce a NEW 2C course **~FAA 409~ Aquaponics and Integrated Aquaculture** (LH 15 + PH 45). Cover **aquaponic system design** (NFT, deep-water culture, media-bed), **integrated fish-rice systems**, fish-vegetable rotations, fish-crop nutrient cycling, and IBC-tank-based smallholder aquaponic units. Each institution must establish a live aquaponics demonstration unit and a fish-vegetable integrated plot as accreditation requirement.	**30 : 70** *Theory : Practical*
15	**Fish-disease diagnostics** — necropsy, microscopy	**FAA 301** Fisheries Biology covers fish biology and stock parameters; **no dedicated**	**Weak**	Introduce a NEW 2C course **~FAA 310~ Fish Health and Disease Diagnostics** (LH 15 + PH 45). Cover **hands-on necropsy, microscopy-based parasite**	**20 : 80** *Theory : Practical*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
	parasitology, PCR diagnostics, vaccine handling (Skills-Gap §3.5 C).	**fish-disease/pathology course at CCMAS level**. Limited compared to NBTE HND FIT 431 Fish Diseases.		**identification, bacterial isolation and sensitivity testing, water-borne pathogen screening, vaccine handling**, antibiotic / chemotherapeutic dosing. Each student conducts at least 5 full disease-investigation cases with written diagnostic reports. Bridges to B.Sc. Veterinary Medicine and Animal Health.	
16	**Fisheries entrepreneurship and value-chain enterprise** (Skills-Gap §3.5 B Critical Gap — feed-cost, cost of production, FCR economics, profitability).	**FAA 201** Entrepreneurship in Fisheries and Aquaculture (2C, LH 15 + PH 45) — already fisheries-specific. Covers value-chain opportunities, business plans, sources of credit. **FAA 405** Fish Marketing, Marketing Management, Accounting Practices and Economics (2C) — strong commercial coverage.	**Strong**	Already the strongest CCMAS coverage — preserve and strengthen. Within **FAA 201** require each student to develop a viable fish-farm business plan (≥ ₦500,000 capital) with **FCR-based cost model, break-even analysis, market channels, cash-flow projection, risk analysis** — assessed by external investor panel. **FAA 405** already covers accounting / fisheries economics; integrate with **digital marketing platforms** (WhatsApp Business, Facebook Marketplace, Instagram).	**40 : 60** *Theory : Practical*
17	**Commercial-scale teaching infrastructure** — institutional fish farms, hatcheries, feed mills (§3.4 of Skills-Gap Report).	Implicit in **FAA 399** SIWES (6C, PH 270) and various PH 45 practical courses. **No mandated minimum infrastructure** in CCMAS.	**Partial**	Adopt as an **NUC accreditation requirement** that every B.Sc. Fisheries department operate a commercial teaching farm capable of **≥ 10,000 kg annual fish production**, a functional hatchery producing ≥ 100,000 fingerlings per annum, a pilot feed mill, an aquaponics demonstration unit, and (for coastal universities) a mariculture demonstration site. Non-compliance → deferred accreditation. This converts **FAA 399** SIWES from a passive placement into a structured production-	**0 : 100** *Infrastructure Requirement*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
				management apprenticeship.	
18	**Industry / academia linkage** — adjunct lecturers, joint certification, MoUs (§3.7 of Skills-Gap Report).	**FAA 399** Industrial Attachment (6C, 270 PH) is the strongest CCMAS structural commitment to industry exposure. **No formal adjunct-lecturer requirement.**	**Moderate**	Strengthen **FAA 399** placement standards: require **commercial-only placements**, supervisor-qualification minimum, structured production-cycle logbook, and joint assessment by university and industry. Mandate each department to engage **at least 3 industry professionals** (commercial fish farmers, processors, hatchery operators, trawler captains) as adjunct lecturers delivering ≥ 20% of practical content in **FAA 401**, **FAA 403**, **FAA 404** and **FAA 405**. Publish adjunct register as part of accreditation evidence.	**n/a : n/a** *Staffing & Placement Policy*
19	**Equipment maintenance and repair** — outboard engines, pumps, hatchery equipment, processing equipment (lowest-scoring role in livestock sector at 2.32; equally critical in fisheries).	**FAA 403** covers boat repair and gear maintenance; **no dedicated maintenance competency for outboard engines, processing equipment, hatchery pumps, water-quality probes**.	**Weak**	Introduce a cross-cutting unit **'Preventive Maintenance of Fisheries Equipment'** within **FAA 403**. Cover **15–40 HP outboard engine maintenance** (fuel, ignition, cooling systems), pumps and aerators, hatchery flow-through systems, processing equipment (smokers, ice machines, vacuum packagers), and **water-quality probe calibration** (DO, pH, conductivity meters). Include log-sheet discipline, spare-part inventory, basic electrical / mechanical fault-finding. Each student disassembles and reassembles at least one outboard engine.	**20 : 80** *Theory : Practical*

Strategic note: Across the 19 recommendations, four new standalone courses are proposed (FAA 308b Nautical Knowledge & Seamanship for Industrial Fishing; FAA 309 Mariculture Technology; FAA 310 Fish Health and Disease Diagnostics; FAA 408 Ornamental Fisheries and Aquarium Technology; FAA 409 Aquaponics and Integrated Aquaculture), and two existing courses (FAA 302 Fish Nutrition; FAA 410 ICT in Fisheries) are recommended for substantial modernisation. Crucially, B.Sc. Fisheries CCMAS already has unique strengths the Animal Science programme lacks: (i) a fisheries-specific Entrepreneurship course (FAA 201) — a benchmark to extend to other agricultural disciplines; (ii) a 6-credit, 270 practical-hour SIWES (FAA 399); and (iii) explicit climate-change content (FAA 407).

Forestry Skills-Gap Analysis vs NUC CCMAS 2023
B.Sc. Forest Resources and Wildlife Management — Recommendations for the NUC Review Committee

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
1	**Carbon and Climate** (Forestry, Wood & Paper Tech, Wildlife Management) — Carbon Accounting (IPCC, Verra, Gold Standard); Climate Modelling (RCP scenarios); GHG Inventory (biomass carbon pools); Carbon Project Development (additionality, leakage, permanence); REDD+ alignment.	**No dedicated course.** **FWM 303** Environmental Impact Assessment (1C, LH 15) and **FWM 202** Natural Ecosystems & Environmental Conservation touch climate impact in passing. Carbon accounting, GHG inventory, REDD+, voluntary carbon markets are absent.	**Absent**	Introduce a NEW 3C course **~FWM 311~ Forest Carbon and Climate** (LH 30 + PH 45) covering **IPCC Tier-1, Tier-2 and Tier-3 carbon accounting**, Verra and Gold Standard protocols, **biomass carbon pools** (above-ground, below-ground, soil, litter, dead wood), **RCP climate scenarios**, REDD+ project design, additionality / leakage / permanence concepts, and bankable Carbon Project Development. Mandatory carbon-project mini-thesis. Lecturers must complete recertification within 12 months. Cross-list with B.Sc. Climate / Environmental Science where available.	**40 : 60** *Theory : Practical*
2	**Forest Protection** — Integrated Pest Management (IPM) for climate-shifting pests; Invasive Species Risk Assessment with predictive GIS mapping; Remote Sensing & AI for	**FWM 404** Forest and Wildlife Resources Improvement and Protection (3C, LH 15 + PH 45) — covers protection of forest estates against insects, disease, fire, drought, flooding, and pest/disease control. Solid foundation but pre-AI, pre-predictive-mapping era.	**Partial**	Modernise **FWM 404** to add **AI-based forest-degradation detection**, **drone & satellite remote-sensing** workflows (Sentinel-2, Landsat, NDVI/NBR analysis), **predictive GIS mapping** for invasive species risk, **integrated fire-management** protocols protecting wildlife corridors, and digital illegal-logging detection (acoustic monitoring, blockchain timber tracking). Strengthen **FWM 203** Remote Sensing & GIS Applications with hands-on Forest Protection use-cases. Mandatory recertification of lecturers within 12 months.	**30 : 70** *Theory : Practical*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
	early detection of forest degradation; Fire prevention/suppression protecting wildlife corridors; Illegal logging detection.				
3	**Timber and NTFP Harvesting** — Value-Chain Analysis for medicinal plants, resins, nuts; Reduced Impact Logging (RIL); Precision Forestry with LiDAR and high-resolution satellite imagery; Certification Compliance (FSC, PEFC) for international markets.	**FWM 408** Forest Products Harvesting, Processing and Utilization (2C, PH 90) — covers harvesting without antecedent waste, modernised processing, value addition to non-wood products, sericulture, apiculture, heliculture. **FWM 309** Ethno-Forestry covers NTFP commercialisation. **FWM 406** Forest Operations and Management covers chainsaw use.	**Partial**	Strengthen **FWM 408** with **Reduced Impact Logging (RIL)** protocols, **LiDAR-based precision-forestry harvest planning**, **FSC / PEFC certification compliance** workflows, and **NTFP value-chain analysis** (cocoa, shea, gum arabic, medicinal plants, resins). Restructure **FWM 309** Ethno-Forestry into a full NTFP value-chain track including market linkages, packaging, and export documentation. Mandatory site visits to certified forest concessions.	**30 : 70** *Theory : Practical*
4	**Silviculture and Nursery** — Adaptive Silviculture (Variable Retention Harvesting); modernised Nursery	Three courses cover this well: **FWM 205** Principles of Silviculture (2C, LH 30); **FWM 302** Tropical Silviculture and Silvicultural Techniques (2C, LH 15 + PH	**Strong**	Already the strongest CCMAS coverage — preserve and refine. Within **FWM 205**, **FWM 302** and **FWM 407** add modules on **Adaptive Silviculture** (Variable Retention Harvesting, multi-aged stand creation), **modernised nursery technology** (drip / mist irrigation, substrate science, **mycorrhizal inoculants**), and **climate-adapted**	**20 : 80** *Theory : Practical*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
	Technology (irrigation systems, substrate science, **mycorrhizal inoculants**); **climate-adapted seed sourcing** from warmer/drier mother-tree zones.	45); **FWM 407** Natural & Man-made Forest Plantation Techniques (2C, PH 90) — strongest CCMAS commitment. **FWM 102** Taxonomy and Autecology of Tropical Trees (1C, PH 45) covers tree identification.		**seed sourcing** strategies. Each student propagates and grows seedlings of at least three indigenous species through to outplanting.	
5	**Forest Law and Governance** — International Environmental Law (Paris Agreement, CITES, CBD); Free, Prior, and Informed Consent (FPIC); Indigenous community legal rights; Conflict Resolution and Negotiation among government, industry, communities; Community forest rights; benefit-sharing models.	**FWM 401** Multiple Land Use (2C, LH 30) mentions "legislation relating to land and environmental planning" but no dedicated forest-law course. International conventions (CITES, CBD, Paris Agreement), FPIC, conflict resolution are absent.	**Weak**	Introduce a NEW 2C course **~FWM 312~ Forest Law, Governance and Community Rights** (LH 30) covering **Paris Agreement, CITES, Convention on Biological Diversity (CBD), Bonn Challenge**, Nigerian Forestry Act, **Free Prior and Informed Consent (FPIC)** protocols, indigenous and local community land rights, **benefit-sharing models** for ecotourism and carbon projects, and **Conflict Resolution and Negotiation** techniques. Each student facilitates a mock multi-stakeholder negotiation. Mandatory recertification of lecturers within 12 months.	**60 : 40** *Theory : Practical*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
6	**Biodiversity Management — Conservation Genetics** (DNA tools for genetic diversity in reforestation); **Landscape Connectivity** (wildlife corridor design for climate-shifting species); **environmental DNA (eDNA) sampling** for non-invasive species monitoring; ecosystem service valuation; species richness assessment; habitat mapping with GIS.	**FWM 206** Introduction to Wildlife Ecology (2C, LH 30); **FWM 307** Wildlife Population Analysis (1C, LH 15) covers capture-recapture, tagging, life tables; **FWM 310** Zoo & Parks Management Techniques (1C, PH 45). Coverage of ecology and population dynamics is moderate; modern molecular tools, eDNA, conservation genetics absent.	**Moderate**	Strengthen **FWM 206**, **FWM 307** and **FWM 310** with **Conservation Genetics** module (PCR, microsatellites, SNP markers for population genetic diversity), **environmental DNA (eDNA)** sampling protocols for non-invasive species monitoring, **Landscape Connectivity** modelling (wildlife corridors using QGIS Connectivity Analysis Toolkit), **ecosystem service valuation** (InVEST, SolVES tools), and **GIS-based habitat mapping**. Cross-list with B.Sc. Biology / Genetics where available. Strengthen **FWM 203** Remote Sensing with biodiversity mapping use-cases.	**30 : 70** *Theory : Practical*
7	**Agroforestry Systems** — System Dynamics (tree-crop competition and facilitation, shade management for coffee/cocoa); Carbon in Agricultural	**FWM 407** Natural & Man-made Forest Plantation Techniques mentions "agro-forestry practices" briefly. **FWM 401** Multiple Land Use covers integrated land use for forestry, wildlife, fisheries and agriculture. **No dedicated**	**Weak**	Introduce a NEW 2C course **~FWM 313~ Agroforestry Systems and Economics** (LH 15 + PH 45) covering **tree-crop system dynamics** (competition, facilitation, shade management for cocoa, coffee, kola), **silvopastoral systems** (alley cropping, *Faidherbia albida* with millet/sorghum, *Leucaena* with livestock), **carbon sequestration measurement** in agroforestry landscapes, and **economic modelling** of	**30 : 70** *Theory : Practical*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
	Landscapes (sequestration in hedgerows and silvopastoral systems); Economic Modelling of agroforestry profitability for farmers.	**agroforestry course.**		agroforestry profitability (NPV, IRR, payback period). Mandatory field visits to functional agroforestry sites.	
8	**Forest Inventory** — currently rated **adequate** in the Skills-Gap Report; should be maintained with regular updates on modern digital tools and techniques.	**FWM 301** Forest Inventory & Mensuration (2C, PH 90) — already a fully-practical course covering biometric techniques, management plans, modern measurement equipment, sampling and enumeration. **FWM 305** Forest and Wildlife Biometrics (2C, LH 30) explicitly references **R, Python, R Markdown, VBA, C++, C#, data science applications in forestry**.	**Strong**	Already the strongest existing CCMAS coverage of digital-tool integration in any FWM course. Preserve and refine **FWM 301** and **FWM 305** with **annual technology updates**: Trimble GPS receivers, terrestrial-laser-scanner (TLS) workflows, smartphone-based DBH apps (e.g. Treebo), drone-based forest inventory, machine-learning species classification. Each student conducts one full forest-stand inventory using both traditional and digital methods.	**10 : 90** *Field Inventory Practical*
9	**Entrepreneurship in Forestry** — must be integrated across all modules; sustainable	**FWM 201** Introduction to Forest Extension and Economics (2C, LH 30) covers business establishment,	**Partial**	Restructure **FWM 201** into **'Forest Enterprise, Extension and Markets'** with three integrated tracks: **(i) Forest Carbon Markets** (project finance, voluntary carbon market entry, REDD+); **(ii) NTFP Value Chains**	**40 : 60** *Theory : Practical*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
	forest enterprise development; **carbon credit markets**; community engagement on sustainable NTFP commercialisation; ecotourism business models; **community-based conservation enterprises**.	profit, extension communication. **No fisheries-specific entrepreneurship-style course** that integrates the carbon, ecotourism, and NTFP value chains. Generic **ENT 211** Entrepreneurship and Innovation (2C, LH 15 + PH 45) is also part of the curriculum but not forestry-specific.		(medicinal plants, gum arabic, shea, honey); **(iii) Ecotourism & Community-Based Conservation Enterprises** (financial planning, marketing of ecotourism destinations, benefit-sharing negotiation). Each student develops a viable forest SME business plan (≥ ₦500,000 capital) assessed by an external investor panel. Embed entrepreneurship learning outcomes across **FWM 308** Urban Forestry, **FWM 309** Ethno-Forestry, and **FWM 408**.	
10	**CROSS-CUTTING: Wood and Paper Technology — pulp & paper carbon footprint, sustainable supply chain, traceability, certification,** bioenergy from forest residues** (bark, wood waste), circular-economy product design.	Within B.Sc. Forest Resources, **FWM 408** Forest Products Harvesting, Processing & Utilization covers wood processing fundamentals. **No dedicated pulp & paper or bioenergy course in CCMAS B.Sc. Forest Resources.** Wood Technology programmes are usually separate at NBTE polytechnic level.	**Weak**	Introduce a NEW 2C course **~FWM 410~ Wood, Pulp and Bioenergy Value Chains** (LH 15 + PH 45) covering **pulpwood-supply-chain GHG accounting**, **bioenergy from forest residues** (bark, sawdust, wood-waste pellets, biochar), **circular-economy product design** for wood-based products, **FSC / PEFC chain-of-custody certification**, and **blockchain timber traceability**. Cross-list with NBTE polytechnic Wood / Pulp & Paper Technology programmes for resource-sharing and dual academic-vocational pathways.	**30 : 70** *Theory : Practical*
11	**CROSS-CUTTING: Wildlife and Ecotourism**	**FWM 206** Wildlife Ecology, **FWM 307** Wildlife Population Analysis, **FWM**	**Weak**	Introduce a NEW 2C course **~FWM 411~ Ecotourism Enterprise and Community-Based Conservation** (LH 15 + PH 45) covering **ecotourism business model**	**40 : 60** *Theory : Practical*

