



NATIONAL BOARD FOR TECHNICAL EDUCATION

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

HIGHER NATIONAL DIPLOMA

CROP PRODUCTION TECHNOLOGY

CURRICULUM AND COURSE SPECIFICATIONS

JUNE, 2026

PREFACE

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

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

Professor Idris M. Bugaje, FNSE
Chairman, Implementation Committee

EXECUTIVE SECRETARY

National Board for Technical Education (NBTE), Kaduna

ACKNOWLEDGEMENT

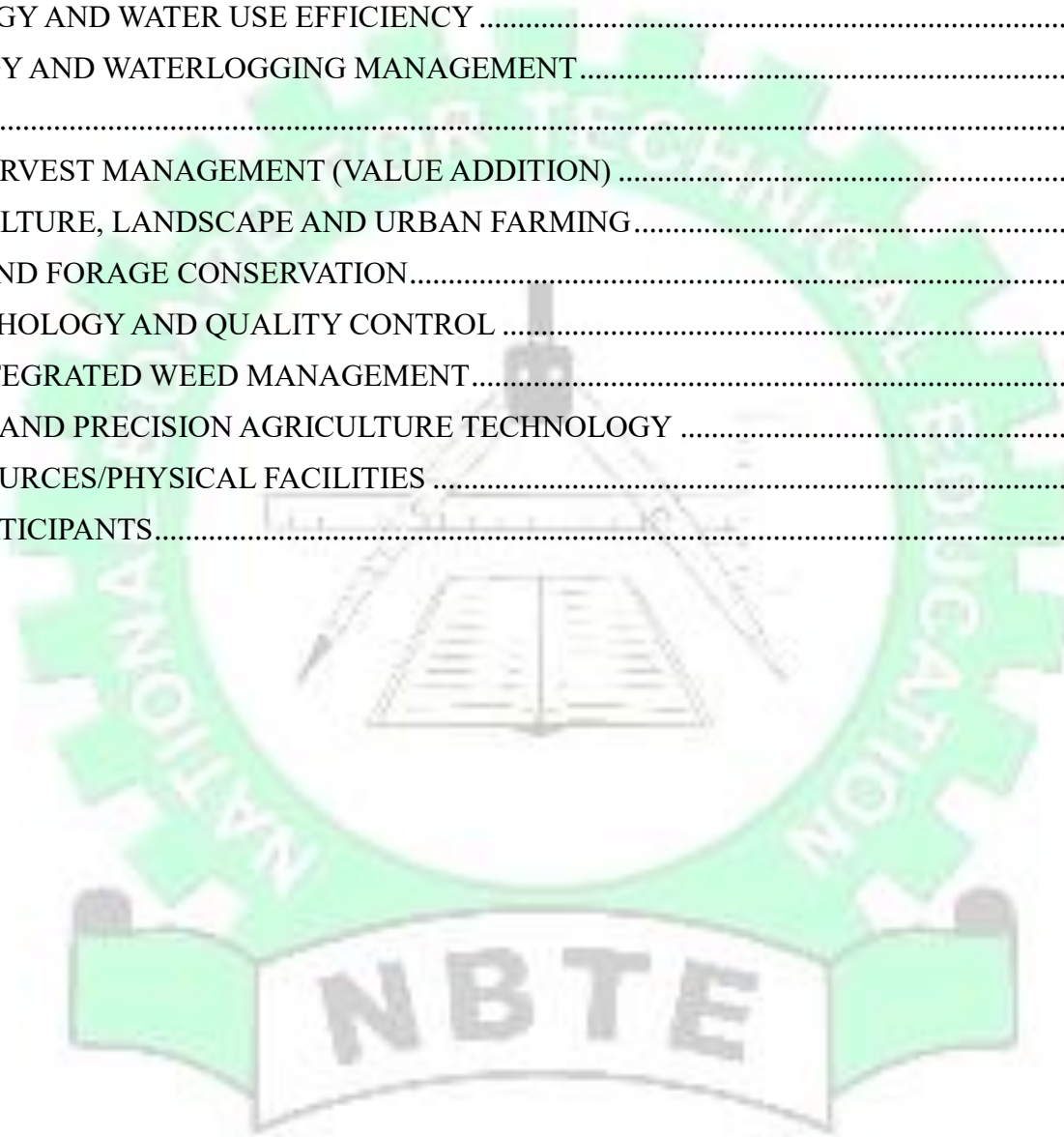
The National Board for Technical Education (NBTE) expresses its profound appreciation to all individuals and organizations whose invaluable support, expertise, and commitment made the successful review and modernization of the Agricultural Education curricula for Nigerian tertiary institutions possible.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

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

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GENERAL INFORMATION

1.0 PROGRAMME NOMENCLATURE

Higher National Diploma (HND) in Crop Production Technology

2.0 PROGRAMME GOAL

The Higher National Diploma (HND) in Crop Production Technology is designed to produce innovative, technologically skilled, entrepreneurial, and environmentally responsible graduates equipped with advanced competencies in sustainable Crop Production, Precision Agriculture, Climate-Smart Farming, Digital Agricultural Technologies, Agribusiness Management and Value-Chain Development for enhanced Food Security, Rural Transformation and National Economic Development.

3.0 OBJECTIVES OF THE PROGRAMME

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

- i. Apply advanced scientific, technological, and practical principles in sustainable Crop Production; Crop Establishment, Management, Harvesting and Post-Harvest Operations.
- ii. Utilize Precision Agriculture, Digital Agriculture Tools, GIS, Remote Sensing, Artificial Intelligence and Smart Farming Technologies for efficient Farm Planning, Monitoring and decision-making.
- iii. Plan, organize and manage Commercial Crop Production Enterprises using Modern Agronomic Practices, Mechanization, Irrigation Systems and Farm Automation Technologies.
- iv. Apply Climate-Smart Agriculture, Conservation Agriculture, Agroforestry, Organic Farming and Regenerative Agricultural Practices to enhance Productivity, Environmental Sustainability, and Resilience to Climate Change.
- v. Conduct Soil Survey, Digital Soil Mapping, Land Evaluation, Soil Fertility Assessment and Nutrient Management for Sustainable Crop Production.
- vi. Identify, diagnose and manage Crop Pests, Diseases and Weeds using Integrated Management approaches, Biological Control Methods and Digital Diagnostic Tools.
- vii. Apply Biotechnology, Plant Breeding, Seed Technology, Crop Physiology and Improved Genetic Resources to enhance Crop Productivity, Adaptability and Quality.
- viii. Carry out Agricultural Research, Field Experimentation, Data Collection, Statistical Analysis, Scientific Reporting and Problem-Solving in Crop Production Systems.
- ix. Apply modern Post-Harvest Handling, Storage, Processing, Quality Assurance and Value-Addition Technologies across Agricultural Value Chains.
- x. Develop and manage Agribusiness Enterprises through effective Financial Planning, Marketing, Entrepreneurship, Leadership, Communication and Project Management Skills.

- xi. Provide Agricultural Extension, Digital Advisory and Community-Based Support Services that promote Technology Transfer, Rural Development and Farmer adoption of Innovations.
- xii. Demonstrate Professional Ethics, Occupational Health and Safety Standards, Teamwork, and Lifelong Learning while contributing to Food Security, Employment Generation, Poverty Reduction and National Economic Development.

4.0 ENTRY REQUIREMENTS

The minimum entry requirements into the HND Crop Production Technology Programme are:

- i) National Diploma (ND) in Agricultural Technology, ND Organic Agricultural Technology, or related disciplines with at least Lower Credit;
- ii) Must have undergone one (1) year post-ND industrial training experience;
- iii) Candidates must satisfy institutional and NBTE admission requirements.
- iv) Candidates with a **Pass** at the ND Level with two (2) or more years post-ND cognate work experience may be considered for admission.

5.0 STRUCTURE/DURATION OF THE PROGRAMME

The Programme is structured to last for **two (2) academic years (four semesters)** of classroom instruction, laboratory work and field practicals. Each semester shall consist of:

- i) 15 contact weeks of teaching (lectures, practicals, fieldwork);
- ii) 2 weeks for tests, registration, and examinations.

6.0 CURRICULUM

The curriculum of the HND Crop Production Technology Programme consists of three (3) main components:

- i. **General Studies Courses:** Courses that develop students' general knowledge, communication skills, values, and personal development outside their main field of study.
- ii. **Foundation Courses:** Basic introductory courses that provide the fundamental knowledge and principles needed for advanced learning in a Programme.
- iii. **Professional Courses:** Specialized courses that equip students with practical and technical skills related to their chosen profession or career field.

7.0 STAFFING REQUIREMENTS

7.1 Core Teaching Staff

A minimum of four (4) Core Lecturers who should be Lecturer II and above, with minimum qualification HND/BSc/MSc/PhD holders in Crop Production or related fields.

7.2 Head of Department (HOD)

The Head of Department shall have at least a Master's degree in agronomy programmes or related fields. He or she shall not be below the rank of a Senior Lecturer, must be registered with the relevant professional body and must have a minimum of twelve (12) years' experience in both academic and industry.

7.3 Technical Staff

There should be technical staff:

i) Technologist

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

ii) Technician

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

iii) Farm Assistants

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

8.0 CERTIFICATION

A diplomate of this Programme shall be awarded the Higher National Diploma (HND) in Crop Production Technology.

9.0 AWARD OF HIGHER NATIONAL DIPLOMA (HND)

The Higher National Diploma certificate in Crop production Technology shall be awarded by the authority of the Academic Board of the institution under the following conditions:

- i) Satisfactory performance in all prescribed course work/assignments, tests/quizzes, workshop practice, laboratory work, field trips, etc.;
- ii) Satisfactory performance in all semester examinations;
- iii) Satisfactory completion of written project/seminar papers;

9.1 Conditions for the Award of HND:

Institutions offering accredited programmes will award the Higher National Diploma to candidates who successfully completed the programme after passing the prescribed course-work, examinations, diploma project etc. Courses shall be graded as follows:

MARK RANGE	LETTER GRADE	WEIGHTING
75% and above	A	4.00
70% – 74%	AB	3.50
65% – 69%	B	3.25
60% – 64%	BC	3.00
55% – 59%	C	2.75
50% – 54%	CD	2.50
45% – 49%	D	2.25
40% – 44%	E	2.00
Below 40%	F	0.00

9.2 Classification of Diplomas:

Diploma Certificates shall be awarded based on the following classifications:

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

10.0 ACCREDITATION OF PROGRAMME

The Crop Production Technology shall be accredited by the NBTE before the diplomates are awarded the certificates. Details about the process of accrediting a programme for the award of HND are available from the Board's website www.nbte.gov.ng or through correspondence to: The Executive Secretary, NBTE, Plot 'B' Bida Road, P.M.B 2239, Kaduna, Nigeria.

11.0 LOGBOOK

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

12.0 FINAL YEAR PROJECTS

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

13.0 GUIDANCE NOTES FOR TEACHERS OF THE PROGRAMME:

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

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

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

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

14.0 GUIDELINES ON MANDATORY SKILLS QUALIFICATIONS (MSQ)

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

CURRICULUM TABLE**Year I- Semester I**

S/N	COURSE CODE	COURSE TITLE	L	T	P	CH	CU
1.	GNS 301	Use of English III	2	0	0	2	2
2.	MSQ 311	Principles of Quality Assurance Assessment	1	0	1	2	2
3.	AED 312	Agricultural Extension Methods	1	0	2	3	3
4.	AED 315	ICT for Agriculture (ICT4Ag) and Digital Extension Systems	1	0	3	4	4
5.	AGR 301	Farm Management	1	0	1	2	2
6.	SST 312	Soil Fertility and Plant Nutrition	1	0	3	4	4
7.	CPT 311	Crop Production I (Roots, Tubers, Fibres and Others)	1	0	2	3	3
8.	CPT 312	Crop Physiology	1	0	2	3	3
9.	CPT 313	Agro-Climatology and Climate-Smart Agriculture	1	0	2	3	3
10.	CPT 314	Cropping Systems and Sustainable Intensification	1	0	2	3	3
11.	CPT 315	Crop Farm Practice I	1	0	3	4	4
12.	CPT 316	Annual Crops	1	0	2	3	3
TOTAL			13	0	23	36	36

Year I- Semester II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CH	CU
1.	GNS 302	Communication in English III	2	0	0	2	2
2.	ENT 326	Practice of Entrepreneurship I	2	0	2	4	4
3.	MSQ 321	Practice of Quality Assurance Assessment	1	0	1	2	2
4.	AGR 302	Field Experimentation and Data Analysis	1	0	1	2	2
5.	SST 322	Soil Genesis and Morphology	1	0	3	4	4
6.	CPT 321	Principles of Genetics and Molecular Biotechnology	1	0	1	2	2
7.	CPT 322	Plant Pathology and Biological Control	1	0	2	3	3
8.	CPT 323	Crop Production II (Cereals, Legumes, Oilseeds)	1	0	3	4	4
9.	CPT 324	Crop Farm Practice II (Precision Agriculture Tools)	1	0	3	4	4
10.	CPT 325	Agricultural Entomology and Integrated Pest Management (IPM)	1	0	3	4	4
11.	CPT 326	Agricultural Biochemistry	1	0	2	3	3
TOTAL			13	0	21	34	34

Year II - Semester I

S/N	COURSE CODE	COURSE TITLE	L	T	P	CH	CU
1.	ENT 416	Practice of Entrepreneurship II	2	0	2	4	4
2.	AGR 401	Research Methodology and Scientific Writing	1	0	1	2	2
3.	AED 414	Extension Administration, Personnel Management and Leadership	1	0	2	3	3
4.	CPT 411	Crop Production III (Plantation/Permanent Crops)	1	0	3	4	4
5.	CPT 412	Plant Breeding, Seed Technology and Biotechnology	1	0	2	3	3
6.	CPT 413	Horticulture, Greenhouse and Vertical Farming	1	0	2	3	3
7.	CPT 414	Crop Farm Practice III	1	0	2	3	3
8.	CPT 415	Irrigation Technology and Water Use Efficiency	1	0	2	3	3
9.	CPT 416	Drainage Technology and Waterlogging Management	1	0	3	4	4
TOTAL			10	0	19	29	29

Year II - Semester II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CH	CU
1.	AED 424	Rural Sociology	1	0	1	2	2
2.	CPT 421	Produce and Post-Harvest Management (Value Addition)	1	0	3	4	4
3.	CPT 422	Ornamental Horticulture, Landscape and Urban Farming	1	0	2	3	3
4.	CPT 423	Pasture Agronomy and Forage Conservation	1	0	2	3	3
5.	CPT 424	Seed Production, Pathology and Quality Controls	1	0	2	3	3
6.	CPT 425	Weed Science and Integrated Weed Management	1	0	2	3	3
7.	CPT 426	Farm Mechanization and Precision Agriculture Technology	1	0	3	4	4
8.	CPT 428	Project	0	0	4	4	4
TOTAL			7	0	19	26	26

Keys: L – Lectures (Hours/week) T – Tutorial (Hours/week) P – Practical (Hours/week) CU – Credit Unit CH – Contact Hours (Hours/week)



CROP PRODUCTION I (ROOTS, TUBERS, FIBRES AND OTHERS)

PROGRAMME: HND CROP PRODUCTION TECHNOLOGY		
COURSE TITLE: CROP PRODUCTION I (ROOTS, TUBERS, FIBRES AND OTHERS)	COURSE CODE: CPT 311	CONTACT HOURS: 3HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK
GOAL: This course is designed to provide students with the knowledge and skills of the agronomic crops production.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand classification and production of root crops; 2.0 Understand classification and production of tuber crops; 3.0 Understand classification and production of fiber crops; 4.0 Know post-harvest, handling, storage and marketing of agronomic crops; 5.0 Know climate-smart practices and record keeping in agronomic crops;		

PROGRAMME: HND CROP PRODUCTION TECHNOLOGY						
COURSE TITLE: CROP PRODUCTION I (ROOTS, TUBERS, FIBRES AND OTHERS)			COURSE CODE: CPT 311		CONTACT HOURS: 3HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 2HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with the knowledge and skills of the agronomic crops production.						
GENERAL OBJECTIVE 1.0: Understand classification and production of root crops.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 3	1.1 Explain the origin of root crops e.g cassava, sweet potatoes, cocoyam, etc. 1.2 Classify root crops based on use and growth characteristics. 1.3 Explain botanical characteristics of roots. 1.4 Outline production and field management of	• Discuss the origin of root crops e.g cassava, sweet potatoes, cocoyam, etc. • Describe root crops based on use and growth characteristics. • Describe botanical characteristics of roots. • Explain production and field management of root crops • Discuss economic and nutritional	Textbooks, journals, white/smart boards, internet, charts, projector	• Identify major root crops grown locally. • Classify root crops according to use and crop group. • Identify botanical characteristics of selected root crops. • Prepare crop identification records and herbarium samples. • Carry out production of some selected root crops • Document field production records	Guide students to: • Identify major root crops grown locally. • Classify root crops according to use and crop group. • Observe botanical characteristics of selected root crops. • Prepare crop identification records and herbarium samples. • Carry out production of some selected root crops • Document field	Crop samples, seeds, planters, tractor, implements, power tillers, field plots, ICT tools, herbarium materials, hand lens, smartphones, PPE, practical manual

	root crops 1.5 Enumerate economic and nutritional importance of root crops.	importance of root crops.			production records	
GENERAL OBJECTIVE 2.0: Understand classification and production of tuber crops.						
4– 6	2.1 Explain the origin of tuber crops e.g yam, carrot, beetroot, etc. 2.2 Classify tuber crops based on use and growth characteristics. 2.3 Explain botanical characteristics of tubers. 2.4 Outline production and field management of tuber crops 2.5 Enumerate economic and nutritional importance of tuber crops.	• Discuss the origin of tuber crops e.g yam, carrot, beetroot, etc. • Describe tuber crops based on use and growth characteristics. • Describe botanical characteristics of tuber. • Explain production and field management of tuber crops • Explain economic and nutritional importance of tuber crops.	• Textbooks, journals, white/smart boards, internet, charts, projector.	• Identify major tuber crops grown locally. • Classify tuber crops according to use and crop group. • Identify botanical characteristics of selected tuber crops. • Prepare crop identification records and herbarium samples. • Carry out production of some selected tuber crops • Document field production records	Guide students to: • Identify major tuber crops grown locally. • Classify tuber crops according to use and crop group. • Observe botanical characteristics of selected tuber crops. • Prepare crop identification records and herbarium samples. • Carry out production of some selected tuber crops • Document field production records	Crop samples, seeds, planters, tractor, implements, power tillers, field plots, ICT tools, herbarium materials, hand lens, smartphones, PPE, practical manual.
GENERAL OBJECTIVE 3.0: Understand classification and production of fiber crops.						
7– 9	3.1 Explain the	• Discuss the origin	Smart/white	• Identify major	Guide students to:	Crop samples,

	origin of fibers e.g kenaf, jute, cotton, etc. 3.2 Classify fibers based on use and growth characteristics. 3.3 Explain botanical characteristics of fibers 3.4 Outline production and field management of fibers. 3.5 Enumerate economic and nutritional importance of fibers.	of fibers e.g kenaf, jute, cotton, etc. - Describe fibers based on use and growth characteristics. - Describe botanical characteristics of fibers. - Explain production and field management of fibers - Explain economic and nutritional importance of fibers.	boards, textbooks, journals, white/smart boards, internet, charts, projector.	fibers grown locally. - Classify fibers according to use. - Identify botanical characteristics of selected fibers. - Prepare crop identification records and herbarium samples. - Carry out production of some selected fibers. - Document field production records	- Identify major fibers grown locally. - Classify fibers according to use. - Observe botanical characteristics of selected fibers. - Prepare crop identification records and herbarium samples. - Carry out production of some selected fibers. - Document field production records	seeds, planters, tractor, implements, power tillers, field plots, ICT tools, herbarium materials, hand lens, smartphones, PPE, practical manual
GENERAL OBJECTIVE 4.0: Know post-harvest, handling, storage and marketing of agronomic crops.						
10 – 12	4.1 Explain crop maturity indices for root, tuber and fiber crops 4.2 Describe harvesting methods and equipment in root, tuber and fiber production	- Discuss crop maturity indices for root, tuber and fiber crops - Explain harvesting methods and equipment in root, tuber and fiber production - Describe handling,	White/Smart boards, markers, textbooks, journals, internet, charts, projector, pest identification manuals.	- Identify maturity indices in root, tuber and fiber crops - Identify harvesting equipment in root, tuber and fiber crops - Carry out harvesting and handling of root, tuber and fiber crops - Carry out sorting and	Guide students to: - Identify maturity indices in root, tuber and fiber crops - Identify harvesting equipment in root, tuber and fiber crops - Carry out harvesting and handling of root, tuber and fiber crops	Threshers, storage bins, dryers, storage inputs, sprayers, Silo, warehouse, drying slabs, Smartphones PPE, practical manual, Harvesting tools, scales, grading

	4.3 Explain handling, sorting and grading in root, tuber and fiber production 4.4 Explain packaging and storage in root, tuber and fiber production 4.5 Describe primary processing for each crop group 4.6 Explain marketing in root, tuber and fiber production	sorting and grading in root, tuber and fiber production • Describe packaging and storage in root, tuber and fiber production • Explain primary processing for each crop group • Explain marketing in root, tuber and fiber production		grading • Carry out threshing, winnowing and other processing operations. • Determine moisture content of selected crops before storage • Carry out packaging and storage of root, tuber and fiber crops • Conduct market survey of root, tuber and fiber crops • Document records of all the operations manually and digitally	• Carry out sorting and grading • Carry out threshing, winnowing and other processing operations. • Determine moisture content of selected crops before storage • Carry out packaging and storage of root, tuber and fiber crops • Conduct market survey of root, tuber and fiber crops • Document records of all the operations manually and digitally	tables, moisture meter, hermetic bags, open sacks.
GENERAL OBJECTIVE 5.0: Know climate-smart practices and record keeping in agronomic crops.						
13 – 15	5.1 Explain climate-smart agricultural practices in roots, tubers and fiber production. 5.2 Explain effects of climate change on roots, tubers and fibers. 5.3 Explain climate risk adaptation	• Discuss climate-smart crop production using local farming examples. • Explain climate change effects on roots, tubers and fibers. • Discuss farm documentation and record keeping procedures.	White/smart boards, markers, textbooks, journals, internet, climate-smart agriculture manuals, annual NIMET reports, charts, projector, videos, weather reports, farm record templates etc.	• Carry out climate-smart demonstration for selected crops on already established plot. • Practice water-efficient irrigation and watering methods where applicable. • Interpret weather information using	Guide students to: • Carry out climate-smart demonstration for selected crops on already established plot. • Practice water-efficient irrigation and watering methods where applicable.	GPS, Sensor, drone, robot, computer, irrigation materials, field plot, smartphone, weather app, farm record sheets, PPE, practical manual, crop production

	practices in field crop production. 5.4 Explain farm record keeping in root, tuber and fiber production.	Describe use of climate information for farm decision-making.		smartphone weather applications. - Prepare climate-based planting calendar for selected crops. - Document farm records on planting date, weather condition, input use and crop performance.	- Interpret weather information using smartphone weather applications. - Prepare climate-based planting calendar for selected crops. - Document farm records on planting date, weather condition, input use and crop performance.	records.
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical 40% Examination: 40% Total: 100%						

CROP PHYSIOLOGY

PROGRAMME: HIGHER NATIONAL DIPLOMA, CROP PRODUCTION TECHNOLOGY		
COURSE TITLE: CROP PHYSIOLOGY	COURSE CODE: CPT 312	CONTACT HOURS: 3HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK
GOAL: This course is designed to acquaint students with the knowledge and skills of crop physiology and response to environmental stress.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand plant cell structure and tissue organization; 2.0 Understand the mechanism and factors affecting photosynthesis and respiratory processes; 3.0 Know translocation, water relations and mineral nutrition in crops; 4.0 Understand plant growth, development, dormancy and senescence mechanisms; 5.0 Understand physiology and agronomic practices in crop yield optimization;		

PROGRAMME: HIGHER NATIONAL DIPLOMA, CROP PRODUCTION TECHNOLOGY						
COURSE TITLE: CROP PHYSIOLOGY			COURSE CODE: CPT 312		CONTACT HOURS: 3HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 2HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to acquaint students with the knowledge and skills of crop physiology and response to environmental stress.						
GENERAL OBJECTIVE 1.0: Understand plant cell structure and tissue organization						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1- 3	1.1 Describe the ultra-structure of plant cells and functions of organelles 1.2 Explain the differences between prokaryotic and eukaryotic cells 1.3 Explain plant tissues (meristematic and permanent) and their functions	- Explain plant cell organelles: nucleus, chloroplast, mitochondria, vacuole, cell wall - Explain the differences between prokaryotes and eukaryotes - Describe plant tissues (meristematic and permanent) and their functions	Marker board, Textbooks, cell diagrams, charts	- Prepare and stain temporary slides of onion epidermis and leaf cross-sections - Observe plant cells under compound microscope - Draw labelled diagrams of plants cells - Cross-sect monocot and dicot stems - Compare tissue organization	Guide students to: - Prepare and stain temporary slides of onion epidermis and leaf cross-sections - Observe under compound microscope and draw labelled diagrams - Cross-sect monocot and dicot stems - Compare tissue organization	Compound microscope, slides, coverslips, stains (safranin, crystal violet), onion, fresh stems, razor blades, drawing materials
GENERAL OBJECTIVE 2.0: Understand the mechanism and factors affecting photosynthesis and respiratory processes						

4 – 6	2.1 Describe the light and dark reactions of photosynthesis 2.2 Distinguish between C3, C4 and CAM pathways 2.3 Explain factors affecting photosynthetic rate 2.4 Describe aerobic and anaerobic respiration processes 2.5 Explain photosynthetic pigments and their roles	• Explain light reactions, Calvin cycle, NADPH and ATP production • Explain the differences between C3, C4 and CAM plants; relate to Nigerian crops (C4: maize, sorghum; C3: cassava, cowpea) • Discuss factors affecting photosynthetic rate • Explain aerobic and anaerobic respiration processes, glycolysis, Krebs cycles • Explain respiratory quotient • Explain chlorophyll a, b, carotenoids and xanthophylls; their absorption spectra, roles	Diagrams, Textbooks, Marker Board charts	• Demonstrate photosynthesis using aquatic plants • Count bubble frequency under different light intensities • Plot light response curve • Test leaves for starch using iodine test after light/dark treatment • Measure CO₂ evolution from germinating seeds • Calculate RQ • Extract chlorophyll using acetone • Run paper chromatography • Identify pigment bands and measure R_f values	• Demonstrate photosynthesis using aquatic plants • Count bubble frequency under different light intensities • Plot light response curve • Test leaves for starch using iodine test after light/dark treatment • Measure CO₂ evolution from germinating seeds • Calculate RQ • Extract chlorophyll using acetone • Run paper chromatography • Identify pigment bands and measure R_f values	Aquatic plants, bench lamp, stopwatch, ruler, test tubes, iodine solution, germinating seeds, conical flasks, lime water, acetone, chromatography paper, pencil, ruler, UV lamp, green leaves
GENERAL OBJECTIVE 3.0: Know translocation, water relations and mineral nutrition in crops						
7 – 9	3.1 Describe water potential, osmosis, turgor and	• Explain water potential, osmosis, turgor and	Textbooks, nutrient deficiency charts	• Measure transpiration rate using potometer	Guide student to: • Measure transpiration rate	Potometer, fresh shoots, petroleum jelly,

	plasmolysis 3.2 Describe transpiration: types, measurement, stomatal regulation 3.3 Describe essential macro and micronutrients and deficiency symptoms	plasmolysis - Discuss transpiration: types, measurement, stomatal regulation - Explain essential macro, micronutrients and deficiency symptoms	Marker Board	under different conditions (light vs dark, humid vs dry) - Set up hydroponic deficiency experiment (-N, -P, -K, -Fe) - Observe and photograph deficiency symptoms weekly for 4 weeks	using potometer under different conditions (light vs dark, humid vs dry) - Set up hydroponic deficiency experiment (-N, -P, -K, -Fe) - Observe and photograph deficiency symptoms weekly for 4 weeks	ruler, stopwatch; hydroponic nutrient salts, plastic cups, seeds, grow light
GENERAL OBJECTIVE 4.0: Understand plant growth, development, dormancy and senescence mechanisms.						
10 – 13	4.1 Describe seed germination seedling establishment and vegetative growth stages 4.2 Explain photoperiodism and vernalisation in flowering 4.3 Describe the roles of plant hormones: auxins, cytokinins, gibberellins, abscisic acid, ethylene etc.	- Explain seed germination stages; vegetative and reproductive growth phases; sigmoid growth curve - Discuss photoperiodism and vernalisation in flowering - Explain the roles of plant hormones: auxins, cytokinins, gibberellins, abscisic acid, ethylene etc.	Marker board , textbooks, Charts	- Plant monocot and dicot - Measure shoot height, leaf area, dry weight weekly - Plot growth curves and identify growth phases - Apply different concentrations of auxin (IBA) to bean cuttings - Measure rooting frequency and root length after 2 weeks	Guide student to: - Plant monocot and dicot - Measure shoot height, leaf area, dry weight weekly; - Plot growth curves and identify growth phases - Apply different concentrations of auxin (IBA) to bean cuttings - Measure rooting frequency and root length after 2 weeks	Pots, seeds, ruler, balance, graph paper, calculator; IBA hormone powder, cuttings, rooting medium, sand, pots

GENERAL OBJECTIVE 5.0: Understand physiology and agronomic practices in crop yield optimization.