S/N	Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict	Recommendations for the Review Committee	Theory : Practical Ratio
	Management — ecotourism business models; community-based conservation; wildlife-friendly coffee/cocoa shade systems; carbon-credit opportunities from wildlife habitat protection; financial planning for wildlife reserves.	**310** Zoo & Parks Management Techniques cover wildlife management technically. **Ecotourism business models, community-based conservation enterprises, and biodiversity-credit markets are absent.**		**canvas**, financial planning for wildlife reserves, **community-based conservation enterprises**, biodiversity-credit and **payments-for-ecosystem-services (PES)** mechanisms, marketing of ecotourism destinations, and benefit-sharing agreements. Each student develops an ecotourism business plan tied to a real wildlife reserve. Mandatory field visit to a Nigerian National Park.	
12	**CROSS-CUTTING: Practical / field-based training infrastructure** — institutional forest reserves, demonstration nurseries, herbaria, GIS labs, drones, LiDAR access (Skills-Gap Report flags inadequate practical infrastructure across forestry programmes).	**FWM 405** Museum and Herbarium Techniques (2C, PH 90), **FWM 301** Forest Inventory (2C, PH 90), **FWM 406** Forest Operations and Management (2C, PH 90), **FWM 407** Plantation Techniques (2C, PH 90), **FWM 408** Forest Products (2C, PH 90), **FWM 499** Project (4C, PH 180) — multiple practical-heavy courses. **No mandated minimum demonstration infrastructure for accreditation.**	**Partial**	Adopt as an **NUC accreditation requirement** that every B.Sc. Forest Resources & Wildlife Management department operate: (i) **a teaching forest reserve of ≥ 10 ha** with permanent sample plots; (ii) a functional **herbarium with ≥ 500 specimens** and a **museum**; (iii) a **GIS / Remote-Sensing laboratory** with QGIS, R, Python, and at least one drone for forest monitoring; (iv) a **demonstration nursery** producing ≥ 10,000 seedlings/year; (v) MoUs with at least 2 forestry / wildlife / agroforestry enterprises for SIWES placements. Non-compliance → deferred accreditation.	**0 : 100** *Infrastructure Requirement*

Strategic note: Across the 12 recommendations, five new standalone courses are proposed (FWM 311 Forest Carbon and Climate; FWM 312 Forest Law, Governance and Community Rights; FWM 313 Agroforestry Systems and Economics; FWM 410 Wood, Pulp and Bioenergy Value Chains; FWM 411 Ecotourism Enterprise and Community-Based Conservation), and three existing courses (FWM 201 Forest Extension and Economics; FWM 404 Forest & Wildlife Resources Improvement and Protection; FWM 408 Forest Products Harvesting) are recommended for substantial modernisation. Two courses already have strong practical commitment and need only refinement (FWM 205/302/407 Silviculture & Nursery; FWM 301/305 Forest Inventory & Biometrics — the latter already explicitly references R, Python and data-science tools — a benchmark to extend to other CCMAS programmes). The Skills-Gap Report mandates recertification of all lecturers in Carbon & Climate, Forest Protection, and Forest Law and Governance within twelve months — this should be a formal accreditation condition.

BACHELOR OF AGRICULTURE (B.Agric.)
21.0 B.Agric. Agronomy — Skills Gap Analysis & Curriculum Reform Framework
NUC CCMAS 2023 · Universities · Agronomy

COMMITTEE REFORM MANDATE: 70% Practical : 30% Theory (Field-Dominant Courses) | 60% Practical : 40% Theory (Lab-Intensive Courses)

FIVE NEW MANDATORY CROSS-CUTTING THEMES	PROGRAMME DETAILS
AI & Digital Farming **Agricultural Robotics & Drones** **Climate Resilience & Adaptation** **Export Certification & Trade Standards** ✔ **Quality Conformity, HACCP & GAP**	Qualification: Bachelor of Agriculture (B.Agric.) / Agronomy Duration:5 Years (10 Semesters) Regulatory Framework: NUC CCMAS 2023 Institution Types: Federal & State Universities, Private Universities Sub-Committee: Agronomy · NBTE Implementation Committee **Reform Target: 70/30 (field) + 60/40 (lab) ·**

Document Type	Comprehensive Baseline Skills Gap Assessment — B.Agric. Agronomy (University Level)
NUC Framework	Core Curriculum and Minimum Academic Standards (CCMAS, 2023)
CCMAS 70/30 Rule	70% NUC-prescribed core courses : 30% university elective courses (curriculum composition)
Reform 70/30 Target	70% of contact hours as practical activity for field-dominant courses (committee mandate)
Reform 60/40 Target	60% practical : 40% theory for lab-intensive and mixed courses (CCMAS credit unit mechanism)
Total Courses Reviewed	23 courses across Years 1–5, including 5 new mandatory course modules
New Courses Proposed	AGR 315 (AI) · AGR 320 (Robotics) · AGR 325 (Climate) · AGR 415 (Export) · AGR 416 (Quality)
Status	Baseline Assessment — Evidence Base and Proposed Curriculum Framework for Reform

21.1 Introduction & Scope

This document presents a comprehensive, standalone skills gap analysis for the Bachelor of Agriculture (B.Agric.) degree at Nigerian universities, calibrated to the NUC Core Curriculum and Minimum Academic Standards (CCMAS, 2023). It serves simultaneously as: (i) an evidence-based assessment of current practical delivery failures across all B.Agric. agronomy courses; (ii) a proposed curriculum framework embedding five new mandatory cross-cutting themes; and (iii) the evidence base for the Agronomy Sub-Committee's mandate to restructure B.Agric. curricula to achieve the practical delivery reform targets.

CRITICAL FINDING: All five new cross-cutting themes are completely absent from every B.Agric. agronomy curriculum reviewed. Practical delivery is estimated at less than 30% across all institutions — the inverse of the reform target.

21.1.1 The Two Reform Ratios — 70/30 and 60/40

The reform targets two delivery ratios, applied by course type:

Ratio	Course Type	Examples	Basis
70% Practical 30% Theory	Field-Dominant Courses: crop production, farming systems, SIWES, weed science, post-harvest, climate resilience	AGR 101, 201, 202, 302, 325, 411, 421, 497	Sub-Committee Reform Mandate: field contact hours
60% Practical 40% Theory	Lab-Intensive & Mixed Courses: soil science, physiology, breeding, research methods, AI, robotics, export, quality	AGR 102, 103, 203, 301, 315, 320, 321, 401, 415, 416, 431, 491	CCMAS credit unit formula: 1 practical credit = 3 lab/field hours; lab-focused courses use the 60/40 split

21.1.2 CCMAS 2023 Framework — Accurate Application

The NUC CCMAS 2023 replaced the BMAS from September 2023. Three provisions are critical for this reform framework:

- The CCMAS 70/30 curriculum composition rule: 70% of courses in any programme are NUC-prescribed core courses; 30% are university elective courses. This is a curriculum composition rule, not a contact hour mandate.
- The CCMAS credit unit formula: 1 credit unit of practical = 3 hours of laboratory or field work per week per semester. This mechanism enables the practical reform: restructuring timetables so practical credit units predominate achieves the 70% or 60% practical contact hour target within the existing credit unit framework.
- Assessment weighting under CCMAS: primarily theoretical courses = 30–40% CA, 60–70% exam. Partly practical courses = 40% CA. Entirely practical courses = 100% CA.

The reform shifts most agronomy courses from primarily theoretical to partly or entirely practical, automatically raising CA weights.

The 70% practical / 30% theory and 60% practical / 40% theory ratios are the committee's proposed reform targets, not current NUC mandates. The CCMAS credit unit formula provides the legitimate mechanism for achieving these targets within the existing regulatory framework.

21.1.3 B.Agric. Programme Structure Under CCMAS 2023

CCMAS 2023 unbundled the B.Agric. into specialist degrees including Agribusiness, Crop Science, Soil Science, Horticulture, alongside the 5-year B.Agric. in Agricultural Science. This framework applies across all these programmes where agronomy content is relevant. The proposed new course codes (AGR 315, 320, 325, 415, 416) are positioned within the CCMAS 30% elective space at years 2–4, ensuring no disruption to the NUC-prescribed core curriculum structure.

Year	Level	New Modules	Reform Ratios	Key Practical Focus
1	100–200	None	70/30 (field) 60/40 (lab)	Crop walks, soil pits, herbarium, microscopy, teaching farm induction
2	200–300	**AGR 315 — AI & Digital Farming**	70/30 (field) 60/40 (AI module)	Season-long crop management; soil sampling; weed scouting; irrigation operation; AI diagnosis practicals
3	300–400	**AGR 320 (Robotics) AGR 325 (Climate)**	70/30 (field) 60/40 (tech/lab)	Field trials; tractor operation; climate risk assessment; drone flight exercise; IoT sensor deployment; agroclimatology
4	400–500	**AGR 415 (Export) AGR 416 (Quality)**	70/30 (field) 60/40 (compliance)	Export audit; HACCP plan; GAP audit; GIS mapping; post-harvest chain simulation; research methods; SIWES

21.2 Analytical Framework & Methodology

21.2.1 Gap Score Calculation

Gap Score = Required Competency Level − Current Competency Level. For the five new themes (AI, Robotics, Climate, Export, Quality), current level = 0 at all universities reviewed (completely absent from curricula and delivery).

Rating	Level	Gap Score	Priority	Recommended Action
1	No Competence	**4–5 — CRITICAL**	**CRITICAL**	Intensive remediation; restrict independent practice
2	Basic	**3 — HIGH**	**HIGH**	Formal programme or practical block; supervised until resolved
3	Proficient	**2 — MEDIUM**	**MEDIUM**	Targeted practical training within 3–6 months
4	Advanced	**1 — LOW**	**LOW**	Self-directed learning or peer coaching
5	Expert	**0 — None**	**NONE**	Monitor at next review

21.3 Consolidated Skills Gap Summary — All B.Agric. Courses

Gap Score = Required Level − Current Level. Scores of 4 are CRITICAL: the competency is entirely absent. Red shading indicates 0% current practical delivery.

#	Course	Theme	Current Practical %	Reform Target	Gap Score	Priority
1	AGR 101/111 — Introduction to Agronomy & Crop Systems	CORE	<30%	70%	2	MEDIUM
2	AGR 102/112 — Soil Science & Land Management	CORE	<20%	60%	2	MEDIUM
3	AGR 103/113 — Introduction to Crop Physiology & Botany	CORE	<20%	60%	2	MEDIUM
4	AGR 104/114 — Pest, Disease & Weed Management	CORE	<20%	70%	2	MEDIUM
5	AGR 201 — Crop Production I: Cereals & Legumes	CORE	<20%	70%	2	MEDIUM
6	AGR 202 — Crop Production II: Root Crops & Horticulture	CORE	<20%	70%	2	MEDIUM
7	AGR 203 — Soil Fertility & Plant Nutrition	CORE	<20%	60%	3	HIGH
8	AGR 204 — Irrigation & Water Management	CORE	0%	70%	3	HIGH
9	**AGR 315 — AI & Digital Farming ★ NEW**	AI	0%	60%	4	CRITICAL
10	AGR 301 — Crop Physiology & Ecology	CORE	<15%	60%	3	HIGH
11	AGR 302 — Advanced IPM	CORE	<20%	70%	3	HIGH

12	**AGR 320 — Agricultural Robotics & Drones ★ NEW**	ROB	0%	60%	**4**	**CRITICAL**
13	AGR 321 — Agroclimatology & Meteorology	CORE/CLR	0%	60%	**3**	**HIGH**
14	**AGR 325 — Climate Resilience & Adaptation ★ NEW**	CLR	0%	70%	**4**	**CRITICAL**
15	AGR 303 — Weed Science & Herbicide Technology	CORE	<15%	70%	**2**	**MEDIUM**
16	AGR 401 — Plant Breeding, Genetics & Biotechnology	CORE	<10%	60%	**3**	**HIGH**
17	AGR 411 — Farming Systems, Agroecology & CSA	CORE/CLR	<10%	70%	**3**	**HIGH**
18	**AGR 415 — Export Certification ★ NEW**	EXP	0%	60%	**4**	**CRITICAL**
19	**AGR 416 — Quality Conformity, HACCP & GAP ★ NEW**	EXP/QMS	0%	60%	**4**	**CRITICAL**
20	AGR 421 — Post-Harvest Technology & Export Readiness	CORE/EXP	0%	70%	**4**	**CRITICAL**
21	AGR 431 — Precision Agriculture, GIS & Remote Sensing	AI/ROB	0%	60%	**4**	**CRITICAL**
22	AGR 491 — Research Methods & AI-Assisted Analysis	CORE/AI	<10%	60%	**3**	**HIGH**
23	AGR 497 — SIWES Industrial Attachment	CORE	Poor Quality	70%	**3**	**HIGH**

YEAR 1	**Foundation Year — 100-Level Courses** Crop Identification · Soil Science · Plant Botany · Pest Introduction · Teaching Farm Induction

Year 1 applies a mixed reform ratio: 70/30 for field-based courses (crop production, pest management) and 60/40 for laboratory-intensive courses (soil science, plant physiology). No new cross-cutting theme modules are introduced in Year 1; however, AI-powered field apps and digital literacy are introduced within existing ICT and Biometrics modules where available.

AGR 101/111 — Introduction to Agronomy & Crop Systems
Year 1 · Semester 1 & 2 · 4 Credit Units · CORE · ● CORE — Foundation Field Science

▶ 70% PRACTICAL · 30% THEORY · Basis: Field-Dominant Reform Mandate

CORE COURSE UNITS & TOPICS

- Principles of Agronomy
- Major Field and Horticultural Crops of Nigeria
- Agro-Ecological Zones and their Characteristics
- Planting Dates, Crop Calendar Planning
- Crop Establishment Methods: Broadcasting, Drilling, Transplanting
- Farm Layout and Land Preparation Techniques

PRACTICAL ACTIVITIES (70%)

- Crop identification field walk — 20 major crops by morphological features
- Agro-ecological transect exercise: identify zone characteristics in the field
- Land preparation practical: manual

THEORY CONTENT (30%)

- Crop classification systems (botanical, agro-ecological, use-based)
- Principles of

clearing, ridging, bed formation • Establish and manage 3 crop types from land prep through emergence on teaching farm • Crop calendar preparation in the field with seasonal overlay mapping • Farm sketch mapping and orientation exercise using compass and tape	agronomy: soil-plant-atmosphere interactions • Agro-ecological zone theory — Nigeria's 7 zones and their agronomy • Seasonal cycle theory: bimodal and unimodal rainfall patterns • Introduction to CCMAS 2023 credit unit framework and degree structure		
EXPECTED COMPETENCY Classify 20 major crops by morphological and agronomic characteristics; describe all agro-ecological zones; establish a field crop from land preparation through planting independently	**GAP SCORE** **2** Req: 3 · Current: 1 **Priority: MEDIUM**	**CURRENT GAP & DELIVERY MODE** Currently <30% practical; field work largely absent; agro-ecological zone application entirely theoretical; teaching farm non-functional at most universities reviewed	**CREDITS** **4** Credit Units

AGR 102/112 — Soil Science & Land Management
Year 1 · Semester 1 & 2 · 4 Credit Units · CORE · ● CORE — Soil & Land Science

▶ 60% PRACTICAL · 40% THEORY · Basis: Lab-Intensive CCMAS Practical Credit

CORE COURSE UNITS & TOPICS

- Soil Formation and Soil Profile
- Soil Texture, Structure, and Colour
- Soil pH, Reaction, and Buffer Capacity
- Soil Organic Matter and Carbon Cycling
- Soil Classification (USDA, FAO-UNESCO)
- Land Degradation: Erosion, Compaction, Salinisation
- Soil Conservation Practices: Terracing, Cover Crops, Mulching
- Composting and Organic Matter Management

PRACTICAL ACTIVITIES (60%)

- Field soil pit excavation — horizon description and profile drawing
- Hand-texture tests — identification of sandy, loamy, and clay soils in the field
- pH meter and buffer kit practical — testing 6 soil samples at varying depths
- Loss on ignition test for organic matter estimation
- Erosion identification field walk — rill, sheet, gully erosion mapping
- Compost pile construction and management — 8-week observation log
- Soil sample collection, labelling, and preparation for lab analysis

THEORY CONTENT (40%)

- Soil formation: rock weathering, pedogenesis, parent material influence
- Soil classification systems — USDA Soil Taxonomy and FAO World Reference Base
- Conservation policy and legislation in Nigeria (NALDA, FDALR mandates)
- Soil chemistry: cation exchange capacity, buffer systems, ionic interactions
- Soil organic

	matter theory: humus formation, C:N ratio, mineralisation		
EXPECTED COMPETENCY Describe a soil profile; determine texture and pH in the field and lab; identify erosion types; construct and manage a compost pile; prepare soil samples for laboratory analysis	**GAP SCORE** 2 Req: 3 · Current: 1 **Priority: MEDIUM**	**CURRENT GAP & DELIVERY MODE** Soil testing equipment absent at most departments; pH meter use untrained; erosion identification from textbook photos only; compost management theoretical; practical delivery estimated at <20%	**CREDITS** 4 Credit Units

AGR 103/113 — Introduction to Crop Physiology & Botany
Year 1 · Semester 1 & 2 · 3 Credit Units · CORE · ● CORE — Plant Science

▶ 60% PRACTICAL · 40% THEORY · Basis: Lab-Intensive CCMAS Practical Credit

CORE COURSE UNITS & TOPICS

- Plant Cell and Tissue Types
- Root, Stem, Leaf: Structure and Function
- Photosynthesis: Light and Dark Reactions
- Transpiration and Stomatal Function

- Seed Germination and Seedling Development
- Vegetative and Reproductive Growth Phases
- Plant Hormones: Auxins, Gibberellins, Cytokinins, Ethylene, ABA
- Plant Stress Responses: Drought, Heat, Waterlogging

PRACTICAL ACTIVITIES (60%)

- Microscopy practical — cross-sections of root, stem, and leaf slides
- Photosynthesis demonstration — leaf disc floating assay; starch iodine test
- Transpiration measurement using potometer; stomatal aperture observation
- Germination bioassay — 5 crop species under 3 temperature conditions
- Growth stage identification walk on teaching farm — BBCH scale for 3 crops
- Plant stress symptom identification — field observation and photographic record

THEORY CONTENT (40%)

- Cell biology: organelle function in plant metabolism
- Photosynthesis biochemistry: C3, C4, CAM pathways
- Phenological development and crop duration theory
- Hormonal regulation of growth and senescence
- Source-sink relationships and assimilate partitioning

EXPECTED COMPETENCY

Identify plant tissue types under microscope; measure transpiration rate; record germination parameters; identify growth stages in the field; describe stress symptom patterns

GAP SCORE

2

Req: 3 · Current: 1

Priority: MEDIUM

CURRENT GAP & DELIVERY MODE

Microscopy practicals rare due to equipment shortage; potometers unavailable; germination bioassays not conducted;

CREDITS

3

Credit Units

		growth stage identification from textbook illustrations only; practical <20%	

AGR 104/114 — Pest, Disease & Weed Management — Introductory
Year 1 · Semester 1 & 2 · 3 Credit Units · CORE · ● CORE — Crop Protection Foundation

▶ 70% PRACTICAL · 30% THEORY · Basis: Field-Dominant Reform Mandate

CORE COURSE UNITS & TOPICS

- Agricultural Entomology — Orders and Major Pests
- Crop Diseases: Fungal, Bacterial, Viral
- Weed Classification, Biology, and Competition
- Disease Triangle: Host, Pathogen, Environment
- Pesticide Classification: Insecticides, Fungicides, Herbicides
- Pesticide Safety and PPE Use
- Economic Thresholds and Pest Scouting
- Biological Control Principles

PRACTICAL ACTIVITIES (70%)

- Field pest scouting walk — 10 major crop pests identified and recorded
- Insect mounting and preservation — collection of 10 specimens with labels
- Disease symptom identification walk — 8 major diseases of 4 crops

THEORY CONTENT (30%)

- Insect morphology; pest lifecycle and seasonal cycles; Order classification
- Disease triangle

• Weed survey — 15 common weeds identified, pressed, and labelled in herbarium • Knapsack sprayer calibration practical — nozzle output measurement, PPE donning/doffing • Economic threshold calculation exercise using field scouting data	and epidemiology; resistance mechanisms • Weed biology: reproduction, dormancy, competitiveness • Pesticide chemistry, mode of action, resistance management • Nigerian pesticide regulatory framework (NAFDAC, NESREA)		
EXPECTED COMPETENCY Identify 10 pests and 8 diseases in the field; collect and mount insect specimens; calibrate a knapsack sprayer; apply PPE correctly; calculate economic threshold for one crop	**GAP SCORE** 2 Req: 3 · Current: 1 **Priority: MEDIUM**	**CURRENT GAP & DELIVERY MODE** Pest identification from photos only; sprayer calibration never practised; PPE not available at most departments; insect mounting kits absent; weed herbarium not maintained; practical <20%	**CREDITS** 3 Credit Units

YEAR 2	**200-Level Courses — Core Crop Production + AI Module** Cereals · Root Crops · Soil Fertility · Irrigation · AGR 315: AI & Digital Farming

Year 2 introduces the first new mandatory cross-cutting theme module: AGR 315 — Artificial Intelligence & Digital Farming. All field crop production courses operate at 70/30. Soil fertility and the AI module operate at 60/40 given their significant laboratory and software-based components.