14 – 15	5.1 Explain yield components, harvest index and source-sink relationships 5.2 Describe crop responses to drought, heat, salinity and waterlogging stress 5.3 Explain the agronomic application of growth regulators	• Explain yield components, harvest index and source-sink relationships • Describe crop responses to drought, heat, salinity and waterlogging stress • Explain the agronomic application of growth regulators	Marker board, textbooks, Charts	• Calculate harvest index using yield component data from demonstration plots; • Compare height index (HI) of two varieties • Subject potted seedlings to 7-day drought; • Measure wilting score, relative water content and recovery ability	Guide students to: • Calculate harvest index using yield component data from demonstration plots; • Compare height index (HI) of two varieties • Subject potted seedlings to 7-day drought; • Measure wilting score, relative water content and recovery ability	Harvested plant samples, scale, calculator, spreadsheet; pots, seedlings, weighing scale, oven
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COURSE ASSESSMENT:

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

AGRO-CLIMATOLOGY AND CLIMATE-SMART AGRICULTURE

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: AGRO-CLIMATOLOGY AND CLIMATE-SMART AGRICULTURE	COURSE CODE: CPT 313	CONTACT HOURS: 3 HOUR/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to provide students with knowledge and skills of effect of weather and climate elements on crop production, through climate-smart agricultural practices.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the structure of the atmosphere and the principal weather elements; 2.0 Understand climate classification and the agro-ecological zones of Nigeria; 3.0 Understand the effect of climate on crop production; 4.0 Understand climate change, weather extremes and crop adaptation strategies; 5.0 Understand weather forecasting tools and climate-smart agricultural advisory services;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: AGRO-CLIMATOLOGY AND CLIMATE-SMART AGRICULTURE			COURSE CODE: CPT 313		CONTACT HOURS: 3	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills of effect of weather and climate elements on crop production, through climate-smart agricultural practices.						
GENERAL OBJECTIVE 1.0: Understand the structure of the atmosphere and the principal weather elements						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 - 3	1.1 Describe the layers of: atmosphere, troposphere stratosphere, mesosphere thermosphere 1.2 Explain the principles of weather elements: solar radiation, temperature, humidity, rainfall, wind and evaporation 1.3 Describe instruments used	- Explain the layers of: atmosphere, troposphere stratosphere, mesosphere thermosphere - Discuss the principles of weather elements: solar radiation, temperature, humidity, rainfall, wind and evaporation - Discuss instruments used in	Marker board, textbooks, NIMET observation guide, sample data sheets, LCD projector,	- Identify meteorological instruments. - Calibrate a rain gauge and tipping-bucket sensor and verify against standard - Read and record weather data daily for 2 weeks at the school weather station	Guide students to: - Identify meteorological instruments. - Calibrate a rain gauge and tipping-bucket sensor and verify against standard - Read and record weather data daily for 2 weeks at the school weather station	Meteorological station, Automated weather station, Stevenson screen, thermometers, rain gauge, anemometer, observation log book.

	in agro-meteorological observations. 1.4 Explain agro-meteorological data recording, summary and reporting	agro-meteorological observations • Discuss agro-meteorological data recording, summary and reporting				
GENERAL OBJECTIVE 2.0: Understand climate classification and the agro-ecological zones of Nigeria						
4 - 6	2.1 Distinguish between weather and climate. 2.2 Describe Köppen and Thornthwaite climate classification systems 2.3 Describe the 5 major agro-ecological zones of Nigeria: Mangrove, Rainforest, Derived Savanna, Guinea Savanna, Sudan Savanna 2.4 Explain the major crops and livestock according to each zone	• Discuss the differences between climate and weather according to WMO standards • Explain Köppen letter codes (Aw, BS, etc.); show Nigeria on Köppen map • Discuss 5 major agro-ecological zones using Nigeria agro-zones' map: rainfall ranges, vegetation, soils, dominant crops per zone • Explain major crops and livestock according to each zone	Nigeria agro-zone map, Köppen world map, NIMET climate atlas, FMAFS crop zone publications, LCD projector and marker board	• Plot 30-year average rainfall and temperature data for one Nigerian station and identify climate type. • Identify 5 suitable crops for each of the 5 zones with climatic justification.	Guide students to: • Plot 30-year average rainfall and temperature data for one Nigerian station and identify climate type. • Identify 5 suitable crops for each of the 5 zones with climatic justification.	NIMET data sheets, graph paper, calculator; Nigeria agro-zone map, crop suitability table, NIMET climate atlas

GENERAL OBJECTIVE 3.0: Understand the effect of climate on crop production

7 - 9	3.1 Explain effect of solar radiation, photoperiod and growing degree days (GDD) on crop development	Explain effect of solar radiation, photoperiod and growing degree days (GDD) on crop development	GDD calculation worksheets, NIMET rainfall data, temperature charts, FAOSTAT climate-yield data, LCD projector	Calculate GDD requirements from sowing to flowering for monocot and dicot using local temperature data	Guide students to: - Calculate GDD requirements from sowing to flowering for monocot and dicot using local temperature data - Analyse a 10-year rainfall record: - Identify reliable onset, dry spells and length of growing season; - Recommend planting dates	Local NIMET temperature data, calculator, GDD worksheet, FAOSTAT climate-yield data, 10-year rainfall data, graph paper, calculator
	3.2 Explain effect of temperature on germination, growth, flowering, ripening	Explain effect of temperature on germination, growth, flowering, ripening		- Analyse a 10-year rainfall record: - Identify reliable onset, dry spells and length of growing season;		
	3.3 Explain effect of rainfall: amount, distribution, intensity, dry spells	Explain effect of rainfall: amount, distribution, intensity, dry spells		Recommend planting dates		
	3.4 Explain effect of climate on pests, diseases, storage and processing	Explain effect of climate on pests, diseases, storage and processing				

GENERAL OBJECTIVE 4.0: Understand climate change, weather extremes and climate-smart agriculture (CSA) adaptation strategies

10 - 12	4.1 Explain climate change greenhouse gases (CO ₂ , CH ₄ , N ₂ O) and global warming	Discuss climate change greenhouse gases (CO₂, CH₄, N₂O) and global warming	IPCC AR6 summary, NEST climate Nigeria reports, FAO CSA brochures, NIMET advisory, conservation agriculture	Compare 30-year vs 10-year rainfall and temperature trend of a Nigerian NIMET station, record the observed changes.	Guide students to: - Compare 30-year vs 10-year rainfall and temperature trend of a Nigerian NIMET station, record the observed changes. - Design a CSA	NIMET 30-year and 10-year rainfall/temperature data, graph paper, calculator; CSA cropping calendar template
	4.2 Explain climate-smart agriculture (CSA)	- Explain climate-smart agriculture (CSA) - Describe the 3		Design a CSA cropping calendar		

	4.3 Describe the 3 pillars (productivity, adaptation, mitigation) of CSA. 4.4 Explain climate change impacts in Nigeria. 4.5 Describe CSA practices: short-duration varieties, conservation agriculture, agroforestry, rainwater harvesting, climate insurance (NIRSAL/NAIC), low-emission rice (AWD irrigation)	pillars (productivity, adaptation, mitigation) of CSA. • Explain climate change impacts in Nigeria. • Describe CSA practices: short-duration varieties, conservation agriculture, agroforestry, rainwater harvesting, climate insurance (NIRSAL/NAIC), low-emission rice (AWD irrigation)	brochures, LCD projector	integrating short-duration variety, conservation tillage, agroforestry component, rainwater harvesting and crop insurance	cropping calendar integrating short-duration variety, conservation tillage, agroforestry component, rainwater harvesting and crop insurance	
GENERAL OBJECTIVE 5.0: Understand weather forecasting tools and climate-smart agricultural advisory						
13 - 15	5.1 Describe types of forecasts: nowcast, short-range, medium-range, seasonal forecast (SCPZ) 5.2 Describe sources of weather/climate information: NIMET SCPZ, ECMWF, NASA	• Describe types of forecasts: nowcast, short-range, medium-range, seasonal forecast (SCPZ) • Describe sources of weather/climate information: NIMET SCPZ,	NIMET SCPZ publication, NASA POWER website, Plantix/Zenvus apps on smartphone, NIRSAL index insurance brochure, LCD projector	• Download NIMET SCPZ for the current year • Analyze predictions for the local agro-zone • Use prediction results to advise farmers on suitable crop variety and planting date	Guide students to: • Download NIMET SCPZ for the current year • Summarize predictions for the local agro-zone • Advise farmers on suitable crop variety and planting date	Laptops/smartphones with internet, NIMET SCPZ; Plantix/Zenvus farm grow apps, smartphone, log book

	POWER, mobile apps (Plantix, Esoko, Zenvus) 5.3 Explain agromet advisory and seasonal forecast for planting decisions 5.4 Describe digital extension tools: SMS-based advisories, weather index insurance	ECMWF, NASA POWER, mobile apps (Plantix, Esoko, Zenvus) • Explain agromet advisory and seasonal forecast for planting decisions • Describe digital extension tools: SMS-based advisories, weather index insurance		• Use Plantix or Zenvus app for 1 week to receive crop advisories • Compile a 1-page usefulness report	• Use Plantix or Zenvus app for 1 week to receive crop advisories • Compile a 1-page usefulness report	
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical 40% Examination: 40% Total: 100%						

CROPPING SYSTEMS AND SUSTAINABLE INTENSIFICATION

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: CROPPING SYSTEMS AND SUSTAINABLE INTENSIFICATION	COURSE CODE: CPT 314	CONTACT HOURS: 3 HOUR/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to provide students with knowledge and skills of different cropping systems in Nigeria for productive and sustainable agriculture.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand cropping systems; 2.0 Understand sole cropping and continuous cropping; 3.0 Understand mixed cropping, intercropping and relay cropping; 4.0 Know crop rotation and its agronomic benefits; 5.0 Know conservation agriculture and agroforestry systems;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: CROPPING SYSTEMS AND SUSTAINABLE INTENSIFICATION			COURSE CODE: CPT 314		CONTACT HOURS: 3 HOUR/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills of different cropping systems in Nigeria for productive and sustainable agriculture.						
General Objective 1.0: Understand cropping systems						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 3	1.1 Explain cropping system, cropping pattern, cropping intensity 1.2 Classify cropping systems: according to time, space, temporal, and water sources 1.3 Describe factors influencing choice of cropping system 1.4 Explain Land Equivalent Ratio (LER) and other productivity	- Explain with illustrations, cropping system, cropping pattern, cropping intensity - Explain cropping systems: according to time, space, temporal, and water sources - Explain the factors influencing choice of cropping system - Describe the calculation of Land Equivalent Ratio (LER), cropping	Cropping systems textbooks, Nigerian farming systems atlas, FAO publications, LER calculation worksheet, LCD projector and marker board	- Survey local farms - Document the cropping systems, - Classify each and tabulate findings - Calculate LER for a cereal-legume intercrop trial.	Guide students to: - Survey local farms - Document the cropping systems, - Classify each and tabulate findings - Calculate LER for a cereal-legume intercrop trial.	Farm survey questionnaire, LER worksheet, calculator, Land area measurement tools, sample yield data

	indices	intensity and other productivity indices				
GENERAL OBJECTIVE 2.0: Understand sole cropping and continuous cropping						
4 – 6	2.1 Explain sole cropping 2.2 Explain the merits and demerits of sole cropping 2.3 Explain continuous cropping 2.4 Describe sole cropping practices for major Nigerian crops 2.5 Explain mechanization suitability and yield potentials under sole cropping	• Explain sole cropping • Explain the merits and demerits of sole cropping • Explain continuous cropping • Describe sole cropping practices for major Nigerian crops • Explain mechanization suitability and yield potentials under sole cropping	Sole crop plot photographs, FAOSTAT yield data, fertilizer brochures, mechanization case studies, Audio visuals, LCD projector and marker board	• Establish a 100 m² sole cereal plot at recommended spacing • Apply fertilizer and manage to harvest • Calculate yield (t/ha) • Compare yields of a sole with the same crop intercropped on similar plot	Guide students to: • Establish a 100 m² sole cereal plot at recommended spacing • Apply fertilizer and manage to harvest • Calculate yield (t/ha) • Compare yields of a sole with the same crop intercropped on similar plot	School farm, cereal seeds, NPK, hoes, measuring tape, weighing scale; sole and intercrop plot data records.
GENERAL OBJECTIVE 3.0: Understand mixed cropping, intercropping and relay cropping						
7 – 9	3.1 Distinguish between mixed cropping, intercropping, and	• Compare and contrast between mixed cropping, intercropping and	Cropping systems textbooks, intercrop	• Establish a 100 m² cereal-legume additive intercrop on the school farm;	Guide students to: • Establish a 100 m² cereal-legume additive intercrop	School farm, cereal and legume seeds, fertilizer,

	relay cropping 3.2 Describe popular Nigerian crop combinations 3.3 Explain the advantages, disadvantages and trade-offs of each system	relay cropping - Explain the popular Nigerian crop combinations - Discuss the advantages, disadvantages and trade-offs of each system	manuals, Nigerian farming systems photographs, Audio visuals, LCD projector	- Measure plant height of both species at 4, 6 and 8 WAP - Calculate LER, gross monetary return for intercrop vs sole cereal	on the school farm; - Measure plant height of both species at 4, 6 and 8 WAP - Calculate LER, gross monetary return for intercrop vs sole cereal	measuring tape, ruler; market price data, calculator
GENERAL OBJECTIVE 4.0: Know crop rotation and its agronomic benefits						
10 - 12	4.1 Explain crop rotation 4.2 Describe a crop rotation plan for a smallholder farm in southern and northern Nigeria 4.3 Explain benefits of crop rotation	- Discuss crop rotation - Explain a crop rotation plan for a smallholder farm in southern and northern Nigeria - Explain benefits of crop rotation	Textbooks, legume rotation guide, FMAFS farm planning guide, Audio visuals, LCD projector	- Design a 2-year crop rotation plan for a 1 ha smallholder farm; justify each year's choice - Observe a 2-year rotated plot compared to a continuously cropped plot on campus; - Record pest, weed and yield differences	Guide students to: - Design a 2-year crop rotation plan for a 1 ha smallholder farm; justify each year's choice - Observe a 2-year rotated plot compared to a continuously cropped plot on campus; - Record pest, weed and yield differences	Rotation planning template, calculator; rotated and continuous plots, observation sheet
GENERAL OBJECTIVE 5.0: Know conservation agriculture, agroforestry and sustainable intensification						
12 –15	5.1 Explain sustainable intensification	Explain sustainable intensification (SI) and conservation	FAO CA brochures, ICRAF	Establish a 50 m² mucuna cover crop plot adjacent to a	Guide students to: Establish a 50 m² mucuna cover crop	Mucuna seeds, school farm plot, weighing scale,

	(SI) and conservation agriculture (CA)	agriculture (CA)	agroforestry manual, IITA cover crop guide, alley cropping diagrams, LCD projector	maize plot	plot adjacent to a maize plot	graph paper, calculator, alley cropping reference
	5.2 Describe cover crops and green manures	• Explain cover crops and green manures • Discuss agroforestry; • Explain SI indicators: yield gain, soil organic carbon, biodiversity, water-use efficiency, GHG balance		• Measure biomass and N contribution at 12 WAP • Design an alley cropping layout for a 1 ha farm with Leucaena/Gliricidia and cereal/legume • Calculate alley spacing	• Measure biomass and N contribution at 12 WAP • Design an alley cropping layout for a 1 ha farm with Leucaena/Gliricidia and cereal/legume • Calculate alley spacing	
	5.3 Explain agroforestry					
	5.4 Explain SI indicators: yield gain, soil organic carbon, biodiversity, water-use efficiency, GHG balance					

COURSE ASSESSMENT:

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

CROP FARM PRACTICE I

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: CROP FARM PRACTICE I	COURSE CODE: CPT 315	CONTACT HOURS: 4 HOUR/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to provide students with the knowledge and skills to carry out routine and seasonal field crop production operations.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know the techniques of land clearing, preparation and seedbed establishment; 2.0 Understand planting operations for annual crops; 3.0 Comprehend crop maintenance, fertilization, weeding and pest/disease scouting; 4.0 Understand the techniques of harvesting and immediate post-harvest handling; 5.0 Understand the operation and maintenance of farm machinery, application of farm safety and record keeping;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: CROP FARM PRACTICE I			COURSE CODE: CPT 315		CONTACT HOURS: 4 HOUR/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with the knowledge and skills to carry out routine and seasonal field crop production operations.						
GENERAL OBJECTIVE 1.0: Know the techniques of land clearing, preparation and seedbed establishment						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 3	1.1 Describe methods of land clearing 1.2 Describe primary and secondary tillage; the merits and demerits of conventional, minimum and zero tillage 1.3 Describe seedbed types appropriate for different crops ridges (cassava, maize), mounds (yam), raised beds (vegetables)	- Discuss the methods of land clearing - Discuss primary and secondary tillage; the merits and demerits of conventional, minimum and zero tillage - Discuss seedbed types appropriate for different crops ridges (cassava, maize), mounds (yam), raised beds (vegetables)	Land preparation textbooks, machinery brochures, conservation tillage publications, LCD projector	- Clear, plough and harrow a 100 m² farm area - Record time and labour - Construct flat seedbed, ridges and mounds suitable for different crops	Guide students to: - Clear, plough and harrow a 100 m² farm area using hand tools and (where available) tractor + disc plough - Record time and labour - Construct flat seedbed, ridges and mounds suitable for different crops	School farm, cutlasses, hoes, farm machines, power tillers / tractor with implements, measuring tape, stopwatch, logbook
GENERAL OBJECTIVE 2.0: Understand planting operations for annual crops						

4 - 6	2.1 Describe viable seeds and pre-plant seed treatment 2.2 Outline planting operations for major annual crops 2.3 Explain proper spacing, depth and seed rate as recommended 2.4 Explain nursery establishment for crop transplanting (tomato, pepper, rice etc.)	• Discuss the process of identifying viable seeds and pre-planting seed treatment • Discuss the planting operations for major annual crops • Discuss proper spacing, planting depth and seed rate as recommended for major crops • Discuss the operations for establishment nurseries for transplanted crops (tomato, pepper, rice)	Textbooks, , Journals LCD projector	• Conduct germination test on 100 seeds of cereal and legume; • Calculate germination percentage • Plant 100 m² each of cereal and legume at recommended spacing • Record planting date and seed rate per ha • Establish a vegetable nursery • Transplant after 4 weeks	Guide students to: • Conduct germination test on 100 seeds of cereal and legume • Calculate germination percentage • Plant 100 m² each of cereal and legume at recommended spacing; record planting date and seed rate per ha • Establish a vegetable nursery • Transplant after 4 weeks	Cereal and legume seeds, blotting paper, petri dishes; school farm, dibble sticks, measuring tape, log book; nursery boxes, soil, manure, vegetable seeds
GENERAL OBJECTIVE 3.0: Comprehend crop maintenance: fertilization, weeding and pest/disease scouting						
7 - 9	3.1 Describe fertilizer requirements for various crops 3.2 Explain various methods of application 3.3 Explain safety and health precautions measures in	• Explain fertilizer requirements for various crops • Explain various methods of application • Explain safety and health precautions measures in	LCD projector Marker Board, Textbooks.	• Calculate NPK 15:15:15 at 200 kg/ha basal and urea at 100 kg/ha top-dress on the maize plot • Apply NPK 15:15:15 at 200 kg/ha basal and urea at 100 kg/ha top-dress on the maize plot	Guide students to: • Calculate NPK 15:15:15 at 200 kg/ha basal and urea at 100 kg/ha top-dress on the maize plot • Apply NPK 15:15:15 at 200 kg/ha basal and urea at 100 kg/ha top-dress on the	Fertilizer, calculator, weighing scale, school farm; herbicide, knapsack sprayer, PPE; smartphones with Plantix, scouting record sheets

	fertilizer application 3.4 Describe methods of weed control. 3.5 Explain fields for pests and diseases using Plantix or Nuru AI 3.6 Describe IPM methodologies in pest management	fertilizer application • Discuss methods of weed control. • Explain fields for pests and diseases using Plantix or Nuru AI • Explain IPM methodologies in pest management		• Mix herbicide for 100 m² weed-infested plot using calibrated knapsack; • Apply the mixed herbicide on a 100 m² weed-infested plot using knapsack sprayer; • Observe weed control after 7 and 14 DAT • Scout cereal and legumes plots weekly using Plantix • Record findings	maize plot • Mix herbicide for 100 m² weed-infested plot using calibrated knapsack; • Apply the mixed herbicide on a 100 m² weed-infested plot using knapsack sprayer; • Observe weed control after 7 and 14 DAT • Scout cereal and legumes plots weekly using Plantix • Record findings	
GENERAL OBJECTIVE 4.0: Understand the techniques of harvesting and immediate post-harvest handling						
10 - 12	4.1 Describe harvest maturity for major annual crops 4.2 Describe manual and machines harvest 4.3 Explain threshing, drying, cleaning and grading 4.4 Describe packaging into hermetic bags / silos and label	• Discuss harvest maturity for major annual crops • Explain manual and machines harvest • Explain threshing, drying, cleaning and grading • Discuss packaging	LCD projector Marker Board, Textbooks.	• Harvest 100 m² cereal plot; thresh, dry to 13% moisture, clean, weigh and pack in hermetic bag • Harvest 100 m² legume plot; thresh, treat with Actellic 2% dust, store in hermetic bag	Guide students to: • Harvest 100 m² cereal plot; thresh, dry to 13% moisture, clean, weigh and pack in hermetic bag • Harvest 100 m² legume plot; thresh, treat with Actellic 2% dust, store in hermetic bag	Cereal and legumes harvest, harvesting tools, thresher, moisture meter, sieves, hermetic bags, Actellic dust, weighing scale, labels

		into hermetic bags / silos and label				
GENERAL OBJECTIVE 5.0: Understand the operation and maintenance of farm machinery, application of farm safety and record keeping						
13 – 15	5.1 Describe basic farm machinery 5.2 Explain basics farm machinery operation, maintenance, use safety precaution 5.2 Explain the maintenance of a daily farm operations record book	• Discuss basic farm machinery • Explain basics farm machinery operation, maintenance, use safety precaution • Explain the maintenance of a daily farm operations record book	LCD projector Marker Board, Textbooks.	• Carry out tractor pre-start check • Attach implement and drive safely on practice ground • Carry out greasing, oil-level check and blade sharpening on at least 3 hand tools • Maintain a daily farm operations log for the entire semester	Guide students to: • Carry out tractor pre-start check • Attach implement and drive safely on practice ground • Carry out greasing, oil-level check and blade sharpening on at least 3 hand tools • Maintain a daily farm operations log for the entire semester	Tractor, implements, grease gun, oil and oil pan, files, hand tools, PPE, first aid kit, log book
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical 40% Examination: 40% Total: 100%						

ANNUAL CROPS

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: ANNUAL CROPS	COURSE CODE: CPT 316	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills of major annual crops production and post-harvest handling.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know the classification and importance of annual crops; 2.0 Understand the agronomy of major cereal crops; 3.0 Understand the agronomy of major legume and oilseed crops; 4.0 Know the production of major root and tuber crops; 5.0 Understand integrated crop management and post-harvest handling of annual crops;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: ANNUAL CROPS			COURSE CODE: CPT 316		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills of major annual crops production and post-harvest handling.						
GENERAL OBJECTIVE 1.0: Know the classification and importance of annual crops.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1 - 2	1.1 Define annual crops. 1.2 Describe annual, biennial and perennial crops. 1.3 Explain the classification of annual crops by: i. Botanical family ii. Economic use (cereals, legumes, oilseeds, roots and tubers, vegetables, fibre) iii. Cropping season (long season, short season) 1.4 Explain the economic and food security importance of annual crops in Nigeria. 1.5 List major annual crops grown in Nigeria with local and botanical names.	• Explain annual crops and distinguish biennial and perennial crops • Explain the classification of annual crops using botanical names: Poaceae (cereals), Fabaceae (legumes), Euphorbiaceae (cassava) • Discuss Nigeria's food production statistics; • Explain contribution of annual crops to GDP, employment and export • Explain major annual crops grown in Nigeria with local and botanical names: <i>Zea mays</i> (maize),	Textbooks, FAOSTAT Nigeria crop production data, classification charts, projector, white/smart board, markers, internet,.	• Identify 15 annual crop specimens (seeds or fresh plant) by local and botanical name; • Classify each by economic use group and botanical family	Guide students to: • Identify 15 annual crop specimens (seeds or fresh plant) by local and botanical name; • Classify each by economic use group and botanical family	Annual crop specimens (seeds, dried plants), identification charts, classification table template, annual crops samples, smartphones, PPE

		<i>Sorghum bicolor</i> (sorghum), <i>Pennisetum glaucum</i> (millet), <i>Oryza sativa</i> (rice), <i>Vigna unguiculata</i> (cowpea), <i>Glycine max</i> (soybean), <i>Manihot esculenta</i> (cassava), <i>Ipomea batatas</i> (sweet potato)				
General Objective 2.0: Understand the agronomy of major cereal crops.						
3 - 5	2.1 Describe the botany, ecology and varieties of maize (<i>Zea mays</i>): - Growth stages (V1–VT–R1–R6) - Improved varieties: SAMMAZ, OBA series, Tela Maize (a GMO seed), etc. 2.2 Explain agronomic practices for maize 2.3 Describe production of rice (upland, lowland, irrigated systems) 2.4 Describe production of sorghum and pearl millet: varieties, management, bird control 2.2 Explain fall armyworm (FAW) management in cereals using IPM.	- Describe the botany, ecology and varieties of maize (<i>Zea mays</i>): - Growth stages (V1–VT–R1–R6) - Improved varieties: SAMMAZ, OBA series, Tela Maize (a GMO seed), etc. - Explain agronomic practices for maize - Describe production of rice (upland, lowland, irrigated systems) - Explain production of sorghum and pearl millet: varieties, management, bird control - Explain fall armyworm (FAW) management in cereals using IPM	Textbook Journal Internet Projector Marker Whiteboard	- Establish maize and cowpea plots at recommended spacing - Apply basal fertilizer - Carry out weed control; - Scout for FAW using Plantix app - Record infestation - Apply appropriate control - Harvest maize at physiological maturity - Thresh manually - Measure grain moisture - Calculate yield per hectare	Guide students to: - Establish maize and cowpea plots at recommended spacing - Apply basal fertilizer - Carry out weed control; - Scout for FAW using Plantix app - Record infestation - Apply appropriate control - Harvest maize at physiological maturity - Thresh manually	School farm plots, fertilizer, urea, herbicide (atrazine), measuring tape, knapsack sprayer, PPE; smartphones (Plantix), pheromone traps; harvesting tools, moisture meter, weighing scale

					• Measure grain moisture • Calculate yield per hectare	
General Objective 3.0: Understand the agronomy of major legume and oilseed crops.						
6 - 8	3.1 Explain the botany, ecology and varieties of cowpea (<i>Vigna unguiculata</i>): 3.2 Explain agronomic practices for cowpea: spacing, fertilization (P only), IPM 3.3 Describe production of soybean (<i>Glycine max</i>): varieties, rhizobium inoculation, herbicide use 3.4 Explain groundnut (<i>Arachis hypogaea</i>) production: varieties, earthing-up, aflatoxin management 3.5 Describe sesame (<i>Sesamum indicum</i>) production and export potential	• Explain the botany, ecology and varieties of cowpea (<i>Vigna unguiculata</i>): • Explain agronomic practices for cowpea: spacing, fertilization (P only), IPM • Explain production of soybean (<i>Glycine max</i>): varieties, rhizobium inoculation, herbicide use • Explain groundnut (<i>Arachis hypogaea</i>) production: varieties, earthing-up, aflatoxin management • Discuss sesame (<i>Sesamum indicum</i>) production and export potential	Textbook Journal Internet Projector Marker Whiteboard	• Inoculate seeds with Rhizobium culture • Plant at 60×5 cm; count and weigh nodules at 6 WAP; • Compare nodulation with uninoculated control • Carry out earthing-up operation on groundnut plots at 3 WAP • Harvest at physiological maturity • Calculate pod yield per hectare	Guide students to: • Inoculate seeds with Rhizobium culture • Plant at 60×5 cm; count and weigh nodules at 6 WAP; • Compare nodulation with uninoculated control • Carry out earthing-up operation on groundnut plots at 3 WAP • Harvest at physiological maturity • Calculate pod yield per hectare	Seeds, Rhizobium culture, cowpea plots, measuring tape; groundnut plots, earthing-up tools, harvesting tools, weighing scale
General Objective 4.0: Know the production of major root and tuber crops.						
9 - 11	4.1 Describe the botany, ecology and varieties of cassava 4.2 Explain cassava agronomic practices	• Describe the botany, ecology and varieties of cassava (<i>Manihot esculenta</i>): - Improved varieties:	Textbooks, Projector, white/smart board, markers,	• Establish a 5x10 m cassava farm carrying out all production and management practices.	Guide students to; • Establish a 5x10 m cassava farm carrying out all production and	Cassava stems, NPK fertilizer, herbicides, measuring

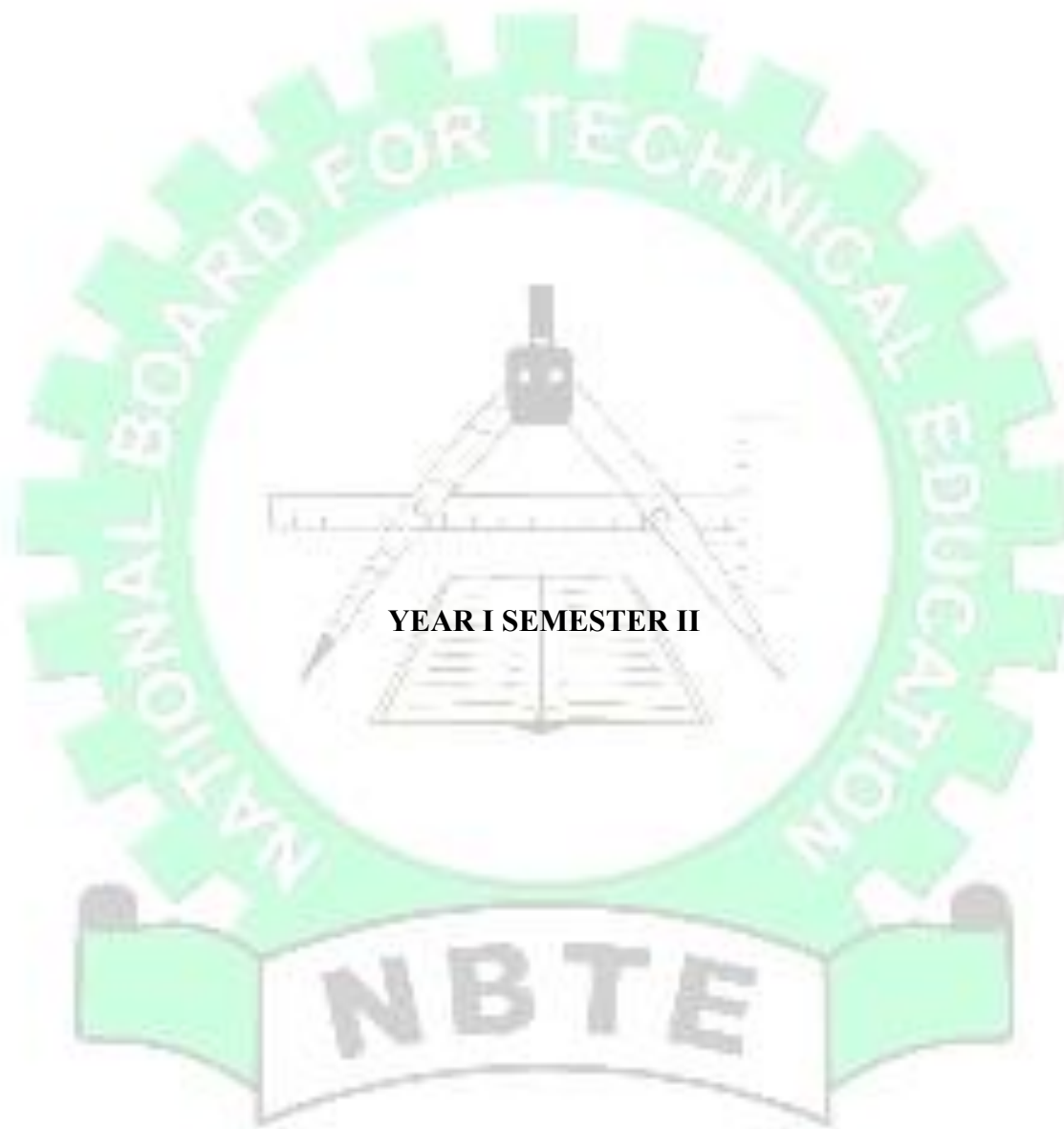
	4.3 Describe yam (<i>Dioscorea spp.</i>) production 4.4 Explain sweet potato (<i>Ipomoea batatas</i>) production.	TMS 30572, IITA TMEB varieties, Pro-vitamin A cassava • Explain cassava agronomic practices • Describe yam (<i>Dioscorea spp.</i>) production: varieties, sett preparation, staking, earthing-up, harvest • Explain sweet potato (<i>Ipomoea batatas</i>) production: varieties, vine cutting propagation, management	internet,	• Record growth parameters at regular interval • Prepare yam mounds and plant setts • Carry out staking and earth-up at 6 WA • Prepare field production records	management practices. • Record growth parameters at regular interval • Prepare yam mounds and plant setts • Carry out staking and earth-up at 6 WA • Prepare field production records	tape, ruler; yam mounds, ridger, tractors, planters, sweet potato vines, cassava disease guide, Plantix app, yam setts, stakes, hoes, weighing scale, PPE, smartphones
General Objective 5.0: Understand integrated crop management and post-harvest handling of annual crops.						
12 - 15	5.1 Explain Integrated Crop Management (ICM) 5.2 Describe major post-harvest losses in annual crops and describe their causes 5.3 Describe post-harvest handling for cereals. 5.4 Describe post-harvest handling for legumes. 5.5 Explain value addition for annual crops 5.6 Explain equipment and quality control measures during value addition of annual crops	• Explain ICM and how agronomic practices, variety selection, fertilization and IPM interact to optimise yield • Explain major post-harvest losses in annual crops and describe their causes • Describe post-harvest handling for cereals: threshing, drying, cleaning, storage in hermetic bags/silos • Describe post-harvest	Textbooks, Projector, white/smart board, markers, internet	• Prepare an integrated crop management (ICM) plan for a major annual crop • Carry out cowpea shelling; cleaning; treating with Actellic 2% dust at 1 g/kg; hermetic storage; fumigation with Phostoxin • Determine the moisture content before and after drying • Carry out storage in	• Guide students to: Prepare an integrated crop management (ICM) plan for a major annual crop • Carry out cowpea shelling; cleaning; treating with Actellic 2% dust at 1 g/kg; hermetic	Manuals, Thresher, moisture meter, hermetic bags soybeans, blender, filter cloth, cooker, threshers, flavour weighing scale, PHL calculation sheet, Actellic dust, silo, processing

		handling for legumes: shelling, cleaning, treatment with Actellic dust, hermetic storage • Explain value addition for annual crops: maize flour, garri, soy milk, groundnut oil extraction • Explain equipment and quality control measures during value addition of annual crops		hermetic bag • Carry out processing of 2 kg soybeans into soy milk: soak, blend, filter, boil, add flavour; assess quality • Determine percentage post-harvest loss from a stored maize sample compared with initial weight • Prepare record of processing activities	storage; fumigation with Phostoxin • Determine the moisture content before and after drying • Carry out storage in hermetic bag • Carry out processing of 2 kg soybeans into soy milk: soak, blend, filter, boil, add flavour; assess quality • Determine percentage post-harvest loss from a stored maize sample compared with initial weight • Prepare record of processing activities	equipment (grater, press, mill), quality testing tools, PPE, smartphones,
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COURSE ASSESSMENT:

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





YEAR I SEMESTER II

FIELD EXPERIMENTATION AND DATA ANALYSIS

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: FIELD EXPERIMENTATION AND DATA ANALYSIS	COURSE CODE: AGR 302	CONTACT HOURS: 2 HOURS/WEEK
	CREDIT UNIT: 2	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 1 HOUR/WEEK
GOAL: This course is designed to equip students with the knowledge and skills of field experimentation, statistical data collection, analysis and interpretation for applied agricultural research.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles of agricultural experimentation. 2.0 Know the basic experimental designs used in agricultural research. 3.0 Understand data collection methods and measurement in field experiments. 4.0 Know the application of basic descriptive and inferential statistical methods to agricultural data. 5.0 Understand analysis of variance (ANOVA) and mean separation techniques. 6.0 Know correlation, regression and non-parametric methods. 7.0 Understand the preparation and presentation of research reports.		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
Course Title: Field Experimentation and Data Analysis			Course Code: AGR 302		Contact Hours: 2 Hours/week	
			Credit Unit: 2		Theoretical: 1 Hour/week	
Year: I Semester: II			Pre-requisite:		Practical: 1 Hour/week	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills of field experimentation, statistical data collection, analysis and interpretation for applied agricultural research.						
GENERAL OBJECTIVE 1.0: Understand the principles of agricultural experimentation.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Define field experimentation. 1.2 Explain its importance in agricultural research. 1.3 Explain the three basic principles of experimental design: i. Replication ii. Randomization iii. Local control (blocking) 1.4 Explain the following terms: treatments, experimental units, plots and blocks. 1.5 Explain the sources of experimental error and methods of minimising	• Explain field experimentation • Explain its importance in agricultural research • Explain the three basic principles of experimental design: - Replication - Randomization - Local control (blocking) • Explain the following terms: treatments, experimental units, plots and blocks • Explain the sources of experimental error and methods of minimising error	Textbooks, field layout diagrams, projector, white/smart board, marker,	• Identify two or three directional slopes • Propose the direction of blocks for a particular slope to improve precision. • Take right-angles with ropes, tapes and ranging poles • Prepare reports	Guide students to: • Identify two or three directional slopes • Propose the direction of blocks for a particular slope to improve precision. • Take right-angles with ropes, tapes and ranging poles • Prepare reports	Farmland, Tapes, Poles, Ropes, Pegs, Cutlass, GPS,

	error.					
General Objective 2.0: Know the basic experimental designs used in agricultural research.						
3-4	2.1 Describe the layout of Completely Randomised Design (CRD). 2.2 Describe the layout of a Randomised Complete Block Design (RCBD). 2.3 Describe the layout of Latin Square Design (LSD). 2.4 Describe Factorial Experiments. 2.5 Describe Split Plot and Strip Plot designs and their applications. 2.6 Explain layout in relation to field contour to achieve effective blocking.	• Explain CRD: homogeneous experimental material; layout with example; describe analysis • Explain RCBD: heterogeneous field; describe blocking direction relative to gradient; layout and randomisation • Explain LSD: two-way blocking; show 5×5 example; • Explain factorial notation; describe main effects and interactions; show a 2×3 factorial example • Explain split-plot assignment of main and sub-plot factors; describe strip plot; give agronomic examples • Explain layout in relation to field contour to achieve effective blocking	Textbooks, field layout diagrams, projector, white/smart board, marker,	• Carry out the layout of a simple 5-treatment by 3 replicates CRD experiment in the laboratory • Randomly assign treatments to experimental units (plots) in the CRD layout using random number table or balloting • Label each plot • Identify potential sources of error in the layout plan • Propose corrective measures • Layout an RCBD with 5 treatments and 3 replications on the school farm • Draw the field plan to scale on graph paper • Randomly assign treatments to experimental units (plots) in the RCBD layout using random	Guide students to: • Carry out the layout of a simple 5-treatment by 3 replicates CRD experiment in the laboratory • Randomly assign treatments to experimental units (plots) in the CRD layout using random number table or balloting • Label each plot • Identify potential sources of error in the layout plan • Propose corrective measures • Design and layout an RCBD with 5 treatments and 3 replications on the school farm • Draw the field plan to scale on graph paper • Randomly assign treatments to	School farm, measuring tape, pegs, string, plot labelling cards, graph paper, pencils, random number table, field layout guide, statistical software (Excel, SPSS, GenStat, SAS, R, etc) outputs, smartphone, PPE,

				number table or balloting • Label each plot • Design a 2×3 factorial experiment (2 varieties × 3 fertilizer levels) • Carry out layout for Split Plot and Strip Plot designs on paper to learn the technique.	experimental units (plots) in the RCBD layout using random number table or balloting • Label each plot • Design a 2×3 factorial experiment (2 varieties × 3 fertilizer levels) • Carry out layout for Split Plot and Strip Plot designs on paper to learn the technique.	
General Objective 3.0: Understand data collection methods and measurement in field experiments.						
5-6	3.1 Explain types of data: quantitative (continuous, discrete) and qualitative (nominal, ordinal). 3.2 Describe methods of measurement: direct measurement, scoring, rating scales. 3.3 Explain sampling methods: simple random, stratified, systematic, cluster sampling, etc. 3.4 Explain time sensitive	• Explain types of data: quantitative (continuous, discrete) and qualitative (nominal, ordinal) • Discuss methods of measurement: direct measurement, scoring, rating scales • Discuss sampling methods: simple random, stratified, systematic, cluster	Textbooks, Projector, white/smart board, marker,	• Design a complete data collection sheet for the established CRD and RCBD trials • Carry out data collection of all relevant parameters using both direct measurement and rated score • Compare consistency between two observers	Guide students to: • Design a complete data collection sheet for the established CRD and RCBD trials • Carry out data collection of all relevant parameters using both direct measurement and rated score	Measuring tape, ruler; weighing scale, data sheet template, laptop/spreadsheet, smartphone, PPE

	nature of all operations. 3.5 Explain concepts of accuracy, precision, bias, validity, reliability, missing plots and mistakes in data collection.	sampling, etc. - Explain time sensitive nature of all operations - Explain concepts of accuracy, precision, bias, validity, reliability, missing plots and mistakes in data collection.			Compare consistency between two observers	
General Objective 4.0: Apply basic descriptive and inferential statistical methods to agricultural data.						
7-8	4.1 Define measures of central tendencies, 4.2 Calculate measures of central tendency: mean, median, mode. 4.3 Define measures of dispersion. 4.4 Calculate measures of variability (dispersion): range, variance, standard deviation, coefficient of variation (CV%). 4.5 Explain frequency distributions tables and histograms. 4.6 Explain the normal distribution and its properties. 4.7 Explain hypothesis testing: null hypothesis, alternative hypothesis, Type I and Type II errors, p-value, significance level.	- Explain mean, median and mode from sample crop data; explain when each is appropriate - Explain how to calculate range, variance, SD and CV% from crop yield data; explain CV% as a measure of experimental precision - Describe properties of normal distribution: symmetry, 68-95-99.7 rule; - Explain how many agricultural variables approximate normality - Explain hypothesis testing framework; define H_0 and H_1; explain Type I (reject true H_0) and Type II errors; describe p-value	Crop yield data sets, calculator, laptop with Excel or R, graph paper, Textbooks, Projector, white/smart board, marker	- Calculate mean, median, mode, SD and CV% for a provided maize yield dataset of 20 plots using manual methods (calculator) and softwares such as Excel, SPSS, Gen Start, - Construct a histogram and interpret the distribution. - Carry out a two-sample t-test using manual methods (calculator) and softwares such as Excel, SPSS, Gen Start; state H_0, H_1, interpret p-value and make conclusion	Guide students to: - Calculate mean, median, mode, SD and CV% for a provided maize yield dataset of 20 plots using manual methods (calculator) and softwares such as Excel, SPSS, Gen Start, - Construct a histogram and interpret the distribution. - Carry out a two-sample t-test using manual methods (calculator) and softwares such as Excel, SPSS, Gen Start; state H_0, H_1,	Dataset, calculator, laptops with softwares (Excel, SPSS, Gen Start, etc), graph paper

	4.8 Explain t-test.	interpretation Explain t-test and carry out a two-sample t-test		Carry out a two-sample t-test	interpret p-value and make conclusion Carry out a two-sample t-test	
General Objective 5.0: Understand analysis of variance (ANOVA) and mean separation techniques.						
9-10	5.1 Explain the purpose and assumptions of ANOVA. 5.2 Explain one-way ANOVA for CRD data. 5.3 Explain two-way ANOVA for RCBD data. 5.4 Explain how to apply mean separation tests: LSD, Duncan's Multiple Range Test (DMRT), Tukey's HSD.	- Explain the purpose and assumptions of ANOVA - Explain one-way ANOVA for CRD data - Explain two-way ANOVA for RCBD data - Discuss how to apply mean separation tests: LSD, Duncan's Multiple Range Test (DMRT), Tukey's HSD	Textbooks, Projector, white/smart board, marker	- Carry out complete ANOVA for the dataset obtained from the established CRD and RCBD trials by hand calculation - Present ANOVA results in a formatted table - Write the interpretation of the result. - Carry out post ANOVA test to the same CRD and RCBD data (a) LSD at 5%. (b) DMRT at 5%. - Carry out the ANOVA, LSD and DMRT of the same data set above using softwares such as Excel, SPSS, Gen Start, etc. and print out the output	- Guide students to: - Carry out complete ANOVA for the dataset obtained from the established CRD and RCBD trials by hand calculation - Present ANOVA results in a formatted table - Write the interpretation of the result. - Carry out post ANOVA test to the same CRD and RCBD data (c) LSD at 5%. (d) DMRT at 5%. - Carry out the ANOVA, LSD and DMRT of the same data set above using	Printed ANOVA worksheet, F-table, calculator; laptop with softwares (Excel, SPSS, Gen Start, etc) ANOVA table template,

				• Prepare the reports	softwares such as Excel, SPSS, Gen Start, etc. and print out the output • Prepare the reports	
General Objective 6.0: Know correlation, regression and non-parametric methods.						
11-12	6.1 Explain correlation. 6.2 Explain simple linear regression 6.3 Explain coefficient of determination (R^2). 6.4 Calculate coefficient of determination (R^2). 6.5 Explain non-parametric tests. 6.6 Explain parametric vs non-parametric tests.	• Discuss correlation. • Explain simple linear regression • Describe coefficient of determination (R^2). • Explain how to calculate coefficient of determination (R^2). • Explain non-parametric tests. • Discuss parametric vs non-parametric tests.	Textbooks, Projector, White/smart board, Marker, Calculator	• Calculate Pearson's r for a provided dataset of 10 paired values (e.g. rainfall vs. yield); • Plot scatter diagram; • Add regression line; • Calculate R^2 and interpret • Apply Chi-square test to a 2×3 contingency table of data • Carry out the above Pearson's r and Chi-square test using softwares such as Excel, SPSS, Gen Start, etc. and print out the output • Prepare all reports	Guide students to: • Calculate Pearson's r for a provided dataset of 10 paired values (e.g. rainfall vs. yield); • Plot scatter diagram; • Add regression line; • Calculate R^2 and interpret • Apply Chi-square test to a 2×3 contingency table of data • Carry out the above Pearson's r and Chi-square test using softwares such as Excel, SPSS, Gen Start, etc. and print out the	Printed paired dataset, graph paper, calculator; Chi-square contingency table worksheet, Chi-square table, laptops with softwares (Excel, SPSS, Gen Start, etc)

					output • Prepare all reports	
General Objective 7.0: Understand the preparation and presentation of research reports.						
13-15	7.1 Describe the standard structure of an agricultural research report: 7.2 Title, Abstract, Introduction, Literature Review, Materials & Methods, Results, Discussion, Conclusion, Recommendations, References 7.3 Describe the procedure for research report writing 7.4 Explain the different referencing styles: APA, Chicago, IAEJ, etc 7.5 Explain ethical considerations in agricultural research	• Describe each section's purpose, typical length and common mistakes • Guide drafting of Materials & Methods and Results sections from class experimental data • Demonstrate APA in-text citation and reference list format; compare with IAEJ journal style • Explain seminar structure: title, background, methods, results, discussion; guide poster layout design • Discuss plagiarism, data fabrication, authorship, informed consent in on-farm research	Textbooks, Projector, White/smart board, Marker, Calculator	• Prepare a complete Materials and Methods section for the CRD and RCBD experiments conducted earlier in the semester; include site, design, treatments, data collected and statistical analysis, etc used • Prepare a 10-slide • Prepare a PowerPoint presentation of field results	• Guide M&M writing; provide feedback using a marking rubric • Facilitate PowerPoint preparation; organise class presentations; guide Q&A	Laptop with MS Word and PowerPoint, projector, journal article examples, APA guide, IAEJ guidelines, marking rubric, smartphone
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

PRINCIPLES OF GENETICS AND MOLECULAR BIOTECHNOLOGY

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: PRINCIPLES OF GENETICS AND MOLECULAR BIOTECHNOLOGY	COURSE CODE: CPT 321	CONTACT HOURS: 2 HOURS/WEEK
	CREDIT UNIT: 2	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 1 HOUR/WEEK
GOAL: This course is designed to provide students with the knowledge and skills of heredity, molecular genetics and biotechnology.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand basic concepts of heredity and Mendelian genetics; 2.0 Know chromosomes, mitosis, meiosis and chromosomal aberrations; 3.0 Comprehend molecular genetics: DNA, RNA and gene expression; 4.0 Understand population genetics and quantitative inheritance; 5.0 Comprehend genetic engineering and biotechnology in crop improvement;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: PRINCIPLES OF GENETICS AND MOLECULAR BIOTECHNOLOGY			COURSE CODE: CPT 321		CONTACT HOURS: 2 HOURS/WEEK	
			CREDIT UNIT: 2		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 1 HOUR/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with the knowledge and skills of heredity, molecular genetics and biotechnology.						
GENERAL OBJECTIVE 1.0: Understand basic concepts of heredity and Mendelian genetics						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1– 3	1.1 Define genetics, heredity, gene, allele, genotype, phenotype, locus. 1.2 Explain Mendel's laws: segregation, independent assortment, dominance. 1.3 Explore monohybrid and dihybrid crosses to predict ratios. 1.4 Describe deviations from Mendelian ratios:-	• Explain genetics, heredity, gene, allele, genotype, phenotype, locus. • Discuss Mendel's laws: segregation, independent assortment, dominance. • Explain monohybrid and dihybrid crosses to predict ratios. • Discuss deviations from Mendelian ratios:-	Textbooks, Projector, White/smart board, Marker,	• Solve 5 genetic problems involving monohybrid and dihybrid crosses. • Show Punnett squares and final ratios • Demonstrate Mendelian ratios using bead-drawing simulation: • Simulate F2 generation with 64 draws. • Apply chi-square to test against 9:3:3:1	Guide students to: • Solve 5 genetic problems involving monohybrid and dihybrid crosses. • Show Punnett squares and final ratios • Demonstrate Mendelian ratios using bead-drawing simulation: • Simulate F2 generation with 64 draws. • Apply chi-square to test against 9:3:3:1	Genetic problems handout, Punnett square sheets; coloured beads (red/white), bag, chi-square table

General Objective 2.0: Know chromosomes, mitosis, meiosis and chromosomal aberrations

4 – 6	2.1 Describe chromosome structure: chromatin, centromere, telomere. 2.2 Describe mitosis 2.3 Describe meiosis I and II; crossing over, recombination, genetic linkage 2.4 Describe Chromosomal aberrations: - Deletion, - Duplication, - Inversion, - Translocation; - Aneuploidy, - Polyploidy.	- Discuss chromosome structure: chromatin, centromere, telomere, - Explain mitosis with diagrams and live time-lapse video; emphasize chromatid behaviour - Discuss meiosis I (homolog separation) and II (chromatid separation) - Discuss chromosomal aberrations: - Deletion, - Duplication, - Inversion, - Translocation; - Aneuploidy, - Polyploidy.	Textbooks, Projector, White/smart board, Marker,	- Examine prepared slides of onion root tip mitosis under microscope; identify and sketch each phase - Observe grasshopper testis squash for meiotic phases - Sketch and label observations	Guide students to: - Examine prepared slides of onion root tip mitosis under microscope; identify and sketch each phase - Observe grasshopper testis squash for meiotic phases - Sketch and label observations	Compound microscopes, prepared onion root tip slides, grasshopper testis squash slides, drawing materials, polyphloidy crop specimens, prepared mitosis/meiosis slides,
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General Objective 3.0: Comprehend molecular genetics: DNA, RNA and gene expression

7 – 10	3.1 Describe DNA structure. 3.2 Describe DNA replication, transcription, translation; central dogma 3.3 Describe gene structure:	- Discuss DNA structure: deoxyribose-phosphate backbone, A-T, G-C base pairing; antiparallel orientation - Explain semi-conservative	Molecular biology textbooks, Codon chart, transcription/translation animations, Audio visuals, LCD projector	- Construct a paper or 3D DNA double helix model showing 10 base pairs with correct A-T, G-C pairing - Identify an mRNA sequence, transcribe and	Guide students to: - demonstrate correct base pairing - Identify mRNA sequences and codon chart - Carry out translation and	DNA model kits, paper, scissors, glue; mRNA sequence handouts, codon chart, pencil
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	promoter, exons, introns, terminator 3.4 Explain mutations point, frameshift, silent, missense, nonsense; mutagens	replication; mRNA transcription by RNA polymerase; translation at ribosome with tRNA • Explain gene structure diagram; promoter (TATA box), 5' and 3' UTRs; intron splicing • Discuss classification of mutations; show codon table consequences; mutagens		translate into amino acids using a codon chart • Identify a point mutation effect (missense, silent, nonsense)	mutation analysis	
General Objective 4.0: Understand population genetics and quantitative inheritance						
11– 12	4.1 Define gene frequency, genotype frequency 4.2 Calculate allele and genotype frequencies in a population 4.3 Describe factors that change gene frequencies: mutation, selection, drift, migration 4.4 Describe quantitative inheritance,	• Discuss gene frequency; state Hardy-Weinberg $p^2 + 2pq + q^2 = 1$ • Discuss the calculation of allele and genotype frequencies in a population • Explain selection coefficients; genetic factors that change gene frequencies: mutation, selection, drift, migration • Explain quantitative inheritance,	Population genetics textbooks, Hardy-Weinberg calculation worksheets, calculator, LCD projector	• Calculate allele and genotype frequencies for a population given phenotype counts • Test Hardy-Weinberg equilibrium • Estimate broad-sense heritability h^2 from a giving data.	Guide students to • Carry out Hardy-Weinberg testing • Carry out variance partitioning and h^2 calculation	Phenotype dataset, calculator, Hardy-Weinberg worksheet; Plant height data, calculator

	polygenes, heritability (h^2)	polygenes, heritability (h^2)				
General Objective 5.0: Comprehend genetic engineering and biotechnology in crop improvement						
13 – 15	5.1 Define genetic engineering, recombinant DNA, transgenic (GM) crops, gene editing 5.2 Describe core molecular biotech techniques: restriction enzymes, gel electrophoresis, PCR, real-time qPCR, DNA sequencing (Sanger, NGS), vectors 5.3 Describe Nigerian and African biotech crops: PBR cowpea (IAR/AATF, 2019 — first GM food crop in Africa), Bt cotton (NABDA), Pro-Vitamin A cassava (HarvestPlus), golden rice	• Discuss genetic engineering, recombinant DNA, transgenic (GM) crops, gene editing • Explain core molecular biotech techniques: restriction enzymes, gel electrophoresis, PCR, real-time qPCR, DNA sequencing (Sanger, NGS), vectors • Discuss Nigerian and African biotech crops: PBR cowpea (IAR/AATF, 2019 — first GM food crop in Africa), Bt cotton (NABDA), Pro-Vitamin A cassava (HarvestPlus), golden rice • Explain CRISPR-Cas9 mechanism (gRNA, PAM, Cas9); demonstrate CRISPOR online tool	Molecular biotechnology textbooks, IAR PBR cowpea publications, NBMA regulatory guidelines, CRISPOR online tool, Audio visuals, LCD projector	• Demonstrate gel electrophoresis using DNA-stained dyes (or use a virtual lab); load wells, run gel, interpret bands • Design a guide RNA (gRNA) targeting a model crop gene (e.g. cowpea or maize); • Evaluate efficiency, off-target risks.	Guide students to • Demonstrate gel electrophoresis setup and operation • Use CRISPOR, review designed guides and report	Electrophoresis kit, agarose, DNA dye, gel tank, power source; laptop with internet, CRISPOR access, sample gene sequence; biotech lab/research institute, Smartphone for documentation

	Vitamin A cassava (HarvestPlus), golden rice 5.4 Describe CRISPR-Cas9 gene editing principles and design (with CRISPOR online tool); biosafety and NBMA regulation	for guide design; NBMA biosafety; Cartagena Protocol				
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical 40% Examination: 40% Total: 100%						

PLANT PATHOLOGY AND BIOLOGICAL CONTROL

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: PLANT PATHOLOGY AND BIOLOGICAL CONTROL	COURSE CODE: CPT 322	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to provide students with the knowledge and skills of plant pathology and biological control for sustainable crop production in Nigeria.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand classification of plant pathogens and disease concepts; 2.0 Understand fungal diseases of major crops in Nigeria; 3.0 Understand bacterial, viral, viroid and phytoplasma diseases; 4.0 Understand nematode diseases and abiotic disorders; 5.0 Understand integrated disease management (IDM) strategies; 6.0 Understand modern disease diagnostics;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: PLANT PATHOLOGY AND BIOLOGICAL CONTROL			COURSE CODE: CPT 322		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with the knowledge and skills of plant pathology and biological control for sustainable crop production in Nigeria.						
GENERAL OBJECTIVE 1.0: Understand classification of plant pathogens and disease concepts						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Define plant pathology, disease, pathogen, parasite, host, vector. 1.2 Classify plant pathogens: fungi, bacteria, viruses, viroids, phytoplasmas, nematodes. 1.3 Describe the disease triangle (host, pathogen, environment) and disease cycle 1.4 Describe symptoms from	• Discuss plant pathology, disease, pathogen, parasite, host, vector • Explain pathogens of crop diseases; with examples for each group • Explain disease triangle as conditions for disease; describe disease cycle: - inoculum - infection - colonization - sporulation • Discuss symptom (host response) from	Marker board, plant pathology textbooks (Agrios), pathogen classification charts, symptom photographs, LCD projector	• Collect 5 diseased plant samples from the school farm and surrounding fields; • Identify symptoms • Classify pathogen groups • Observe pathogen signs (mycelium, spores, bacterial ooze, virus particles diagram) using hand lens and microscope	Guide students to • Collect 5 diseased plant samples from the school farm and surrounding fields; • Identify symptoms • Classify pathogen groups • Observe pathogen signs (mycelium, spores, bacterial ooze, virus particles diagram) using hand lens and microscope	Diseased plant samples, hand lens, dissecting microscope, sample bags, labels, drawing materials

	signs; 1.5 State types of symptoms (necrosis, chlorosis, wilting, gall, mosaic)	sign (pathogen presence).				
GENERAL OBJECTIVE 2.0: Understand fungal diseases of major crops in Nigeria						
4 - 5	2.1 Classify fungal diseases: - Ascomycetes, - Basidiomycetes, - Zygomycetes, - Oomycetes, - Deuteromycetes. 2.2 Describe common fungal diseases of cereals: maize rust, smuts, downy mildew, head blight 2.3 Describe common fungal diseases of legumes: cowpea rust, anthracnose, root rot 2.4 Describe common fungal diseases of root/tubers and trees: cassava anthracnose, yam tuber rot, cocoa black pod (Phytophthora)	- Discuss fungal diseases: - Ascomycetes, - Basidiomycetes, - Zygomycetes, - Oomycetes, - Deuteromycetes. - Explain common fungal diseases of cereals: maize rust, smuts, downy mildew, head blight - Explain common fungal diseases of legumes: cowpea rust, anthracnose, root rot - Explain common fungal diseases of root/tubers and trees: cassava anthracnose, yam tuber rot, cocoa black pod (Phytophthora)	Marker board, Fungal disease photographs, IITA/ICRISAT disease guides, LCD projector	- Examine 5 fungal disease samples on slides under microscope; - Identify reproductive structures of uredospores, basidiospores, conidia. - Identify 5 fungal diseases by symptoms; - Collect samples - Isolate fungi on PDA	Guide students to: - Examine 5 fungal disease samples on slides under microscope; - Identify reproductive structures of uredospores, basidiospores, conidia. - Identify 5 fungal diseases by symptoms; - Collect samples - Isolate fungi on PDA	Diseased samples, lactophenol cotton blue, microscope slides, microscopes; PDA medium, petri dishes, alcohol, scalpel, incubator

GENERAL OBJECTIVE 3.0: Understand bacterial, viral, viroid and phytoplasma diseases

6 - 7	3.1 Describe bacterial diseases of cassava, rice and citrus. 3.2 Describe viral diseases of: Cassava, Maize and Cowpea. 3.3 Describe viroid and phytoplasma diseases (e.g. lethal yellowing of coconut) 3.4 Describe vector-borne diseases and control of disease vectors	• Explain bacterial diseases of cassava bacterial blight (CBB); rice bacterial leaf blight; citrus canker • Explain viral diseases of: Cassava Mosaic Disease (CMD), Cassava Brown Streak Disease (CBSD), Maize Streak Virus (MSV), Cowpea Aphid-Borne Mosaic Virus • Explain viroids as small RNA; phytoplasmas as wall-less prokaryotes; lethal yellowing in palms • Discuss vector identification and control methods (chemical cultural, planting of resistant varieties)	Plant pathology textbooks, IITA virus disease publications, Marker board, LCD projector	• Identify CMD and CBSD symptoms on cassava plots using Plantix or Nuru AI; • Map disease incidence in 100 m² plot • Demonstrate Streak test for bacterial diseases on suspect cassava and rice samples (immerse cut stem in water; observe milky exudate)	Guide students to: • Identify CMD and CBSD symptoms on cassava plots using Plantix or Nuru AI; • Map disease incidence in 100 m² plot • Demonstrate Streak test for bacterial diseases on suspect cassava and rice samples (immerse cut stem in water; observe milky exudate)	Cassava plots, smartphones with Plantix/Nuru AI, mapping sheet; suspect cassava and rice samples, water, transparent containers, scalpel
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GENERAL OBJECTIVE 4.0: Understand nematode diseases and abiotic disorders

8 - 9	4.1 Describe plant-parasitic nematodes: root-	• Explain plant-parasitic nematodes: root-knot	Marker board Nematology textbooks,	• Extract nematodes from soil samples with Baermann	Guide students to • Extract nematodes from soil samples	Soil samples, Baermann funnel, water,
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	knot (Meloidogyne), cyst (Heterodera), lesion (Pratylenchus) 4.2 Describe nematode symptoms and damage; sample collection and analysis 4.3 Describe nematode management methods of crop rotation, resistant varieties, nematicides, soil solarization 4.4 Describe abiotic disorders: nutrient deficiency, toxicity, water-logging, lightning, ozone damage.	(Meloidogyne), cyst (Heterodera), lesion (Pratylenchus) • Explain symptom diagnosis: galls, yellowing, stunting; describe Baermann funnel for extraction • Explain rotation with non-host crops (e.g. cassava-sorghum-cowpea); resistant tomato Mi gene; nematicides (Furadan); solarization • Discuss abiotic disorders: nutrient deficiency, toxicity, water-logging, lightning, ozone damage	Nematode photographs, abiotic disorder photographs, LCD projector	funnel • Identify under microscope by morphology • Document at least 3 abiotic disorders (with photographs); recommend corrective action	with Baermann funnel • Identify under microscope by morphology • Document at least 3 abiotic disorders (with photographs); recommend corrective action	microscope; vegetable plots, smartphones, recording sheets
GENERAL OBJECTIVE 5.0: Understand integrated disease management with emphasis on biological control						
10 - 12	5.1 Define IDM and biological control 5.2 Explain principles of biocontrol (antagonism, parasitism, induced resistance)	• Explain IDM and biological control; • Explain biocontrol modes (antagonism by Trichoderma, induced resistance by Bacillus,	Marker board, IDM textbooks, IITA biocontrol guide, IAR resistant variety catalogue, LCD projector	• Apply Trichoderma soil drench on a tomato plot • Compare disease incidence with untreated control at	Guide students to: • Apply Trichoderma soil drench on a tomato plot • Compare disease incidence with	Trichoderma product, tomato plots, watering can; AflaSafe product, groundnut plot, aflatoxin strip

	5.3 Describe key biocontrol agents in Nigerian agriculture 5.4 Describe cultural control: rotation, sanitation, planting time, resistant varieties; integration with biocontrol 5.5 Describe selective chemical control as last resort.	mycoparasitism) • Discuss each biocontrol agent: Trichoderma asperellum drench for soil-borne; AflaSafe broadcast for aflatoxin pre-harvest; Bacillus subtilis for post-harvest decay; mycoviruses (e.g. CHV1 hypovirus controlling chestnut blight) • Discuss rotation against soil-borne; resistant cassava (TME 419 CMD-resistant), rice (FARO 44 BLB-tolerant); integrate with biocontrol • Discuss selective chemical control as last resort: copper fungicide, mancozeb, systemic fungicides; IRAC/FRAC resistance management		4 and 8 WAP • Apply AflaSafe to a groundnut plot at flowering; • Harvest, dry, test for aflatoxin using strip; • Compare with untreated control • Prepare mancozeb fungicide • Apply on a cassava anthracnose-affected plot only after biocontrol assessment; • Assess disease severity before and 14 days after	untreated control at 4 and 8 WAP • Apply AflaSafe to a groundnut plot at flowering; • Harvest, dry, test for aflatoxin using strip; • Compare with untreated control • Prepare mancozeb fungicide • Apply on a cassava anthracnose-affected plot only after biocontrol assessment; • Assess disease severity before and 14 days after	kit; Sprayer, PPE, cassava plot, severity rating chart
GENERAL OBJECTIVE 6.0: Understand modern disease diagnostics						
13 - 15	6.1 Describe visual	• Discuss visual	Marker board,	• Use AI-based	Guide students to:	Smartphones

	diagnosis: inspection, microscopy, isolation. 6.2 Describe immunological diagnostics: ELISA, lateral flow strips 6.3 Describe molecular diagnostics: PCR, real-time PCR, LAMP 6.4 Explain AI-based smartphone apps.	diagnosis using diagnostic key; show isolation on PDA, NA media • Discuss immunological diagnostics: ELISA, lateral flow strips • Explain PCR primer design, denaturation, annealing, extension; LAMP for field diagnosis • Explain Plantix and Nuru AI use; explain AI-trained image recognition; show mobile diagnostic in real-time	Diagnostic key, Video, smartphones LCD projector	smartphone apps to diagnose at least 5 different crop diseases on the school farm; • Demonstrate ELISA and PCR; document procedure and applications.	• Use AI-based smartphone apps to diagnose at least 5 different crop diseases on the school farm; • Demonstrate ELISA and PCR; document procedure and applications.	with Plantix and Nuru AI; research lab access, notebooks, PPE
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COURSE ASSESSMENT:

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

CROP PRODUCTION II (CEREALS, LEGUMES, OILSEEDS)

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: CROP PRODUCTION II (CEREALS, LEGUMES, OILSEEDS)	COURSE CODE: CPT 323	CONTACT HOUR: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to provide students with knowledge and skills in the production of major cereal, legume and oilseed crops grown in Nigeria.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand classification and production of cereal crops; 2.0 Understand classification and production of legume and pulses crops; 3.0 Understand classification and production of oilseed crops; 4.0 Know post-harvest, handling, storage and marketing of cereal, legume and oilseed crops; 5.0 Know climate-smart practices and record keeping in cereal, legume/pulses and oilseed crops;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: CROP PRODUCTION II (CEREALS, LEGUMES, OILSEEDS)			COURSE CODE: CPT 323		CONTACT HOUR: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills in the production of major cereal, legume and oilseed crops grown in Nigeria.						
GENERAL OBJECTIVE 1.0: Understand classification and production of cereal crops.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 3	1.1 Explain the origin of cereal crops e.g maize, sorghum, rice etc. 1.2 Classify cereal crops based on use and growth characteristics. 1.3 Explain botanical characteristics of cereals. 1.4 Explain production and field management of cereal crops 1.5 Outline economic	• Discuss the origin of cereal crops e.g maize, sorghum, rice etc. • Describe cereal crops based on use and growth characteristics. • Describe botanical characteristics of cereals. • Explain production and field management of cereal crops • Explain economic	Textbooks, journals, white/smart boards, internet, charts, projector, crop samples, videos etc.	•Identify major cereal crops grown locally. •Classify cereal crops according to use and crop group. •Observe botanical characteristics of selected cereal crops. •Prepare crop identification records and herbarium samples. •Carry out production of some selected cereal crops •Document field	Guide students to: •Identify major cereal crops grown locally. •Classify cereal crops according to use and crop group. •Observe botanical characteristics of selected cereal crops. •Prepare crop identification records and herbarium samples. •Carry out prod``uction of some	Crop samples, seeds, planters, tractor, implements, power tillers, field plots, ICT tools, herbarium materials, hand lens, notebooks, smartphones, PPE, practical manual

	and nutritional importance of cereal crops.	and nutritional importance of cereal crops.		production records	selected cereal crops • Document field production records	
GENERAL OBJECTIVE 2.0: Understand classification and production of legume and pulses crops.						
4– 6	2.1 Explain the origin of legume crops e.g cowpea, Soybeans, groundnut etc. 2.2 Classify legume crops based on use and growth characteristics. 2.3 Explain botanical characteristics of legumes. 2.4 Explain production and field management of legume crops 2.5 Outline economic and nutritional importance of legume crops.	• Discuss the origin of legume crops e.g cowpea, Soybeans, groundnut etc. • Describe legume crops based on use and growth characteristics. • Describe botanical characteristics of legume. • Explain production and field management of legume crops • Explain economic and nutritional importance of legume crops.	Textbooks, journals, white/smart boards, internet, charts, projector, crop samples, videos etc.	• Identify major legume crops grown locally. • Classify legume crops according to use and crop group. • Observe botanical characteristics of selected legume crops. • Prepare crop identification records and herbarium samples. • Carry out production of some selected legume crops • Document field production records	Guide students to: • Identify major legume crops grown locally. • Classify legume crops according to use and crop group. • Observe botanical characteristics of selected legume crops. • Prepare crop identification records and herbarium samples. • Carry out production of some selected legume crops • Document field production records	Crop samples, seeds, planters, tractor, implements, power tillers, field plots, ICT tools, herbarium materials, hand lens, notebooks, smartphones, PPE, practical manual.
GENERAL OBJECTIVE 3.0: Understand classification and production of oilseed crops.						
7– 9	3.1 Explain the origin of oilseeds e.g sesame, sunflower, melon, etc.	• Discuss the origin of oilseeds e.g sesame, sunflower, melon, etc.	Textbooks, journals, white/smart boards, internet,	• Identify major oilseeds grown locally. • Classify oilseeds	Guide students to: • Identify major oilseeds grown	Crop samples, seeds, planters, tractor, implements,