AGR 201 — Crop Production Technology I — Cereals & Legumes
Year 2 · Semester 1 · 3 Credit Units · CORE · ● CORE — Field Crop Production

▶ 70% PRACTICAL · 30% THEORY · Basis: Field-Dominant Reform Mandate

CORE COURSE UNITS & TOPICS

- Maize, Rice, Sorghum, Millet Production Agronomy
- Cowpea, Groundnut, Soybean, Bambara Nut Agronomy
- Planting Populations and Spacing Optimisation
- Nutrient Management for Cereals and Legumes
- Irrigation Scheduling for Field Crops
- Harvesting, Threshing, and Storage of Cereals and Legumes

PRACTICAL ACTIVITIES (70%)

- Season-long management of 2 cereal and 2 legume plots on teaching farm from planting to harvest
- Yield component measurement — plant population count, ear count, grain weight
- Nutrient deficiency symptom

THEORY CONTENT (30%)

- Agronomy of major cereal and legume crops: growth stages, critical periods, yield determinants
- Nutrient uptake

identification walk in the field • Fertiliser calculation and application exercise — N-P-K rates for 2 crops • Irrigation scheduling practical — crop water requirement calculation (FAO-56) • Post-harvest: manual threshing, moisture testing, grain bagging and labelling	patterns; nitrogen fixation by legumes; fertiliser use efficiency • Irrigation methods and scheduling theory; water use efficiency • Post-harvest physiology of grains: respiration, moisture equilibrium		
EXPECTED COMPETENCY Manage a cereal and legume crop from land preparation through post-harvest; measure yield components; apply fertilisers at recommended rates; schedule irrigation; conduct post-harvest handling	**GAP SCORE** 2 Req: 3 · Current: 1 **Priority: MEDIUM**	**CURRENT GAP & DELIVERY MODE** Teaching farm non-functional at majority of universities; crop management = case studies; yield measurement not conducted; fertiliser application calculations on paper only; practical <20%	**CREDITS** 3 Credit Units

AGR 202 — Crop Production Technology II — Root Crops & Horticulture

Year 2 · Semester 2 · 3 Credit Units · CORE · ● CORE — Field Crop Production

▶ 70% PRACTICAL · 30% THEORY · Basis: Field-Dominant

Reform Mandate			
CORE COURSE UNITS & TOPICS • Cassava, Yam, Sweet Potato, Cocoyam Agronomy • Tomato, Pepper, Onion, Leafy Vegetable Production • Nursery Management and Transplanting • Irrigation for Horticultural Crops • Mulching, Staking, and Trellising • Harvesting, Handling, and Market Preparation of Root Crops and Vegetables			
PRACTICAL ACTIVITIES (70%) • Season-long management of 1 root crop and 1 vegetable crop on teaching farm • Nursery bed preparation and seedling raising — 3 vegetable species • Transplanting exercise with correct spacing and establishment monitoring • Mulching and staking demonstration on tomato or pepper plot • Harvest and post-harvest handling — weight, grading, packaging for market • Market readiness assessment — colour, size, damage scoring to market standards	**THEORY CONTENT (30%)** • Agronomy of major root and horticultural crops: growth requirements, critical operations, yield formation • Nursery management theory: substrate, temperature, irrigation, hardening off • Post-harvest physiology of root crops and vegetables: respiration, ethylene, curing		
EXPECTED COMPETENCY Raise seedlings in a nursery; manage a root crop and vegetable crop through harvest; harvest and grade produce to market standards; manage post-harvest losses for vegetables	**GAP SCORE** **2** Req: 3 · Current: 1 **Priority: MEDIUM**	**CURRENT GAP & DELIVERY MODE** Nursery management not practised;	**CREDITS** **3** Credit Units

		teaching farm plots absent; root crop management from slides only; post-harvest handling not demonstrated; practical <20%	

AGR 203 — Soil Fertility & Plant Nutrition
Year 2 · Semester 1 · 3 Credit Units · CORE · ● CORE — Soil & Nutrition Science

▶ 60% PRACTICAL · 40% THEORY · Basis: Lab-Intensive CCMAS Practical Credit

CORE COURSE UNITS & TOPICS

- Macronutrient and Micronutrient Functions
- Soil Nutrient Cycling: N, P, K, Ca, Mg, S, Micronutrients
- Soil Testing Methodology
- Fertiliser Types: Organic, Inorganic, Bio-Fertilisers
- Fertiliser Programme Design and Agronomic Efficiency
- Integrated Soil Fertility Management (ISFM)
- Manure Management and Composting
- Liming and Soil Amelioration

PRACTICAL ACTIVITIES (60%)	THEORY CONTENT (40%)
• Full soil sampling protocol — 0-20 cm and 20-40 cm depths, composite and core samples • Laboratory soil analysis — pH, EC, N (Kjeldahl), P (Bray), K	• Plant nutrient functions and deficiency symptoms

(Flame photometer) measurements • Fertiliser recommendation calculation exercise — using soil test result to design NPK programme • ISFM design exercise — combining mineral and organic inputs for 2 crops • Compost quality assessment — C:N ratio estimation, maturity testing • Nutrient deficiency symptom identification — field identification in 4 crops	• Biogeochemical nutrient cycles; soil organic matter dynamics; nutrient leaching • Fertiliser chemistry; slow-release mechanisms; organic matter decomposition • Soil amelioration: liming calculations, gypsum application, waterlogging correction		
EXPECTED COMPETENCY Collect soil samples correctly; interpret a complete soil analysis report; design an ISFM programme; prepare and assess compost quality; identify nutrient deficiencies in the field	**GAP SCORE** **3** Req: 4 · Current: 1 **Priority: HIGH**	**CURRENT GAP & DELIVERY MODE** Soil laboratory equipment poorly maintained or absent; Kjeldahl and flame photometer rarely operational; fertiliser programme remains desk exercise; ISFM not demonstrated; practical <20%	**CREDITS** **3** Credit Units

AGR 204 — Irrigation & Water Management
Year 2 · Semester 2 · 3 Credit Units · CORE · ● CORE — Water Science

▶ 70% PRACTICAL · 30% THEORY · Basis: Field-Dominant Reform Mandate

CORE COURSE UNITS & TOPICS

- Water Sources and Hydrology Basics
- Crop Water Requirements and Evapotranspiration (FAO-56 Penman-Monteith)
- Irrigation Methods: Surface, Drip, Sprinkler
- Irrigation Scheduling and Efficiency
- Drainage Systems Design
- Water Quality for Irrigation
- Waterlogging and Salinity Management

PRACTICAL ACTIVITIES (70%)

- Furrow irrigation layout and water advance monitoring exercise
- Drip irrigation system setup — emitter spacing, pressure testing, system priming
- Sprinkler system installation and uniformity coefficient measurement
- Crop water requirement calculation using FAO-56 and field ETo data
- Soil moisture estimation — gravimetric method and tensiometer reading
- Water quality testing — EC, pH, SAR of irrigation water samples

THEORY CONTENT (30%)

- Hydrology: catchment water balance, groundwater recharge, flow measurement
- Evapotranspiration theory: reference ET, crop coefficients, Penman-Monteith
- Irrigation efficiency: distribution uniformity, application efficiency, conveyance loss
- Salinity management: leaching fraction, drainage design principles

EXPECTED COMPETENCY	GAP SCORE	CURRENT GAP & DELIVERY MODE	CREDITS
Set up a drip and furrow irrigation system; schedule irrigation using FAO-56; measure soil moisture; test irrigation water quality; calculate leaching fraction for salt-affected soil	3 Req: 3 · Current: 0 Priority: HIGH	Irrigation practicals entirely absent at most B.Agric. programmes; FAO-56 calculation done on paper; drip systems not available; tensiometers unavailable; practical = 0%	3 Credit Units

AGR 315 — Artificial Intelligence & Digital Farming ★ NEW COURSE
Year 2 · Semester 2 · 3 Credit Units · NEW MANDATORY · ● AI — Digital & Technology

▶ 60% PRACTICAL · 40% THEORY · Basis: Lab-Intensive CCMAS Practical Credit

CORE COURSE UNITS & TOPICS

- What is Artificial Intelligence — fundamentals for agronomists
- Machine Learning Basics: classification, prediction, and pattern recognition in crop systems
- Smartphone-Based Crop Diagnosis Tools: Plantix, CGIAR AI platforms, AgroStar
- Remote Sensing Indices: NDVI, EVI, SAVI — interpretation and application
- Digital Farm Records and Management Systems

• Predictive Analytics: yield forecasting, climate advisory, market price alerts • Responsible AI Use in Research: citations, limitations, ethics • e-Extension Platforms and Digital Advisory Services in Nigeria	
PRACTICAL ACTIVITIES (60%) • AI crop diagnosis practical — use Plantix/CGIAR tools on 5 live crop stress situations on teaching farm; compare AI diagnosis with field diagnosis • NDVI and EVI map interpretation exercise using Sentinel Hub and EO Browser — 3 field scenarios • Predictive yield modelling exercise using open-source agri-analytics platform (Google Earth Engine intro) • Digital farm record system setup exercise — input, crop, and harvest records for one plot • Weather and climate alert interpretation — parsing SMS and app-based advisory for 2 weeks • AI-assisted literature review exercise — using AI tools responsibly; detecting hallucinations; citation checking	**THEORY CONTENT (40%)** • AI fundamentals: supervised, unsupervised, and reinforcement learning; neural network concepts for non-computer scientists • Remote sensing physics: electromagnetic spectrum, satellite platforms, image resolution • Digital data management: data types, data integrity, cloud storage, data privacy • Ethics of AI in agriculture: accuracy limitations, bias risks, proprietary data concerns • Nigeria's digital agricultural ecosystem: ATA, FMARD digital strategy, e-wallet platforms

EXPECTED COMPETENCY		CURRENT GAP & DELIVERY MODE	
Diagnose crop stress using AI-powered tool; interpret NDVI/EVI crop health maps; set up and maintain a digital farm record system; use AI advisory platforms for planting decisions; apply AI tools responsibly in academic research	**GAP SCORE** **4** Req: 4 · Current: 0 **Priority: CRITICAL**	AI entirely absent from all B.Agric. curricula reviewed; no digital agronomy beyond basic ICT; no AI agri-platform licences; faculty untrained; practical = 0% — CRITICAL gap for 21st-century graduates	**CREDITS** **3** Credit Units

YEAR 3	**300-Level Courses — Advanced Agronomy + Robotics & Climate Modules** Crop Physiology · IPM · Weed Science · AGR 320: Robotics · AGR 321: Climate Data · AGR 325: Climate Resilience

Year 3 introduces two new mandatory cross-cutting theme modules: AGR 320 (Agricultural Robotics, Drones & Smart Mechanisation) and AGR 325 (Climate Resilience & Adaptation Agronomy). AGR 321 (Agroclimatology) is an existing course substantially revised to meet the 60/40 reform standard. All crop field practicals operate at 70/30.

AGR 301 — Crop Physiology & Ecology

Year 3 · Semester 1 · 3 Credit Units · CORE · ● CORE — Advanced Plant Science

▶ 60% PRACTICAL · 40% THEORY · Basis: Lab-Intensive CCMAS Practical Credit

CORE COURSE UNITS & TOPICS

- Photosynthesis and Dry Matter Accumulation
- Leaf Area Index, Crop Growth Rate, Net Assimilation Rate
- Canopy Architecture and Light Interception
- Crop Water Relations and Stomatal Regulation
- Source-Sink Dynamics and Assimilate Partitioning
- Phenological Development and Thermal Time
- Yield Formation and Yield Component Analysis
- Crop Modelling Introduction: DSSAT, APSIM concepts

PRACTICAL ACTIVITIES (60%)

- Leaf area index measurement using LAI meter and destructive

THEORY CONTENT (40%)

- Photosynthesis

sampling on teaching farm plots • Crop growth rate and net assimilation rate calculation from sequential harvested samples • Stomatal conductance measurement using porometer; canopy temperature with infrared thermometer • Chlorophyll content measurement using SPAD meter — comparison across fertilised and unfertilised plots • Yield component analysis — ears per plant, grains per ear, 100-grain weight measured on 20 plants • Canopy cover estimation using digital photography and image analysis (ImageJ intro)	biochemistry; C3 vs. C4 efficiency; photorespiration; dark respiration • Source-sink theory; sink strength; harvest index theory; remobilisation • Phenological scales (BBCH, Haun); thermal time and growing degree days • Crop modelling fundamentals: DSSAT and APSIM model structure, inputs, outputs		
EXPECTED COMPETENCY Measure LAI and CGR from field samples; interpret water stress symptoms; quantify yield components; use SPAD meter; calculate thermal time for crop phenology	**GAP SCORE** **3** Req: 4 · Current: 1 **Priority: HIGH**	**CURRENT GAP & DELIVERY MODE** Growth analysis instruments (LAI meter, porometer, SPAD) unavailable; destructive sampling not practised; yield component analysis rarely conducted; DSSAT/APSIM entirely untrained; practical <15%	**CREDITS** **3** Credit Units

AGR 302 — Advanced Integrated Pest & Disease Management
Year 3 · Semester 1 · 3 Credit Units

· CORE · ● CORE — Crop Protection

▶ 70% PRACTICAL · 30% THEORY · Basis: Field-Dominant Reform Mandate

CORE COURSE UNITS & TOPICS

- Integrated Pest Management (IPM) Framework
- Epidemiology and Disease Forecasting
- Biopesticides and Biological Control Agents
- Pesticide Resistance Management
- MRL Compliance and Pesticide Withdrawal Periods
- IPM Implementation on Commercial Farms
- Phytosanitary Standards and Export Compliance (Introduction)