	3.2 Classify oilseeds based on use and growth characteristics. 3.3 Explain botanical characteristics of oilseeds 3.4 Explain production and field management of oilseeds. 3.5 Outline economic and nutritional importance of oilseeds.	- Describe oilseeds based on use and growth characteristics. - Describe botanical characteristics of oilseeds. - Explain production and field management of oilseeds - Explain economic and nutritional importance of oilseeds.	charts, projector, crop samples, videos etc.	according to use. - Observe botanical characteristics of selected oilseeds. - Prepare crop identification records and herbarium samples. - Carry out production of some selected oilseeds - Document field production records	locally. - Classify oilseeds according to use. - Observe botanical characteristics of selected oilseeds. - Prepare crop identification records and herbarium samples. - Carry out production of some selected oilseeds - Document field production records	power tillers, field plots, ICT tools, herbarium materials, hand lens, notebooks, smartphones, PPE, practical manual.
GENERAL OBJECTIVE 4.0: Know post-harvest, handling, storage and marketing of cereal, legume and oilseed crops.						
10 – 12	4.1 Explain crop maturity indices for cereal, legume and oilseed crops 4.2 Describe harvesting methods and equipment in cereal, legume and oilseed production 4.3 Explain handling, sorting and grading in cereal, legume and oilseed production 4.4 Explain packaging	- Discuss crop maturity indices for cereal, legume and oilseed crops - Explain harvesting methods and equipment in cereal, legume and oilseed production - Describe handling, sorting and grading in cereal, legume and oilseed production	White/Smart boards, markers, textbooks, journals, internet, charts, projector, pest identification manuals, videos etc.	- Identify maturity indices in cereal, legume and oilseed crops - Identify harvesting equipment in cereal, legume and oilseed crops - Carry out harvesting and handling of cereal, legume and oilseed crops - Carry out sorting and grading	Guide students to: - Identify maturity indices in cereal, legume and oilseed crops - Identify harvesting equipment in cereal, legume and oilseed crops - Carry out harvesting and handling of cereal, legume and oilseed crops - Carry out sorting and	Threshers, storage bins, dryers, storage inputs, sprayers, Silo, warehouse, drying slabs, Smartphones PPE, practical manual, Harvesting tools, scales, grading tables, moisture meter, hermetic bags, open sacks, etc.

	and storage in cereal, legume and oilseed production 4.5 Describe primary processing for each crop group 4.6 Explain marketing in cereal, legume and oilseed production	• Describe packaging and storage in cereal, legume and oilseed production • Explain primary processing for each crop group • Explain marketing in cereal, legume and oilseed production		• Carry out threshing, winnowing and other processing operations. • Determine moisture content of selected crops before storage • Carry out packaging and storage of cereal, legume and oilseed crops • Conduct market survey of cereal, legume and oilseed crops • Document records of all the operations manually and digitally	grading • Carry out threshing, winnowing and other processing operations. • Determine moisture content of selected crops before storage • Carry out packaging and storage of cereal, legume and oilseed crops • Conduct market survey of cereal, legume and oilseed crops • Document records of all the operations manually and digitally	
GENERAL OBJECTIVE 5.0: Know climate-smart practices and record keeping in cereal, legume/pulses and oilseed crops						
13 – 15	5.1 Explain climate-smart agricultural practices in cereals, legumes and oilseed production. 5.2 Explain effects of climate change on cereals, legumes and oilseeds. 5.3 Explain climate risk adaptation practices in field	• Discuss climate-smart crop production using local farming examples. • Explain climate change effects on cereals, legumes and oilseeds. • Discuss farm documentation and record keeping	White/smart boards, markers, textbooks, journals, internet, climate-smart agriculture manuals, annual NIMET reports, charts, projector, videos, weather reports, farm record templates	• Carry out climate-smart demonstration for selected crops on already established plot. • Practice water-efficient irrigation and watering methods • Access weather information using smartphone weather	Guide students to: • Carry out climate-smart demonstration for selected crops on already established plot. • Practice water-efficient irrigation and watering methods • Access weather information using	GPS, Sensors, drones, robots, computer, irrigation materials, field plots, smartphones, weather apps, notebooks, farm record sheets, PPE, practical manual, crop

	crop production. 5.4 Explain farm record keeping in cereal, legume and oilseed production.	procedures. • Describe use of climate information for farm decision-making.		applications. • Interpret weather information using smartphone weather applications • Prepare climate-based planting calendar for selected crops. • Document farm records on planting date, weather condition, input use and crop performance.	smartphone weather applications. • Interpret weather information using smartphone weather applications • Prepare climate-based planting calendar for selected crops. • Document farm records on planting date, weather condition, input use and crop performance.	production records.
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical 40% Examination: 40% Total: 100%						

CROP FARM PRACTICE II AND PRECISION AGRICULTURE TOOLS

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: CROP FARM PRACTICE II AND PRECISION AGRICULTURE TOOLS	COURSE CODE: CPT 324	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to provide students with knowledge and skills of establishing, integrating-managing, fertilizing and harvesting crops with precision agriculture		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand crop establishment for cereals, legumes and oilseeds; 2.0 Understand integrated pest, disease and weed management practices; 3.0 Know modern fertilization (4Rs); 4.0 Know harvesting, post-harvest handling and value addition; 5.0 Understand comprehensive farm records with modern precision record-keeping tools;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: CROP FARM PRACTICE II AND PRECISION AGRICULTURE TOOLS			COURSE CODE: CPT 324		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills of establishing, integrating-managing, fertilizing and harvesting crops with precision agriculture						
GENERAL OBJECTIVE 1.0: Understand crop establishment for cereals, legumes and oilseeds						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 3	1.1 Explain certified seed source, seed selection, seed dressing and germination test 1.2 Explain the planting of: maize, sorghum, cowpea, soybean and groundnut at recommended spacing 1.3 Explain transplanting where applicable (e.g rice and vegetables)	• Discuss certified seed source, seed selection, seed dressing and germination test • Describe the planting of: maize, sorghum, cowpea, soybean and groundnut at recommended spacing • Discuss transplanting where applicable (e.g rice	Seeds of various crops, Apron Star sachets, dibble sticks, measuring tape, school farm, LCD projector	• Conduct germination test on 100 seeds of 4 crops (maize, cowpea, soybean, groundnut); • Calculate germination % and seed rate adjustment • Establish 100 m² each of maize, cowpea and groundnut at recommended spacing • Record planting	Guide students to: • Conduct germination test on 100 seeds of 4 crops (maize, cowpea, soybean, groundnut); • Calculate germination % and seed rate adjustment • Establish 100 m² each of maize, cowpea and groundnut at recommended spacing • Record planting date, seed rate, depth	Seed germination paper, Apron Star, petri dishes; school farm, dibble sticks, measuring tape, logbook; tomato seedlings, watering can

	1.4 Explain spot and broadcast sowing techniques	and vegetables) Discuss spot and broadcast sowing techniques		date, seed rate, depth Transplant tomato seedlings from nursery into a 50 m² ridged plot	Transplant tomato seedlings from nursery into a 50 m² ridged plot	
GENERAL OBJECTIVE 2.0: Understand integrated pest, disease and weed management practices						
4 – 6	2.1 Describe biological control: Bt, NPV, Trichoderma, Beauveria 2.2 Explain safe application of herbicides: (atrazine, glyphosate, paraquat) using knapsack 2.3 Explain the application of IPM/IDM action thresholds	- Explain Bt, Trichoderma application, timing and shelf life - Describe the application of herbicide mixing, calibration - Describe action thresholds; IRAC group rotation to delay resistance	Textbook Journal Internet Whiteboard Market projector	- Scout maize, cowpea and soybean plots weekly using Plantix; - Submit weekly scouting reports for 6 weeks - Apply Bt or Beauveria spray to a FAW-infested maize plot; - Compare with control after 7 and 14 days - Mix atrazine pre-emergence on maize plot - Apply atrazine pre-emergence on maize plot - Compare weed pressure with untreated plot	Guide students to: - Scout maize, cowpea and soybean plots weekly using Plantix; - Submit weekly scouting reports for 6 weeks - Apply Bt or Beauveria spray to a FAW-infested maize plot; - Compare with control after 7 and 14 days - Mix atrazine pre-emergence on maize plot - Apply atrazine pre-emergence on maize plot - Compare weed pressure with untreated plot	Smartphones, scouting record sheets; Bt/Beauveria, knapsack sprayer, PPE, FAW-infested plot; atrazine, sprayer, PPE, maize plot

GENERAL OBJECTIVE 3.0: Know modern fertilization (4Rs)

6 – 9	3.1 Explain fertilizer requirements based on soil test and target yield 3.2 Explain 4R principles: right source (NPK, urea, organic), right rate, right time (split), right place (band, side-dress) 3.3 Explain organic fertilizers: poultry manure, compost, vermicomposting 3.4 Explain micro-dosing technique for resource-poor smallholders	• Explain fertilizer requirements based on soil test and target yield • Explain 4R principles: right source (NPK, urea, organic), right rate, right time (split), right place (band, side-dress) • Explain organic fertilizers: poultry manure, compost, vermicomposting • Explain micro-dosing technique for resource-poor smallholders	Textbook Journal Internet Whiteboard Market projector	• Calculate NPK basal + urea split top-dress on maize plot • Apply NPK basal + urea split top-dress on maize plot • Record application date, rate and method • Prepare a 5 kg compost pile from crop residue, kitchen waste and poultry manure; turn weekly • harvest after 6–8 weeks • Apply micro-dosing on a sorghum plot • compare growth and yield with conventional broadcast	Guide students to: • Calculate NPK basal + urea split top-dress on maize plot • Apply NPK basal + urea split top-dress on maize plot • Record application date, rate and method • Prepare a 5 kg compost pile from crop residue, kitchen waste and poultry manure; turn weekly • harvest after 6–8 weeks • Apply micro-dosing on a sorghum plot • compare growth and yield with conventional broadcast	Soil test report, NPK, urea, calculator, weighing scale, school farm; compost bin, crop residue, manure, water; sorghum plot, NPK, sieve
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GENERAL OBJECTIVE 4.0: Know harvesting, post-harvest handling and value addition

10 – 12	4.1 Explain harvesting procedures for cereals, legumes	Explain harvesting procedures for cereals, legumes and oilseeds	Textbook Journal Internet	• Harvest and process 100 m² each of maize	Guide students to: • Harvest and process	Maize, cowpea, harvesting tools, thresher,
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	and oilseeds at maturity 4.2 Explain threshing, drying, cleaning and grading 4.3 Describe packaging into hermetic bags or silos and label correctly 4.4 Explain value addition: Pap, soy milk, garri, oil extraction etc.	at maturity Explain threshing, drying, cleaning and grading Explain packaging into hermetic bags or silos and label correctly Explain value addition: Pap, soy milk, garri, oil extraction etc.	Whiteboard Market projector	and cowpea; thresh, dry, pack and label hermetic bags • Process 5 kg maize into Pap; 2 kg soybean into soy milk; 2 kg groundnut into oil; • Document processing flow and yield	100 m² each of maize and cowpea; thresh, dry, pack and label hermetic bags • Process 5 kg maize into Pap; 2 kg soybean into soy milk; 2 kg groundnut into oil; • Document processing flow and yield	hermetic bags, moisture meter; soybean, groundnut, blender, hand press, frying pan
GENERAL OBJECTIVE 5.0: Understand comprehensive farm records with modern precision record-keeping tools						
13– 15	5.1 Explain GPS for mapping field boundaries and plot waypoints 5.2 Explain AI scouting tools (Plantix, Nuru AI, FAMEWS) for disease/pest scouting in field 5.3 Explain drone-based observation (DJI Mini, agricultural drones) for crop monitoring and	• Describe GPS waypoint capture; transfer to QGIS or Google Earth; calculate area • Discuss Plantix/Nuru AI/FAMEWS use for weekly scouting; show integration with farm decisions • Discuss DJI Mini agricultural drone flight; explain NDVI mapping for crop health	Textbook Journal Internet Whiteboard Market projector	• Map a 1 ha crop field using smartphone GPS; transfer to QGIS; calculate area and perimeter; • Produce a labelled field map • Use Plantix and Nuru AI to weekly-scout maize and cassava plots for 6 weeks • Submit consolidated scouting log with	Guide students to: • Map a 1 ha crop field using smartphone GPS; transfer to QGIS; calculate area and perimeter; • Produce a labelled field map • Use Plantix and Nuru AI to weekly-scout maize and cassava plots for 6 weeks • Submit consolidated scouting log with management recommendations	Smartphones with GPS apps, laptops with QGIS, Google Earth; smartphones with Plantix/Nuru AI/FAMEWS, scouting record sheets; laptops with Excel/Google Sheets, internet; smartphones with internet,

	NDVI mapping where available 5.4 Explain digital farm records using Excel/Google Sheets and mobile farm-management apps (FarmCrowdy, AGSMEIS portal, Hello Tractor, Zenvus Smartfarm)	• Explain Excel/Google Sheets templates; mobile apps for crop, input, labour, finance records		management recommendations • Set up an Excel farm record system with tabs for planting, inputs, labour, harvest and finance; populate with semester data • Register at least 1 farm-management mobile app (Zenvus, Hello Tractor or Farm Crowdy) and complete a sample data entry	• Set up an Excel farm record system with tabs for planting, inputs, labour, harvest and finance; populate with semester data • Register at least 1 farm-management mobile app (Zenvus, Hello Tractor or Farm Crowdy) and complete a sample data entry	app accounts
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COURSE ASSESSMENT:

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

AGRICULTURAL ENTOMOLOGY AND INTEGRATED PEST MANAGEMENT (IPM)

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: AGRICULTURAL ENTOMOLOGY AND INTEGRATED PEST MANAGEMENT (IPM)	COURSE CODE: CPT 325	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to provide students with knowledge and skills of insect classification and IPM.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand insect classification, morphology and anatomy; 2.0 Understand insect biology; 3.0 Know the major insect pests of cereals, legumes, root/tuber, vegetable and tree crops in Nigeria; 4.0 Understand insect pest sampling, scouting and economic thresholds; 5.0 Understand integrated pest management strategies; 6.0 Understand current pest threats and digital scouting tools;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: AGRICULTURAL ENTOMOLOGY AND INTEGRATED PEST MANAGEMENT (IPM)			COURSE CODE: CPT 325		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills of insect classification and IPM.						
GENERAL OBJECTIVE 1.0: Understand insect classification, morphology and anatomy						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 3	1.1 Define Entomology 1.2 Explain the classification of Insecta within Phylum Arthropoda 1.3 Describe insect external morphology 1.4 Describe insect internal anatomy 1.5 Explain the classification of major insect orders of agricultural importance	• Explain entomology • Discuss the classification of Insecta within Phylum Arthropoda • Explain insect body regions on diagrams - chewing, piercing, sucking, lapping, mouthparts • Explain open circulatory system; tracheal respiration ventral nerve cord; ovipositor function • Explain insect orders: Orthoptera,	Marker board, lecture notes, Entomology textbooks, chart, Projector	• Sketch external morphology of grasshopper, cockroach, beetle and butterfly using hand lens • Dissect a grasshopper to expose digestive and tracheal systems • Sketch and label structures observed	Guide students to: • Sketch the external morphology of grasshopper, cockroach, beetle and butterfly using hand lens • Dissect a grasshopper to expose digestive and tracheal systems • Sketch and label structures observed	Preserved insect specimens, hand lens, dissecting kit, dissecting microscope, drawing materials

		Hemiptera, Coleoptera, Lepidoptera, Diptera, Hymenoptera, Thysanoptera with examples				
GENERAL OBJECTIVE 2.0: Understand insect biology						
4 – 6	2.1 Describe insect reproduction: oviposition, viviparity, parthenogenesis 2.2 Describe metamorphosis: ametabolous, hemimetabolous, holometabolous 2.3 Explain insect development under temperature 2.4 Describe insect behaviour: feeding, mating, dispersal, diapause, migration	• Explain reproduction modes and cite examples (aphids parthenogenetic, tsetse viviparous) • Discuss metamorphosis: ametabolous, hemimetabolous, holometabolous • Explain insect development under temperature • Describe insect behaviour: feeding, mating, dispersal, diapause, migration	Textbook Journal Internet Whiteboard Market projector	• Rear cowpea bruchid (<i>Callosobruchus maculatus</i>) on cowpea seeds in jars; • Document life cycle stages over 4 weeks • Monitor a sex-pheromone trap for FAW or cotton bollworm • Record weekly catches • Calculate cumulative degree-days • Document all activities	Guide students to: • Rear cowpea bruchid (<i>Callosobruchus maculatus</i>) on cowpea seeds in jars; • Observe and document life cycle stages over 4 weeks • Monitor a sex-pheromone trap for FAW or cotton bollworm • Record weekly catches • Calculate cumulative degree-days • Document all activities	Cowpea seeds, jars with mesh covers, hand lens; pheromone traps with FAW/bollworm lures, weather data PPE
GENERAL OBJECTIVE 3.0: Know the major insect pests of cereals, legumes, root/tuber, vegetable and tree crops in Nigeria						
7 – 8	3.1 Describe major pests of cereals: stem borers (e.g	• Discuss major pests of cereals: stem borers (e.g	Textbook Journal Internet	• Identify 25 major insect pests from photographs and	Guide students to: • Identify 25 major insect pests from	Pest photographs, preserved

	Busseola fusca, Sesamia), army worms, FAW, grain weevils 3.2 Explain major pests of legumes: thrips (Megalurothrips), pod borer (Maruca), bruchids 3.3 Explain major pests of root/tubers: e.g cassava mealybug, green mite, sweet potato weevil, yam beetle 3.4 Explain major pests of vegetables and tree crops: Tuta absoluta, whitefly, cocoa mirids, citrus psyllid	Busseola fusca, Sesamia), army worms, FAW, grain weevils - Discuss major pests of legumes: thrips (Megalurothrips), pod borer (Maruca), bruchids - Explain major pests of root/tubers: e.g cassava mealybug, green mite, sweet potato weevil, yam beetle - Explain major pests of vegetables and tree crops: Tuta absoluta, whitefly, cocoa mirids, citrus psyllid	Whiteboard Market Projector	preserved specimens - Record host crop, damage type, life stage causing damage - Visit a field with mixed crops - Collect 10 insect specimens - Identify based on physical features - Classify the insects based on insect orders - Preserve in alcohol	photographs and preserved specimens - Record host crop, damage type, life stage causing damage - Visit a field with mixed crops - Collect 10 insect specimens - Identify based on physical features - Classify the insects based on insect orders - Preserve in alcohol	specimens, identification key; sweep nets, collection bottles, 70% ethanol, labels, microscope
GENERAL OBJECTIVE 4.0: Understand insect pest sampling, scouting and economic thresholds						
9 - 10	4.1 Define pest: - Key pest - Occasional pest - Major pest - Minor pest	Explain pest: - Key pest - Occasional pest - Major pest - Minor pest	Textbook Journal Internet Whiteboard Market	Collect insect samples in a cereal and a legume field using sweep net (10 sweeps × 5	Guide students Collect insect samples in a cereal and a legume field using sweep net (10	Sampling equipment (sweep net, sticky traps, pheromone

	4.2 Describe sampling methods: - Visual count, - Sweep net, - Sticky traps, Pheromone traps, - Light traps, - Beating tray 4.3 Explain Economic Injury Level (EIL) and the calculation: - Economic Threshold (ET) - Action Threshold	Describe sampling methods: - Visual count, - Sweep net, - Sticky traps, Pheromone traps, - Light traps, - Beating tray Explain Economic Injury Level (EIL) and the calculation: - Economic Threshold (ET) - Action Threshold	Projector	spots) and beating tray - Identify and tabulate findings - Calculate EIL and ET for FAW in cereal using provided cost and damage data	sweeps × 5 spots) and beating tray - Identify and tabulate findings - Calculate EIL and ET for FAW in cereal using provided cost and damage data	lures, beating tray), EIL calculation worksheets, scouting record sheets,
GENERAL OBJECTIVE 5.0: Understand integrated pest management strategies						
11 - 13	5.1 Define IPM and its principles 5.2 Describe cultural control methods 5.3 Describe biological control methods 5.4 Describe chemical control methods	- Explain IPM and decision pyramid (avoid → prevent → monitor → treat) - Discuss cultural control methods: rotation, sanitation, planting dates, resistant varieties, trap crops - Explain biological control methods:	Textbook Journal Internet Whiteboard Market Projector	- Apply Bt or Beauveria spray on FAW-infested maize plot - Compare with untreated plot at 7 and 14 DAT - Read 5 insecticide labels - Tabulate active ingredient (IRAC group, dosage, PHI, PPE)	Guide students to: - Apply Bt or Beauveria spray on FAW-infested maize plot - Compare with untreated plot at 7 and 14 DAT - Read 5 insecticide labels - Tabulate active ingredient (IRAC group, dosage, PHI,	Bt/Beauveria products, knapsack sprayer, PPE, FAW-infested plots; insecticide labels, tabulation worksheet

		predators (Coccinellids, lacewings), parasitoids (Trichogramma, Cotesia), pathogens (NPV, Bt, Beauveria) Explain chemical control methods: insecticide groups, modes of action, IRAC classification, resistance management		requirement); Develop rotation calendar	PPE requirement); Develop rotation calendar	
GENERAL OBJECTIVE 6.0: Understand current pest threats and digital scouting tools						
14 – 15	6.1 Describe Fall army worm (Spodoptera frugiperda): biology, damage, monitoring, management 6.2 Describe Tuta absoluta in tomato: damage, biology, IPM strategies 6.3 Explain digital pest scouting tools: Plantix, FAMEWS, Nuru	- Describe Fall army worm (Spodoptera frugiperda): biology, damage, monitoring, management - Explain Tuta absoluta serpentine mines; biology, semiochemical traps, Nesidiocoris parasitoid - Describe Plantix; FAW monitoring with FAMEWS	Textbook Journal Internet Whiteboard Market Projector	- Identify pests/diseases on at least 3 different crop fields using Plantix or Nuru AI - Record results and recommendations - Use FAMEWS app to record FAW pheromone trap catches over	Guide students to: - Identify pests/diseases on at least 3 different crop fields using Plantix or Nuru AI - Record results and recommendations - Use FAMEWS app to record FAW pheromone trap catches over 4 weeks - Submit data and analyse trend	Smartphones with internet; Plantix, Nuru AI, FAMEWS apps; pheromone traps, lures, scouting record sheet

	AI app for cassava 6.4 Describe bee/pollinator conservation in pesticide use	app; Nuru AI for cassava CMD/CBSD • Explain pollinator decline; selective insecticide use; spraying timing (evening)		4 weeks • Submit data and analyse trend		
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COURSE ASSESSMENT:

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

AGRICULTURAL BIOCHEMISTRY

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: AGRICULTURAL BIOCHEMISTRY	COURSE CODE: CPT 326	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to provide students with knowledge and skills of biomolecules and metabolic pathways relevant to crop production.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand carbohydrates, lipids, proteins and nucleic acids in plants; 2.0 Understand enzymes; 3.0 Know basic metabolic pathways; 4.0 Know nitrogen metabolism, biological nitrogen fixation and secondary metabolites; 5.0 Understand biochemistry of post-harvest physiology and quality changes;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: AGRICULTURAL BIOCHEMISTRY			COURSE CODE: CPT 326		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills of biomolecules and metabolic pathways relevant to crop production.						
GENERAL OBJECTIVE 1.0: Understand carbohydrates, lipids, proteins and nucleic acids in plants						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Explain the classification of carbohydrates	- Discuss carbohydrates classification - Discuss the structures of starch in casava (85% DM) and cellulose in cell wall - Explain the difference between saturated and unsaturated fatty acids - Discuss palmitic, oleic, and linoleic acids; - Discuss DNA and	Textbook Journal Internet Whiteboard Market Projector	- Conduct test for carbohydrates: (Benedict's test on glucose, sucrose, starch; iodine test for starch) - Carry out test for proteins(Biuret test on egg white, soybean extract). - Conduct oil extraction from groundnut by Soxhlet method; - Calculate percentage oil	Guide students to: - demonstrate Benedict's and iodine tests and their interpretation - demonstrate Biuret test and their positive/negative reactions - carry out Soxhlet extraction, solvent recovery and oil content	Glucose, sucrose, starch solutions, Benedict's reagent, iodine; egg white, soybean meal, milk, NaOH, CuSO ₄ ; groundnut, Soxhlet apparatus, hexane
	1.2 Describe the structure of starch, cellulose, hemicellulose					
	1.3 Explain the classification lipids					
	1.4 Describe protein structure					
	1.5 Describe DNA and RNA structure and					

	function	RNA structure and function		content		
GENERAL OBJECTIVE 2.0: Understand enzymes						
4 – 6	2.1 Define enzyme 2.2 Describe classification of enzymes 2.3 Describe enzyme structure, active site, cofactors and coenzymes 2.4 Describe enzyme kinetics: Michaelis-Menten, K_m , and V_{max} 2.5 Describe factors affecting enzyme activity 2.6 Explain the applications of enzyme technology in agriculture	• Explain enzyme; introduce 6 IUBMB classes with examples (amylase, transaminase, lipase) • Explain active site; lock-and-key vs induced fit; cofactors (Mg^{2+}), coenzymes (NAD^+, FAD) • Explain enzyme structure, active site, cofactors and coenzymes • Explain enzyme kinetics: Michaelis-Menten, K_m, and V_{max} • Explain factors affecting enzyme activity • Discuss the applications of enzyme technology in agriculture	Textbook Journal Internet Whiteboard Market Projector	• Demonstrate amylase activity: incubate amylase with starch at varying pH (4, 6, 7, 8) and temperature (25, 40, 60, 80°C); • test residual starch with iodine • Extract papain from pawpaw latex; demonstrate meat tenderisation	Guide students to; • Demonstrate amylase activity: incubate amylase with starch at varying pH (4, 6, 7, 8) and temperature (25, 40, 60, 80°C); • test residual starch with iodine • Extract papain from pawpaw latex; demonstrate meat tenderisation	Sprouted maize, water, starch solution, iodine, water bath, pH buffers; pawpaw latex, beef tough cut, knife, plate, PPE

GENERAL OBJECTIVE 3.0: Know basic metabolic pathways

7 – 9	3.1 Describe glycolysis 3.2 Describe TCA (Krebs cycle) and electron transport chain; ATP yield from glucose 3.3 Describe light reactions of photosynthesis: PSII, PSI, photophosphorylation 3.4 Describe Calvin cycle (C3); C4 and CAM	• Explain glycolysis steps; net 2 ATP and 2 NADH per glucose • Explain TCA cycle; ETC and ATP synthase; • Describe Z-scheme; pigments; ATP and NADPH production • Discuss light reactions of photosynthesis: PSII, PSI, photophosphorylation • Describe Calvin cycle (C3); C4 and CAM	Textbook Journal Internet Whiteboard Market Projector	• Demonstrate fermentation (anaerobic glycolysis) • Use yeast and glucose • Measure CO₂ produced over time • Demonstrate Hill reaction • Extract chloroplasts • Measure DCPIP reduction under light	Guide students to: • Demonstrate fermentation (anaerobic glycolysis) • Use yeast and glucose • Measure CO₂ produced over time • Demonstrate Hill reaction • Extract chloroplasts • Measure DCPIP reduction under light	Yeast, glucose, water, fermentation flask, CO ₂ collection setup; spinach/cassava leaves, blender, DCPIP, light source, spectrophotometer
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GENERAL OBJECTIVE 4.0: Know nitrogen metabolism, biological nitrogen fixation and secondary metabolites

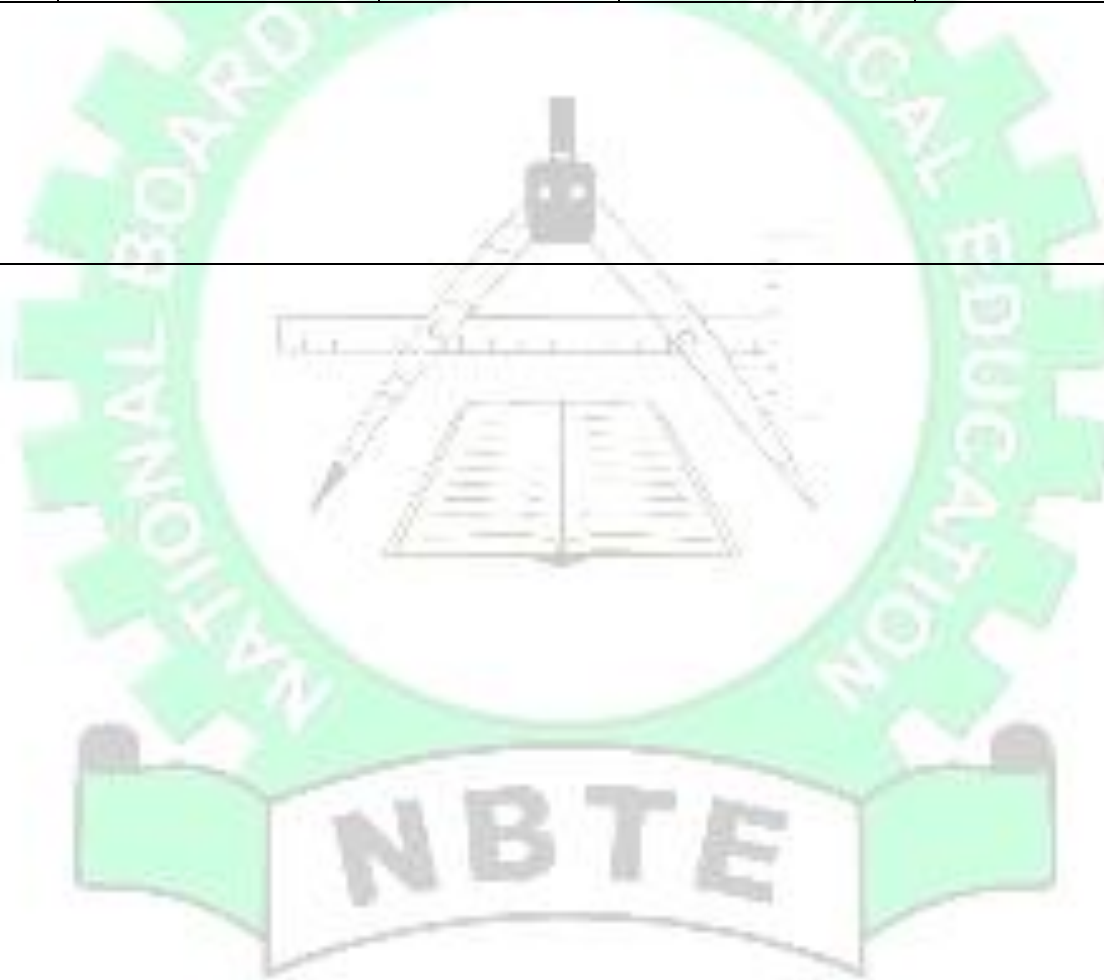
10 - 12	4.1 Describe nitrogen cycle in soil-plant systems. 4.2 Describe biological nitrogen fixation. 4.3 Describe nitrogen assimilation: nitrate reduction, glutamine	• Describe nitrogen cycle in soil-plant systems. • Describe biological nitrogen fixation. • Describe nitrogen assimilation: nitrate reduction, glutamine synthesis (GS-GOGAT).	Textbook Journal Internet Whiteboard Market Projector	• Inoculate soybean seeds with Rhizobium culture • Plant in pots • Count nodules at 6 WAP • Weigh nodules at 6 WAP;	Guide students to: • Inoculate soybean seeds with Rhizobium culture • Plant in pots • Count nodules at 6 WAP • Weigh nodules at 6 WAP;	Soybean seeds, Rhizobium culture, pots, soil, weighing scale; kola nut/tea leaves, water, beaker, filter paper
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	synthesis (GS-GOGAT). 4.4 Describe major plant secondary metabolites and their agricultural significance.	Describe major plant secondary metabolites and their agricultural significance		- Compare with un-inoculated - Extract caffeine from kola nut or tea using boiling water - Observe crystal formation on cooling	- Compare with un-inoculated - Extract caffeine from kola nut or tea using boiling water - Observe crystal formation on cooling	
GENERAL OBJECTIVE 5.0: Understand biochemistry of post-harvest physiology and quality changes						
13 - 15	5.1 Describe respiration and ethylene production in harvested produce 5.2 Describe climacteric vs non-climacteric fruits; ripening, biochemistry. 5.3 Describe aflatoxin biosynthesis in stored groundnut or maize 5.4 Describe biochemical changes in stored grains	- Explain post-harvest respiration losses; ethylene as ripening hormone; effect of storage temperature - Explain climacteric (banana, tomato, mango) and non-climacteric (orange, pineapple); describe sugar/acid/colour changes - Describe <i>Aspergillus flavus</i> growth; aflatoxin B1, B2, G1, G2; risk factors (drought, mechanical	Textbook Journal Internet Whiteboard Market Projector	- Measure Brix, pH and titratable acidity in ripening tomatoes daily for 5 days; - Record ripening trend - Plot ripening trend - Use aflatoxin test strip on a stored groundnut sample (or sourced sample); - Interpret result and recommend management	Guide students to: - Measure Brix, pH and titratable acidity in ripening tomatoes daily for 5 days; - Record ripening trend - Plot ripening trend - Use aflatoxin test strip on a stored groundnut sample (or sourced sample); - Interpret result and recommend management	Tomato fruits, refractometer, pH meter, NaOH, indicator; groundnut sample, aflatoxin strip kit, water

		damage, RH > 70%) • Discuss biochemical changes in stored grains				
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COURSE ASSESSMENT:

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





YEAR II SEMESTER I

CROP PRODUCTION III (PLANTATION/PERMANENT CROPS)