PRACTICAL ACTIVITIES (70%)

- Full seasonal IPM implementation on 2 teaching farm plots — pest scouting (weekly), decision-making log, intervention records
- Disease severity scoring using standard rating scales (0-9, 1-5) on inoculated plants
- Biopesticide preparation exercise — neem oil extraction, Trichoderma application
- MRL compliance exercise — matching pesticide applications to withdrawal periods for 5 crops
- Pesticide withholding period calculation for export market standards (EU, US)
- IPM farm audit exercise using FAO IPM checklist on external farm visit

THEORY CONTENT (30%)

- IPM principles: prevention, monitoring, decision-making, intervention hierarchy
- Disease epidemiology: infection cycle, monocyclic vs. polycyclic diseases; forecasting models
- Biocontrol agents: modes of action, mass production, commercial products in

	Nigeria • Resistance mechanisms: target site mutation, metabolic resistance, cross-resistance		
EXPECTED COMPETENCY Implement an IPM programme for one cropping season; score disease severity; prepare a neem-based biopesticide; calculate MRL compliance for 3 pesticides; conduct an IPM farm audit	**GAP SCORE** **3** Req: 4 · Current: 1 **Priority: HIGH**	**CURRENT GAP & DELIVERY MODE** IPM implementation as season-long exercise absent; biopesticide preparation untrained; MRL compliance unknown; IPM audits not conducted; practical <20%	**CREDITS** **3** Credit Units

AGR 320 — Agricultural Robotics, Drones & Smart Mechanisation ★ NEW COURSE
Year 3 · Semester 1 · 3 Credit Units · NEW MANDATORY · ● ROBOTICS — Technology & Mechanisation

▶ 60% PRACTICAL · 40% THEORY · Basis: Lab-Intensive CCMAS Practical Credit

CORE COURSE UNITS & TOPICS

- Drone Technology in Agriculture: types, sensors, regulatory framework (NCAA)
- Drone Flight Planning and Mission Setup (DJI Ground Station, Pix4D

intro)

- Drone Data Capture: RGB, Multispectral, Thermal Imaging
- Drone Imagery Analysis: NDVI maps, crop stress identification, plant counting
- Automated Irrigation Systems: controllers, sensors, actuators
- GPS-Guided Tractor Operations and Auto-Steering Systems
- IoT in Farm Management: soil sensors, weather stations, yield monitors
- Robotic Weeding, Harvesting, and Spraying Systems — concepts and economics
- Economic Analysis: Robotic vs. Manual Operations — cost-benefit framework

PRACTICAL ACTIVITIES (60%)

- Drone flight planning exercise using DJI Ground Station app — flight path, overlap, GSD for a 5-hectare field
- Drone imagery interpretation practical — RGB and NDVI maps of 3 field scenarios; identify stress zones and count plants
- Automated irrigation controller programming exercise — set irrigation schedule, soil moisture thresholds, and override protocol
- IoT soil sensor deployment exercise: install, calibrate, and read data from soil moisture and temperature sensors
- GPS field mapping exercise using mobile GPS app — boundary marking, area calculation, waypoint creation
- Economic comparison exercise: calculate cost per hectare for drone spraying vs. manual knapsack for 3 scenarios

THEORY CONTENT (40%)

- Drone aerodynamics; sensor types and spectral bands; image resolution; battery endurance; regulatory framework (NCAA Part 21 for RPAS)
- Remote sensing from UAV platforms: photogrammetry, orthomosaics, DSM generation
- IoT architecture: sensor networks, data transmission (LoRa, GSM), cloud platforms
- Robotics principles:

	actuators, navigation systems, computer vision in agriculture • Automation economics: capital cost, depreciation, operational cost, breakeven analysis for Nigerian farm contexts		
EXPECTED COMPETENCY Plan a drone flight for crop monitoring; interpret drone-captured NDVI imagery; programme an automated irrigation controller; deploy and read IoT sensors; calculate cost-benefit of robotic vs. manual operations	**GAP SCORE** **4** Req: 4 · Current: 0 **Priority: CRITICAL**	**CURRENT GAP & DELIVERY MODE** Drones, robotics, and IoT entirely absent from all B.Agric. programmes reviewed; mechanisation limited to theory about tractors; drone regulatory framework unknown; practical = 0% — CRITICAL gap	**CREDITS** **3** Credit Units

AGR 321 — Agroclimatology & Meteorology
Year 3 · Semester 2 · 3 Credit Units · CORE · ● CORE | ● CLR — Climate Science

▶ 60% PRACTICAL · 40% THEORY · Basis: Lab-Intensive CCMAS Practical Credit

CORE COURSE UNITS & TOPICS

- Atmospheric Elements: Temperature, Humidity, Wind, Radiation
- Rainfall Analysis and Return Period Estimation
- Crop-Water Relationships and Reference ETo (Penman-Monteith)
- Drought Indices: SPI, PDSI, VHI
- Climate Variability and ENSO Effects on Nigerian Agriculture
- Agro-meteorological Monitoring Networks in Nigeria (NIMET)
- Climate Data Analysis Tools: Excel, R, CHIRPS satellite rainfall data

PRACTICAL ACTIVITIES (60%)

- Weather station operation — daily data recording (rainfall, temperature, humidity, wind, solar radiation) for 4 weeks
- Rainfall analysis using 20-year historical data — frequency analysis, return periods, dry spell estimation
- Reference ETo calculation using FAO-56 Penman-Monteith in Excel
- SPI (Standardised Precipitation Index) calculation for 3 stations — drought characterisation
- CHIRPS satellite rainfall data download, processing, and visualisation exercise
- Crop water requirement and irrigation scheduling for 2 crops using weather station data

THEORY CONTENT (40%)

- Atmospheric structure; climate classification (Köppen, Thornthwaite); solar geometry
- Evapotranspiration theory: energy balance, aerodynamic resistance, surface resistance
- Climate change science: greenhouse effect, radiative forcing, West Africa IPCC projections
- Teleconnections: ENSO, Atlantic ITCZ, monsoon variability and their effects on Nigerian crop calendars

EXPECTED COMPETENCY Record and process weather station data; calculate reference ETo using FAO-56; calculate SPI for drought monitoring; interpret CHIRPS rainfall products; schedule irrigation from climate data	**GAP SCORE** **3** Req: 3 · Current: 0 **Priority: HIGH**	**CURRENT GAP & DELIVERY MODE** Automatic weather stations absent; climate data analysis not conducted; FAO-56 calculation on paper without real data; CHIRPS products entirely unknown; practical = 0%	**CREDITS** **3** Credit Units

AGR 325 — Climate Resilience & Adaptation Agronomy ★ NEW COURSE

Year 3 · Semester 2 · 3 Credit Units · NEW MANDATORY · ● CLR — Climate Resilience

▶ 70% PRACTICAL · 30% THEORY · Basis: Field-Dominant Reform Mandate

CORE COURSE UNITS & TOPICS

- Climate Risk Assessment for Farm Systems
- Climate-Smart Agriculture (CSA) Framework and Practices
- Drought-Tolerant and Early-Maturing Variety Selection
- Conservation Agriculture:

Minimum Tillage, Mulching, Cover Crops

- Agroforestry Systems: Design, Species Selection, Establishment
- Carbon Sequestration Estimation: Biomass Measurement and Allometric Equations
- Flood and Drought Management Strategies
- Climate Finance Instruments: GCF, GEF, REDD+, Adaptation Fund
- Community-Level Adaptation Planning and Farmer Communication

PRACTICAL ACTIVITIES (70%)

- Farm-level climate risk assessment using CCAFS tools — hazard mapping, vulnerability scoring, and adaptation priority ranking for a real or simulated farm
- Climate-smart cropping system design — design and plant a minimum tillage + mulch + cover crop trial on teaching farm; monitor for one semester
- Agroforestry plot establishment — lay out tree spacing, plant 3 species (leucaena, gliricidia, neem), record survival rates
- Carbon sequestration estimation — allometric biomass measurement of 5 trees; estimate CO2 equivalent per hectare
- Drought-tolerant variety comparative trial — plant and compare 3 varieties under water-limited conditions; record phenology and yield
- Climate finance desk research exercise — identify 3 finance instruments applicable to a defined smallholder context; prepare a one-page brief

THEORY CONTENT (30%)

- Climate science for agronomists: scenarios, regional projections, crop yield impact models
- IPCC AR6 findings for West Africa; national NDC and NAPA framework; FMARD climate agriculture policy
- CSA framework: productivity, resilience, mitigation co-benefits; FAO CSA Sourcebook
- Carbon markets: voluntary carbon market,

	REDD+, Article 6 Paris Agreement; measurement, reporting, and verification		
EXPECTED COMPETENCY Conduct a farm climate risk assessment; design a climate-resilient crop rotation; establish an agroforestry plot; estimate carbon sequestration; identify applicable climate finance instruments; present adaptation recommendations	**GAP SCORE** **4** Req: 4 · Current: 0 **Priority: CRITICAL**	**CURRENT GAP & DELIVERY MODE** Climate risk assessment not practised at any B.Agric. programme reviewed; CSA demonstrations absent; carbon sequestration entirely untrained; climate finance instruments unknown; practical = 0%	**CREDITS** **3** Credit Units

AGR 303 — Weed Science & Herbicide Technology
Year 3 · Semester 1 · 2 Credit Units · CORE · ● CORE — Crop Protection

▶ 70% PRACTICAL · 30% THEORY · Basis: Field-Dominant Reform Mandate

CORE COURSE UNITS & TOPICS

- Weed Taxonomy and Identification
- Weed-Crop Competition and Economic Thresholds
- Herbicide Classification by Mode of Action
- Herbicide Application Technology: Equipment, Timing, Rates
- Integrated Weed Management

- Herbicide Resistance: Mechanisms and Management
- Environmental Impacts of Herbicides

PRACTICAL ACTIVITIES (70%)

- Weed survey and mapping — 25 species identified, keyed, and pressed in herbarium
- Critical period of weed control experiment — 4 weed-free windows vs. full season; yield impact recorded
- Herbicide calibration exercise — back-pack and boom sprayer calibration; rate calculation
- Field application of pre- and post-emergence herbicides — correct timing, dilution, and safety
- Weed resistance screening exercise — dose-response bioassay on suspected resistant population

THEORY CONTENT (30%)

- Weed biology: seed dormancy, allelopathy, vegetative reproduction, seed rain
- Herbicide chemistry: absorption, translocation, site of action, degradation pathways
- Resistance mechanisms: target site resistance, metabolic resistance, enhanced degradation

EXPECTED COMPETENCY

Identify 25 weed species; determine critical period of weed control; calibrate a boom sprayer; apply herbicides at correct rates and timing; design an IWM programme

GAP SCORE

2

Req: 3 · Current: 1

Priority: MEDIUM

CURRENT GAP & DELIVERY MODE

Weed identification from photos; herbicide calibration not practised; boom sprayer not available; IWM planning as paper exercise; practical <15%

CREDITS

2

Credit Units

YEAR 4	**400-Level Courses — Professional Agronomy + Export & Quality Modules + SIWES** Plant Breeding · Farming Systems · AGR 415: Export · AGR 416: Quality · Post-Harvest · GIS · Research Methods · SIWES

Year 4 introduces the final two new mandatory cross-cutting theme modules: AGR 415 (Export Certification & International Trade Standards) and AGR 416 (Quality Conformity, HACCP & GAP). SIWES must now be completed exclusively in agronomy-relevant organisations with documented AI, export, or quality compliance exposure. All Year 4 field courses operate at 70/30; compliance, quality, and research courses at 60/40.