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: CROP PRODUCTION III (PLANTATION/PERMANENT CROPS)	COURSE CODE: CPT 411	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills of plantation crop production using sustainable, climate-smart and environment friendly farming practices.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand classification, characteristics, production and importance of tree crops; 2.0 Understand classification, characteristics, production and importance of plantation crops; 3.0 Know post-harvest, handling, storage and marketing of tree and plantation crops; 4.0 Know climate-smart practices and record keeping in tree and plantation crops;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: CROP PRODUCTION III (PLANTATION/PERMANENT CROPS)			COURSE CODE: CPT 411		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills of plantation crop production using sustainable, climate-smart and environment friendly farming practices.						
GENERAL OBJECTIVE 1.0: Understand classification, characteristics, production and importance of tree crops.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 3	1.1 Explain the origin of tree crops e.g cocoa, kola, rubber, etc. 1.2 Classify tree crops based on use and growth characteristics. 1.3 Explain botanical characteristics of trees. 1.4 Discuss production and field management of tree crops 1.5 Discuss economic and nutritional	- Discuss the origin of tree crops e.g cocoa, kola, rubber, etc. - Describe tree crops based on use and growth characteristics. - Describe botanical characteristics of trees. - Explain production and field management of tree crops - Explain economic	Textbooks, journals, white/smart boards, internet, charts, projector, crop samples, videos etc.	- Identify major tree crops grown locally. - Classify tree crops according to use and crop group. - Observe botanical characteristics of selected tree crops. - Prepare crop identification records and herbarium	Guide student to: - Identify major tree crops grown locally. - Classify tree crops according to use and crop group. - Observe botanical characteristics of selected tree crops. - Prepare crop identification records and herbarium samples. - Carry out production of some selected	Crop samples, seeds, planters, tractor, implements, power tillers, field plots, ICT tools, herbarium materials, hand lens, notebooks, smartphones, PPE, practical manual.

	importance of tree crops.	and nutritional importance of tree crops.		samples. • Carry out production of some selected tree crops • Keep field production records	tree crops • Keep field production records	
GENERAL OBJECTIVE 2.0: Understand classification, characteristics, production and importance of plantation crops.						
7– 9	2.1 Explain the origin of plantation crops e.g cocoa, rubber, coffee, coconut, tea etc. 2.2 Classify plantation crops based on use and growth characteristics. 2.3 Explain botanical characteristics of plantation crops 2.4 Discuss production and field management of plantation crops. 2.5 Discuss economic and nutritional	• Discuss the origin of plantation crops e.g cocoa, rubber, coffee, coconut, tea etc. • Describe plantation crops based on use and growth characteristics. • Describe botanical characteristics of plantation crops. • Explain production and field management of plantation crops • Explain economic and nutritional importance of	Textbooks, journals, white/smart boards, internet, charts, projector, crop samples, videos etc.	• Identify major plantation crops grown locally. • Classify plantation crops according to use. • Observe botanical characteristics of selected plantation crops. • Prepare crop identification records and herbarium samples. • Carry out production of some selected plantation crops.	Guide students to: • Identify major plantation crops grown locally. • Classify plantation crops according to use. • Observe botanical characteristics of selected plantation crops. • Prepare crop identification records and herbarium samples. • Carry out production of some selected plantation crops. • Keep field	Crop samples, seeds, planters, tractor, implements, power tillers, field plots, ICT tools, herbarium materials, hand lens, notebooks, smartphones, PPE, practical manual etc.

	importance of plantation crops.	plantation crops.		Keep field production records	production records	
GENERAL OBJECTIVE 3.0: Know post-harvest, handling, storage and marketing of tree and plantation crops.						
10 – 12	3.1 Explain crop maturity indices for tree and plantation crops 3.2 Describe harvesting methods and equipment in tree and plantation crop production 3.3 Explain handling, sorting and grading in tree and plantation crop production 3.4 Explain packaging and storage in tree and plantation crop production. 3.5 Describe primary processing for each crop group. 3.6 Discuss marketing in tree and plantation crop production.	- Discuss crop maturity indices for tree and plantation crops - Explain harvesting methods and equipment in tree and plantation crop production - Describe handling, sorting and grading in tree and plantation crop production - Describe packaging and storage in tree and plantation crop production - Explain primary processing for each crop group - Explain marketing in tree and plantation crop production	White/Smart boards, markers, textbooks, journals, internet, charts, projector, pest identification manuals, videos	- Identify maturity indices in tree and plantation crops - Identify harvesting equipment in tree and plantation crops - Carry out harvesting and handling of tree and plantation crops - Carry out sorting and grading - Carry out threshing, winnowing and other processing operations. - Determine moisture content of selected crops before storage - Carry out packaging and storage of tree and plantation crops - Undertake market survey of tree and plantation crops - Keep records of all	Guide students to: - Identify maturity indices in tree and plantation crops - Identify harvesting equipment in tree and plantation crops - Carry out harvesting and handling of tree and plantation crops - Carry out sorting and grading - Carry out threshing, winnowing and other processing operations. - Determine moisture content of selected crops before storage - Carry out packaging and storage of tree and plantation crops - Undertake market survey of tree and plantation crops - Keep records of all the	Threshers, storage bins, dryers, storage inputs, sprayers, Silo, warehouse, drying slabs, Smartphones PPE, practical manual, Harvesting tools, scales, grading tables, moisture meter, hermetic bags, open sacks, etc.

				the operations manually and digitally	operations manually and digitally	
GENERAL OBJECTIVE 4.0: Know climate-smart practices and record keeping in tree and plantation crops.						
13 – 15	4.1 Explain climate-smart agricultural practices in trees and plantation crop production. 4.2 Discuss effects of climate change on trees and plantation crops. 4.3 Explain climate risk adaptation practices in field crop production. 4.4 Explain farm record keeping in tree and plantation crop production.	• Discuss climate-smart crop production using local farming examples. • Explain climate change effects on trees, s and plantation crops. • Discuss farm documentation and record keeping procedures. • Describe use of climate information for farm decision-making.	White/smart boards, markers, textbooks, journals, internet, climate-smart agriculture manuals, annual NIMET reports, charts, projector, videos, weather reports, farm record templates etc.	• Carry out climate-smart demonstration for selected crops on already established plot. • Practice water-efficient irrigation and watering methods where applicable. • Interpret downloaded weather information using smartphone weather applications. • Prepare climate-based planting calendar for selected crops. • Keep farm records on planting date, weather condition, input use and crop performance. • Practice farm documentation for	Guide students to: • Carry out climate-smart demonstration for selected crops on already established plot. • Practice water-efficient irrigation and watering methods where applicable. • Access and interpret weather information using smartphone weather applications. • Prepare climate-based planting calendar for selected crops. • Keep farm records on planting date, weather condition, input use and crop performance. • Practice farm documentation for trees and plantation crop production.	GPS, Sensors, drones, robots, computer, irrigation materials, field plots, smartphones, weather apps, notebooks, farm record sheets, PPE, practical manual, crop production records etc.

				trees and plantation crop production.		
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COURSE ASSESSMENT:

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



PLANT BREEDING, SEED TECHNOLOGY AND BIOTECHNOLOGY

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: PLANT BREEDING, SEED TECHNOLOGY AND BIOTECHNOLOGY	COURSE CODE: CPT 412	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills of plant breeding principles and modern seed and biotechnology tools		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand principles, history and importance of plant breeding; 2.0 Understand methods of breeding self-pollinated crops; 3.0 Understand methods of breeding cross-pollinated crops; 4.0 Understand breeding for biotic and abiotic stress resistance; 5.0 Understand modern breeding tools: marker-assisted selection, genomic selection, biotechnology;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: PLANT BREEDING, SEED TECHNOLOGY AND BIOTECHNOLOGY			COURSE CODE: CPT 412		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills of plant breeding principles and modern seed and biotechnology tools						
GENERAL OBJECTIVE 1.0: Understand principles, history and importance of plant breeding						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1- 3	1.1 Explain plant breeding; describe its objectives (yield, quality, resistance, adaptation). 1.2 Explain the history of plant breeding: domestication, Mendelian era, Green Revolution, biotech era. 1.3 Explain sources of variation: natural, induced (mutation breeding); centres	•Describe Understand principles, history and importance of plant breeding. •Describe the history of plant breeding: domestication, Mendelian era, Green Revolution, biotech era •Describe sources of variation: natural, induced (mutation breeding); centres of origin (Vavilov) •Describe breeders'	White/Smart boards, markers, textbooks, journals, internet, charts, projector, pest identification manuals, videos	• Visit a breeding Institute (IAR, IITA, NCRI, NIHORT or NRCRI) in person or virtually (online tour); • Document objectives, breeding Programmes and recently released varieties • Compile a list of 10 IAR/IITA improved	• Arrange visit (physical or online); • Supervise observation and documentation • Provide variety of catalogues	Breeding institute (or online tour), notebook, smartphone; variety catalogues, internet, laptop

	of origin (Vavilov). 1.4 Explain breeders' role in food security and Nigerian breeding institutions: IAR, IITA, NCRI, NIHORT, NRCRI.	role in food security and Nigerian breeding institutions: IAR, IITA, NCRI, NIHORT, NRCRI		Nigerian varieties (cereals, legumes, roots, vegetables) with year of release and key trait		
GENERAL OBJECTIVE 2.0: Understand methods of breeding self-pollinated crops						
4 - 6	2.1 Explain pure line, mass selection, single seed descent, pedigree, bulk methods. 2.2 Describe back-cross breeding for trait introgression. 2.3 Describe hybridisation procedure: emasculation, pollination, bagging, harvest of F₁. 2.4 Explain self-pollinated breeding: rice, wheat, cowpea, soybean, groundnut	- Describe pure line, mass selection, single seed descent, pedigree, bulk methods - Explain back-cross breeding for trait introgression - Explain hybridisation procedure: emasculation, pollination, bagging, harvest of F₁ - Describe self-pollinated breeding: rice, wheat, cowpea, soybean, groundnut	White/Smart boards, markers, textbooks, journals, internet, charts, projector, pest identification manuals, videos	- Carry out emasculation and hand pollination on cowpea or tomato flowers bag and label - Record fruit set and seed yield - Design a pedigree breeding scheme for cowpea improvement targeting drought tolerance + striga resistance over 6 generations	Guide students to: - Carry out emasculation and hand pollination on cowpea or tomato flowers bag and label - Record fruit set and seed yield - Design a pedigree breeding scheme for cowpea improvement targeting drought tolerance + striga resistance over 6 generations	Cowpea/tomato plants, forceps, fine scissors, bagging paper, labels, hand lens; pedigree template, breeding goal handout

GENERAL OBJECTIVE 3.0: Understand methods of breeding cross-pollinated crops						
7 – 9	3.1 Describe mass, recurrent and synthetic varieties for population improvement 3.2 Describe inbred line development and hybrid breeding (single, three-way, double cross) 3.3 Describe heterosis (hybrid vigour) and combining ability	• Define mass, recurrent and synthetic varieties for population improvement • Explain inbred line development and hybrid breeding (single, three-way, double cross) • Explain heterosis (hybrid vigour) and combining ability • Describe: maize hybrids (SAMMAZ hybrids), oil palm Tenera D × P, sunflower hybrids	White/Smart boards, markers, textbooks, journals, internet, charts, projector, pest identification manuals, videos	• Establish a maize hybrid trial on the school farm or research field • Compare hybrid vs inbred parent yield • Calculate mid-parent and high-parent heterosis given parents and F₁ yield data for maize	• Guide students to: • Establish a maize hybrid trial on the school farm or research field • Compare hybrid vs inbred parent yield • Calculate mid-parent and high-parent heterosis given parents and F₁ yield data for maize	Yield dataset, calculator; maize hybrid and inbred plots, weighing scale, recording sheet
GENERAL OBJECTIVE 4.0: Understand breeding for biotic and abiotic stress resistance						
10 – 12	4.1 Describe types of resistance: vertical (R-gene, qualitative) vs horizontal (polygenic, quantitative) 4.2 Describe sources of resistance: - Wild relatives, - Landraces, - Induced	• Distinguish types of resistance: vertical (R-gene, qualitative) vs horizontal (polygenic, quantitative) • Explain sources of resistance: wild relatives, landraces, induced mutation	White/Smart boards, markers, textbooks, journals, internet, charts, projector, pest identification manuals, videos	• Conduct a screening of 4 cowpea varieties for drought tolerance Subject to water stress; • Measure relative water content (RWC) and recovery • Observe a CMD-resistance	• Guide students to: • conduct a screening of 4 cowpea varieties for drought tolerance • observe a CMD-resistance screening field • record disease incidence on resistant vs susceptible variety	Cowpea varieties, pots, balance, oven; cassava varieties CMD scoring chart

	mutation. 4.3 Describe screening methods for resistance: - Field, - Glasshouse, - Controlled (inoculation). 4.4 Describe abiotic stress breeding: - Drought tolerance, - Heat tolerance, - Salinity tolerance, - Flooding tolerance	- Explain screening methods for resistance: field, glasshouse, controlled inoculation - Explain abiotic stress breeding: drought, heat, salinity, flooding tolerance		screening field on campus Record disease incidence on resistant vs susceptible variety		
GENERAL OBJECTIVE 5.0: Understand modern breeding tools, seed technology and biotechnology						
13 – 15	5.1 Explain molecular markers (SSR, SNP, KASP); marker-assisted selection (MAS) and marker-assisted backcrossing (MABC) 5.2 Explain genomic selection (GS), high-throughput phenotyping with	- Describe molecular markers (SSR, SNP, KASP); describe marker-assisted selection (MAS) and marker-assisted backcrossing (MABC) - Describe genomic selection (GS), high-throughput	White/Smart boards, markers, textbooks, journals, internet, charts, projector, pest identification manuals, videos	- Visit a molecular breeding lab (IITA, IAR, NABDA, etc.) - Document SSR/KASP genotyping workflow - Use the free online CRISPOR tool to design a guide RNA targeting a model	Guide students to: - Visit a molecular breeding lab (IITA, IAR, NABDA, etc.) - Document SSR/KASP genotyping workflow - Use the free online CRISPOR tool to design a guide RNA targeting a model plant gene	Lab access, notebooks; laptops with internet, CRISPOR access, sample gene sequence; seed company/NASC office, notebooks

	drones, and AI-assisted breeding 5.3 Describe seed technology integration: - Breeder - Foundation - Certified - commercial NASC certification standards; Seed health testing 5.4 Describe biotech tools: tissue culture (cassava, banana, plantain), genetic transformation, CRISPR-Cas9 gene editing with the CRISPOR online tool.	phenotyping with drones, and AI-assisted breeding - Explain seed technology integration: - Breeder - Foundation - Certified commercial; NASC certification standards; seed health testing - Explain biotech tools: tissue culture (cassava, banana, plantain), genetic transformation, CRISPR-Cas9 gene editing with the CRISPOR online tool		plant gene - Visit a seed company or NASC zonal office - Document seed certification process and quality testing	- Visit a seed company or NASC zonal office - Document seed certification process and quality testing	
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COURSE ASSESSMENT:

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

HORTICULTURE, GREENHOUSE AND VERTICAL FARMING

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: HORTICULTURE, GREENHOUSE AND VERTICAL FARMING	COURSE CODE: CPT 413	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to provide students with the knowledge and skills of horticultural crops production.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the scope, importance and classification of horticulture; 2.0 Understand vegetable production under open field conditions; 3.0 Know fruit production in orchards; 4.0 Comprehend protected cultivation; 5.0 Know horticultural nursery establishment and management techniques.		



PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: HORTICULTURE, GREENHOUSE AND VERTICAL FARMING			COURSE CODE: CPT 413		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with the knowledge and skills of horticultural crops production.						
GENERAL OBJECTIVE 1.0: Understand horticulture: scope, importance and classification						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 3	1.1 Define horticulture 1.2 Describe the scope of horticulture 1.3 Explain the Classification of horticultural crops by use, growth habit and climate 1.4 Describe nutritional and economic importance of horticulture 1.5 Describe Nigeria's horticultural exports and CBN/NIRSAL support	- Explain horticulture - Explain the Classification of horticultural crops by use, growth habit and climate - Discuss the nutritional and economic value of horticultural cops with emphasis on vitamin and mineral contribution; horticulture as	White/Smart boards, markers, textbooks, journals, internet, charts, projector, pest identification manuals, videos	- Identify 15 horticultural crops by botanical name and use group; - Tabulate by climate adaptation - Visit a local horticultural farm - Visit a local horticultural market; - Document the value chain from farm to market identify gaps and opportunities	- Guide students to: - Identify 15 horticultural crops by botanical name and use group; - Tabulate by climate adaptation - Visit a local horticultural farm or market; - Document the value chain from farm to market identify gaps and opportunities	Horticultural specimens, identification chart, classification table; horticultural farm or market, notebooks, smartphone

		climate-smart high-value sector • Explain nutritional and economic importance of horticulture • Discuss vegetable export to Europe (chilli, ginger, hibiscus), pineapple, mango exports				
GENERAL OBJECTIVE 2.0: Understand vegetable production (open field)						
4 – 6	2.1 Describe production of leafy vegetables: amaranth, fluted pumpkin (Telfairia). 2.2 Describe production of fruit vegetables: tomato, pepper, okra, 2.3 Explain production of bulb/root vegetables: onion, ginger 2.4 Explain major pests (Tuta absoluta on	• Explain each leafy vegetable; nursery sowing, transplanting, fertilization, harvest within 4–8 weeks • Discuss tomato, pepper and okra agronomy; spacing, staking, fertilization • Discuss onion and ginger production • Discuss IPM approach for	Marker board, Vegetable plots on school farm, NIHORT vegetable variety brochures, pheromone traps, fungicides, knapsack sprayer, audio visuals PPE, LCD projector	• Establish 50 m² each of tomato (transplanted from nursery), okra and amaranth at recommended spacing • Manage from transplanting to harvest • Calculate yield (kg/m²) • Install Tuta absoluta pheromone trap on tomato plot; • Record weekly	• Guide students on nursery transplanting, spacing, fertilization; supervise harvest and yield calculation, • Installation of pheromone trap; supervise weekly catch counting and threshold-based recommendation	School farm, vegetable seedlings, NPK, hoes, weighing scale; pheromone traps, lures, smartphone, scouting record

	tomato, fruit fly on pepper) and diseases (bacterial wilt, Phytophthora)	control of Tuta absoluta; fruit fly; bacterial wilt resistant varieties; copper for Phytophthora		catches for 4 weeks; recommend management based on threshold		
GENERAL OBJECTIVE 3.0: Understand fruit (orchard) production						
7 – 9	3.1 Describe orchard establishment: site selection, layout (square, triangular, hexagonal), spacing 3.2 Describe production of mango, citrus, banana/plantain, pawpaw, pineapple 3.3 Explain the methods of asexual propagation: budding, grafting, layering, sucker separation 3.4 Discuss the management of major pests and diseases of fruit crops; harvest, packaging, cold-chain	- Discuss site factors (slope, soil drainage, water access); compare layout systems - Explain each fruit crop agronomy; mango grafting; banana sucker management; pineapple slip propagation - Discuss the methods of asexual propagation: budding, grafting, layering, sucker separation - Explain bunchy top virus; mango anthracnose;	Marker board, Fruit crop seedlings and suckers, grafting tools, NIHORT/NRCR I fruit guides, knapsack audio visuals, sprayers, LCD projector	- Carry out T-budding on 10 citrus rootstocks and air-layering on 5 guava branches; - Record success rate after 4 weeks - Establish a 50 m² mini-orchard with 4 fruit species (mango, citrus, banana, pawpaw) at recommended spacing	- Guide students to: - Carry out T-budding on 10 citrus rootstocks and air-layering on 5 guava branches; - Record success rate after 4 weeks - Establish a 50 m² mini-orchard with 4 fruit species (mango, citrus, banana, pawpaw) at recommended spacing	Citrus rootstocks, scion sticks, grafting knife, parafilm; guava branches, polythene, soil, plastic; mango, citrus, banana, pawpaw seedlings

		pineapple mealybug; harvest indices and cold-chain logistics				
GENERAL OBJECTIVE 4.0: Understand greenhouse, hydroponic and vertical farming systems						
10 – 12	4.1 Describe types of protected structures 4.2 Describe greenhouse environment control 4.3 Describe hydroponics and aeroponics systems: Nutrient Film Technique (NFT), Deep Water Culture (DWC), drip hydroponics, aeroponics; 4.4 Describe vertical farming and modern protected agriculture in Nigeria: Tomato Jos, FreshDirect Nigeria container farming, LED-lit indoor farms	• Describe types of protected structures • Describe greenhouse environment control • Describe hydroponics and aeroponics systems: Nutrient Film Technique (NFT), Deep Water Culture (DWC), drip hydroponics, aeroponics; • Describe vertical farming and modern protected agriculture in Nigeria: Tomato Jos, FreshDirect Nigeria container farming, LED-lit indoor farms.	Marker board, Greenhouse/scren house textbooks, hydroponic kit (PVC pipes, pumps, nutrient solution), NIHORT publications, Audio visuals, LCD projector	• Set up a small NFT • Drip hydroponic unit using PVC pipes; • Grow lettuce or tomato; • Monitor pH, EC of nutrient solution • Design a 1-tier vertical farming layout for leafy vegetables (lettuce, basil) • Use LED lighting and drip-fertigation specify components and cost • Visit a working greenhouse, container farm or vertical farm (Tomato Jos, FreshDirect Nigeria or local); • Document	• Set up a small NFT • Drip hydroponic unit using PVC pipes; • Grow lettuce or tomato; • Monitor pH, EC of nutrient solution • Design a 1-tier vertical farming layout for leafy vegetables (lettuce, basil) • Use LED lighting and drip-fertigation specify components and cost • Visit a working greenhouse, container farm or vertical farm (Tomato Jos, FreshDirect Nigeria or local); • Document	PVC pipes, water pump, nutrient solution, lettuce/tomato seedlings, EC and pH meters; vertical-farm design template, LED specs, calculator; greenhouse/container/vertical farm, smartphone, notebooks

				structure, climate control and economics	structure, climate control and economics	
GENERAL OBJECTIVE 5.0: Understand horticultural nursery establishment and management						
13 – 15	5.1 Describe nursery types: i. Ground bed, ii. Raised bed, iii. Container, iv. Plug tray, v. Screen house nursery 5.2 Describe growing medium preparation: topsoil, compost, perlite, coco peat 5.3 Explain nursery operations 4.1 5.4 Explain damping-off, weeds, pests in nursery; nursery business model	• Discuss nursery types; • Discuss suitability for different scales • Explain media composition; sterilisation by solarisation, steaming or chemicals (formalin) • Discuss nursery sowing, watering schedule, fertigation; hardening before transplanting • Explain damping-off, weeds, pests in nursery; nursery business model	Nursery trays, growing media, seeds, watering can, Trichoderma, NIHORT nursery manual, Audio visuals LCD projector	• Establish a 20 m² nursery for tomato, and amaranth seedlings using mixed media, • Record germination % and survival • Develop a small nursery business plan for selling vegetable seedlings; • Calculate cost, price, profit	Guide students to: • Establish a 20 m² nursery for tomato, and amaranth seedlings using mixed media, • Record germination % and survival • Develop a small nursery business plan for selling vegetable seedlings; • Calculate cost, price, profit	Nursery trays, growing media, seeds, watering can, Trichoderma; business plan template, market data, calculator
COURSE ASSESSMENT:						
Course work: 10%						
Test/Assignments: 10%						
Practical 40%						
Examination: 40%						
Total: 100%						

CROP FARM PRACTICE III

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: CROP FARM PRACTICE III	COURSE CODE: CPT 414	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills of field competence in establishing and managing commercial-scale permanent crop and horticultural enterprises.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand permanent crop plantations; 2.0 Know plantation maintenance; 3.0 Understand integrated pest and disease management in plantations; 4.0 Know harvesting, post-harvest processing and storage of permanent crops; 5.0 Understand a plantation/horticultural farm enterprise business plan.		

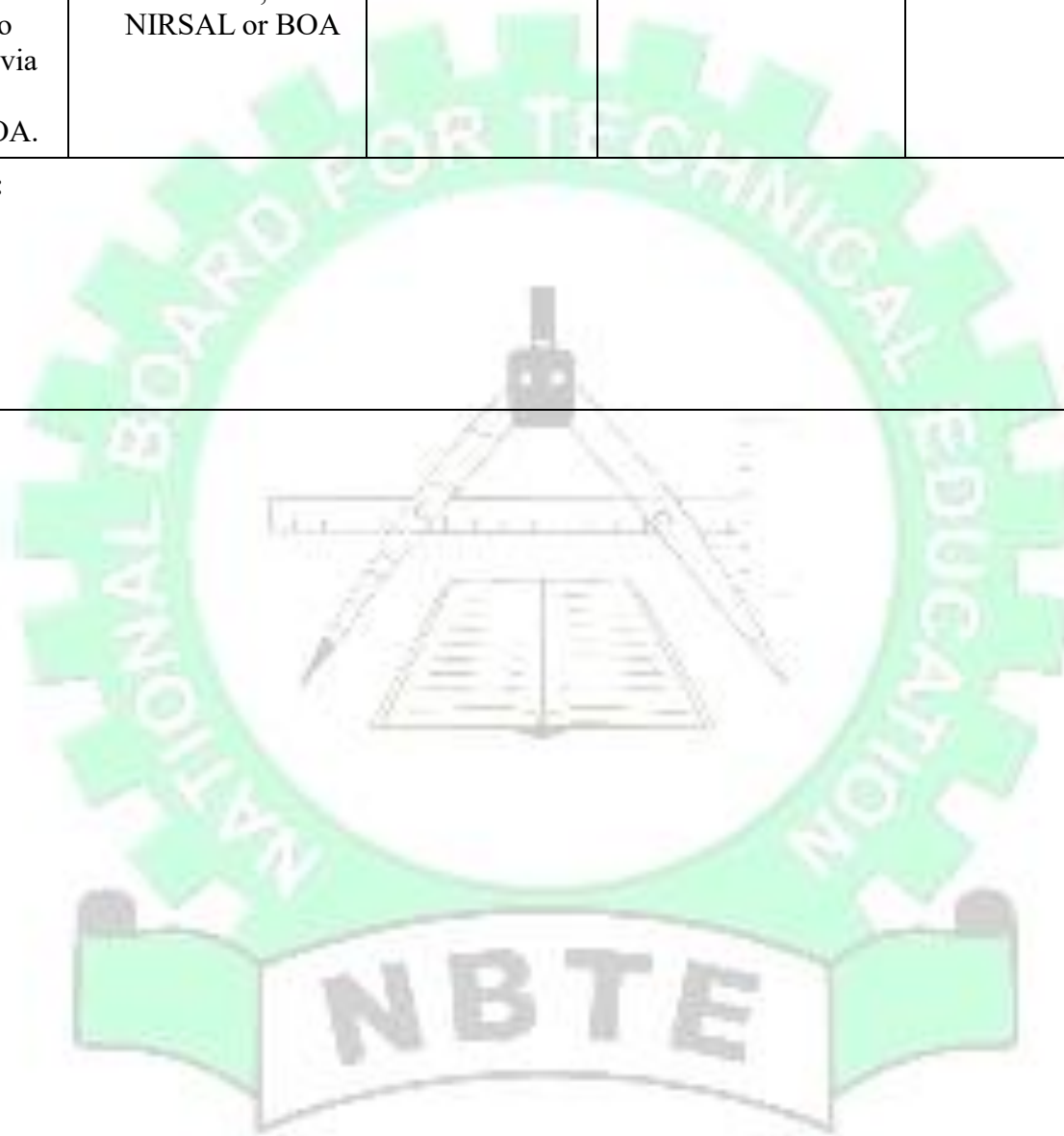
PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: CROP FARM PRACTICE III			COURSE CODE: CPT 414		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills of field competence in establishing and managing commercial-scale permanent crop and horticultural enterprises.						
GENERAL OBJECTIVE 1.0: Understand permanent crop plantations						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Explain site selection, soil testing, land clearing for a plantation 1.2 Explain lay out of a plantation: square, triangular, hexagonal; mark planting holes 1.3 Describe the Planting of cocoa, oil palm, citrus and mango seedlings at correct depth and spacing 1.4 Explain beating-up	- Discuss evaluation: slope, drainage, soil; collect samples for analysis - Discuss layout marking with surveyor's tape, pegs and string; calculate density per hectare - Discuss hole digging (60×60×60 cm); planting depth; staking and watering	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Establish a 0.25 ha mini-plantation with cocoa or citrus at 3 m × 3 m or 6 m × 6 m respectively; - Carry out marking, digging, planting, watering, labelling mini plantation. - Monitor establishment for 4 weeks; - Beat-up any failed plants	Guide student to - Establish a 0.25 ha mini-plantation with cocoa or citrus at 3 m × 3 m or 6 m × 6 m respectively; - Carry out marking, digging, planting, watering, labelling mini plantation. - Monitor establishment for 4 weeks; - Beat-up any failed plants	School farm 0.25 ha, cocoa/citrus seedlings, planting tools, water, labels, recording sheet Plantation establishment scored Monitoring and beating-up assessed Mid-semester practical exam

	of failed plants	Explain beating-up at 4–6 weeks for non-establishing seedlings				
GENERAL OBJECTIVE 2.0: Know plantation maintenance						
4-6	2.1 Describe formation and sanitation pruning on cocoa and citrus 2.2 Explain the application of NPK + Mg fertilizer at recommended rates; manure top-dressing 2.3 Explain circle weeding and inter-row weeding using slasher, hoe or herbicide 2.4 Explain mulching and irrigation in dry season.	- Describe formation and sanitation pruning on cocoa and citrus - Explain the application of NPK + Mg fertilizer at recommended rates; manure top-dressing - Explain circle weeding and inter-row weeding using slasher, hoe or herbicide - Explain mulching and irrigation in dry season	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Carry out pruning on 20 cocoa or citrus trees. - Document the type of cuts made - Apply fertilizer to 50 plants at recommended rate - Carry out circle weeding - Apply mulch around 30 plants in the school plantation	Guide student to; - Carry out pruning on 20 cocoa or citrus trees. - Document the type of cuts made - Apply fertilizer to 50 plants at recommended rate - Carry out circle weeding - Apply mulch around 30 plants in the school plantation	Cocoa/citrus trees, secateurs, saw; NPK + MgO, hoes, weighing scale; mulch (palm fronds, dry grass) Pruning practical scored Fertilization practical scored Mulching practical scored
GENERAL OBJECTIVE 3.0: Understand integrated pest and disease management in plantations						
7-9	3.1 Describe Scouting of plantation for major pests: cocoa mirids, oil palm rhinoceros beetle, citrus psyllid (HLB vector), mango	Describe Scouting of plantation for major pests: cocoa mirids, oil palm rhinoceros beetle, citrus psyllid (HLB vector), mango fruit	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Install pheromone traps for mango fruit fly and light trap for rhinoceros beetle - Record catches	Guide students to: Install pheromone traps for mango fruit fly and light trap for rhinoceros beetle	Pheromone traps + lures, light trap, recording sheet; copper fungicide, knapsack sprayer, PPE,

	fruit fly 3.2 Explain integrated control: cultural sanitation, light traps, pheromone traps, biological control 3.3 Explain the management of major diseases: cocoa black pod, citrus greening (HLB), mango anthracnose 3.4 Describe selective chemical control with PPE.	fly • Explain integrated control: cultural sanitation, light traps, pheromone traps, biological control • Explain the management of major diseases: cocoa black pod, citrus greening (HLB), mango anthracnose • Describe selective chemical control with PPE.		weekly for 4 weeks • Apply copper fungicide on cocoa for black pod • Assess black pod severity before and 14 days after	• Record catches weekly for 4 weeks • Apply copper fungicide on cocoa for black pod • Assess black pod severity before and 14 days after	severity rating chart Trap monitoring report Fungicide spray report Final practical examination
GENERAL OBJECTIVE 4.0: Know harvesting, post-harvest processing and storage						
10-12	4.1 Describe the harvesting of cocoa pods at colour break; ferment in heaps for 5–7 days; sun-dry to 7% MC 4.2 Explain harvesting of oil palm FFB at colour break; process to crude palm oil 4.3 Describe harvesting of citrus at maturity; sort,	• Discuss cocoa pod harvesting with chisel; opening; bean fermentation in heaps; sun-drying • Discuss FFB harvesting with chisel/sickle; small-scale palm oil extraction at college mill • Explain citrus harvesting (clip,	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Harvest 10 cocoa pods • Ferment beans for 5 days; sun-dry • Calculate dry bean yield per pod • Harvest 5 oil palm FFB; • Observe small-scale processing (where mill available) • Estimate oil-to-FFB ratio	• Guide student to: • Harvest 10 cocoa pods • Ferment beans for 5 days; sun-dry • Calculate dry bean yield per pod • Harvest 5 oil palm FFB; • Observe small-scale processing (where mill available) • Estimate oil-to-	Cocoa pods, fermentation mat, drying area, weighing scale; FFB, palm oil mill (where available); citrus, sorting tray, packaging materials Cocoa harvest-to-dry-bean report Oil palm processing

	wash, wax (where applicable), pack 4.4 Explain harvesting of mango and cashew; sort and grade; pack for market or processing	no pulling); washing; wax application; Discuss mango/cashew harvesting; sorting by size and ripeness; nut and apple separation		- Harvest 5 kg citrus; - Carry out sorting, washing, packing and record losses	FFB ratio - Harvest 5 kg citrus; - Carry out sorting, washing, packing and record losses	report Citrus packing assessed
GENERAL OBJECTIVE 5.0: Understand plantation/horticultural farm enterprise business plan with mechanization integration						
13-15	5.1 Explain business plan covering executive summary, market analysis, production plan, mechanization plan, operations, finance. 5.2 Explain establishment cost, annual operations cost, mechanization cost (own vs Hello Tractor hire), revenue projection over 5–10 years 5.3 Describe financial indicators: NPV, IRR, payback period, BCR	- Discuss business plan template sections with examples - Discuss cost-revenue projection for 1 ha cocoa or oil palm including mechanization costs; show Hello Tractor rates vs ownership - Discuss NPV/IRR formula; use Excel or calculator; payback formula; BCR - Discuss the use of business plan to access finance via	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Develop a complete 10-year business plan for 1 ha cocoa or 5 ha oil palm and include mechanization plan (Hello Tractor hire), - Calculate NPV, IRR and BCR - Complete an AGSMEIS or NIRSAL loan application form using the developed business plan	- Guide students to: - Develop a complete 10-year business plan for 1 ha cocoa or 5 ha oil palm and include mechanization plan (Hello Tractor hire), - Calculate NPV, IRR and BCR - Complete an AGSMEIS or NIRSAL loan application form using the developed business plan	Business plan template, calculator, laptop with Excel, Hello Tractor rates; AGSMEIS/NIRSAL application forms Business plan assessed (with NPV/IRR) Loan application assessed Final practical examination