AGR 401 — Plant Breeding, Genetics & Biotechnology
Year 4 · Semester 1 · 3 Credit Units · CORE · ● CORE — Genetics & Improvement

▶ 60% PRACTICAL · 40% THEORY · Basis: Lab-Intensive CCMAS Practical Credit

CORE COURSE UNITS & TOPICS

- Mendelian Genetics and Quantitative Inheritance
- Breeding Methods: Mass Selection, Pure Line, Hybridisation, Recurrent
- Hybridisation Techniques: Emasculation, Pollination, Crossing Block Management
- Multi-Environment Trials and AMMI Analysis
- Marker-Assisted Selection: SSR, SNP markers, GWAS introduction
- Variety Release Process in Nigeria (NASC, NVRS)
- Intellectual Property Rights and Biosafety in Plant Breeding
- Biotechnology Applications: Tissue Culture, Transformation, CRISPR concepts

PRACTICAL ACTIVITIES (60%) • Crossing block management — maintain a 2m x 2m crossing block for one crop species across one semester • Emasculation and hand pollination exercise — conduct F1 hybrid crosses with pollen viability test • Field trial data collection and scoring — disease, maturity, lodging, yield on 6-entry trial • Selection index calculation using field data — rank 6 entries by combined criteria • Tissue culture laboratory exercise — MS media preparation; surface sterilisation; explant inoculation • Gel electrophoresis practical — DNA extraction and agarose gel visualisation of PCR products	**THEORY CONTENT (40%)** • Genetics: gene action, epistasis, heterosis, inbreeding depression, GxE interaction • Population genetics: HWE, allele frequencies, selection effects • Molecular markers: types, applications in selection, linkage mapping • Biosafety: Cartagena Protocol, Nigeria Biosafety Law, GMO regulatory pathway		
EXPECTED COMPETENCY Conduct hand crossing and emasculation; score a variety trial; calculate selection index; prepare tissue culture media; extract DNA and interpret gel image; describe Nigeria variety release process	**GAP SCORE** **3** Req: 4 · Current: 1 **Priority: HIGH**	**CURRENT GAP & DELIVERY MODE** Crossing blocks not managed by students; variety trial data rarely collected; tissue culture labs dysfunctional or absent; molecular lab practicals non-existent; lectures dominate; practical <10%	**CREDITS** **3** Credit Units

AGR 411 — Farming Systems, Agroecology & Climate-Smart Agriculture

Year 4 · Semester 1 · 3 Credit Units · CORE · ● CORE | ● CLR — Systems Science

▶ 70% PRACTICAL · 30% THEORY · Basis: Field-Dominant Reform Mandate

CORE COURSE UNITS & TOPICS

- Systems Thinking in Agriculture
- Major Farming Systems of Nigeria
- Intercropping: Indices, Design, and Economics
- Crop Rotation Design and Soil Health
- Organic Agriculture: Certification, Input Systems, Markets
- CSA Practices: Minimum Tillage, Residue Management, Agroforestry Integration
- Gender and Social Dimensions of Farming Systems

PRACTICAL ACTIVITIES (70%)

- Farming systems diagnosis — structured farm walk and semi-structured farmer interview in peri-urban or rural farm; prepare diagnosis report
- Intercrop trial design and planting — 4 combinations; measure LER (Land Equivalent Ratio) and partial LER
- Organic input preparation — compost, liquid biofertiliser, neem extract; quality check protocols
- CSA demonstration practicals — minimum tillage vs. conventional; mulch application; cover crop

THEORY CONTENT (30%)

- Systems analysis: input-output flow, feedback loops, sustainability indicators; MESMIS framework
- Agroecology principles: biodiversity, nutrient cycling, biological control, human ecology

establishment; compare soil temperatures and moisture • Agroforestry plot visit — describe system design, species interactions, labour and economic data collection	• CSA framework: productivity, resilience, mitigation co-benefits; trade-off analysis		
EXPECTED COMPETENCY Diagnose a farming system; calculate LER for intercrop system; design a climate-resilient crop rotation; prepare organic inputs; demonstrate 3 CSA practices; present system analysis findings	**GAP SCORE** **3** Req: 4 · Current: 1 **Priority: HIGH**	**CURRENT GAP & DELIVERY MODE** Farming system diagnosis not conducted as practical; LER measurement untrained; organic input preparation as lecture; CSA demonstrations absent; agroforestry plot visits rare; practical <10%	**CREDITS** **3** Credit Units

AGR 415 — Export Certification & International Trade Standards ★ NEW COURSE
Year 4 · Semester 1 · 3 Credit Units · NEW MANDATORY · ● EXP — Export & Trade Compliance

▶ 60% PRACTICAL · 40% THEORY · Basis: Lab-Intensive CCMAS Practical Credit

CORE COURSE UNITS & TOPICS

- Codex Alimentarius: Structure, Standards, and Maximum Residue Limits (MRLs)
- SPS Agreement (WTO): Sanitary and Phytosanitary Measures
- EU, US, and GCC Market Requirements: MRL Thresholds,

Banned Substances, Packaging

- Phytosanitary Certification: NAQS, NPPO, Treatment and Fumigation Standards
- NXP Export Procedures: Form E, Pre-Export Documentation, Traceability
- AfCFTA and ECOWAS-TLS: Regional Trade Facilitation for Agricultural Commodities
- Mock Export Compliance Audit
- NAFDAC and SON Regulatory Frameworks for Export Products

PRACTICAL ACTIVITIES (60%)

- MRL compliance exercise — check 5 Nigerian export crops (sesame, cashew, cocoa, ginger, hibiscus) against EU and US MRL databases; identify non-compliant pesticide use records
- Phytosanitary inspection simulation — inspect a consignment, identify phytosanitary risk factors, prepare NPPO inspection checklist and certificate template
- Pesticide withdrawal period calculation — calculate re-entry intervals and pre-harvest intervals for 6 active ingredients across 3 target markets
- NXP Form E completion — work through complete pre-export documentation for a simulated groundnut consignment
- Mock export compliance audit — use a composite checklist covering pesticide records, storage hygiene, moisture, packaging, and documentation
- AfCFTA tariff and rules of origin exercise — determine eligibility of 3 Nigerian commodities for preferential tariff under AfCFTA schedules

THEORY CONTENT (40%)

- International food law: WTO TBT Agreement, SPS Agreement, Codex structure and process
- EU Food Safety Law: Regulation (EC) 178/2002; US FSMA import provisions
- NAFDAC Act and SON Standards Order: legal mandate, product registration, export permits
- Trade facilitation: customs procedures, HS codes for agricultural commodities, rules of origin
- Nigeria's agricultural export policy: NEXIM, NXP,

	NEPC strategies; ECOWAS trade protocols		
EXPECTED COMPETENCY Check produce against MRL requirements for EU and US markets; prepare phytosanitary documentation; calculate pesticide withdrawal periods for target markets; complete an NXP export form; conduct a compliance audit; interpret AfCFTA rules of origin	**GAP SCORE** **4** Req: 4 · Current: 0 **Priority: CRITICAL**	**CURRENT GAP & DELIVERY MODE** Export standards entirely absent from all B.Agric. curricula reviewed; MRLs, SPS Agreement, Codex structure, NXP procedures all unknown to graduates; phytosanitary certification entirely untrained; practical = 0% — CRITICAL gap	**CREDITS** **3** Credit Units

AGR 416 — Quality Conformity, HACCP & Good Agricultural Practices ★ NEW COURSE
Year 4 · Semester 2 · 3 Credit Units · NEW MANDATORY · ● EXP | ● QMS — Quality Management

▶ 60% PRACTICAL · 40% THEORY · Basis: Lab-Intensive CCMAS Practical Credit

CORE COURSE UNITS & TOPICS

- Quality Management Systems: ISO 9001 and ISO 22000
- HACCP: Principles, Hazard

Analysis, and CCP Determination

- Good Agricultural Practices (GAP): GlobalG.A.P., Nigeria GAP, Rainforest Alliance
- Traceability Systems: QR Codes, Barcodes, Digital Farm-to-Market Documentation
- Grading and Packaging Standards for Domestic and Export Markets
- Aflatoxin Management: Prevention, Sampling, Testing, and Compliance
- Certification Pathways: GlobalG.A.P., Fairtrade, Rainforest Alliance, Organic
- Third-Party Auditing: How Audits Work and What They Assess

PRACTICAL ACTIVITIES (60%)

- HACCP plan development — full 7-principle HACCP plan for one commodity (cassava gari, dried ginger, or sesame) including hazard analysis, CCP determination, monitoring procedures, and corrective actions
- GAP field audit exercise — conduct a simulated GlobalG.A.P. audit using an adapted checklist on teaching farm; score compliance percentage; prepare NCR report
- Traceability system implementation — set up QR-code-based farm-to-market documentation for one lot of produce; trace lot from field to simulated dispatch
- Aflatoxin risk assessment — assess 5 stored maize or groundnut samples for moisture and visible contamination; complete aflatoxin risk scoring matrix
- ISO 22000 awareness workshop — map one commodity value chain to ISO 22000 clauses; identify documentation requirements

THEORY CONTENT (40%)

- ISO 22000 and HACCP theory: prerequisite programmes, hazard types, CCP vs. OPRP
- GAP principles: soil health, water use, pest management, worker welfare, food safety
- Certification economics: cost of certification, premium markets, payback period for small-scale producers
- Food safety law in Nigeria: NAFDAC Food Safety Standards, Consumer Protection Council Act

• Grading and packaging exercise — grade 3 commodities to export specifications; prepare labelling with correct content per SON standard			
EXPECTED COMPETENCY Develop a HACCP plan for one commodity; conduct a GAP audit; implement a produce traceability system; assess aflatoxin risk; grade produce to export standards; describe GlobalG.A.P. certification requirements	**GAP SCORE** **4** Req: 4 · Current: 0 **Priority: CRITICAL**	**CURRENT GAP & DELIVERY MODE** HACCP, traceability, and GAP entirely absent from all B.Agric. programmes reviewed; quality management systems unknown to graduates; GlobalG.A.P. not mentioned in any curriculum; practical = 0% — CRITICAL gap	**CREDITS** **3** Credit Units

AGR 421 — Post-Harvest Technology, Value Addition & Export Readiness

Year 4 · Semester 2 · 3 Credit Units · CORE · ● CORE | ● EXP — Value Chain

▶ 70% PRACTICAL · 30% THEORY · Basis: Field-Dominant Reform Mandate

CORE COURSE UNITS & TOPICS

- Maturity Indices and Harvest Timing

- Harvesting Methods and Equipment
- Post-Harvest Losses: Causes, Measurement, and Reduction
- Storage Technology: Hermetic, Cold Chain, Silo Management
- Value Addition Processing: Drying, Milling, Packaging
- Quality Grading to Export Standards
- Export Packaging, Labelling, and Documentation
- Post-Harvest Financing and Market Linkage

PRACTICAL ACTIVITIES (70%)

- Field maturity assessment exercise — measure physical and chemical maturity indices for 3 crops (refractometer for sugar content; colour charts)
- Post-harvest chain simulation — complete chain: harvest → field clean → grade → weigh → dry → package → label → document for one crop
- Grain moisture testing — use digital moisture meter on 5 samples; interpret results against storage safety thresholds
- Hermetic bag and metallic silo management — loading, sealing, and monitoring protocol exercise
- Export packaging and labelling exercise — pack and label 3 commodities to meet EU, US, and Gulf market specifications
- Value addition trial — develop one simple processed product (e.g., groundnut paste, dried ginger powder, cashew nut roasting) with cost-benefit analysis

THEORY CONTENT (30%)

- Post-harvest physiology: respiration, ethylene production, ripening, senescence in horticultural produce
- Storage pest biology: grain weevils, moths, rodents; integrated storage pest management
- Food safety standards for post-harvest: aflatoxin, mycotoxins, heavy metals, pesticide residues
- Value addition economics: gross margin analysis, break-even for

	processing investment		
EXPECTED COMPETENCY Assess crop maturity using physical and chemical indices; manage a complete post-harvest chain; test grain moisture; manage hermetic storage; grade and package produce to export standards; develop a simple processed product	**GAP SCORE** **4** Req: 4 · Current: 0 **Priority: CRITICAL**	**CURRENT GAP & DELIVERY MODE** Storage demonstrations absent; moisture meters unavailable; export grading and packaging not practised; hermetic storage not available; value addition as lectures; practical = 0%	**CREDITS** **3** Credit Units

AGR 431 — Precision Agriculture, GIS & Remote Sensing
Year 4 · Semester 1 · 3 Credit Units · CORE · ● AI | ● ROB — Geospatial & Precision

▶ 60% PRACTICAL · 40% THEORY · Basis: Lab-Intensive CCMAS Practical Credit

CORE COURSE UNITS & TOPICS

- GPS Fundamentals and Differential GPS
- Geographic Information Systems (GIS): QGIS Training
- Remote Sensing: Satellite Platforms, Spatial Resolution, Bands
- NDVI, EVI, SAVI, LAI Products from Satellite Imagery
- Drone Applications in Precision Agriculture

- Variable Rate Technology: Input Application Optimisation
- Farm Management Information Systems (FMIS)
- Soil Sampling Grids and Management Zones

PRACTICAL ACTIVITIES (60%)

- QGIS installation and interface exercise — digitise a farm boundary; add soil sample points; create a thematic map
- Satellite imagery download and processing — Sentinel-2 false colour composite; NDVI map generation for a study area
- Drone imagery analysis — interpret an orthomosaic and NDVI map produced from a drone flight; delineate management zones
- Variable rate fertiliser application exercise — design a variable rate application map from soil and NDVI data in QGIS; calculate savings vs. uniform rate
- Soil sampling grid layout exercise — design a 100m grid sampling plan; GPS waypoint collection; interpolation map creation
- Farm management software practical — enter a season's data; generate input use report; interpret yield map

THEORY CONTENT (40%)

- Coordinate systems, datums, projections: WGS84, UTM, geographic vs. projected coordinates
- Remote sensing physics: spectral signatures of soil, water, vegetation; sensor platforms; error sources
- Precision agriculture economics: cost of technology adoption; return on investment; Nigeria-specific case studies
- Digital agriculture ecosystem: API integration, cloud platforms, IoT data pipelines

EXPECTED COMPETENCY

Create a farm map in QGIS; generate and interpret an NDVI map from satellite data; analyse drone imagery; design a variable rate application plan; interpret yield maps; design a soil sampling grid

GAP SCORE

4

Req: 4 · Current: 0

Priority: CRITICAL

CURRENT GAP & DELIVERY MODE

GIS, drones, and remote sensing entirely

CREDITS

3

Credit Units

		absent from all B.Agric. curricula; no QGIS installation; no satellite data access; no drone imagery experience; practical = 0% — CRITICAL gap	

AGR 491 — Research Methods, Scientific Writing & AI-Assisted Analysis

Year 4 · Semester 2 · 3 Credit Units · CORE · ● CORE | ● AI — Research Science

▶ 60% PRACTICAL · 40% THEORY · Basis: Lab-Intensive CCMAS Practical Credit

CORE COURSE UNITS & TOPICS

- Scientific Method and Research Design
- Experimental Design: RCBD, CRD, Split-Plot, Factorial
- Data Collection Tools: KoboToolbox, ODK, Paper Forms
- Statistical Analysis: R Software — ANOVA, Regression, Correlation, Multivariate
- Scientific Writing: IMRaD Structure, Abstract Writing, Literature Review
- AI-Assisted Analysis: ChatGPT for literature, Google Colab for data viz, ethical use
- Research Ethics: Consent, Data Integrity, Plagiarism, Citation Standards

• Seminar Presentation and Peer Review			
PRACTICAL ACTIVITIES (60%) • Field trial layout on teaching farm — mark out RCBD with 4 treatments and 3 replications; measure plot dimensions; randomise using R • KoboToolbox form design and data collection exercise — design a 20-question agronomic survey; collect data from 5 informants • R software analysis workshop — import data; run ANOVA and Tukey HSD; generate publication-quality graphs; interpret output • AI-assisted literature review exercise — use AI tools to find and synthesise 10 papers on a topic; verify accuracy; prepare annotated bibliography with correct citations • Scientific writing workshop — write a complete Methods section and Results section for the field trial data • Seminar presentation — present 10-minute research findings from field trial to peer group; receive structured feedback	**THEORY CONTENT (40%)** • Research design theory: hypothesis formulation, control and treatment, replication, randomisation, blocking • Statistical theory: parametric and non-parametric tests; Type I and II error; power analysis • Research ethics: Nuremberg Code, Helsinki Declaration, institutional review; academic integrity • AI tool limitations: hallucination risks; bias in training data; responsible use framework for academic work		
EXPECTED COMPETENCY Layout a replicated field trial; collect data using KoboToolbox; analyse in R; write a journal-quality results section; use AI tools responsibly in research; present findings at departmental seminar	**GAP SCORE** **3** Req: 4 · Current: 1 **Priority: HIGH**	**CURRENT GAP & DELIVERY MODE** Field trial layouts rarely conducted; R/SAS untrained at	**CREDITS** **3** Credit Units

		most departments; KoboToolbox entirely unknown; scientific writing poor; AI use in research not taught; practical <10%	

AGR 497 — SIWES — Students Industrial Work Experience Scheme
Year 4/5 · Semester Full Year · 6 Credit Units · CORE — MANDATORY · ● CORE — Industry Attachment

▶ 70% PRACTICAL · 30% THEORY · Basis: Field-Dominant Reform Mandate

CORE COURSE UNITS & TOPICS

- 6-Month Placement in Agronomy-Related Organisation
- Weekly Practical Log and Supervision
- Digital Portfolio of Practical Activities
- Technical Report (Professional Standard)
- Employer Evaluation and HOD Assessment
- Pre-Placement Professional Skills Seminar
- Post-Placement Debriefing Seminar

PRACTICAL ACTIVITIES (70%)

- All hours = practical industry work in one of: commercial agronomy farm, agri-export firm, seed company, food processing firm with

THEORY CONTENT (30%)

- Pre-placement briefing: workplace

GAP certification, ADP, IITA, NRCRI, SON, NAFDAC, or NXP • Weekly log — supervisor-verified record of activities; minimum 3 core agronomy competency areas documented • Digital portfolio — photographic and written record of at least 10 practical competencies completed • Employer performance evaluation — rated on: technical competence, initiative, communication, AI/digital tool use, quality awareness • Technical report — professionally written, IMRaD-structured account of one technical problem encountered and resolved during placement	safety, professional conduct, digital tool use, quality and export compliance awareness • Post-placement debriefing: lessons learned, competency self-rating, career planning • Report writing guidance: structure, referencing, presentation standards		
EXPECTED COMPETENCY Apply academic knowledge across agronomy, digital tools, quality, and export compliance in a real organisation; produce a professional technical report and digital portfolio demonstrating at least 10 practical competencies	**GAP SCORE** **3** Req: 4 · Current: 1 **Priority: HIGH**	**CURRENT GAP & DELIVERY MODE** Majority of students placed in non-agronomy organisations (banks, shops, government offices); supervision absent; reports superficial; no digital portfolio; quality or export placement context extremely rare; practical quality = very low	**CREDITS** **6** Credit Units

21.4 Comprehensive Assessment Form — B.Agric. Agronomy

B.Agric. Agronomy — Comprehensive Skills Gap & Reform Baseline Assessment Form	
Assessment Date	DD / MM / YYYY
Assessor Name & Role	Full name · Designation · Organisation · NUC/NBTE affiliation
Student Name & Matric No.	Full name · Matric Number · Current Level (Year 1–5) · Department
University & Department	Name of institution · State · NUC Accreditation Status · Teaching Farm Status
Programme Type	B.Agric. (5-year) / B.Sc. Crop Science (4-year) / B.Sc. Agribusiness / Other
Teaching Farm Status	Fully Functional / Partly Functional / Non-Functional — Hectares under cultivation: _____
AI Tool Experience (self-report)	Plantix / NDVI platform / Digital farm records / Predictive analytics / None — tick all used
Drone / IoT Experience	Observed drone flight / Analysed drone imagery / Deployed IoT sensor / None
AGR 315 Completed	Yes / No — AI diagnosis practical completed: Yes / No — NDVI map interpreted: Yes / No
AGR 320 Completed	Yes / No — Drone imagery analysed: Yes / No — IoT sensor deployed: Yes / No
Climate Module (AGR 325)	Yes / No — Climate risk assessment done: Yes / No — Agroforestry plot established: Yes / No
Export Compliance (AGR 415)	Yes / No — NXP form completed: Yes / No — MRL compliance checked: Yes / No
HACCP / Quality (AGR 416)	Yes / No — HACCP plan prepared: Yes / No — GAP audit conducted: Yes / No
SIWES Placement Organisation	Name / Type — Agronomy-relevant: Yes / No — Duration: ____ months
Practical Hours This Semester	Actual field/lab hours _____ vs. total contact hours _____ (70/30 target: ____% ; 60/40 target: ___%)
Assessment Method(s)	Practical demonstration / Field observation / Software test / Simulation / Interview / Report review
Assessor Signature & Date	Signature: _____ Date: _____
Student Signature & Date	Signature: _____ Date: _____

21.5 New Course Module Register — B.Agric. Agronomy

Code	Year	Theme	Credits	Ratio	Course Description
AGR 315	2	**AI**	3	**60/40**	Artificial Intelligence & Digital Farming — AI crop diagnosis; NDVI & satellite imagery interpretation; predictive analytics; digital farm records; responsible AI use in research
AGR 320	3	**Robotics**	3	**60/40**	Agricultural Robotics, Drones & Smart Mechanisation — drone flight planning and imagery analysis; automated irrigation programming; IoT sensor deployment; GPS field mapping; robotic systems economics
AGR 325	3	**Climate**	3	**70/30**	Climate Resilience & Adaptation Agronomy — farm climate risk assessment; CSA system design; agroforestry establishment; carbon sequestration estimation; climate finance instruments identification
AGR 415	4	**Export**	3	**60/40**	Export Certification & International Trade Standards — Codex/MRL compliance; phytosanitary documentation; NXP Form E procedures; SPS Agreement; mock export audit; AfCFTA rules of origin
AGR 416	4	**Quality**	3	**60/40**	Quality Conformity, HACCP & GAP — HACCP plan development; GlobalG.A.P. audit; ISO 22000 awareness; traceability system setup; aflatoxin risk assessment; grading to export standards

B.Agric. Agronomy Skills Gap Analysis & Curriculum Reform Framework · NUC CCMAS 2023 · NBTE Implementation Committee · Democracy Day Deadline: 29 May 2026

— Produced by the Agronomy Sub-Committee, NBTE Implementation Committee on Agricultural Curricula Review —

22.0 Summary and Recommendations of Skills Gap Report on Forestry and Related Programmes

S/no	Section	Programmes	Skills Gaps	Recommendation	Action by
1.	Forestry	ND Forestry and Environmental Technology HND Forestry and Environmental Technology	Carbon and Climate	The curriculum must move beyond general theory to include practical Carbon Accounting using IPCC guidelines, Verra, and Gold Standard protocols. Students and lecturers require training in Climate Modeling using Representative Concentration Pathway (RCP) scenarios, Greenhouse Gas (GHG) Inventory methodologies for measuring biomass carbon pools (aboveground, below-ground, soil, and litter), and Carbon Project Development focusing on concepts of additionality, leakage, and permanence to ensure projects are bankable.	Curriculum review panel
			Forest Protection	The curriculum should be updated to include Integrated Pest Management (IPM) for monitoring pests expanding their range due to climate change, and Invasive Species Risk Assessment using predictive mapping with GIS. Short-term training courses	

				on the use of Remote Sensing and Artificial Intelligence for early detection of forest degradation or disease outbreaks are recommended for both lecturers and students	
			Timber & NTFP Harvesting	Curriculum enhancement is recommended rather than full overhaul. The curriculum should emphasize the sustainable commercialization of non-timber forest products. Students need training in Value-Chain Analysis to bring medicinal plants, resins, and nuts to market sustainably. The concept of Reduced Impact Logging (RIL) should be taught alongside Precision Forestry techniques using LiDAR and high-resolution satellite imagery to plan harvests that minimize soil disturbance and damage to residual trees. Certification Compliance training is also essential to ensure timber meets international market requirements.	
			Silviculture and Nursery	The curriculum must be updated to include Adaptive Silviculture strategies such as Variable Retention Harvesting to create multi-aged, resilient stands. Nursery Technology should adopt modernize irrigation systems, substrate science, and the use of	

				mycorrhizal inoculants to improve seedling survival rates. Crucially, training on Seed Sourcing for the future is required, teaching students how to select seeds from mother trees in warmer and drier zones to prepare for future climate shifts	
			Forest Law and Governance	Course contents must emphasize International Environmental Law including the Paris Agreement, CITES, and the Convention on Biological Diversity (CBD). Topics such as Free, Prior, and Informed Consent (FPIC) and the legal rights of Indigenous and local communities should be integrated. Professionals and students will benefit from training in Conflict Resolution and Negotiation to manage competing interests among government, private industry, and local communities.	
			Biodiversity Management	Biodiversity Management requires the introduction of new courses in Conservation Genetics, using DNA tools to ensure genetic diversity in reforestation efforts for climate resilience, and Landscape Connectivity, designing wildlife corridors that allow species to migrate as climate zones shift. Training in envi-	

				ronmental DNA (eDNA) sampling for non-invasive species monitoring is also recommended.	
			Timber & NTFP Harvesting	In Timber and NTFP Harvesting, the curriculum should include Value-Chain Analysis to bring non-timber forest products (medicinal plants, resins, nuts) to market sustainably, Precision Forestry using LiDAR and high-resolution satellite imagery to plan harvests that minimize soil disturbance, and Certification Compliance training to ensure timber meets international "green" market requirements.	
			Agroforestry Systems	Agroforestry Systems content should cover System Dynamics, providing understanding of competition and facilitation between trees and crops including shade management for coffee and cocoa, Carbon in Agricultural Landscapes measuring sequestration potential of hedgerows and silvo pastoral systems, and Economic Modeling to prove financial viability to farmers.	
			Forest Inventory	Forest Inventory is currently rated as adequate, but should be maintained with regular updates on modern digital tools and techniques.	
			Entrepreneurship skills in forestry	Entrepreneurship skills in forestry must	

				be integrated across all modules, with mandatory recertification for all lecturers in Carbon & Climate, Forest Protection, and Forest Law and Governance within twelve months, focusing on business planning, sustainable forest enterprise development, professionalism and introduction to carbon credit markets. Community engagement and enlightenment programmes on sustainable NTFP commercialization should be organized for students and local communities to ensure long-term sustainability of forest resources.	
2.	Wood and Paper Tech.	ND Wood and Paper Technology HND Wood Technology	Timber & NTFP Harvesting	In Timber and NTFP Harvesting, the curriculum should include Value-Chain Analysis to bring non-timber forest products (medicinal plants, resins, nuts) to market sustainably, Precision Forestry using LiDAR and high-resolution satellite imagery to plan harvests that minimize soil disturbance, and Certification Compliance training to ensure timber meets international "green" market requirements.	
		HND Pulp and Paper Tech	Carbon and Climate	The curriculum must focus on the specific role of pulp and paper supply chains within national GHG inventories and climate re-	

				porting obligations. Students need practical training in measuring biomass carbon pools, including above-ground, below-ground, soil, and litter components. Understanding how pulpwood harvesting and processing contribute to carbon emissions and sequestration is essential for aligning the sector with international climate frameworks such as REDD+ and carbon markets.	
			Entrepreneurship skills in Wood and paper Tech. programme	The programme should develop modules on sustainable supply chain management for pulp and paper industries, including traceability and certification requirements. Training on renewable energy resources from forest residues, such as converting bark and wood waste to bio energy, should be integrated. Business models for eco-friendly pulp and paper products, including circular economy approaches and waste reduction strategies, will prepare graduates for emerging market opportunities. Lecturers delivering these modules should undergo mandatory recertification in Carbon & Climate competency areas within twelve months.	