	5.4 Explain the use of business plan to access finance via AGSMEIS, NIRSAL or BOA.	AGSMEIS, NIRSAL or BOA				
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical 40% Examination: 40% Total: 100%						



IRRIGATION TECHNOLOGY AND WATER USE EFFICIENCY

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: IRRIGATION TECHNOLOGY AND WATER USE EFFICIENCY	COURSE CODE: CPT 415	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills of irrigation principles, methods and modern smart-irrigation technologies.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand water sources, water quality and irrigation requirements; 2.0 Understand surface irrigation methods; 3.0 Understand sprinkler and drip irrigation systems; 4.0 Understand irrigation scheduling and water-use efficiency (WUE); 5.0 Understand modern smart irrigation: IOT, soil moisture sensors and mobile apps.		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: IRRIGATION TECHNOLOGY AND WATER USE EFFICIENCY			COURSE CODE: CPT 415	CONTACT HOURS: 3 HOURS/WEEK		
			CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK		
YEAR: II SEMESTER: I			PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills of irrigation principles, methods and modern smart-irrigation technologies.						
General Objective 1.0: Understand water sources, water quality and irrigation requirements						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 3	1.1 State sources of irrigation water: surface and groundwater. 1.2 Describe water quality parameters: EC, SAR, pH, salinity hazards (FAO classification) 1.3 Explain crop water requirement (CWR) using $ET_o \times K_c$ method 1.4 Describe irrigation requirement, irrigation efficiency and	• Explain sources of irrigation water: surface and groundwater. • Describe water quality parameters: EC, SAR, pH, salinity hazards (FAO classification) • Explain crop water requirement (CWR) using $ET_o \times K_c$ method • Describe irrigation requirement, irrigation efficiency and irrigation	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Test 3 water samples (river, borehole, school tap) for EC, pH • Classify each per FAO guidelines • Calculate CWR for a 1 ha tomato crop in dry season using ET_o pan data and K_c values • Produce a weekly irrigation schedule	• Guide students to: • Test 3 water samples (river, borehole, school tap) for EC, pH • Classify each per FAO guidelines • Calculate CWR for a 1 ha tomato crop in dry season using ET_o pan data and K_c values • Produce a weekly irrigation schedule	Water samples, EC meter, pH meter; ET_o data, K_c tables, calculator, schedule template

	irrigation frequency	frequency				
General Objective 2.0: Understand surface irrigation methods						
4 - 7	2.1 Describe basin irrigation: design, application to rice and orchards 2.2 Describe border irrigation: long narrow strips, suitability for cereals and pasture 2.3 Describe furrow irrigation: corrugated furrows, suitability for row crops 2.2 Compare merits, demerits, water-use efficiency of each method	• Describe basin irrigation: design, application to rice and orchards • Describe border irrigation: long narrow strips, suitability for cereals and pasture • Describe furrow irrigation: corrugated furrows, suitability for row crops • Compare merits, demerits, water-use efficiency of each method	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Construct a 100 m² basin (4 × 25 m) on the school farm. • Demonstrate levelling and bunding • Perform water-test and uniformity assessment • Lay out furrows for a 100 m² maize/cassava plot; flow water • Measure advance and recession times • Assess uniformity	Guide students to: • Construct a 100 m² basin (4 × 25 m) on the school farm. • Demonstrate levelling and bunding • Perform water-test and uniformity assessment • Lay out furrows for a 100 m² maize/cassava plot; flow water • Measure advance and recession times • Assess uniformity	School farm, hoes, shovels, levelling stakes, water source; measuring tape, stopwatch, recording sheet
General Objective 3.0: Understand sprinkler and drip irrigation systems						
8 - 10	3.1 Describe sprinkler system components: 3.2 Describe sprinkler types: - Impact, - Rotor, - Micro-sprinkler, gun, - Centre pivot.	• Describe sprinkler system components: • Describe sprinkler types: - Impact, - Rotor, - Micro-sprinkler, gun,	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Install a 50 m² drip kit on a tomato plot: • Lay out laterals • Install emitters at 30 cm spacing, • Connect filter and water source; • Verify uniform	Guide students to: • Install a 50 m² drip kit on a tomato plot: • Lay out laterals • Install emitters at 30 cm spacing, • Connect filter and water source;	Drip kit (lateral, emitters, filter, connector), water source, tomato plot, catch cans; sprinkler set, pump, catch

	3.3 Describe drip irrigation components: filters, emitters, lateral lines, connectors, fertigation venturi 3.4 Compare sprinkler vs drip vs surface for water-use efficiency, energy, capital cost	- Centre pivot. - Describe drip irrigation components: filters, emitters, lateral lines, connectors, fertigation venturi - Compare sprinkler vs drip vs surface for water-use efficiency, energy, capital cost		discharge - Assemble a 50 m² sprinkler system with 2 sprinklers - Measure throw radius and overlap - Calculate Christiansen Uniformity Coefficient (CU)	- Verify uniform discharge - Assemble a 50 m² sprinkler system with 2 sprinklers - Measure throw radius and overlap Calculate Christiansen Uniformity Coefficient (CU)	cans, measuring tape
General Objective 4.0: Understand irrigation scheduling and water-use efficiency						
11-13	4.1 Define irrigation scheduling; 4.2 Describe approaches: water balance, soil moisture-based, plant-based, evaporation pan 4.3 Describe deficit irrigation and regulated deficit irrigation 4.4 Calculate water-use efficiency (WUE = yield/water used) and water productivity 4.2 Explain rainwater harvesting for supplementary	- Define irrigation scheduling; - Describe approaches: water balance, soil moisture-based, plant-based, evaporation pan - Describe deficit irrigation and regulated deficit irrigation - Calculate water-use efficiency (WUE = yield/water used) and water productivity - Explain rainwater harvesting for supplementary irrigation.	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Use a tensiometer to determine soil moisture status of an irrigated tomato plot daily for 1 week - Design a rainwater harvesting system for the school farm building roof - Calculate annual harvestable volume - Recommend irrigation timing	- Use a tensiometer to determine soil moisture status of an irrigated tomato plot daily for 1 week - Design a rainwater harvesting system for the school farm building roof - Calculate annual harvestable volume - Recommend irrigation timing	Tensiometer, tomato plot, recording sheet; rainwater design template, NIMET rainfall data, calculator

	irrigation.					
General Objective 5.0: Understand modern smart irrigation: IOT, sensors and mobile apps						
14-15	5.1 Define smart irrigation. 5.2 Describe IoT-based irrigation systems 5.3 Describe soil moisture sensors (capacitive, TDR, gypsum block) and weather-station integration 5.4 Describe automated controllers and solenoid valves 5.5 Describe mobile apps for irrigation management: CropX, FieldNet, Zenvus Smartfarm	• Define smart irrigation; • Describe IoT-based irrigation systems • Describe soil moisture sensors (capacitive, TDR, gypsum block) and weather-station integration • Describe automated controllers and solenoid valves • Describe mobile apps for irrigation management: CropX, FieldNet, Zenvus Smartfarm	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Use a simple Arduino/ESP32-based soil moisture monitoring circuit • Identify sensor and trigger an LED at threshold • Use a Zenvus Smartfarm or similar app for 4 weeks on a campus plot • Submit dashboard screenshots and observations	Guide students to: • Use a simple Arduino/ESP32-based soil moisture monitoring circuit • Identify sensor and trigger an LED at threshold • Use a Zenvus Smartfarm or similar app for 4 weeks on a campus plot • Submit dashboard screenshots and observations	Arduino/ESP32 kit, soil moisture sensor, breadboard, LED, jumper wires, USB cable, laptop with Arduino IDE; smartphones, Zenvus app
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical 40% Examination: 40% Total: 100%						

DRAINAGE TECHNOLOGY AND WATERLOGGING MANAGEMENT

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: DRAINAGE TECHNOLOGY AND WATERLOGGING MANAGEMENT	COURSE CODE: CPT 416	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills of drainage design, construction, operation and maintenance of drainage systems for agricultural land.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand the importance and principles of drainage; 2.0 Understand surface drainage methods and design; 3.0 Understand sub-surface drainage methods and design; 4.0 Understand drainage system installation and construction; 5.0 Understand drainage maintenance and environmental considerations;		

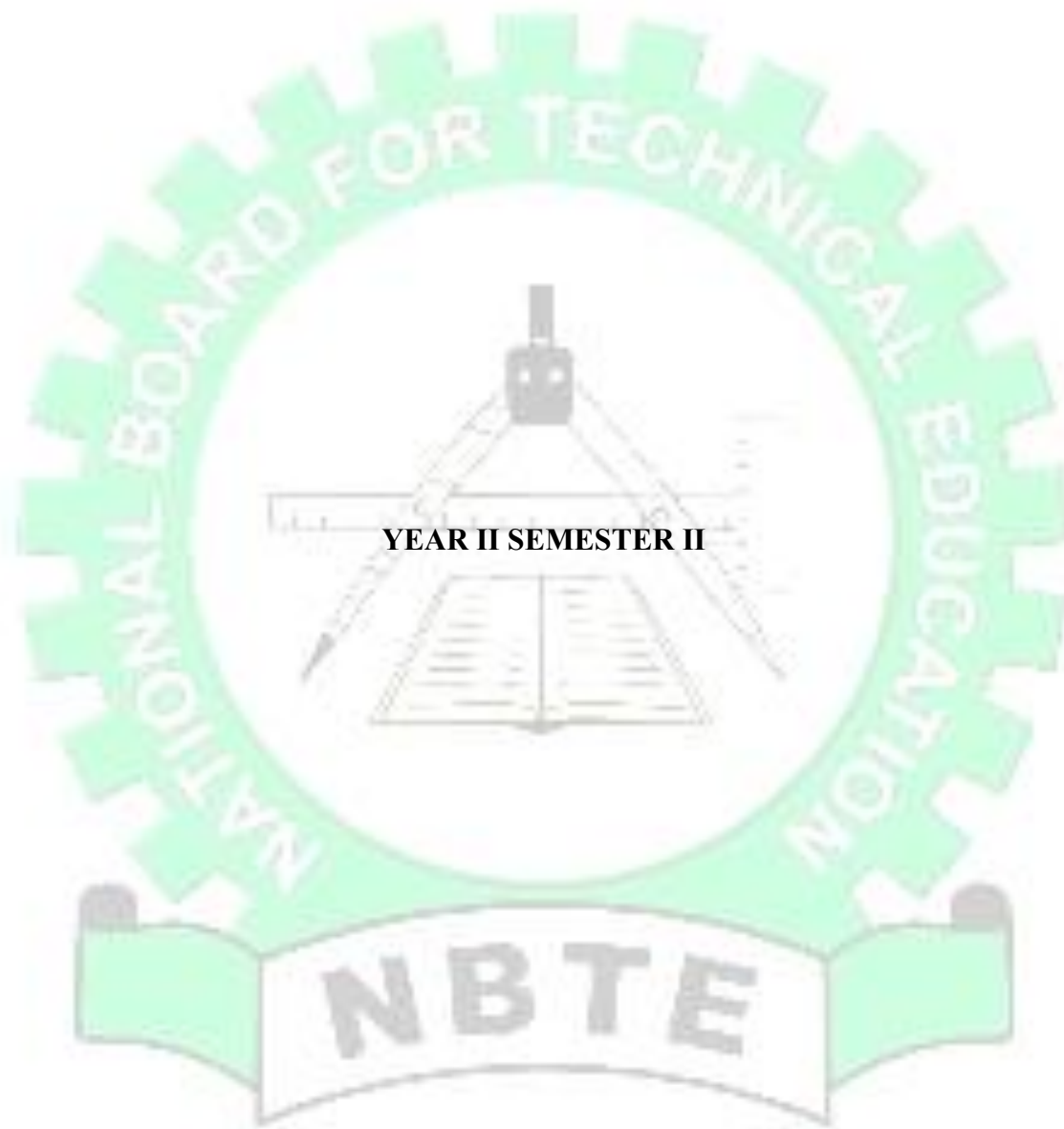
PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: DRAINAGE TECHNOLOGY AND WATERLOGGING MANAGEMENT			COURSE CODE: CPT 416		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills of drainage design, construction, operation and maintenance of drainage systems for agricultural land.						
General Objective 1.0: Understand the importance and principles of drainage						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 3	1.1 Define drainage 1.2 Describe drainage importance in agriculture 1.3 Describe sources of excess water 1.4 Describe effects of poor drainage 1.5 Describe drainage principles.	• Explain drainage • Describe drainage importance in agriculture • Describe sources of excess water • Describe effects of poor drainage • Describe drainage principles.	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Identify a drainage-impaired area on or near campus • Document symptoms (waterlogging, root rot, weed shifts, yield loss) • Carry out a drainage problem-diagnosis exercise: • Dig a 1 m deep hole • Observe water table and saturated layer	• Guide students to: • Identify a drainage-impaired area on or near campus • Document symptoms (waterlogging, root rot, weed shifts, yield loss) • Carry out a drainage problem-diagnosis exercise: • Dig a 1 m deep hole • Observe water table and saturated layer	Field site with drainage problem, notebooks, smartphone; spades, measuring tape, recording sheet
General Objective 2.0: Understand surface drainage methods and design						
4 -7	2.1 Describe random	• Describe random	White/Smart	• Lay out a parallel	• Lay out a parallel	School farm

	field drainage; bedding 2.2 Describe collector and main drains 2.3 Describe design parameters. 2.2 Calculate runoff using Rational Formula ($Q = CIA$)	field drainage; bedding • Describe collector and main drains • Describe design parameters. • Calculate runoff using Rational Formula ($Q = CIA$)	boards, markers, textbooks, journals, internet, charts, projector	field ditch system on a 200 m ² plot at the school farm; • Mark with stakes; Calculate ditch dimensions • Calculate design discharge for a 1 ha agricultural area using Rational Formula given runoff coefficient and design rainfall	field ditch system on a 200 m ² plot at the school farm; • Mark with stakes; Calculate ditch dimensions • Calculate design discharge for a 1 ha agricultural area using Rational Formula given runoff coefficient and design rainfall	plot, stakes, measuring tape, calculator; rational formula worksheet, NIMET rainfall data
General Objective 3.0: Understand sub-surface drainage methods and design						
8 – 10	3.1 Describe types of sub-surface drainage. 3.2 Describe drain materials, depth, spacing 3.3 Calculate drain spacing using Hooghoudt formula 3.4 Describe envelope materials and outlets.	• Describe types of sub-surface drainage. • Describe drain materials, depth, spacing • Calculate drain spacing using Hooghoudt formula • Describe envelope materials and outlets.	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Lay out sub-surface drain pattern on grid paper for a 1 ha plot • Label main, sub- main, lateral drains and outlet • Calculate drain spacing for a clay loam soil ($K = 0.5$ m/day) using Hooghoudt formula given target drawdown	• Guide students to: • Lay out sub-surface drain pattern on grid paper for a 1 ha plot • Label main, sub- main, lateral drains and outlet • Calculate drain spacing for a clay loam soil ($K = 0.5$ m/day) using Hooghoudt formula given target drawdown	Hooghoudt formula worksheet, calculator; grid paper, drainage design template, pencils
General Objective 4.0: Understand drainage system installation and construction						
11-13	4.1 Describe pre- installation	• Describe pre- installation	White/Smart boards, markers,	• Construct a 5 m hand-dug surface	Guide studentd to:	School farm, shovels,

	4.2 Describe surface drain construction 4.3 Describe sub-surface drain installation 4.2 Describe pump-assisted drainage and pump station design	• Describe surface drain construction • Describe sub-surface drain installation • Describe pump-assisted drainage and pump station design	textbooks, journals, internet, charts, projector	drain on the school farm • Dig to proper depth/slope, profile cross-section • Lay 3 m sub-surface drain at 1 m depth • Lay perforated PVC with envelope, backfill • Install a small pump station; • Specify pump capacity	• Construct a 5 m hand-dug surface drain on the school farm • Dig to proper depth/slope, profile cross-section • Lay 3 m sub-surface drain at 1 m depth • Lay perforated PVC with envelope, backfill • Install a small pump station • Specify pump capacity	levellers, measuring tape; perforated PVC, gravel, geotextile, shovel; pump (where available), discharge pipe
General Objective 5.0: Understand drainage maintenance and environmental considerations						
14-15	5.1 Describe routine maintenance. 5.2 Describe drain inspection and monitoring 5.3 Describe environmental considerations 5.4 Describe drainage water reuse and constructed wetlands for treatment	• Describe routine maintenance. • Describe drain inspection and monitoring • Describe environmental considerations • Describe drainage water reuse and constructed wetlands for treatment	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Carry out maintenance on the constructed surface and sub-surface drains • Clear weeds • Remove silt, • Repair damage • Document • Design a small constructed wetland (10 m × 5 m) for treating drainage water; • Specify plants	Guide students to: • Carry out maintenance on the constructed surface and sub-surface drains • Clear weeds • Remove silt, • Repair damage • Document • Design a small constructed wetland (10 m × 5 m) for treating drainage	Constructed drains, hoes, shovels; wetland design template, drainage water source

				(Typha, Phragmites) and inflow/outflow	water; Specify plants (Typha, Phragmites) and inflow/outflow	
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical 40% Examination: 40% Total: 100%						





PRODUCE AND POST-HARVEST MANAGEMENT (VALUE ADDITION)

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: PRODUCE AND POST-HARVEST MANAGEMENT (VALUE ADDITION)	COURSE CODE: CPT 421	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills of the physiological, biochemical and quality changes in harvested produce.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand post-harvest physiology and the nature of post-harvest losses; 2.0 Understand handling, sorting, grading and packaging of fresh produce; 3.0 Know modern storage systems for grains, roots, fruits and vegetables; 4.0 Know processing and value addition for major Nigerian crops; 5.0 Understand food safety, quality standards and modern cold-chain management.		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: PRODUCE, POST-HARVEST MANAGEMENT And COLD CHAIN			COURSE CODE: CPT 421		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills of the physiological, biochemical and quality changes in harvested produce.						
GENERAL OBJECTIVE 1.0: Understand post-harvest physiology and the nature of post-harvest losses						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 3	1.1 Describe respiration, transpiration and ethylene production in harvested produce 1.2 Distinguish climacteric vs non-climacteric fruits; ripening biochemistry 1.3 Describe causes and magnitude of post-harvest losses (PHL): physiological, mechanical,	- Describe respiration, transpiration and ethylene production in harvested produce - Distinguish climacteric vs non-climacteric fruits; ripening biochemistry - Describe causes and magnitude of post-harvest losses (PHL): physiological, mechanical, biological, environmental	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Measure Brix, pH and titratable acidity in ripening tomatoes daily for 5 days - Plot ripening trend - Quantify PHL in stored maize sample: - Weigh fresh, after 4 weeks, - Calculate loss; - Identify causes (insect damage, mould, weight loss)	Guide students to; - Measure Brix, pH and titratable acidity in ripening tomatoes daily for 5 days - Plot ripening trend - Quantify PHL in stored maize sample: - Weigh fresh, after 4 weeks, - Calculate loss; - Identify causes (insect damage, mould, weight loss)	Tomato fruits, refractometer, pH meter, NaOH, indicator; maize sample, weighing scale, sieve; tomato, leafy vegetable, root samples, balance

	biological, environmental 1.4 Describe Nigerian PHL: cereals (10–20%), tubers (40–50%), fruits/vegetables (40–60%)	Describe Nigerian PHL: cereals (10–20%), tubers (40–50%), fruits/vegetables (40–60%)				
GENERAL OBJECTIVE 2.0: Understand handling, sorting, grading and packaging of fresh produce						
4 -7	2.1 Describe pre-cooling methods 2.2 Describe sorting and grading by size, colour, defects, ripeness; manual vs mechanical 2.3 Describe packaging materials 2.4 Describe palletisation and stacking for transport	- Explain pre-cooling methods: room cooling, forced-air, hydro cooling, vacuum - Identify sorting and grading by size, colour, defects, ripeness; manual vs mechanical - Discuss packaging types and show MAP for fruits/vegetables; - Explain palletisation, stacking pattern, and transportation	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Perform grading of 20 kg of tomatoes into 3 grades (Class I, II, III); - Package in cartons - Document sorting criteria - Compare 3 packaging methods (open basket, ventilated carton, hermetic bag) for tomatoes after 7 days; - Assess weight loss and quality - Demonstrate hydrocooling on green leafy vegetable - Cool half a batch in cold water, leave half at room temp	- Guide students to: - Sort, grade and packaging - compare weight loss and quality assessment - Demonstrate hydrocooling and half batch in cold water react.	Tomatoes, weighing scale, sorting tray, cartons; open basket, ventilated carton, hermetic bag, weighing scale; leafy vegetables, cold water, plastic crates

				• Compare wilting and quality after 24 hours		
GENERAL OBJECTIVE 3.0: Understand modern storage systems for grains, roots, fruits and vegetables						
8 - 10	3.1 Describe traditional grain storage 3.2 Describe modern grain storage 3.3 Describe root and tuber storage 3.4 Describe fruit and vegetable in cold storage	• Explain traditional grain storage: cribs, rhombus, granaries, jute bags • Explain modern grain storage: hermetic bags (PICS), metal silos, GrainPro Cocoons • Discuss root tuber storage; yam barn, cassava heap clamps; ventilated cold rooms for sweet potato, Irish potato • Discuss fruit and vegetable in cold storage: refrigeration, ColdHubs solar-powered cold rooms	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Pack 10 kg cowpea in hermetic bag (treated with Actellic 2% dust at 1 g/kg) and 10 kg in jute bag • weigh after 8 weeks • Assess weevil damage and weight loss • Visit a ColdHubs facility or cold storage room (where available) • Document operations, temperature, humidity, capacity, cost • Construct a small yam barn (or replica) using locally available materials; • Place 10 yam tubers • Observe over 4	Guide students to: • Pack 10 kg cowpea in hermetic bag (treated with Actellic 2% dust at 1 g/kg) and 10 kg in jute bag • weigh after 8 weeks • Assess weevil damage and weight loss • Visit a ColdHubs facility or cold storage room (where available) • Document operations, temperature, humidity, capacity, cost • Construct a small yam barn (or replica) using locally available materials; • Place 10 yam tubers	Hermetic vs jute bag comparison report Cold storage visit report Yam barn observation Mid-semester practical exam

				weeks for sprouting and rot	Observe over 4 weeks for sprouting and rot	
GENERAL OBJECTIVE 4.0: Understand processing and value addition for major Nigerian crops						
11-13	4.1 Describe processing of cereals 4.2 Describe processing of legumes. 4.3 Describe processing of roots/tubers 4.4 Explain the processing of tomato paste, mango drying, orange juice extraction, and pineapple jam are conducted.	- Explain processing of cereals: pap, maize flour, masa, semolina - Discuss how legumes: moin-moin, akara, soy milk, soy cake are processed - Explain processing of roots/tubers: garri, fufu, HQCF (high-quality cassava flour), elubo, sweet potato puree (OFSP) biofortified bread - Describe the processing of fruits and vegetables: jam, juice, dried slices, tomato paste	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Process 5 kg cassava into garri - Record process flow - Assess quality (colour, taste, swelling) and yield (kg garri per kg fresh root) - Process 2 kg soybean into soya milk, pasteurise, package, and assess quality. - Process 5 kg ripe tomatoes into paste, - Package in clean jars - Calculate processing loss - Process 3 kg orange-flesh sweet potato (OFSP) into puree for bread enrichment.	- Guide students to: - Process 5 kg cassava into garri - Record process flow - Assess quality (colour, taste, swelling) and yield (kg garri per kg fresh root) - Process 2 kg soybean into soya milk, pasteurise, package, and assess quality. - Process 5 kg ripe tomatoes into paste, - Package in clean jars - Calculate processing loss - Process 3 kg orange-flesh sweet potato (OFSP) into puree for bread enrichment.	Cassava, grater, hydraulic press, frying pan, sieves; soybean, blender, cooker, sieve; tomatoes, blender, cooker, jars; OFSP, blender, cooker
GENERAL OBJECTIVE 5.0: Understand food safety, quality standards and modern cold-chain management						
14-15	5.1 Describe Hazard Analysis Critical Control Point	Describe Hazard Analysis Critical Control Point	White/Smart boards, markers, textbooks,	Develop a HACCP plan for a chosen processing flow	Guide students to: Develop a HACCP plan for a chosen	HACCP plan template, sample processing

	(HACCP) principles 5.2 Describe NAFDAC, SON quality standards and Codex Alimentarius 5.3 Describe aflatoxin testing and management 5.4 Describe cold chain logistics	(HACCP) principles • Describe NAFDAC, SON quality standards and Codex Alimentarius • Describe aflatoxin testing and management • Describe cold chain logistics	journals, internet, charts, projector	(garri, soy milk or tomato paste) • Identify hazards and CCPs • Use aflatoxin test strip on a stored groundnut sample • Interpret result • Recommend action if positive • Visit a NAFDAC office or food processing factory (where available); • Document quality control practices • Reporting requirements	processing flow (garri, soy milk or tomato paste) • Identify hazards and CCPs • Use aflatoxin test strip on a stored groundnut sample • Interpret result • Recommend action if positive • Visit a NAFDAC office or food processing factory (where available); • Document quality control practices • Reporting requirements	flows; aflatoxin strip kit, groundnut sample, water; NAFDAC office or factory, notebooks
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical 40% Examination: 40% Total: 100%						

ORNAMENTAL HORTICULTURE, LANDSCAPE AND URBAN FARMING

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: ORNAMENTAL HORTICULTURE, LANDSCAPE AND URBAN FARMING	COURSE CODE: CPT 422	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills of ornamental plants in their propagation and public landscapes in Nigeria		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand ornamental plants; 2.0 Know propagation of ornamental plants; 3.0 Know lawn establishment and maintenance; 4.0 Understand landscape design principles and digital design tools; 5.0 Understand floriculture and floral arrangement;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: ORNAMENTAL HORTICULTURE, LANDSCAPE AND URBAN FARMING			COURSE CODE: CPT 422		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge of ornamental plants and skills in their propagation, and public landscapes in Nigeria						
GENERAL OBJECTIVE 1.0: Understand ornamental plants: classification and importance						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 - 4	1.1 Define ornamental horticulture 1.2 Describe scope and importance of ornamental horticulture. 1.3 Explain classification of ornamentals: trees, shrubs, climbers, ground cover, lawn grass, foliage, flowering, succulent, indoor plants 1.4 Describe popular Nigerian ornamentals:	•Discuss ornamental horticulture; describe its scope and importance •Explain classification of ornamentals show photographs of each category •Describe each species: growth habit, flower colour, propagation, climate tolerance •Discuss economic value: floriculture	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Identify 30 ornamental plants on campus or nursery by botanical and common name • Classify each by category and use • Visit a commercial nursery or landscape company • Document range of ornamentals stocked, propagation	• Guide students to: • Identify 30 ornamental plants on campus or nursery by botanical and common name • Classify each by category and use • Visit a commercial nursery or landscape company • Document range of ornamentals stocked,	Chart, Experimental Plot, Watering can, PPE

	i. Bougainvillea, ii. Hibiscus, iii. Ixora, Ficus, iv. Croton, v. Heliconia, vi. Anthurium, vii. Allamanda. 1.5 Describe economic value: floriculture exports, landscaping industry, urban greening	exports, landscaping industry, urban greening		methods and prices	propagation methods and prices	
GENERAL OBJECTIVE 2.0: Understand propagation of ornamental plants						
5 – 7	2.1 Describe sexual propagation by seed; 2.2 Describe nursery seed sowing and care 2.3 Describe asexual propagation: stem cutting, leaf cutting, layering, division, grafting, budding 2.4 Describe tissue culture for orchids and selected ornamentals 2.5 Describe rooting hormones (IBA, NAA) and their application	- Describe sexual propagation by seed - Describe nursery seed sowing and care - Describe asexual propagation: stem cutting, leaf cutting, layering, division, grafting, budding - Describe orchid mass propagation via tissue culture; mention LSC Lagos and Abuja TC labs - Discuss IBA	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Carry out 30 stem cuttings of Hibiscus, Bougainvillea and Ixora using IBA dip - Record root initiation and survival after 4 weeks - Carry out simple layering on a Hibiscus or Croton plant - Assess root formation after 6 weeks	- Guide students to: - Carry out 30 stem cuttings of Hibiscus, Bougainvillea and Ixora using IBA dip - Record root initiation and survival after 4 weeks - Carry out simple layering on a Hibiscus or Croton plant - Assess root formation after 6 weeks	Plant materials, IBA, secateurs, propagation media, polythene bags, watering can; healthy plant for layering, scalpel, sphagnum moss, polythene

		dipping for hard-to-root cuttings				
GENERAL OBJECTIVE 3.0: Understand lawn establishment and maintenance						
8 – 10	3.1 Describe lawn grass species: <i>Cynodon dactylon</i>, <i>Stenotaphrum secundatum</i> (St. Augustine), <i>Zoysia matrella</i>, <i>Paspalum notatum</i> (Bahia) 3.2 Describe lawn establishment: seeding, sodding, sprigging, plugging 3.3 Describe lawn maintenance 3.4 Describe lawn pest and disease management	- Describe lawn grass species: <i>Cynodon dactylon</i>, <i>Stenotaphrum secundatum</i> (St. Augustine), <i>Zoysia matrella</i>, <i>Paspalum notatum</i> (Bahia) - Describe lawn establishment: seeding, sodding, sprigging, plugging - Describe lawn maintenance - Describe lawn pest and disease management	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Establish a 5 m² lawn using sodding or sprigging; water and maintain for 4 weeks - Record establishment and weed pressure - Carry out mowing, fertilization and weed control on an existing lawn - Record before/after appearance and growth	Guide students to: - Establish a 5 m² lawn using sodding or sprigging; water and maintain for 4 weeks - Record establishment and weed pressure - Carry out mowing, fertilization and weed control on an existing lawn - Record before/after appearance and growth	Sods/sprigs, school lawn area, fertilizer, water, weeding tools; existing lawn, mower, fertilizer, weed killer
GENERAL OBJECTIVE 4.0: Understand landscape design principles and digital design tools						
11 – 13	4.1 Describe landscape design principles: 4.2 Describe types of gardens: formal, informal, English, Japanese, tropical 4.3 Describe site survey, base map, concept design, planting plan.	- Describe landscape design principles: - Describe types of gardens: formal, informal, English, Japanese, tropical - Describe site survey, base map, concept design, planting plan.	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Carry out a site survey of a 10 m² area on campus - Produce base map - Develop a concept design and Plan on paper - Use SketchUp or Garden Planner to produce a 3D	Guide students to: - Carry out a site survey of a 10 m² area on campus - Produce base map - Develop a concept design plan on paper - Use SketchUp or Garden Planner to	Campus area, measuring tape, drawing materials, base map paper; laptops with SketchUp Free, sample design templates

	4.4 Discuss the use of digital tools: SketchUp (free), Garden Planner, AutoCAD basic for landscape design	• Discuss the use of digital tools: SketchUp (free), Garden Planner, AutoCAD basic for landscape design.		landscape design for a residential home garden.	produce a 3D landscape design for a residential home garden.	
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GENERAL OBJECTIVE 5.0: Understand floriculture and floral arrangement

14 - 15	5.1 Describe production of cut flowers 5.2 Describe floral arrangement principles 5.3 Describe care and handling of cut flowers 5.4 Describe floriculture business in Nigeria	• Describe production of cut flowers • Describe floral arrangement principles • Describe care and handling of cut flowers • Describe floriculture business in Nigeria	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Create 3 different floral arrangements (formal triangular, ikebana, modern free-style) using locally available flowers • Demonstrate post-harvest treatment of cut flowers • Carry out hydration and sugar pulsing assess vase life vs untreated control	Guide students to: • Create 3 different floral arrangements (formal triangular, ikebana, modern free-style) using locally available flowers • Demonstrate post-harvest treatment of cut flowers • Carry out hydration and sugar pulsing assess vase life vs untreated control	Flowers, floral foam, vases, knife, scissors, ribbons; cut flowers, sugar, citric acid, bleach, vases
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COURSE ASSESSMENT:

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

PASTURE AGRONOMY AND FORAGE CONSERVATION

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: PASTURE AGRONOMY AND FORAGE CONSERVATION	COURSE CODE: CPT 423	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills of pasture grasses and legumes, their establishment and management for livestock production in Nigeria.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the importance and types of pastures; 2.0 Understand pasture grasses and their agronomy; 3.0 Know pasture legumes and their agronomy; 4.0 Know pasture establishment and management; 5.0 Understand pasture utilization and forage conservation;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: PASTURE AGRONOMY AND FORAGE CONSERVATION			COURSE CODE: CPT 423		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills of pasture grasses and legumes, their establishment and management for livestock production in Nigeria.						
GENERAL OBJECTIVE 1.0: Understand the importance and types of pastures						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 3	1.1 Define pasture, range, forage, fodder, silage, hay 1.2 Describe importance of pastures in livestock systems: dairy, beef, sheep, goat 1.3 Explain the classification of pastures: natural (rangelands), cultivated; sown, semi-sown 1.4 Describe pasture distribution in	- Define each term in 1.1; distinguish forage (fed) from fodder (cut and carried) - Discuss importance of pastures in livestock systems: dairy, beef, sheep, goat - Discuss the classification pastures: natural (rangelands), cultivated; sown, semi-sown - Explain pasture distribution in	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Identify 10 natural and 10 cultivated pasture species on campus or nearby rangeland - Tabulate location and dominant species - Visit a livestock farm; - Document the pasture system in use - Assess animal nutrition adequacy	Guide students to: - Identify 10 natural and 10 cultivated pasture species on campus or nearby rangeland - Tabulate location and dominant species - Visit a livestock farm; - Document the pasture system in use - Assess animal nutrition adequacy	Field site, identification key, hand lens, notebooks; livestock farm, observation guide, smartphone

	Nigeria's agro-ecological zones	Nigeria's agro-ecological zones				
GENERAL OBJECTIVE 2.0: Understand pasture grasses and their agronomy						
4 – 6	2.1 Describe major tropical pasture grasses: 2.2 Describe agronomic requirements 2.3 Describe productivity: dry matter yield, regrowth, palatability 2.4 Describe weed management in pastures	• Discuss each major tropical pasture grasses in 2.1 according to morphology, ecology, palatability, key strengths • Discuss agronomic requirements: ecology, planting (seed, vegetative), spacing, fertilization • Discuss productivity: dry matter yield, regrowth, palatability • Discuss weed management in pastures	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Establish a 10 m² Panicum maximum and Pennisetum purpureum pasture plot using vegetative cuttings • Manage DM yield at first cut (8–10 weeks) • Identify weed species • Control 5 major weed species in the established pasture • Document control methods used	Guide students to: • Establish a 10 m² Panicum maximum and Pennisetum purpureum pasture plot using vegetative cuttings • Manage DM yield at first cut (8–10 weeks) • Identify and control 5 major weed species in the established pasture • Document control methods used	School farm, Panicum and Pennisetum cuttings, NPK fertilizer, hoes, machete, weighing scale; weed identification key, hoes, herbicide
GENERAL OBJECTIVE 3.0: Understand pasture legumes and their agronomy						
7 – 9	3.1 Describe major tropical pasture legumes 3.2 Describe biological N ₂ fixation by Rhizobium; its	• Describe major tropical pasture legumes • Describe biological N₂ fixation by Rhizobium; its contribution to soil	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Establish a 5 m² Stylosanthes-Andropogon mixed pasture • Inoculate seeds with Rhizobium • Record nodulation	Guide students: • Establish a 5 m² Stylosanthes-Andropogon mixed pasture • Inoculate seeds with Rhizobium	Stylosanthes seeds, Rhizobium inoculant, school farm, hoes; weighing scale, drying oven,

	contribution to soil fertility 3.3 Describe agronomic requirements and management 3.4 Describe legume-grass mixtures and their advantages	fertility • Describe agronomic requirements and management • Describe legume-grass mixtures and their advantages		at 6 WAP • Measure dry matter yield and N content (laboratory or by calculation) of legume vs grass-only plot	• Record nodulation at 6 WAP • Measure dry matter yield and N content (laboratory or by calculation) of legume vs grass-only plot	calculator
GENERAL OBJECTIVE 4.0: Understand pasture establishment and management						
10 – 12	4.1 Describe site selection, land preparation, seeding/planting, beating-up 4.2 Describe pasture fertilization: NPK basal, periodic top-dressing 4.3 Describe grazing management: rotational, continuous, deferred; stocking rate calculation 4.4 Describe pasture rejuvenation.	• Discuss site selection, land preparation, seeding/planting, beating-up • Explain fertilization: 100 kg/ha NPK basal; 100 kg/ha urea after each cut/grazing • Compare grazing systems; calculate stocking rate (TLU/ha) based on DM yield and animal requirement • Explain rejuvenation triggers; oversowing Stylosanthes into degraded grasslands	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Implement a rotational grazing system on a 0.5 ha pasture (paper or actual) with 4 paddocks • Calculate rest period Calculate stocking rate for a 5 ha pasture producing 10 t DM/ha given a TLU consumes 7 kg DM/day • Recommend stocking rate	Guide students to: • Implement a rotational grazing system on a 0.5 ha pasture (paper or actual) with 4 paddocks • Calculate rest period Calculate stocking rate for a 5 ha pasture producing 10 t DM/ha given a TLU consumes 7 kg DM/day • Recommend stocking rate	Calculator, pasture data; pasture plot, fencing materials (where actual), grazing schedule template
GENERAL OBJECTIVE 5.0: Understand pasture utilization and forage conservation						

13 – 15	5.1 Describe pasture utilization. 5.2 Describe silage making. 5.3 Describe hay making: principles, drying methods, baling, storage 5.4 Describe quality assessment of silage and hay: colour, smell, pH, DM	• Discuss pasture utilization: grazing, cut-and-carry, soiling • Explain hay drying (sun) to <15% moisture; baling; storage in dry shed • Discuss hay making: principles, drying methods, baling, storage • Explain quality assessment of silage and hay: colour, smell, pH, DM	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Make 5 kg of silage from cut Pennisetum or maize using a polythene-bag silo. • Assess quality after 4 weeks (pH, colour, smell) • Make hay from 5 kg cut Andropogon or Panicum • Sun-dry for 3 days; • Bale by hand • Assess quality	Guide students to: • Make 5 kg of silage from cut Pennisetum or maize using a polythene-bag silo. • Assess quality after 4 weeks (pH, colour, smell) • Make hay from 5 kg cut Andropogon or Panicum • Sun-dry for 3 days; • Bale by hand • Assess quality	Cut forage (Pennisetum or maize), molasses, polythene bag/drum, weighing scale, pH meter; cut grass, drying area, baling tools, dry storage
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COURSE ASSESSMENT:

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

SEED PRODUCTION, PATHOLOGY AND QUALITY CONTROL

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: SEED PRODUCTION, PATHOLOGY AND QUALITY CONTROL	COURSE CODE: CPT 424	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to provide students with the knowledge and skills of the seed industry and pathology in seed production.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the importance of quality seed in agricultural production; 2.0 Understand seed production: breeder, foundation, certified, commercial classes; 3.0 Understand seed certification and seed quality testing; 4.0 Understand seed-borne diseases and seed dressing; 5.0 Understand seed processing, packaging and storage;		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: SEED PRODUCTION, PATHOLOGY AND QUALITY CONTROL			COURSE CODE: CPT 424		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with the knowledge and skills of the seed industry and pathology in seed production.						
GENERAL OBJECTIVE 1.0: Understand the importance of quality seed in agricultural production						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 3	1.1 Define seed 1.2 Distinguish seed from grain 1.3 Describe attributes of quality seed 1.4 Describe consequences of poor-quality seed; yield loss 1.5 Describe Nigerian seed industry.	• Explain seed; distinguish seed from grain • Explain attributes of quality seed: genetic purity, physical purity, viability, vigour, seed health • Explain consequences of poor-quality seed; yield loss • Explain the role of NASC; major seed companies (Premier Seeds, Maslaha Seeds,	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Compare 3 seed lots • Document differences • Visit a seed company or NASC zonal office. • Document seed business operations and quality control	Guide students to: • Compare 3 seed lots • Document differences • Visit a seed company or NASC zonal office. • Document seed business operations and quality control	Seed lots, hand lens, weighing scale; seed company/NASC office, notebooks, smartphone

		Value Seeds); WASA Foundation				
GENERAL OBJECTIVE 2.0: Understand seed production: breeder, foundation, certified, commercial classes						
4 – 6	2.1 Describe seed multiplication chain: - Breeder - Foundation - Certified/registered - Commercial 2.2 Describe isolation requirements (spatial, temporal) to maintain purity 2.3 Describe roguing: removal of off-types, diseased plants, weed species 2.4 Describe seed harvesting: timing, threshing, immediate handling	- Explain seed multiplication chain: - Breeder - Foundation - Certified/registered - Commercial - Explain isolation requirements (spatial, temporal) to maintain purity - Explain roguing in a seed-multiplication plot; criteria for off-type identification - Explain harvesting at maturity (avoid early harvest); careful threshing to avoid mechanical damage	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Establish a small seed-multiplication plot (5 m²) of cowpea using foundation seed - Carry out 2 roguing during the season - Harvest the seed-production plot at maturity - Thresh, clean and pack; calculate seed yield (kg/ha)	Guide students to: - establish a small seed-multiplication plot - Supervise plot establishment for roguing - Supervise harvesting, threshing, cleaning packing and yield calculation	Foundation seed (cowpea), 5 m ² plot, hoes, identification chart; threshing tools, sieves, weighing scale, packaging bags
GENERAL OBJECTIVE 3.0: Understand seed certification (NASC) and seed quality testing						

7 - 9	3.1 Explain NASC seed certification process and standards 3.2 Describe field inspection and laboratory testing 3.3 Describe seed quality tests: purity, germination, moisture, vigour 3.4 Describe ISTA international standards	- Describe NASC certification: registration, inspection, testing, labelling - Explain field inspection at flowering and maturity; lab testing procedures - Explain seed quality tests by hand-sorting; purity germination test on rolled paper or petri dish; moisture by oven and vigour - Explain ISTA Rules; refer to international seed certification systems	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Conduct full seed quality test on 1 kg cowpea seed - Find Purity %, - Find Germination % (4 replicates of 100 seeds), - Find Moisture %; - Submit lab report - Conduct vigour test: standard germination vs accelerated ageing or cold test on the same seed lot	- Guide students to: - Conduct full seed quality test on 1 kg cowpea seed - Find Purity %, - Find Germination % (4 replicates of 100 seeds), - Find Moisture %; - Submit lab report - Conduct vigour test: standard germination vs accelerated ageing or cold test on the same seed lot	Cowpea seed sample, balance, germination paper, petri dishes, oven, calculator, lab report template; accelerated ageing chamber or refrigerator
GENERAL OBJECTIVE 4.0: Understand seed-borne diseases and seed dressing						
10-12	4.1 Describe seed-borne pathogens. 4.2 Describe modes of transmission external, internal 4.3 Describe seed health testing 4.4 Describe seed	- Describe seed-borne pathogens: - Describe modes of transmission: external, internal - Describe seed health testing - Describe seed	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Conduct blotter method seed health test on cowpea or rice seed; - Identify fungal pathogens after 7 days incubation - Apply Apron Star or	- Guide students to: - Conduct blotter method seed health test on cowpea or rice seed; - Identify fungal pathogens after 7 days incubation	Seed sample, blotter paper, petri dishes, water, microscope; cowpea seed, Apron Star, mixing bag,

	dressing.	dressing.		Dress Force to 5 kg of cowpea seed • Verify uniform coverage, bag and label	• Apply Apron Star or Dress Force to 5 kg of cowpea seed • Verify uniform coverage, bag and label	labels
GENERAL OBJECTIVE 5.0: Understand seed processing, packaging and storage						
13-15	5.1 Explain seed cleaning 5.2 Describe seed grading: size, weight, colour 5.3 Explain seed packaging. 5.4 Describe seed storage.	• Explain seed cleaning • Describe seed grading: size, weight, colour • Discuss seed packaging • Describe seed storage.	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Grade 5 kg cowpea seed using sieves • Sort into 3 size grades • Weigh each grade and calculate % • Package graded cowpea seed in 3 different packaging materials (paper bag, foil, hermetic) • Store for 4 weeks • Assess viability and storage quality	Guide students to: • Grade 5 kg cowpea seed using sieves • Sort into 3 size grades • Weigh each grade and calculate % • Package graded cowpea seed in 3 different packaging materials (paper bag, foil, hermetic); • Store for 4 weeks; • Assess viability and storage quality	Cowpea seed, sieves, weighing scale, sorting tray; paper bags, foil bags, hermetic bags, labels, germination paper
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical 40% Examination: 40% Total: 100%						

WEED SCIENCE AND INTEGRATED WEED MANAGEMENT

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: WEED SCIENCE AND INTEGRATED WEED MANAGEMENT	COURSE CODE: CPT 425	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills of weed biology, classification and ecology in weed identification and integrated weed management (IWM)		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand weed concepts, importance and economic loss; 2.0 Understand weed classification and field identification; 3.0 Understand weed biology, ecology and reproduction; 4.0 Understand weed control methods; 5.0 Understand integrated weed management (IWM) and herbicide resistance management.		

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)						
COURSE TITLE: WEED SCIENCE AND INTEGRATED WEED MANAGEMENT			COURSE CODE: CPT 425		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills of weed biology, classification and ecology in weed identification and integrated weed management (IWM)						
GENERAL OBJECTIVE 1.0: Understand weed concepts, importance and economic loss						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Define weed 1.2 Explain the characteristics of successful weeds. 1.3 Describe types of weed losses 1.4 Explain global and Nigerian crop losses to weeds. 1.5 Describe positive uses of some weeds (medicinal, fodder, soil cover)	• Explain weed • Explain the characteristics of successful weeds. • Describe types of weed losses • Discuss global and Nigerian crop losses to weeds. • Explain positive uses of some weeds (medicinal, fodder, soil cover)	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Establish a maize trial plot (5 m² each) • Compare weeding-vs-no-weeding to see the difference. • Compare crop yield at harvest. • Identify 5 weeds with positive uses on the school farm.	• Guide student to: • Establish a maize trial plot (5 m² each) • Compare weeding-vs-no-weeding to see the difference. • Compare crop yield at harvest. • Identify 5 weeds with positive uses on the school farm.	School farm, maize seeds, weeding tools, weighing scale; weed photographs, identification guide, notebooks
GENERAL OBJECTIVE 2.0: Understand weed classification and field identification						
4-6	2.1 Describe weed by life cycle.	• Describe weed by life cycle	White/Smart boards, markers,	• Identify 25 weed species on the	Guide students to: • Identify 25 weed	School farm and surrounding

	2.2 Describe weed by morphology. 2.3 Explain common Nigerian weeds 2.4 Explain the use Plantix for weed identification; build a campus weed herbarium	• Describe weed by morphology. • Explain common Nigerian weeds • Explain the use Plantix for weed identification; build a campus weed herbarium	textbooks, journals, internet, charts, projector	school farm and surrounding fields • Classify by life cycle and morphology • Build a herbarium of 20 mounted, labelled weed specimens (with botanical name, family, life cycle, control suggestion)	species on the school farm and surrounding fields • Classify by life cycle and morphology • Build a herbarium of 20 mounted, labelled weed specimens (with botanical name, family, life cycle, control suggestion)	fields, smartphones, identification key; herbarium press, mounting paper, labels, glue, notebooks
GENERAL OBJECTIVE 3.0: Understand weed biology, ecology and reproduction						
7-10	3.1 Describe weed seed production, dormancy, viability and seed bank 3.2 Describe weed dispersal 3.3 Describe vegetative reproduction 3.4 Describe weed-crop competition: critical period, allelopathy	• Describe weed seed production, dormancy, viability and seed bank • Describe weed dispersal • Describe vegetative reproduction • Describe weed-crop competition: critical period, allelopathy	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Conduct a soil seed bank study • Collect topsoil samples from 3 plots • Germinate in trays • Count emerging weeds • Identify emerging weeds • Demonstrate allelopathy • Extract water from Imperata or Tridax leaves	Guide students to: • Conduct a soil seed bank study • Collect topsoil samples from 3 plots • Germinate in trays • Count emerging weeds • Identify emerging weeds • Demonstrate allelopathy • Extract water from Imperata or Tridax leaves applied to germinating	Soil samples, germination trays, watering can, identification key; plant material, water, blender, filter, petri dishes

				applied to germinating maize/cowpea; Record germination % and seedling growth	maize/cowpea; Record germination % and seedling growth	
GENERAL OBJECTIVE 4.0: Understand weed control methods						
11-13	4.1 Explain weed control 4.2 Describe mechanical/manual control. 4.3 Explain biological control 4.4 Describe chemical control	- Discuss rotation against grass weeds; mucuna mulch against Imperata; cassava-maize-legume rotation - Discuss hand hoeing labour cost with mechanical weeder (rotary, disc); discuss timing - Explain biological control: livestock grazing, classical biocontrol (e.g. weevils on water hyacinth) - Discuss chemical control: herbicide groups, modes of action, HRAC classification, application timing	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Compare 4 weed control methods on 25 m² plots each at 3 and 6 WAP for weed cover and crop yield - Mix atrazine pre-emergence and 2,4-D post-emergence - Apply on maize plot and compare weed control efficacy	Guide students to: - Compare 4 weed control methods on 25 m² plots each at 3 and 6 WAP for weed cover and crop yield - Mix atrazine pre-emergence and 2,4-D post-emergence - Apply on maize plot and compare weed control efficacy	School farm plots, hoes, mucuna seeds, atrazine, glyphosate; knapsack sprayer, PPE, atrazine, 2,4-D, scoring sheet
GENERAL OBJECTIVE 5.0: Understand integrated weed management (IWM) and herbicide resistance management						

13-15	5.1 Explain IWM and its principles 5.2 Explain an IWM Programme combining cultural, mechanical, biological and chemical methods 5.3 Describe Striga management with push-pull, resistant varieties (SAMMAZ-43), seed treatment (Imazapyr) 5.4 Describe the methods of IWM, benefits of IWM and IWM practices	• Explain IWM. • Explain IWM principles and how multiple tactics reduce reliance on any single method • Discuss Striga management with push-pull, resistant varieties (SAMMAZ-43), seed treatment (Imazapyr) • Explain Describe the methods of IWM, benefits of IWM and IWM practices	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Develop a complete IWM Programme for a 0.5 ha maize-cowpea rotation farm • Document each tactic with timing and cost • Document Striga damage on a sorghum/maize plot • Compare with adjacent push-pull or STRIGAWAY plot if available	Guide students to: • Develop a complete IWM Programme for a 0.5 ha maize-cowpea rotation farm • Document each tactic with timing and cost • Document Striga damage on a sorghum/maize plot • Compare with adjacent push-pull or STRIGAWAY plot if available	IWM template, calculator, market price data; sorghum/maize plot, push-pull/STRIGAWAY reference, observation sheet
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COURSE ASSESSMENT:

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

FARM MECHANIZATION AND PRECISION AGRICULTURE TECHNOLOGY

PROGRAMME: CROP PRODUCTION TECHNOLOGY — HIGHER NATIONAL DIPLOMA (HND)		
COURSE TITLE: FARM MECHANIZATION AND PRECISION AGRICULTURE TECHNOLOGY	COURSE CODE: CPT 426	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills of farm power, tractors and implements including modern precision-agriculture tools.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand farm power and prime movers; 2.0 Understand tractors: types, components and operation; 3.0 Understand tillage, planting, fertilizer and weeding implements; 4.0 Understand harvesting and post-harvest machinery; 5.0 Understand precision agriculture; 6.0 Understand farm machinery economics, maintenance and safety;		

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COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills of farm power, tractors and implements including modern precision-agriculture tools.						
GENERAL OBJECTIVE 1.0: Understand farm power and prime movers						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 3	1.1 Define farm power 1.2 Describe sources of farm power. 1.3 Describe internal combustion engine. 1.4 Describe major engine systems: 1.5 Explain power requirement for farm operations	• Explain farm power • Describe sources of farm power. • Describe internal combustion engine. • Describe major engine systems: • Explain power requirement for farm operations	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Identify the major components of a 4-stroke diesel engine on a stationary engine or tractor • Calculate the tractor power required to plough 5 ha of medium-textured soil within 8 hours • Recommend tractor HP	Guide students to: • Identify the major components of a 4-stroke diesel engine on a stationary engine or tractor • Calculate the tractor power required to plough 5 ha of medium-textured soil within 8 hours • Recommend tractor HP	Stationary diesel engine, tractor in workshop, hand lens; calculator, formula sheet
GENERAL OBJECTIVE 2.0: Understand tractors: types, components and operation						
4 – 6	2.1 Describe types of tractor.	• Describe types of tractor.	White/Smart boards, markers,	• Carry out complete tractor	Guide students to: • Carry out complete	Available Tractor in good

	2.2 Describe major components of tractor. 2.3 Explain tractor pre-start, start-up, driving, stopping and parking safely 2.4 Describe the use of 3-point linkage and PTO to attach implements	- Describe major components of tractor. - Explain tractor pre-start, start-up, driving, stopping and parking safely - Describe the use of 3-point linkage and PTO to attach implements	textbooks, journals, internet, charts, projector	pre-start checklist - Drive in figure-8 on practice ground - Park safely - Attach a disc plough or harrow using 3-point linkage - Engage PTO - Demonstrate ploughing on a practice strip	tractor pre-start checklist - Drive in figure-8 on practice ground - Park safely - Attach a disc plough or harrow using 3-point linkage - Engage PTO - Demonstrate ploughing on a practice strip	condition, practice ground, PPE; disc plough, harrow, 3-point linkage, PTO shaft (with guard)
GENERAL OBJECTIVE 3.0: Understand tillage, planting, fertilizer and weeding implements						
7 – 9	3.1 Describe primary tillage implements 3.2 Describe secondary tillage 3.3 Describe planting and fertilizer applicators 3.4 Describe weeding implements.	- Discuss each primary plough mould board for inversion, disc for trash, chisel for sub-soiling - Explain each secondary tool disc harrow for clod breaking ridger for cassava/yam - Explain row planter for maize/cowpea (calibration for seed rate) broadcast	White/Smart boards, markers, textbooks, journals, internet, charts, projector	- Calibrate a row planter for maize at 75×25 cm spacing - Verify seed rate per hectare - Plant 100 m² strip - Calibrate a motorised knapsack sprayer - Mix herbicide at recommended rate - Spray 100 m² maize plot	Guide students to: - Calibrate a row planter for maize at 75×25 cm spacing; - Verify seed rate per hectare; - Plant 100 m² strip - Calibrate a motorised knapsack sprayer - Mix herbicide at recommended rate; - Spray 100 m² maize plot	Row planter, maize seeds, scale, school farm; motorised knapsack, herbicide, PPE, calibration template

		spreader; fertilizer drill • Discuss manual vs motorised knapsack • Explain calibration; precision in row crops				
GENERAL OBJECTIVE 4.0: Understand harvesting and post-harvest machinery						
10 – 11	4.1 Describe harvesting machinery 4.2 Explain threshing and cleaning 4.3 Explain drying machinery 4.4 Describe milling and processing equipment: hammer mill, oil expeller, grater, hydraulic press	• Describe harvesting machinery • Explain threshing and cleaning: • Explain drying machinery • Describe milling and processing equipment: hammer mill, oil expeller, grater, hydraulic press	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Operate a thresher to thresh 5 kg maize cobs; calculate threshing efficiency and breakage rate • Operate a hammer mill to mill maize into flour; or oil expeller to extract groundnut oil; • Record yield and quality	Guide students to: • Operate a thresher to thresh 5 kg maize cobs; calculate threshing efficiency and breakage rate • Operate a hammer mill to mill maize into flour; or oil expeller to extract groundnut oil; • Record yield and quality	Thresher, maize cobs, weighing scale; hammer mill, oil expeller, groundnut, weighing scale, sieve
GENERAL OBJECTIVE 5.0: Understand precision agriculture						
12 –13	5.1 Define precision agriculture. 5.2 Describe precision agriculture principles. 5.3 Describe GPS-	• Discuss PA; explain spatial variability and 4Rs concept extended to PA • Discuss John	White/Smart boards, markers, textbooks, journals, internet, charts, projector	• Take GPS waypoints and map a 1 ha plot. • Transfer to free GIS (QGIS) • Calculate area and	• Guide students to: • Take GPS waypoints and map a 1 ha plot. • Transfer to free GIS (QGIS)	GPS unit/smartphone, laptop with QGIS; drone, smartphone, demo site;

	guided tractors, auto-steer, variable rate technology (VRT). 5.4 Describe drones (UAVs) for crop monitoring, NDVI mapping, spraying. 5.5 Describe IoT, on-farm sensors, AI-based decision support, mobile farm management apps.	Deere Auto Track, RTK GPS, VRT for fertilizer/seeds - Discuss DJI/Hello Tractor drones; NDVI mapping with multispectral camera; agricultural spray drones - Discuss IoT (Zenvus Smartfarm), AI advisory, mobile-based market information		perimeter - Observe a drone flight (commercial demo or partnered drone service) - Document image acquisition and NDVI processing - Use Zenvus or similar app on a campus plot for 4 weeks - Submit dashboard observations	- Calculate area and perimeter - Observe a drone flight (commercial demo or partnered drone service) - Document image acquisition and NDVI processing - Use Zenvus or similar app on a campus plot for 4 weeks - Submit dashboard observations	smartphones with Zenvus
GENERAL OBJECTIVE 6.0: Understand farm machinery economics, maintenance and safety						
14-15	6.1 Explain fixed and variable costs of farm machinery. 6.2 Explain buying vs hiring machinery. 6.3 Describe preventive maintenance. 6.4 Describe application of farm machinery safety.	- Discuss the calculation of depreciation, interest, taxes (fixed); fuel, oil, repairs, labour (variable); cost per hour - Explain the conditions to buying vs hiring	Machinery economics worksheets, Hello Tractor app, machinery in school workshop, grease gun, oil, files, PPE, first aid kit, LCD projector	- Calculate ownership cost per hectare for a 75 HP tractor with 1,000-hour annual use - Compare with hiring at Hello Tractor rate - Carry out preventive	Guide students to: - Calculate ownership cost per hectare for a 75 HP tractor with 1,000-hour annual use - Compare with hiring at Hello Tractor rate - Carry out preventive	Cost worksheet, calculator, Hello Tractor rate sheet; tractor/implementation, grease gun, oil, files, PPE, log book

		machinery (Hello Tractor, NIRSAL, FMARD tractor schemes) • Discuss preventive maintenance schedule; show grease points, oil change, blade sharpening • Discuss tractor safety: ROPS, seat belt, PTO guard; agro-chemical safety; first aid for cuts, eye irritation, PPE		maintenance on a tractor • Carry out greasing, oil-level check, filter inspection, blade sharpening. • Document preventive maintenance	maintenance on a tractor • Carry out greasing, oil-level check, filter inspection, blade sharpening. • Document preventive maintenance	
COURSE ASSESSMENT: Course work: 10% Test/Assignments: 10% Practical 40% Examination: 40% Total: 100%						

LIST OF MINIMUM RESOURCES/PHYSICAL FACILITIES

A. FARMS

S/N	Item / Equipment	Qty Required	Specification / Notes
1.	Experimental / Teaching Farm	≥ 2 ha	Sub-divided into teaching, research and demonstration plots; fully fenced and secured; access road; reliable water source.
2.	Commercial Farm (Tuber, Cereals & Legumes Demonstration)	≥ 5 ha	For full-cycle commercial-scale demonstration of major arable crops.
3.	Horticultural Farm	≥ 1 ha	For vegetables, ornamentals and short-cycle horticultural crops.
4.	Orchard	≥ 1 ha	Permanent fruit-crop plantation: mango, guava, cashew, citrus, pawpaw, avocado.
5.	Plantation Estate	≥ 1 ha	Oil palm (NIFOR Tenera D × P), rubber, cocoa (CRIN hybrids), coffee, kola.
6.	Nursery / Seedling-Production Area	1 unit (10–20 m ²)	Raised beds + screen house; for seedling raising of all crops.
7.	Demonstration Plots — Root & Tuber Crops	0.5 ha	Cassava (TME 419, TMS 419, Sango Pona, NR 8082), yam (TDr 95/19177), sweet potato OFSP (Umuspo 1, 2, 3), Irish potato, cocoyam.
8.	Demonstration Plots — Cereals	0.5 ha	Maize (SAMMAZ-39, SAMMAZ-43 striga-tolerant), rice (FARO), sorghum, millet, wheat.
9.	Demonstration Plots — Legumes / Oilseeds	0.5 ha	Cowpea (IT-series), soybean (TGx), groundnut, bambara nut; rhizobium-inoculated.
10.	Demonstration Plots — Fibre Crops	0.25 ha	Cotton, kenaf, jute (where ecologically applicable).
11.	Cropping-Systems Demonstration Plots	0.5 ha	Sole, mixed, intercropping and rotation systems in adjacent layout for comparison.

S/N	Item / Equipment	Qty Required	Specification / Notes
12.	Conservation Agriculture (CA) Demo Plot	0.1 ha	Permanent cover, minimum tillage, crop rotation; demonstrates SI principles.
13.	Climate-Smart Agriculture (CSA) Demo Plot	0.1 ha	Climate-resilient varieties, conservation tillage, agroforestry corner with Faidherbia/Leucaena.
14.	Mini Plantation (Cocoa / Citrus / Oil Palm Demonstration)	1.0 ha	For HND plantation-management course; CRIN/NIFOR/NIHORT-supplied stock at recommended spacing.
15.	Pasture Demonstration Plots	0.25 ha	Grass + legume mixture: Panicum, Pennisetum, Andropogon + Stylosanthes, Centrosema; NAPRI/ILRI-supplied.
16.	Compost / Manure Site	1 site	Open-bin composting; vermicompost optional; manure store.
17.	Fertilizer Store	1 unit	Lockable, ventilated, dry storage; segregated from agro-chemical store.
18.	Implement / Tool Shed	1 unit	Secure, ventilated, racked storage for hand tools and small equipment.
19.	Farm-Machinery Shed	1 unit	Roofed, locked, drained; capacity for 4 tractors and implements.
20.	Yam Barn (Traditional Storage)	1 unit	Bamboo / wood structure for yam-storage demonstration practicals.
21.	Cocoa Fermentation Mat / Heap Area	1 unit	Concrete or wooden platform with banana-leaf or polythene cover.
22.	Sun-Drying Area (Plantation Crops)	1 unit	Concrete or mat platform for cocoa, coffee, pepper drying.
23.	Water Supply (Borehole + Overhead Tank)	1 system	Reliable potable / irrigation water for farm, lab and greenhouse use; min. 10 000-L overhead capacity.
24.	Artificial Lake / Pond	1 ($\geq$ 1 ha)	For rainwater harvesting, irrigation reservoir, and aquaculture-integration demonstration.
25.	Perimeter Fencing	Site total	Chain-link or palisade with at least one secured gate; livestock-proof.
26.	Plot-Identification Materials	Class set	Weatherproof markers, plot labels, pegs, ranging poles, twine.

B. GENERAL TEACHING LABORATORY
Biology/ Microbiology Laboratory

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Compound microscopes ($\times 400$ / $\times 1000$)	40	One (1) per pair of students; binocular preferred; built-in LED illumination.
2	Stereo / dissecting microscopes	40	For seed, insect and tissue specimen examination.
3	Hand lenses ($\times 10$, $\times 20$)	80	One (1) per student.
4	Laboratory benches with sink, gas and electric outlets	20	4 students per bench; chemical-resistant top.
5	Glassware sets (beakers, flasks, pipettes, slides, petri dishes)	80 sets	Standard teaching-laboratory glassware; borosilicate.
6	pH meter (digital, benchtop)	10	For soil, water and nutrient-solution measurement.
7	EC / TDS meter	10	For water-quality and nutrient-solution measurement.
8	Refrigerator (laboratory-grade)	1	For reagent and sample storage; 4 °C constant.
9	Incubators (28 °C and 37 °C)	2	For pathology cultures and microbial work.
10	Hot-air drying oven	2	For sample preparation, moisture determination; 105–200 °C range.
11	Thermometers, hygrometers, barometers	10 sets	Climate-monitoring and lab environment.
12	Magnetic stirrers + hot plates	4	For solution preparation.
13	Analytical balance (0.001 g)	2	For precise weighing.
14	Bench-top balance (0.01 g)	4	For general weighing.
15	Reagent storage cabinets	4	Fire-resistant; chemical-segregation compliant.
16	Wash sinks with running water	4	Standard laboratory sinks with mixer taps.

S/N	Item / Equipment	Qty Required	Specification / Notes
17	Bunsen burners + gas points	20	Standard laboratory burners.
18	Slide dispensers, staining troughs, test-tube racks	Set	For microscope-slide preparation.
19	Distilled-water apparatus	1	For reagent and stain preparation.
20	Fume hood	1	Required for chemical-handling safety.
21	Eye-wash station and safety shower	1	NBTE safety standard for chemistry laboratories.

A. Soil Science Laboratory

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Drying oven (soil-dedicated)	2	105 °C constant for moisture determination.
2	Muffle furnace / electric furnace	1	For organic-carbon determination by ignition.
3	Soil augers (Edelman / screw type)	10	For profile sampling.
4	Soil profile-pit kit (spade, trowel, knife, profile boxes)	10 sets	For pit-description practicals.
5	Munsell soil colour chart	10	For soil-colour determination.
6	Soil-sieve set (0.2 mm and graded)	10 sets	For particle-size analysis and sample preparation.
7	Particle-size analysis equipment (hydrometer, Bouyoucos)	5 sets	For texture determination.
8	Bulk-density rings (100 cm ³ cores)	20	Standard core-sampling rings.
9	Soil-sedimentation apparatus	5	For mechanical analysis.
10	Soil-capillary determination apparatus	4	For water-retention practicals.
11	Soil-permeability meter	2	For infiltration / permeability determination.