3.	Wild life Management	ND Wild life and Eco Tourism Management HND Wild life and Eco Tourism Management	Carbon and Climate	Training should focus on climate adaptation planning in forest landscapes, including direct impacts on wildlife habitats, migration patterns, and phenological changes. Students and staff need practical skills in assessing how carbon sequestration projects affect biodiversity outcomes	
			Forest Protection	The curriculum must emphasize fire prevention planning and suppression techniques that protect wildlife corridors, illegal logging detection and reporting methods that minimize disturbance to ecotourism assets, and forest pest and disease diagnosis that considers impacts on keystone species. Remote sensing and AI training for early detection of forest degradation is particularly relevant for wildlife habitat monitoring.	
			Forest Law and Governance	Curriculum should strengthen understanding of community forest rights, benefit-sharing models from ecotourism enterprises, land tenure documentation, and international biodiversity agreements including the Convention on Biological Diversity. Training in agreement facilitation between government, private operators, and local	

				communities is essential.	
			Biodiversity Management	Biodiversity Management must be prioritized as a core competency. The curriculum should include species richness assessment methods, wildlife corridor identification, invasive species monitoring and control, habitat mapping using GIS, and ecosystem service valuation techniques. New courses in Conservation Genetics and Landscape Connectivity are strongly recommended.	
			Timber and NTFP Harvesting	For Timber and NTFP Harvesting, students need training in sustainable harvesting practices that minimize disturbance to wildlife populations and ecotourism infrastructure. Reduced impact logging techniques should be taught alongside sustainable yield calculation and non-timber forest product identification for medicinal plants and other resources that support local livelihoods.	
			Agro forestry Systems	Agro forestry Systems content should cover integration of trees into agricultural landscapes to support biodiversity and ecotourism values. System dynamics, shade management for wildlife-friendly coffee and	

				cocoa production, and carbon measurement in agricultural landscapes are priority topics.	
			Forest Inventory	Forest Inventory skills must include permanent plot establishment, DBH and height measurement, basal area and volume calculation, species identification, and stand assessment specifically for wildlife habitat monitoring and ecotourism planning.	
			Entrepreneurship skills in forestry	Entrepreneurship skills in forestry should focus on developing ecotourism business models, community-based conservation enterprises, and understanding carbon credit opportunities from forest protection and biodiversity conservation. Students should be trained in financial planning for wildlife reserves, marketing of ecotourism destinations, and negotiating benefit-sharing agreements with local communities. Given the breadth of gaps, all lecturers should undergo mandatory recertification in Carbon & Climate, Forest Protection, Forest Law & Governance, and Biodiversity Management within twelve months.	

23.0 Agronomy Panel Sub-committee (NCE Crop and Agribusiness Option)

S/N	Subject Clusters	Existing Curriculum (NCCE 2020)	Skill Gap Identified	Remark
1	Crop Production I & II	Six (6) courses covered the subject cluster from principle and practice of crop production.	- Key practical activities on focus areas are lacking, - modern crop production techniques like greenhouse not available, -Equipment, tools and facilities are obsolesce. - No exposure to irrigation and irrigation facilities	To be reviewed
2	Soil Science and Land Management	Two (2) courses covering introductory and soil fertility management in the entire period of the study	- Two courses in the subject cluster are inadequate for the specialist, - Soil laboratory practices, soil field test and practices are not taking cared up. -land management practices for the specialist are inadequate	To be reviewed
3	Horticulture and Vegetable Production	AGC324 is the only horticultural course in the course of study.	-specialist are not exposed to various horticultural and vegetable crop practices from seed health practices, sowing, nursery bed preparation, transplanting, management practices to harvesting and post-harvest management practices.	To be reviewed
4	Pest and Disease Management	AGC222 & AGC322 are the two (2) courses that is limited to theoretical aspects of crop pest and disease management	- No practical field identification of these crop pest and diseases, - Inadequate laboratory equipment to train students diagnostic, treatment and control of these diseases.	
5	Agricultural Economics,	The subject cluster has enough courses ten	- many courses that are theoretically based,	To be reviewed to

	Management and Accounts	(10) courses within the course of study.	- absent of the modern value chain practice - lack of exposure to modern marketing system, cooperative visits and market surveys.	accommodate practical training
6	Agricultural Extension and Rural Development	Only AGE122 which is an introductory aspect of the knowledge of extension and rural settings is in the current NCE Agric curriculum.	-limited coverage of extension and rural sociology knowledge - training may exclude vital knowledge on communication channels. -	
7	SIWES, Field trip, Field Practical's	- 16 Weeks Industrial SIWES, - 1 CU field practical - I time field trip visit to agro-allied industry	- very limited highly organized industries with modern facilities for the SIWES - students on SIWES lack capacity to meet serious industries demands.	
Fishery Panel				
8	Fisheries and Aquaculture	AGA 222; Introduction to fisheries and aquaculture, only 1CU, course without practical.	-The only fishery related course the curriculum covered - practical are not covered	To be reviwed
Forestry Panel				
9	Forestry, Silviculture,	Absent	The entire NCCE/NCE 2020 minimum standard has not covered any forestry related course	To be reviewed to accommodate aspect of forestry

Identified Gap / Skill Area	NCCE (NCE Agricultural Education) Coverage	Coverage Verdict
Poultry Value Chain (Score 3.17 — Low-Moderate)	AGE 212 Poultry Production (1C) — introductory only, theoretical bias.	**Moderate**
Swine Value Chain (2.58 — Moderate)	AGE 323 Livestock Production II (Non-Ruminants) (2C) — generic treatment; no practical AI or finishing.	**Partial**
Dairy Value Chain (2.89 — Moderate)	AGE 225 Livestock Production I (Ruminants) (2C) — mentions milk preservation; no cold chain, AI or modern tech.	**Partial**
Beef Value Chain (3.07 — Low-Moderate)	AGE 225 Livestock Production I (Ruminants) — generic; no feedlot operations.	**Moderate**
Small Ruminants (3.17 — Low-Moderate)	AGE 225 Livestock Production I (Ruminants) — included as part of the ruminant bundle.	**Moderate**
Apiary Value Chain (1.87 — CRITICAL)	AGE 327A Beekeeping/Farming (1C) — offered only as an ELECTIVE ALTERNATIVE to Snail Farming (327B) or Cane Rat (327C).	**Weak**
Feed & Nutrition (2.86 — Moderate)	AGE 122 Introduction to Animal Science and Nutrition (2C) — covers feedstuff classification; no software.	**Moderate**
Processing & Value Addition (2.67 — Moderate)	No dedicated livestock processing course; touched only in AGE 326 Agricultural Marketing and Co-operatives (1C).	**Partial**
CROSS-CUTTING: Digital Livestock Farming (robotics, automation, remote sensing)	Absent. AGE 125 references "ICT in teaching of Agriculture" only.	**Absent**

CROSS-CUTTING: Feed formulation software (Allix, AFOS, Best Mix, Excel)	Absent.	**Absent**
CROSS-CUTTING: Cold chain management (meat, milk, eggs)	Absent. Some storage references in AGE 225 (milk preservation), no cold chain concept.	**Absent**
CROSS-CUTTING: Climate-smart livestock practices	Absent. AGE 115 Introduction to Agroclimatology mentions climate change and agriculture generally.	**Absent**
CROSS-CUTTING: Practical/field-based training (92% preference)	AGE 117 and AGE 227 Practical Agriculture I & II (1C each) + SIWES (AGE 228, 2C). Total practical weighting is modest.	**Moderate**
CROSS-CUTTING: Entrepreneurship as a standalone livestock value chain	AGE 217 Entrepreneurship in Agriculture (2C) — generic, not livestock-specific.	**Partial**
CROSS-CUTTING: Leather processing (standalone value chain)	Absent.	**Weak**
CROSS-CUTTING: Extension service gap (44% of respondents lack access)	AGE 123 Introduction to Extension and Youth Organization in Agriculture (2C) — introductory.	**Moderate**
CROSS-CUTTING: Farm machinery & equipment operation (tractors, feed mills, balers, forage harvesters)	AGE 215 Farm Power and Machinery (1C) — theoretical: describes tractor, PTO, ploughs, seeders.	**Partial**
CROSS-CUTTING: Artificial Insemination (across Poultry breeders, Dairy, Beef, Small	Absent. AGE 324 Animal Breeding (1C) mentions "Artificial insemination and its importance" only as a line item — no practical.	**Moderate**

Ruminants)		
CROSS-CUTTING: Equipment maintenance (lowest-scoring role, 2.32)	Indirect — AGE 215 Farm Power and Machinery touches on maintenance of tillage implements.	**Weak**

Identified Gap / Skill Area	NUC (CCMAS 2023) Coverage	Coverage Verdict
Poultry Value Chain (Score 3.17 — Low-Moderate)	ANS 304 Non-Ruminant Animal Production (2C); AGR 204 Introduction to Animal Production (2C); content within ANS 405.	**Moderate**
Swine Value Chain (2.58 — Moderate)	ANS 304 Non-Ruminant (covers swine briefly); ANS 408 Reproductive Physiology & AI (LH 15 + PH 45).	**Partial**
Dairy Value Chain (2.89 — Moderate)	ANS 305 Ruminant Animal Production (2C); ANS 403 Animal Products Processing (PH 90) — includes dairy; no cold chain module.	**Partial**
Beef Value Chain (3.07 — Low-Moderate)	ANS 305 Ruminant Animal Production; ANS 403 Animal Products Processing (covers meat cuts); ANS 409 Pasture & Range.	**Moderate**
Small Ruminants (3.17 — Low-Moderate)	ANS 305 Ruminant Animal Production — sheep & goats explicitly named; ANS 405 Animal Husbandry.	**Moderate**
Apiary Value Chain (1.87 — CRITICAL)	No dedicated course in Animal Science. Appears only as one line inside AGR 204: "Bee-keeping (Apiculture), Animal Improvement".	**Weak**
Feed & Nutrition (2.86 — Moderate)	ANS 303 Principles of Nutrition & Biochemistry (2C); ANS 309 Nigerian Feed & Feeding Stuffs (2C); ANS 402 Feed Production Technology (PH 90).	**Moderate**
Processing & Value Addition (2.67 — Moderate)	ANS 403 Animal Products, Processing, Handling & Marketing (2C, PH 90); additional coverage in B.Sc. Food Science and Technology.	**Partial**

CROSS-CUTTING: Digital Livestock Farming (robotics, automation, remote sensing)	Absent from Animal Science. Generic references to AI, IoT, Blockchain in ENT 312 Venture Creation — not applied to livestock.	**Absent**
CROSS-CUTTING: Feed formulation software (Allix, AFOS, Best Mix, Excel)	Absent — no named software. Only "linear programming" is mentioned in Agribusiness/Ag Economics courses (farm planning, not feed formulation).	**Absent**
CROSS-CUTTING: Cold chain management (meat, milk, eggs)	Absent. ANS 403 references "storage of meat, milk and poultry products" and "milk hygiene" — but cold chain as a system is not covered.	**Absent**
CROSS-CUTTING: Climate-smart livestock practices	Absent in Animal Science. Some treatment in B.Sc. Water Resources Management & Agro-Meteorology but not applied to livestock.	**Absent**
CROSS-CUTTING: Practical/field-based training (92% preference)	Fourth year of Animal Science is devoted to practical training (ANS 402–408 are all PH 90 courses); SIWES embedded. Strongest structural commitment.	**Moderate**
CROSS-CUTTING: Entrepreneurship as a standalone livestock value chain	ENT 211 + ENT 312 (generic); ANS 402 Feed Production Technology and Entrepreneurship combines the two. Not a standalone pathway.	**Partial**
CROSS-CUTTING: Leather processing (standalone value chain)	Mentioned once in ANS 403 learning outcomes: "hides and skin processing such as flaying, curing and tanning." No dedicated leather course.	**Weak**
CROSS-CUTTING: Extension service gap (44% of respondents lack access)	Entire B.Sc. Agricultural Extension programme (AGX 201–499). Strong on paper; weak linkage to livestock-specific extension.	**Moderate**

CROSS-CUTTING: Farm machinery & equipment operation (tractors, feed mills, balers, forage harvesters)	Mentioned in ANS 402 Feed Production Technology (feed mill equipment operation) — partial. Balers and forage harvesters not named.	**Partial**
CROSS-CUTTING: Artificial Insemination (across Poultry breeders, Dairy, Beef, Small Ruminants)	ANS 408 Reproductive Physiology & AI (2C, LH 15 + PH 45) — the strongest AI treatment. Covers semen collection & AI techniques. But limited to species-general treatment.	**Moderate**
CROSS-CUTTING: Equipment maintenance (lowest-scoring role, 2.32)	ANS 402 Feed Production Technology references feed mill operation; no dedicated maintenance competency.	**Weak**