S/N	Item / Equipment	Qty Required	Specification / Notes
12	Soil-hardness tester (penetrometer)	2	For compaction measurement.
13	Pocket penetrometer	5	Quick field strength testing.
14	Soil-testing kit (field NPK + pH strips)	10	Farmer-style quick field testing.
15	Soil-moisture meter (capacitive)	4	In-field moisture determination.
16	Soil pH meter (digital, portable)	4	Direct-reading field unit.
17	Soil salt tester / portable EC meter	4	For salinity assessment.
18	Flame photometer	1	For Na and K determination.
19	Spectrophotometer (UV-Vis)	1	For phosphorus, micronutrient analysis.
20	Kjeldahl apparatus (digestion + distillation)	1 set	For total-N determination; micro-digester variant included.
21	Analytical balance (0.0001 g)	1	For precision lab work.
22	Atomic Absorption Spectrophotometer (AAS)	1	For heavy-metal and micronutrient analysis; or partnered access where institutional procurement is unfeasible.
23	Soil exchange-capacity (CEC) determination apparatus	1 set	For ammonium-acetate or BaCl ₂ method.
24	Soil-testing outfit (complete portable kit)	4	Standard portable analyser.
25	Humidity / desiccator cabinet	2	For sample equilibration.
26	Vacuum pump	3	For filtration and distillation.
27	Reagents (Bray, Olsen, ammonium-acetate, HCl, H ₂ O ₂ , NaOH)	Per term	Standard pedology and chemistry reagents.
28	Handheld GPS units (Garmin or	10	For soil-survey waypoint mapping.

S/N	Item / Equipment	Qty Required	Specification / Notes
	smartphone-equivalent)		
29	Computer workstation with QGIS, Google Earth Pro	1	For Digital Soil Mapping (DSM); access to AfSIS, SoilGrids, Sentinel-2.
30	Topographic / soil maps of locality	Set	From OSGOF and FMAFS; for survey practicals.
31	Reference: USDA Soil Taxonomy and FAO/WRB classification	Set	For pedology classification.

B. Agricultural Biochemistry Laboratory

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Biochemistry laboratory benches	4	With sinks, gas, electric outlets and storage.
2	Spectrophotometer (UV-Vis)	1	For pigment, protein and sugar quantification.
3	Centrifuge (bench-top)	2	For sample preparation; 6 000–10 000 rpm.
4	Water baths (37 °C and 60 °C)	2	For enzyme-assay incubation.
5	pH meter (bench-top digital)	2	For buffer preparation.
6	Conductivity meter	2	For ionic-strength assessment.
7	Glassware sets (volumetric flasks, pipettes, burettes, test tubes)	80 sets	Standard biochemistry glassware.
8	Reagents (Benedict, Biuret, ninhydrin, DNS, starch, iodine)	Per term	Carbohydrate, protein and amino-acid assays.
9	Micropipettes (variable 0.1–1 mL and 1–10 mL)	10 sets	For precision liquid handling.
10	Mortar and pestle	10	For tissue homogenisation.

S/N	Item / Equipment	Qty Required	Specification / Notes
11	Enzyme samples (amylase, catalase, urease)	Per session	For enzyme-kinetics demonstrations.
12	Refrigerator (lab-grade)	1	Reagent and enzyme storage.
13	Deep freezer	1	For long-term sample storage at -20°C .

C. Crop Physiology Laboratory

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Plant physiology laboratory bench	1	Dedicated bench in teaching laboratory.
2	Light meter / lux meter	2	For measuring solar radiation in field and greenhouse.
3	Leaf-area meter	1	Or smartphone-based LeafByte / Easy Leaf Area app alternative.
4	Photosynthesis demonstration apparatus (Hill reaction / bell-jar)	1	For light-reaction demonstration.
5	Chlorophyll extraction setup (acetone, mortar, pestle, centrifuge)	Set	For chlorophyll a/b extraction practical.
6	Hand-held SPAD-502 chlorophyll meter	2	Non-destructive chlorophyll measurement.
7	Spectrophotometer (visible)	1	For chlorophyll quantification.
8	Porometer (or stomatal-imprint setup)	1	For stomatal-conductance and density practicals.
9	Germination chambers / petri dishes / blotter paper	Set	For seed-germination practicals.
10	Light / dark growth chambers	1	For etiolation and photoperiod demonstrations.
11	Growth-analysis materials (charts, calipers, rulers)	Set	For NAR, RGR, LAR, CGR calculations.

S/N	Item / Equipment	Qty Required	Specification / Notes
12	Hot-air drying oven (for biomass DM)	1	Shared with general laboratory.

D. Plant Pathology and Biological Control Laboratory

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Autoclave	1	For media and tool sterilisation; 121 °C, 15 psi.
2	Refrigerator (lab-grade)	1	For pathogen-culture preservation.
3	Deep freezer	1	For long-term pathogen storage.
4	Incubators (25 °C and 30 °C)	2	For fungal- and bacterial-culture growth.
5	Anaerobic jar	2	For anaerobic-pathogen isolation.
6	Inoculation chamber / moist chamber	2	For disease-inoculation practicals.
7	Laminar-flow cabinet	1	For aseptic transfer and inoculation.
8	Bunsen burners + platinum wire loops	10 sets	For sterile inoculation.
9	Lovibond colour comparator	1	For colour-disease diagnostics.
10	Colony counter	2	For microbial-load enumeration.
11	Water bath	1	For media preparation.
12	Stirrer (magnetic)	4	For media preparation.
13	Flask shaker	2	For broth cultures.
14	Compound microscopes (oil-immersion ×1000)	10	For high-magnification pathogen identification.
15	Disease-specimen collection (preserved)	≥ 80	Common Nigerian crop diseases.

S/N	Item / Equipment	Qty Required	Specification / Notes
16	Disease herbarium (mounted)	1	Reference herbarium of Nigerian crop diseases.
17	Petri dishes and growth media (PDA, V8, NA)	Set	For pathogen isolation.
18	Biocontrol products (Trichoderma asperellum, AflaSafe, Bacillus subtilis)	Per season	For biological-control demonstrations.
19	Aflatoxin lateral-flow strip kit	20 strips	For aflatoxin testing practical.
20	Chemical fungicides (copper, mancozeb, systemic)	Per season	For chemical-control demonstration with PPE.
21	FRAC chart / fungicide-rotation worksheets	Class set	For fungicide-resistance management.
22	Smartphones with Plantix and Nuru AI	Per student	Digital disease-diagnosis practical.
23	Disease-severity rating charts	Class set	Standard area diagrams.

E. Agricultural Entomology and Integrated Pest Management (IPM) Laboratory

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Insect-collecting kits (sweep nets, killing jars, ethyl acetate, forceps)	40 sets	One (1) per pair of students.
2	Insect-rearing cages / containers	40	For life-cycle observation.
3	Insect cabinets / specimen drawers	8	For pinned reference collection.
4	Insect pins, spreading boards, mounting needles	80 sets	Standard entomology mounting kit.
5	Specimen bottles + labels	200	For preserved specimen collection.
6	Magnifying lamps + dissecting	40	For pest identification.

S/N	Item / Equipment	Qty Required	Specification / Notes
	microscopes		
7	Insect-identification keys (Polaszek, Schmutterer, IITA pest guides)	Class set	For reference.
8	Reference collection of Nigerian agricultural pests	10	Pinned/preserved specimens; ≥ 50 species.
9	Pheromone traps + lures (FAW, fruit fly, Tuta absoluta)	6	For monitoring practicals.
10	Biopesticides (Bt, NPV, Beauveria bassiana)	Per season	For biocontrol demonstrations.
11	Insecticides (sample IRAC groups)	Per season	For chemical-control demonstration with PPE.
12	Knapsack pressure sprayers	10	16-L capacity; for application practicals.
13	Motorised mist sprayers	2	For commercial-scale demonstration.
14	Ultra-low-volume (ULV) sprayers	2	For efficient pesticide application.
15	Electrodyn sprayers	2	For controlled droplet application demonstration.
16	Boom sprayer (tractor-mounted)	1	For mechanised application demonstration.
17	Smartphones with Plantix, Nuru AI, FAMEWS apps	Per student	For digital pest-scouting practicals.
18	IRAC chart / IPM decision worksheets	Class set	For resistance management.

F. Plant Breeding, Seed Technology and Biotechnology Laboratory

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Seed-quality testing kit (germination,	5	For ISTA/NASC standards compliance.

S/N	Item / Equipment	Qty Required	Specification / Notes
	purity, moisture)		
2	Germinator / germination cabinet (25 °C / 30 °C)	5	For standard germination test.
3	Seed sieves (graded set)	10 sets	For size classification.
4	Seed counter (manual or automatic)	1	For 1 000-seed weight determination.
5	Aspirator / blower (seed cleaning)	2	For seed-processing demonstration.
6	Moisture oven (105 °C constant)	2	For seed-moisture determination.
7	Analytical balance (0.001 g)	2	For seed-weight determination.
8	Blotter paper, petri dishes	Per term	For seed-health testing.
9	Seed-storage containers (hermetic, foil, paper, vacuum)	Per term	For storage-method comparison.
10	Seed-dressing chemicals (Apron Star, Dress Force, Trichoderma)	Per season	For seed-treatment practicals.
11	Crossing kits (forceps, scissors, glassine bags, labels)	40 sets	For hand-pollination practicals.
12	Karyotype demonstration slides / models	Set	For mitosis / meiosis observation.
13	Pedigree-chart / Punnett-square worksheets	Class set	For genetics problem-solving.
14	Agarose gel-electrophoresis kit (or virtual lab access)	1	For DNA-fingerprinting demonstration.
15	DNA-staining dyes (food colour or commercial)	Set	For demonstration electrophoresis.

S/N	Item / Equipment	Qty Required	Specification / Notes
16	Power source for electrophoresis	1	Standard low-voltage DC supply.
17	Computer workstation with CRISPOR online tool	1	For gRNA-design practicals.
18	Reference: PBR cowpea, Pro-Vit A cassava, Bt cotton brochures	Set	IAR / AATF / HarvestPlus publications.

G. Weed Science Laboratory

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Weed herbarium (mounted specimens)	100+	Common Nigerian arable and plantation weeds.
2	Weed-identification charts / Akobundu's Weed Manual	Class set	For identification reference.
3	Herbicide samples (HRAC-classified)	Per season	Atrazine, glyphosate, paraquat, 2,4-D, fluazifop, imazapyr.
4	Knapsack sprayers + PPE	10 + 10 sets	16-L capacity, with overalls, gloves, goggles, masks, boots.
5	Calibration buckets, measuring cylinders	Set	For sprayer-calibration practical.
6	Soil seed-bank germination trays	20	For seed-bank-study practicals.
7	Smartphones with Plantix (weed-ID feature)	Per pair	For digital weed identification.
8	HRAC chart / herbicide-rotation worksheet	Class set	For resistance-management practicals.

H. Post-Harvest, Food Quality and Cold-Chain Laboratory

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Refractometer (Brix)	4	For sugar-content determination.
2	Titration setup (burette, indicator)	Set	For acidity testing.
3	Grain-moisture meter	2	For determining drying-end point.
4	Fruit-moisture meter	2	For fresh-produce moisture assessment.

S/N	Item / Equipment	Qty Required	Specification / Notes
5	Hermetic storage bags (PICS, GrainPro)	100+	For storage-comparison practical.
6	Jute and polythene bags (control)	Set	For storage-comparison practical.
7	Metal silo (small, demonstration)	1	For modern-storage demonstration.
8	Solar dryer	1	Or improvised; for drying demonstrations.
9	Cold room access / laboratory refrigerator	1	For cold-chain demonstration; ColdHubs partnership ideal.
10	Temperature data-loggers (IoT-enabled)	4	For cold-chain monitoring.
11	Aflatoxin lateral-flow test strips	Per term	For food-safety practical.
12	HACCP plan templates	Class set	For food-safety planning.
13	NAFDAC / SON / Codex reference materials	Set	For quality-standards reference.

I. PROTECTED CULTIVATION FACILITY (GREENHOUSE, SCREENHOUSE AND VERTICAL FARMING)

Horticulture, Greenhouse Technology, Hydroponics, Vertical Farming and Genetics / Molecular Biotechnology (segregation plots) practical

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Greenhouse (polycarbonate or polythene)	1 ($\geq 50 \text{ m}^2$)	For tomato / pepper protected cultivation; equipped with ventilation, irrigation and benching.
2	Screen house / shade house	1 ($\geq 30 \text{ m}^2$)	For nursery and shade-loving crops.
3	Greenhouse benches	20	Galvanised mesh; 4 students per bench.
4	Plastic pots (assorted sizes)	30+	For container experiments.
5	Plastic cups (for student experiments)	15+	For seedling raising.
6	Hand forks, trowels, secateurs, budding knives	30 each	For greenhouse practicals.

S/N	Item / Equipment	Qty Required	Specification / Notes
7	Polythene bags (5 L, 10 L)	500+	For nursery seedling-raising.
8	Maximum / minimum thermometers	5	For environmental monitoring.
9	Windage counter and barometers	2 each	For greenhouse environmental records.
10	NFT hydroponic system (PVC channels, pump, reservoir)	1	For lettuce or tomato hydroponics demonstration.
11	DWC (Deep-Water-Culture) system	1	Alternative hydroponics demonstration.
12	Drip-irrigation kit (with venturi for fertigation)	1	Standard greenhouse drip system.
13	Hydroponic nutrient salts (Cooper / Hoagland)	Per season	Stock A and Stock B.
14	EC meter, pH meter (pocket and bench-top)	4	For nutrient-solution monitoring.
15	LED grow lights (full-spectrum)	4–8	For vertical-farming demonstration.
16	Vertical-farming racks / shelving	2 units	Multi-tier herb / lettuce setup.
17	Vegetable, fruit and ornamental seeds and seedlings	Per season	NIHORT-improved varieties.

J. WEATHER STATION AND AGRO-CLIMATOLOGY FACILITY

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Class A Automatic Weather Station (AWS)	1	Temperature, humidity, rainfall, wind, solar radiation, pressure with data logger.
2	Stevenson's screen with thermometers	1	Standard meteorological enclosure with maximum, minimum, wet- and dry-bulb thermometers.

S/N	Item / Equipment	Qty Required	Specification / Notes
3	Thermo hydrograph	1	For continuous temperature and humidity recording.
4	Maximum and minimum thermometers	5	Standard meteorological thermometers.
5	Rain gauge (manual + tipping-bucket)	2	For daily rainfall recording.
6	Measuring glasses (rain-gauge cylinders)	10	For rainfall measurement.
7	Wind vane	1	For wind-direction measurement.
8	Anemometer	1	For wind-speed measurement.
9	Evaporimeter (Piché or Class A pan)	2	For evaporation measurement.
10	Pyranometer / solar-radiation meter	1	For solar-energy measurement.
11	Hygrometer	5	For atmospheric-humidity measurement.
12	Psychrometer	3	For wet/dry bulb humidity determination.
13	Barometer	2	For atmospheric-pressure measurement.
14	Soil thermometers (5, 10, 30 cm depths)	Set	For soil-temperature profile.
15	NIMET 30-year climate-data subscription	1	Long-term records for the locality.
16	CSA reference materials (FAO, FMARD)	Set	FAO CSA Sourcebook and FMARD CSA guidelines.
17	Smartphone access to NiMet AgroClimate App	Per student	NiMet smartphone advisory.

K. IRRIGATION AND DRAINAGE FACILITY

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Drip-irrigation kit (laterals, emitters, filter, connectors)	1 kit (50 m ²)	For tomato / vegetable plot.
2	Sprinkler-irrigation kit	2 000 m ² capacity	Rotating sprinkler for 1-ha block.
3	Big-Boss irrigation gun	1 (8 ha capacity)	For large-area irrigation demonstration.
4	Impact and micro-sprinkler set + pump	1 set	For 50 m ² plot.
5	Tensiometer (0–100 cb)	4	For soil-moisture monitoring.
6	Gypsum blocks / capacitive soil-moisture sensors	20	For sensor-based irrigation practical.
7	Arduino-based IoT irrigation kit	6	For smart-irrigation demonstration.
8	EC and pH meters (water-quality testing)	4	For FAO water-quality classification.
9	Catch cans (sprinkler-uniformity test)	30+	For Christiansen Uniformity Coefficient determination.
10	Electric motor pump	2	For irrigation-water lifting.
11	Hygrometer (for irrigation scheduling)	2	For evapotranspiration estimation.
12	Evaporation gauge	2	For ET measurement.
13	Soil pH meter, soil-salt tester, portable salt tester	2 each	For irrigation-water-quality and soil-salinity assessment.
14	Water-analysis kit	3	For complete irrigation-water analysis.
15	Portable E.C. meter and chloride-testing set	3 each	For salinity-hazard classification.
16	Current meter / flow meter	2	For irrigation-channel flow measurement.

S/N	Item / Equipment	Qty Required	Specification / Notes
17	Water-measuring devices (Weir, Parshall flume, Cut-throat flume)	1 each	For channel-flow measurement practicals.
18	Stopwatch and water meter	Set	For application-rate measurement.
19	Surface-irrigation site (basin / border / furrow)	100 m ² each	Hand-dug basins, ridges and furrows.
20	Rainwater-harvesting demo (roof catchment + storage)	1	Sahel zai pits or roof system.
21	Zenvus Smartfarm app (smartphone)	Per student	For IoT-irrigation dashboard.
22	ET _o / K _c calculation worksheets, NIMET data	Class set	FAO 56 method practical.
23	Reference: FAO Irrigation and Drainage Paper 56	Class set	Standard reference for crop-water requirement.
24	Irrigation-equipment store	1	Secure, ventilated, dry storage; segregated from chemical store.
25	Surveying instruments (level + staff, theodolite optional)	1 set	For drainage-layout surveying.
26	Surveyor's tapes (50 m, 30 m, 5 m)	10 mixed	For field marking.
27	Perforated PVC pipe samples (75–100 mm)	30 m	For sub-surface drain practical.
28	Gravel + geotextile envelope material	Per term	For sub-surface drain envelope.
29	Trenching tool or partnered excavator	1	For sub-surface drain installation.
30	Drainage demonstration site	≥ 200 m ²	For surface + sub-surface drain construction.
31	Constructed wetland demo plot (Typha, Phragmites)	10 m × 5 m	For wetland water-treatment practical.

S/N	Item / Equipment	Qty Required	Specification / Notes
32	Hooghoudt formula / Rational formula worksheets	Class set	For drain-spacing and discharge-design calculation.

L. FARM MACHINERY WORKSHOP AND MECHANIZATION FACILITY

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Tractors (range of HP — 40, 65, 75 HP)	4	Various models; or partnered access via Hello Tractor.
2	Power tiller (walking tractor)	2	For smallholder-mechanisation demonstration.
3	Disc plough	4	Standard primary-tillage implement.
4	Disc harrow	4	Secondary-tillage implement.
5	Disc ridger	4	For ridge-making practicals.
6	Mouldboard plough	2	Primary-tillage for heavy soils.
7	Sub-soiler	1	For deep-tillage and compaction-breaking.
8	Chisel plough	1	For conservation-tillage demonstration.
9	Rotavator / rotary tiller	1	For seedbed preparation.
10	Versatile cultivator	1	For inter-row cultivation.
11	Inter-row weeder	1	For mechanical weed control.
12	Stump jumper	1	For land-clearing demonstration.
13	Earth scoop	1	For earth-moving demonstration.
14	4-wheel trailer	2	For farm-product haulage.
15	Tractor pulley (stationary work attachment)	2	For belt-driven equipment operation.
16	Seed drill / row planter	2	For mechanical-planting demonstration.

S/N	Item / Equipment	Qty Required	Specification / Notes
17	Versatile seed loader	2	For planter loading.
18	Manual maize planter	2	For smallholder-planting demonstration.
19	Rice planter	3	Walking or mechanical type.
20	Combine harvester (or shared)	1	For mechanical-harvest demonstration.
21	Cutterbar mower / rotary slasher	1 each	For grass-cutting and forage harvest.
22	Hay baler	1	For hay-baling demonstration.
23	Forage shredder with cut hood	1	For pasture / silage chopping.
24	Cereal thresher	1	For grain-threshing demonstration.
25	Seed cleaner and seed grader	1 + 2	For seed-processing demonstration.
26	Fertilizer spreader	2	Broadcast and band-placement types.
27	Manure spreader	1	For organic-fertiliser-application demonstration.
28	Root cutter	1	For root-crop processing demonstration.
29	Boom sprayer (tractor-mounted)	1	For mechanised plant-protection demonstration.
30	Stationary diesel engine (cut-away teaching model)	2	For engine-component teaching.
31	Tractor engines, trailers, ploughs (teaching models / scraps)	Set	For component-identification practicals.
32	Service pit	1	For tractor-under-chassis maintenance.
33	Hydraulic jacks (assorted capacities)	2	For lifting tractors and implements.
34	Grease gun, battery charger, oil dispensers	Set	For preventive-maintenance practicals.

S/N	Item / Equipment	Qty Required	Specification / Notes
35	Tool boxes (complete mechanic sets)	4	Standard mechanic-tool sets.
36	Workshop manuals (tractor and implement service)	Class set	For maintenance reference.
37	PPE for machinery operation (helmets, ear protection, gloves)	Per class set	NBTE safety standard.
38	Hello Tractor partnership / app access	1	For digital tractor-booking practical.

M. Farm-Machinery Maintenance Workshop — Woodwork Section

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Working benches with vice	5	4 students per bench.
2	Band saw	1	For wood-cutting operations.
3	Surface planer	1	For wood surfacing.
4	Thicknessing planer	1	For wood-thickness uniformity.
5	Drilling machine (bench)	1	For precision wood drilling.
6	Hand-tool sets (saws, chisels, try squares, gauges, rules, screwdrivers, drill bits, hammers, mallets, pinchers, oilstones, planers)	15 sets	Each set complete for student use.

N. Farm-Machinery Maintenance Workshop — Metalwork Section

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Lathe machine	1	For precision metal turning.

S/N	Item / Equipment	Qty Required	Specification / Notes
2	Pipe benders	3	For pipe forming.
3	Anvils	3	For metal forging demonstration.
4	Micrometers (inside and outside)	1 set	For precision measurement.
5	Stock and dice set	5	For thread cutting.
6	Drill sets	5	Range of drill bits in case.
7	Electric hand drills	2	For portable drilling.
8	Hydraulic jacks (12-ton)	1	For metalwork support.
9	Tool boxes (complete sets)	5	Standard metalwork tools.
10	Box of drills (assorted)	4	Set of HSS drills.
11	Battery charger	1	For workshop batteries.
12	Grease gun	2	For lubrication practicals.
13	Pipe cutter	1	For pipe-cutting practicals.
14	Scribers, steel rulers, mallet sets	5 each	For metal marking and forming.
15	Pipe-screwing / threading equipment	2	For pipe-thread cutting.
16	Arc-welding equipment	1 set	Standard arc-welding station.
17	Arc welder	1	Welding machine with electrodes.
18	Electric grinder	2	For weld-finishing and metal-shaping.
19	Welding gloves and helmets	8 each	Safety equipment.
20	Wire brushes	12	For weld cleaning.
21	Welding booths and screens	2	For safety isolation.

O. Farm-Machinery Maintenance Workshop — Soldering and Sheet-Metal Section

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Blow torch	15	Soldering torch.
2	Tin snips	15	For sheet-metal cutting.
3	Soldering thix (irons)	5	For solder application.
4	Sheet-metal shear	15	For sheet-metal cutting.
5	Mallet hammer	4	For sheet-metal forming.
6	Hacksaw	4	For metal cutting.
7	Oxygen and acetylene bottles	4 each	For gas welding and cutting.
8	Oxygen and acetylene regulators	4 each	For gas pressure control.
9	Cylinder wrenches	2	For gas-bottle valve operation.
10	Spark lighter	2	For safe torch ignition.

P. POST-HARVEST PROCESSING AND STORAGE FACILITY

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Rice-milling machine	1	For rice-processing demonstration.
2	Rice thresher	1	For rice-harvest processing.
3	Parboil machine	1	For rice-parboiling demonstration.
4	Maize sheller	1	For maize-shelling demonstration.
5	Groundnut decorticator	1	For groundnut-shelling demonstration.
6	Hand oil press	1	For oilseed-processing demonstration.

S/N	Item / Equipment	Qty Required	Specification / Notes
7	Grain dryer	1	For grain-drying demonstration.
8	Cassava peeler	1	For cassava-peeling demonstration.
9	Cassava grater	1	For cassava-processing demonstration.
10	Garri-processing line (small scale)	1	Complete from grating to frying — for cassava value-addition.
11	Hammer mill	1	For dry milling of cereals and tubers.
12	Hydraulic press (cassava cake dewatering)	1	For cassava-processing chain.
13	Soybean processor (soy-milk machine)	1	For legume value-addition.
14	Tomato-processing equipment (blender, cooker, jars)	1 set	For tomato paste / sauce production.
15	OFSP-processing tools	Set	Sweet-potato puree processing for bread.
16	Mini thresher / mechanical sheller	1	Cereal-threshing demonstration.
17	Storage silos (large)	1	For grain-storage demonstration.
18	Cribs	2	For ear-maize storage.
19	Rumbus (mud-built storage)	1	Traditional storage demonstration.
20	Refrigerated warehouse / cold room access	1	ColdHubs partnership ideal; for cold-chain demonstration.
21	Temperature data-loggers (IoT)	4	For cold-chain monitoring.
22	Solar dryer	1	For drying demonstration.
23	Hermetic bags (PICS, GrainPro)	100+	For storage-method comparison.

S/N	Item / Equipment	Qty Required	Specification / Notes
24	Storage-bag comparison (jute, polythene)	Set	For storage-loss study.

Q. DIGITAL AGRICULTURE AND COMPUTER LABORATORY

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Computer laboratory (laptops or desktops)	80	One (1) per pair of students; Intel i3 or equivalent; 8 GB RAM; 256 GB SSD; reliable internet.
2	Reliable broadband internet (≥ 20 Mbps)	1 service	Critical for cloud tools (Google Colab, Sentinel-2 download, ChatGPT/Claude).
3	Power backup (UPS + generator)	Per workstation / facility	For mitigation of power outages.
4	Android smartphones (student-owned acceptable)	80	GPS chip, camera, ≥ 32 GB storage; for app practicals.
5	Smartphone tripods / stabilisers (for video)	4	For video-extension practicals.
6	Handheld GPS units (Garmin or smartphone-equivalent)	2	For field-mapping practicals.
7	Arduino Uno / ESP32 IoT kits with soil-moisture sensors	6 kits	For IoT practicals; one (1) per group of 4 students.
8	Software stack (free / free-tier)	Software	MS Office or Google Workspace, Canva, QGIS, Google Earth Pro, Mapit GIS, Avenza, Plantix, Nuru AI, FAMEWS, Zenvus Smartfarm, Hello Tractor, Google Colab, pandas/NumPy/matplotlib, Looker Studio, ChatGPT/Claude/Gemini, WhatsApp Business, Telegram, Quetext, Google Authenticator.
9	Programming environments	Per workstation	Python (Anaconda); VS Code or PyCharm; Arduino IDE; SQLite + DB

S/N	Item / Equipment	Qty Required	Specification / Notes
			Browser; Flask.
10	Statistical software (free)	Per workstation	R, GenStat (educational), JASP, Excel Data-Analysis Toolpak.
11	Dashboarding software (free / educational)	Per student	Looker Studio, Power BI Free, Tableau Public.
12	Sample agricultural datasets (CSV)	Set	Maize yield, rainfall, farm records — for pandas / Excel / Looker Studio practicals.
13	Programming textbooks	Class set	Python for Everyone — Reema Thareja; Python for Data Analysis — Wes McKinney.
14	Reference: FAO Status of Digital Agriculture in 47 SSA Countries, NDPR, NITDA, NDEPS	Set	For policy / reference.
15	Multimedia projector	2	For lab demonstrations.
16	Reliable LAN switch and Wi-Fi access points	2 + 4	For lab networking.

R. PRECISION AGRICULTURE AND IoT LABORATORY

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Drone (DJI Mini 3 or agricultural drone)	1	Shared resource; can be partner-supplied; for NDVI mapping and herd-counting.
2	Drone software	1 lab	Pix4D, OpenDroneMap, Map Pilot.
3	GPS unit (high-accuracy / RTK if available)	1	For precision-agriculture demonstrations.

S/N	Item / Equipment	Qty Required	Specification / Notes
4	Multispectral / NDVI sensor	1	Or smartphone with NDVI app for crop-health imaging.
5	IoT sensors (soil-moisture, Arduino-based)	6 kits	Shared with Computer Lab.
6	Pheromone traps with FAMEWS app integration	3	For FAW digital monitoring.
7	Smartphones with Plantix, Nuru AI, FAMEWS apps	Per student	For AI-based scouting practicals.
8	Smartphones with Mapit GIS, Avenza apps	Per pair	For field-mapping practicals.
9	Computer-lab access for QGIS and Google Earth Pro	1	For plot mapping and area calculation.
10	Hello Tractor partnership / app access	1	For live tractor-booking demonstration.
11	Zenvus Smartfarm app accounts	Per student	For dashboard-monitoring practical.
12	Excel templates for digital farm records	Class set	For modern record-keeping.

R. PASTURE AGRONOMY AND FORAGE-CONSERVATION FACILITY

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Pasture demonstration plots (grass + legume mixture)	0.25 ha	Panicum, Pennisetum, Andropogon + Stylosanthes, Centrosema.
2	Pasture seeds / cuttings (NAPRI / ILRI)	Per season	Improved tropical pasture species.
3	Rhizobium inoculant (legume-specific)	Per season	For pasture-legume nodulation.

S/N	Item / Equipment	Qty Required	Specification / Notes
4	Fencing materials (posts, wire) for grazing trial	1 set	For rotational-grazing demonstration.
5	Livestock access (sheep / goats — partnered)	Optional	For live-grazing trial.
6	Silage drum / pit / bag (polythene)	2	For silage-making practical.
7	Molasses (silage additive)	Per season	Standard fermentation aid.
8	Hay-drying area / mat	1	For hay-making practical.
9	Manual baling tools or simple baler	1	For hay-baling demonstration.
10	Pasture clipping shears / sickles	12	For forage cutting.
11	Drying oven (DM determination)	1	Shared with general laboratory.
12	Reference: ILRI, NAPRI pasture publications	Set	For tropical-pasture-management reference.

S. ORNAMENTAL HORTICULTURE AND LANDSCAPE DESIGN FACILITY (Ornamental Horticulture and Landscape Design courses at HND level)

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Ornamental plant collection (mother plants)	30+	Bougainvillea, Hibiscus, Ixora, Croton, Allamanda, etc.
2	Lawn establishment area	$\geq 100 \text{ m}^2$	Cynodon, Stenotaphrum sods / sprigs.
3	Lawn mower (push or motorised)	1	For lawn-maintenance practical.
4	Pruning shears, hedge trimmers, secateurs	12 sets	For shaping practicals.
5	Rooting hormones (IBA, NAA)	Per term	For cutting-propagation.
6	Propagation media (peat, perlite, sand, coco peat)	Per season	For nursery media.

S/N	Item / Equipment	Qty Required	Specification / Notes
7	Polythene bags + propagation trays	200+	For cutting establishment.
8	Computer-lab access with SketchUp Free / Garden Planner	1	For 3D landscape design.
9	Drawing materials (graph paper, base maps, scales)	Class set	For manual landscape design.
10	Floral-arrangement materials (vases, foam, ribbon)	Class set	For floral-arrangement practical.
11	Cut flowers (rotational supply)	Per session	For arrangement and vase-life practicals.

T. COMMON HAND TOOLS AND FIELD EQUIPMENT

Common hand tools and field equipment shared across all field-based courses.

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Hoes, cutlasses, shovels, rakes	80 each	Standard farm hand tools (1 per student).
2	Spades, pickaxes	10 each	For earth-moving tasks.
3	Wheelbarrows	10	Standard farm wheelbarrows.
4	Watering cans (10 L)	20	For nursery and small-plot watering.
5	Head pans	10	For materials transport.
6	Matchets	10	For brush clearing.
7	Cutting knives, planting hoes	10 each	For planting practicals.
8	Knapsack sprayers (16 L)	10	For agro-chemical application practicals.

S/N	Item / Equipment	Qty Required	Specification / Notes
9	Measuring tapes (50 m, 30 m, 5 m)	10 mixed	For plot layout.
10	Weighing scales (digital, 5 kg + 50 kg)	5	Bench scale and platform scale.
11	Pegs, ranging poles, twine	Set	For plot layout and surveying.
12	Stakes, plot labels, weatherproof markers	Set	For plot identification.
13	Garden tools (hand fork, trowel, pruning shears, secateurs, budding knife)	30 each	Standard garden hand tools.
14	Flame weeders and hedgers	5	For thermal weed control.
15	G.H.P. pump	3	For nursery watering.
16	Rubber hose (3/4")	5	For nursery and irrigation.
17	Seed sowers	5	For nursery sowing.
18	Root pruners and plant lifters	5 each	For nursery operations.

S. SAFETY AND PERSONAL PROTECTIVE EQUIPMENT (PPE)

(Safety equipment required across all field, laboratory, workshop and processing facilities, in compliance with NBTE minimum safety standards).

S/N	Item / Equipment	Qty Required	Specification / Notes
1	Personal Protective Equipment (overalls, gloves, goggles, dust masks, rubber boots)	Per class set	For laboratory, field and chemical-handling practicals.
2	First-aid kits	3	One per major area: laboratory, farm, workshop.
3	Eye-wash stations	3	One per chemical-handling laboratory.

S/N	Item / Equipment	Qty Required	Specification / Notes
4	Safety showers	2	For chemical-spill emergencies.
5	Fire extinguishers (CO ₂ , dry chemical, water)	6	One per major facility; serviced annually.
6	Fire blankets	4	For laboratory and workshop.
7	Spill-containment kits	4	For chemical spills.
8	Welding gloves, welding helmets, leather aprons	8 each	For metalwork-section safety.
9	Ear-protection muffs / plugs	20	For workshop and machinery operations.
10	Safety signage (chemical, biological, electrical)	Per facility	Standard NBTE safety signage.
11	Emergency-exit lighting	Per facility	Battery-backup illumination.
12	Material Safety Data Sheets (MSDS) folder	Per facility	For all chemical reagents in use.

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